R17

CHADALAWADA RAMANAMMA ENGINEERING COLLEGE

(Autonomous)

(Approved by AICTE | NAAC Accreditation with 'A' Grade | Permanently Affiliated to JNTUA)

Chadalawada Nagar, Tirupati - 517506, Andhra Pradesh.

OUTCOME BASED EDUCATION
WITH
CHOICE BASED CREDIT SYSTEM

BACHELOR OF TECHNOLOGY

ACADEMIC REGULATIONS
UNDER AUTONOMOUS STATUS

B.Tech Regular Four Year Degree Programme

(for the batches admitted from the academic year 2017- 2018)

&

B.Tech (Lateral Entry Scheme)

(for the batches admitted from the academic year 2018 - 2019)

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

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"Take up one idea.
Make that one idea your life-think of it, dream of it, live on that idea. Let the brain muscles, nerves, every part of your body be full of that idea and just leave every other idea alone.
This is the way to success"

Swami Vivekananda

VISION AND MISSION OF THE INSTITUTE

VISION

To impart academic training to students so that they become competent, motivated engineers and scientists. The institute celebrates freedom of thought, cultivates vision and encourages growth and also inculcates human values and concern for environment and country.

MISSION

- To provide state-of-art and world class quality of education to sharpen the intellect of the students.
- To produce full-fledged personalities who can contribute their knowledge and skills learnt for benefit and development of the individual and state.
- To mould the students educationally, ethically, spiritually, physically and mentally splendid.

PRELIMINARY DEFINITIONS AND NOMENCLATURES

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two main semesters i.e., (one odd + one even) and one supplementary semester.

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Anantapuramu) and State Government.

Backlog Course: A course is considered to be a backlog course if the student has obtained a failure grade (F) in that course.

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry, Biology etc., are considered to be foundational in nature.

Betterment: Betterment is a way that contributes towards improvement of the student's grade in any course(s). It can be done by either (a) re-appearing or (b) re-registering for the course.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

Branch: Means specialization in a program like B.Tech degree program in Mechanical Engineering, B.Tech degree program in Computer Science and Engineering etc.

Certificate Course: It is a course that makes a student gain hands-on expertise and skills required for holistic development in a specific area/field.

Choice Based Credit System: The credit based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Commission: Means University Grants Commission (UGC), New Delhi.

Continuous Internal Examination: It is an examination conducted towards sessional assessment.

Course: A course is a subject offered by a department for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture/tutorial hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources, and processes for evaluating the attainment of Program Educational Objectives.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff and other resources in the process of study for a degree.

Dropping from the Semester: A student who doesn't want to register for any semester can apply in writing in prescribed format before commencement of that semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and/or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 - point scale.

Institute: Means CHADALAWADA RAMANAMMA ENGINEERING COLLEGE, Tirupati unless indicated otherwise by the context.

Massive Open Online Course (MOOC): MOOC courses inculcate the habit of self learning. MOOC courses would be additional choices in all the elective group courses.

Pre-requisite: A course, the knowledge of which is required for registration into higher level course.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Professional Elective: It indicates a course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Means, Bachelor of Technology (B.Tech) degree program / PG degree program: M.Tech/ MBA.

Program Educational Objectives: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project work: It is a design or research-based work to be taken up by a student during his/her final yearto achieve a particular aim. It is a credit-based course and is to be planned carefully by the student.

Re-Appearing: A student can reappear only in the semester end examination for the theory component of a course, subject to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester of a Program.

Regulations: The regulations, common to all B.Tech programs offered by Institute are designated as "CREC Regulations R-17" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. The odd Semester starts usually in July and even semester in December.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

S/he: Means "she" and "he" both.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means the Jawaharlal Nehru Technological University Anantapur, Anantapuramu.

FOREWORD

The autonomy is conferred to CHADALAWADA RAMANAMMA ENGINEERING COLLEGE (CREC), Tirupati by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like J N T University Anantapur (JNTUA), Anantapuramu and AICTE. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own curriculum, examination system and monitoring mechanism, independent of the affiliating University but under its observance.

CREC is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUA to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute to order to produce a quality engineering graduate to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

ACADEMIC REGULATIONS

B.Tech. Regular Four Year Degree Programme
(For the batches admitted from the academic year 2017-18)
&
B.Tech. (Lateral Entry Scheme)
(For the batches admitted from the academic year 2018 - 19)

For pursuing four year undergraduate Bachelor Degree programme of study in Engineering (B.Tech) offered by CHADALAWADA RAMANAMMA ENGINEERING COLLEGE under Autonomous status and herein after referred to as CREC.

1.0. CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions (HEI's) are changing from the conventional course structure to Choice Based Credit System (CBCS) along with introduction to semester system at first year itself. The semester system helps in accelerating the teaching-learning process and enables vertical and horizontal mobility in learning.

The credit-based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice-based credit system provides a 'cafeteria'type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

Choice Based Credit System (CBCS) is a flexible system of learning and provides choice for students to select from the prescribed elective courses. A course defines learning objectives and learning outcomes and comprises of lectures / tutorials / laboratory work / field work / project work / comprehensive Examination / seminars / assignments / alternative assessment tools / presentations / self-study etc. or a combination of some of these.

Under the CBCS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.

The CBCS permits students to:

- Choose electives from a wide range of elective courses offered by the departments.
- Undergo additional courses of interest.
- Adopt an interdisciplinary approach in learning.
- Make the best use of expertise of the available faculty.

2.0 MEDIUM OF INSTRUCTION

The medium of instruction shall be English for all courses, examinations, seminar presentations and project work. The curriculum will comprise courses of study as given in course structure, in accordance with the prescribed syllabi.

3.0 TYPES OF COURSES

Courses in a programme may be of three kinds: **Foundation / Skill, Core and Elective.**

3.1 Foundation / Skill Course:

Foundation courses are the courses based upon the content leads to enhancement of skill and knowledge as well as value based and are aimed at man making education. Skill subjects are those areas in which one needs to develop a set of skills to learn anything at all. They are fundamental to learning any subject.

3.2 Core Course:

There may be a core course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

3.3 Elective Course:

Electives provide breadth of experience in respective branch and applications areas. Electivecourse is a course which can be chosen from a pool of courses. It may be:

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student’s proficiency/skill.

An elective may be discipline centric (Professional Elective) focusing on those courses which add generic proficiency to the students or may be chosen from an unrelated discipline called as “Open Elective”.

There are four professional elective groups; students can choose not more than two courses from each group. Overall, students can opt for four professional elective courses which suit their project work in consultation with the faculty advisor/mentor. Nevertheless, one course from each of the two open electives has to be selected.

4.0 SEMESTER STRUCTURE

Each academic year is divided into two semesters, odd and even.

4.1 Students admitted under Lateral Entry Scheme shall register Environmental Studies course and pass the subject by the end of III Year II semester for the award of the degree. This is a mandatory course for students admitted under Lateral Entry Scheme.

4.2 Students admitted on transfer from JNTU affiliated institutes, Universities and other institutesin the subjects in which they are required to earn credits so as to be on par with regular students as prescribed by concerned “Board of Studies”.

4.3 Each semester shall be of 21 weeks (Table 1) duration and this period includes time for registration of courses, course work, examination preparation and conduct of examinations.

4.4 Each semester shall have a minimum of 90 working days; out of which number of contact days for teaching / practical are 75 and 15 days for conduct of exams and preparation.

4.5 The academic calendar shown in Table 1 is declared at the beginning of the academic year.

Table 1: Academic Calendar

FIRST SEMESTER (21 weeks)	I Spell Instruction Period	8 weeks	19 weeks
	I Continuous Internal Examination (CIE-I)	1 week	
	II Spell Instruction Period	8 weeks	
	II Continuous Internal Examination (CIE-II)	1 week	
	Preparation and Practical Examinations	1 week	
	Semester End Examinations		2 weeks
Semester Break and Supplementary Exams			2 weeks
SECOND SEMESTER (21 weeks)	I Spell Instruction Period	8 weeks	19 weeks
	I Continuous Internal Examination (CIE-I)	1 week	
	II Spell Instruction Period	8 weeks	
	II Continuous Internal Examination (CIE-II)	1 week	
	Preparation & Practical Examinations	1 week	
	Semester End Examinations		2 weeks

5.0 REGISTRATION

Each student has to compulsorily register for course work at the beginning of each semester as per the schedule mentioned in the Academic Calendar. It is absolutely compulsory for the student to register for courses in time. The registration will be organized departmentally under the supervision of the Head of the Department.

IN ABSENTIA registration will not be permitted under any circumstance.

At the time of registration, students should have cleared all the dues of Institute and Hostel in the previous semesters, paid the prescribed fees for the current semester and not been debarred from institute for a specified period on disciplinary or any other ground.

6.0 UNIQUE COURSE IDENTIFICATION CODE

Every course of the B.Tech program will be placed in one of the four groups of courses as listed in the Table 2. The various courses and their two-letter codes are given below;

Table 2: Group of Courses

S. No	Branch	Code
1	Electrical and Electronics Engineering	02
2	Mechanical Engineering	03
3	Electronics and Communication Engineering	04
4	Computer Science and Engineering	05

7.0 CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Foundation / Skill Courses, Core Courses, Elective Courses, Laboratory Courses, Audit Courses, Mandatory Courses, Comprehensive Examination, Mini Project, Internship and Project work. The list of elective courses may include subjects from allied disciplines also.

Contact Periods: Depending on the complexity and volume of the course, the number of contact periods per week will be assigned. Each Theory and Laboratory course carries credits based on the number of hours/weeks as follows:

- Contact classes (Theory): 1credit per lecture hour per week.
- Tutorial Classes (Theory): 1credit per 2 lecture hours per week.
- Laboratory Hours (Practical): 1 credit for 2 Practical hours.

7.1 Credit distribution for courses offered is shown in Table 3.

Table 3: Credit distribution

S. No	Course	Hours	Credits
1	Theory Course (Core/Foundation/Elective)	3	3
2	Theory Course (Core/Foundation/Elective)	2+2(T)	3
3	MOOC Courses	-	3
4	Laboratory Courses	2	1
5	Mandatory Course/Value added Course	-	1
6	Comprehensive Examination	-	1
7	Audit Course	1	-
8	Mini Project	-	2
9	Summer Internship	-	-
10	Technical Seminar	-	2
11	Full Semester Internship (FSI)	-	15
12	Project Work	-	15

7.2 Course Structure

Every program of study shall be designed to have 38 - 42 theory courses and 20 - 26 laboratory courses. Every course of the B.Tech program will be placed in one of the eight categories with minimum credits as listed in the Table 4.In addition, a student has to carry out a mini project, project work and comprehensive Examination.

Table 4: Category Wise Distribution of Credits

S. No	Category	Subject Area and % of Credits	Average No. of Credits
1	Humanities and Social Sciences (HS), including Management.	HS (05% to 10%)	**14**
2	Basic Sciences (BS) including Mathematics, Physics and Chemistry.	BS (15% to 20%)	**24**
3	Engineering Sciences (ES), including Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Computer Engineering.	ES (15% to 20%)	**24**
4	Professional Subjects - Core (PC), relevant to the chosen specialization/branch.	PC (30% to 40%)	**77**
5	Professional Subjects - Electives (PE), relevant to the chosen specialization/branch.	PE (10% to 15%)	**12**
6	Open Subjects - Electives (OE), from other technical and/or emerging subject areas.	OE (01% to 5%)	**06**
7	Project Work or Full Semester Internship, Mini Project, Comprehensive Examination.	10% to 15%	**20**
8	Mandatory Courses / Audit Courses/Value added course.	MC / AC	**03**
TOTAL			**180**

7.3 Semester-wise course break-up

Following are the **TWO** models of course structure out of which any student shall choose or will be allotted with one model based on their academic performance.

- **i.** Full Semester Internship (FSI) Model and
- **ii.** Non Full Semester Internship (NFSI) Model.

7.4 For Four year Regular program(FSI Model):

In the FSI Model, selected/eligible students shall undergo Full Semester Internship in IV Year I semester. In the Non FSI Model, the remaining students shall carry out the course work and Project work as specified in the course structure. A student who secures a minimum CGPA of upto II Year II semester with no current arrears and maintains the CGPA of 7.5 till III Year II Semester shall be eligible to opt for FSI.

For Four year Regular program(FSI Model):

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
I Year I Semester	5 Foundation + Audit Course	3	21
I Year II Semester	5 Foundation + Audit Course	3	21
II Year I Semester	6 + Mandatory Course (3 Core + 3 Foundation)	2	23
II Year II Semester	6 +Value Added Course(3 Core + 3 Foundation)	2	23
III Year I Semester	6(5 Core + 1 Professional Elective)	2 + Soft skills Lab	24
III Year II Semester	6 (4 Core + 1 Professional Elective + 1Open Elective)	2 + Mini Project	24
IV Year I Semester	**Full Semester Internship (FSI) +2 MOOC Courses+ 1 ValueAdded Course**		22
IV Year II Semester	5 (3 Core + 2 Professional Elective)	2+ Technical Seminar + Comprehensive Examination	22
Total	**41 (16 Foundation + 18 Core + 4 Professional Electives + 1 Open Electives+ 2 MOOC Courses) + 1 Mandatory Course +2 Audit courses +2 Value Added Course**)	**16 + Comprehensive Examination + Mini Project + Technical Seminar+ Soft skills Lab+ Full Semester Internship**	**180**

7.5 For Four year Regular program(Non FSI Model):

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
I Year I Semester	5 Foundation + Audit Course	3	21
I Year II Semester	5 Foundation + Audit Course	3	21
II Year I Semester	6 + Mandatory Course (3 Core + 3 Foundation)	2	23
II Year II Semester	6 + Value Added Course (3 Core + 3 Foundation)	2	23
III Year I Semester	6(5 Core + 1 Professional Elective)	2 + Soft skills Lab	24

III Year II Semester	6 (4 Core + 1 Professional Elective + 1 Open Elective)	2 + Mini Project	24
IV Year I Semester	5 (2 Core + 1 Professional Elective + 2 MOOC) + Value Added Course	2+ Technical Seminar	22
IV Year II Semester	2 (1 Core + 1 Professional Elective)	Project Work + Comprehensive Examination	22
Total	**41 (16 Foundation + 18 Core + 4 Professional Electives + 1 Open Electives+ 2 MOOC Courses)+ 1 Mandatory Course + 2 Audit Courses + 2 Value Added Course**	**16 + Mini Project + Technical Seminar +Comprehensive Examination + Project work + Soft skills Lab**	**180**

7.6 For Three-year lateral entry program(FSI Model):

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
II Year I Semester	6 + Mandatory Course (3 Core + 3 Foundation)	2	23
II Year II Semester	6 +Value Added Course(3 Core + 3 Foundation)	2	23
III Year I Semester	6(5 Core + 1 Professional Elective)	2 + Soft skills Lab	24
III Year II Semester	6 (4 Core + 1 Professional Elective + 1 Open Elective)	2 + Mini Project	24
IV Year I Semester	**Full Semester Internship (FSI) +2 MOOC Courses + 1 ValueAdded Course**		22
IV Year II Semester	5 (3 Core + 2 Professional Elective)	2+ Technical Seminar + Comprehensive Examination	22
Total	**31 (6 Foundation + 18 Core + 4Professional Electives + 1 Open Electives+ 2 MOOC) +Mandatory Course + 2 Value Added Course**	**10 + Comprehensive Examination + Mini Project + Technical Seminar+ Soft skills Lab+ Full Semester Internship**	**138**

7.7 For Three-year lateral entry program (Non FSI Model):

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
II Year I Semester	6 + Mandatory Course (3 Core + 3 Foundation)	2	23
II Year II Semester	6 + Value Added Course (3 Core + 3 Foundation)	2	23
III Year I Semester	6(5 Core + 1 Professional Elective)	2 + Soft skills Lab	24
III Year II Semester	6 (4 Core + 1 Professional Elective + 1 Open Elective)	2 + Mini Project	24
IV Year I Semester	5+ Value Added Course (2 Core + 1Professional Elective + 2 MOOC	2+ Technical Seminar	22

IV Year II Semester	2 (1 Core + 1 Professional Elective)	Project Work + Comprehensive Examination	22
Total	**31 (6 Foundation + 18 Core + 4 Professional Electives + 1 Open Electives+2 MOOC)+ Mandatory Course + 2 Value Added Course**	**10 + Mini Project + Technical Seminar +Comprehensive Examination + Project work + Soft skills Lab**	**138**

7.8 Course wise break-up for Four-year Regular program (FSI Model):

Total Theory Courses (41) (16 Foundation + 18 Core + 4 Professional Electives + 1 Open Electives+ 2 MOOC Courses) + Mandatory Course + 2 value added course +2 Audit course	16@3credits + 18 @ 3 credits + 04 @ 3 credits + 01 @3 credits + 02 @ 3 credits + 01 @ 1 credits + 02 @ 1 credits +02 @ 0 credits	126
Total Laboratory Courses (16)	16@2credits	32
Comprehensive Examination	1@ 1 credit	01
Mini Project	1 @ 2credits	02
Soft Skills Lab	1 @ 2credits	02
Full Semester Internship (FSI)	1 @15credits	15
Technical Seminar	1 @ 2credits	02
TOTAL CREDITS		**180**

7.9 Course wise break-up for Four year Regular program(Non FSI Model):

Total Theory Courses (41) (16 Foundation + 18 Core + 4 Professional Electives + 1 Open Electives+ 2 MOOCS)+ Mandatory Course + 2 Audit Course + 2 Value Added Course	16 @ 3credits + 18 @3 credits + 04 @ 3 credits + 01 @ 3 credits + 02 @ 3 credits + 01 @ 1 credits +02 @ 0 credits + 02 @ 1credits	126
Total Laboratory Courses (16)	16@2credits	32
Comprehensive Examination	1@1credit	01
Soft Skills Lab	1@2credit	02
Mini Project	1 @2credits	02
Project work	1 @15credits	15
Technical Seminar	1@2credit	02
TOTAL CREDITS		**180**

7.10 Course wise break-up for three year lateral entry program(FSI Model):

Total Theory Courses (31) (6 Foundation + 18 Core + 4 Professional Electives + 1 Open Electives+ 2 MOOC Courses) + Mandatory Course + 2 Value added course	06@3credits + 18 @ 3 credits + 04 @ 3 credits + 01 @3 credits + 02 @ 3 credits + 01 @ 1 credits + 02 @ 1 credits	96
Total Laboratory Courses (10)	10@2credits	20
Comprehensive Examination	1@ 1 credit	01
Mini Project	1 @ 2credits	02

Soft Skills Lab	1 @ 2credits	02
Full Semester Internship (FSI)	1 @15credits	15
Technical Seminar	1 @ 2credits	02
TOTAL CREDITS		**138**

7.11 Course wise break-up for three-year lateral entry program(Non FSI Model):

Total Theory Courses (31) (06 Foundation + 18 Core + 4 Professional Electives + 1 Open Electives)+ Mandatory Course + 2 Value Added Course	06@3credits + 18 @ 3 credits + 04 @ 3 credits + 01 @ 3 credits + 01 @ 1 credits + 02 @ 1 credits	96
Total Laboratory Courses (10)	10@2credits	20
Comprehensive Examination	1@1credit	01
Soft Skills Lab	1@2credit	02
Mini Project	1 @ 2credits	02
Project work	1 @ 15credits	15
Technical Seminar	1@2credit	02
TOTAL CREDITS		**138**

8.0 EVALUATION METHODOLOGY

8.1 Theory Course:

Each theory course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, final marks for 25 shall be arrived by considering 80% weightage to the better internal exam and 20% to the other. The remaining 5 Marks will be considered through Alternative Assessment Tool (AAT).

8.1.1 Semester End Examination (SEE):

The syllabus for each theory course consists of FIVE units and each unit carries equal weightage in terms of marks distribution. The semester end examination is conducted for 70 marks of 3 hours duration.

The Semester End Examination (SEE) consists of two parts i.e Part A and Part B. Part A consists of 12 short questions, student has to answer any ten questions, each question carries two marks. Part B consists of five questions with “either” or choice will be drawn from each unit. Each question carries 10 marks. There could be a maximum of three sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept
30 %	To test the analytical skill of the concept
20 %	To test the application skill of the concept

8.1.2 Continuous Internal Assessment (CIA):

For each theory course the CIA shall be conducted by the faculty/teacher handling the course as given in Table-5. CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Alternative Assessment Tool (AAT).

Table-5: Assessment pattern for Theory Courses

COMPONENT	THEORY		TOTAL MARKS
Type of Assessment	CIE	AAT	

Max. CIA Marks	25	05	30

8.1.2.1 Continuous Internal Examination (CIE):

Two Continuous Internal Examinations (CIE) shall be conducted at the end of the 9th and 17th week of the semester respectively. The CIE is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. The calculation of CIE marks is carried out by considering 80% weightage of the better marks scored in both tests and 20% for the other test. Thevaluation and verification of answer scripts of CIE shall be completed within a week after the conduct of the Internal Examination.

8.1.2.2 Alternative Assessment Tool (AAT)

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). This AAT enables faculty to design own assessment patterns during the CIA. The AAT enhances theautonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. If properly applied, the AAT converts the classroom into an effective learning center. The AAT may include seminars, assignments, micro- projects, five minutes video, flip class, etc.

However, it is mandatory for a faculty to obtain prior permission from the concerned HOD and spell out the teaching/assessment pattern of the AAT prior to commencement of the classes.

8.2 Laboratory Course:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day-to-day performance and 10 marks for end lab internal assessment.

The semester end lab examination is 70 marks and shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the principal from the panel of experts recommended by Chairman, BOS.

All the drawing related courses are evaluated in line with theory courses. The distribution shall be 30 marks for internal evaluation (15 marks for day–to–day work, and 15 marks for internal tests) and 70 marks for semester end lab examination.

8.3 MOOC Courses:

Meeting with the global requirements, to inculcate the habit of self and independent learning and incompliance with UGC guidelines, MOOC (Massive Open Online Course) courses have been introduced through the means of electives.

8.3.1. The proposed MOOC courses would be additional choice in all the elective groups subject to the availability during the respective semesters and respective departments will declare the list of the courses at the beginning of the semester. Course content for the selected MOOC courses shall be drawn from respective MOOCs links or shall be supplied by the department. Course(s) will be mentored by faculty members.

8.3.2. Three credits will be awarded upon successful completion of each MOOC courses having minimum of 8 weeks duration.

8.3.3. Students interested in doing MOOC courses shall register the course title at their department office at the start of the semester against the courses that are announced by the department.

8.3.4. In the event of non-availability, a suitable /relevant course in a given semester is not available through any service provider, the departments would offer an appropriate taught course in lieu of the MOOCs course, the assessment in such a case would be similar to that of any other regular theory courses.

8.4 Audit Courses (AC) / Mandatory Courses (MC):

These courses are amongst the compulsory courses.

a) Human values and professional ethics are mandatory course in II Year I semester for all the students.

b) The student has to choose one audit course at the beginning of I Year I semester, and second audit course at the I Year II semester under self-study mode. By the end of III Year II semester, all the students (regular and lateral entry students) are required to complete the audit course.

c) The students will have four chances in total to clear the audit/ value added / mandatory course. Further, the student has an option to change the audit course in case if s/he is unable to clear the audit course in the first two chances. However, the audit course should be completed by the end of the III Year II semester and its result will be given in the III Year II semester grade sheet.

Mandatory/Value added courses will carry one credit and a pass in each such course after completing SEE requirements during the programme to qualify for the award of Degree. The student is required to obtain 40 % of the marks to qualify out of the maximum 100 marks.

8.5 Value Added Courses:

The value added courses are audit courses in nature offered through joint ventures with various organizations provide ample scope for the students as well as faculty to keep pace with the latest technologies pertaining to their chosen field of studies. A plenty of value-added programs will be proposed by the departments one week before the commencement of class work. The students are given the option to choose the courses according to their academic interest and inclinations using 'cafeteria' approach. The expertise gained through the value-added programs should enable them to face the formidable challenges of the future and also assist them in exploring new opportunities. These courses will carry one credit. The student is required to obtain 40 % of the marks to qualify out of the maximum 100 marks.

8.6 Comprehensive Examination

The comprehensive Examination is aimed at assessing the students understanding of various Foundation, Skill and Core courses studied till the end of IV Year II semester and is intended to test the extent of understanding in chosen field of study by the students.

The Comprehensive Examination consists of 50 multiple choice questions and shall carry 100 marks. It will be conducted by the concerned department under the supervision of HOD through online or written examination of one hour duration.

8.7 Mini Project

The Mini Project shall be carried out during III Year II semester along with other lab courses by having regular weekly slots. Students will take mini project batch-wise and the batches will be divided as per the guidelines issued. The topic of mini project should be so selected that the students are enabled to complete the work in the stipulated time with the available resources in the respective laboratories. The scope of the mini project could be handling part of the consultancy work, maintenance of the existing equipment, development of new experiment setup or can be a prelude to the main project with a specific outcome. Mini project report will be evaluated for 100 marks in total. Assessment will be done by the supervisor/guide for 30 marks based on the work and presentation/execution of the mini project. Subdivision for the remaining 70 marks is based on report, presentation, execution and viva-voce. Evaluation shall be done by a committee comprising the mini project supervisor, Head of the department and an examiner nominated by the Principal from the panel of experts recommended by Chairman, BOS in consultation with Head of the department.

8.8 Project work

In the non-FSI Model, the project work shall be evaluated for 200 marks out of which 60 marks for internal evaluation and 140 marks for semester end evaluation. The project work will be in IV Year II semester. The project work shall be innovative in nature, exploring the research bent of the mind of the student. A project batch shall usually comprise four to five students.

In IV Year II semester, a first review is conducted after 8 weeks by Project Review Committee (PRC) for 30 marks. At the end of semester, a second review is conducted for award of internal marks of another 30 marks, making the total internal marks 60.

The semester end examination shall be based on the report submitted and a viva-voce exam for 140 marks by a committee comprising the Head of the department, project supervisor and an external examiner nominated by the Principal. A minimum of 60% of maximum marks shallbe obtained to earn the corresponding credits.

8.9 Full Semester Internship (FSI)

FSI is a full semester internship programme carries 16 credits. During the FSI, student has to spend one full semester in an identified industry /firm / organization and has to carry out the internship as per the stipulated guidelines of that industry / firm / organization and the institute.

Following are the evaluation guidelines:

- Profile and abstract –Student has to submit the industry profile and abstract of the project within four weeks from date of commencement of internship through mail or post.

  Weightage: 10%.
- Seminar 1 -at 9th week from date of commencement of internship - weightage: 10%
- Seminar 2 -Pre submission at 17th week from date of commencement of internship– weightage: 10%
- Internship Diary, weightage: 15 %
- Project Report, weightage: 15%
- Viva-voce & Final Presentation, weightage: 40%

The internship shall be evaluated for 200 marks out of which 60 marks for internal evaluation and 140 marks for external evaluation.

The external evaluation based on the report submitted and viva-voce exam for 140 marks by a committee comprising the HOD, Project supervisor and external examiner (Industry/ Academia).A minimum of 60% of maximum marks shall be obtained to earn the corresponding credits.

FSI shall be open to all the branches in the IV Year I semester. The selection procedure is:

- Choice of the students
- CGPA (> 7.5) upto II Yeear II semester with no current arrears and maintains the CGPA of

  7.5 till III Year II Semester

9. ATTENDANCE REQUIREMENTS AND DETENTION POLICY

9.1. It is desirable for a candidate to put on 100% attendance in each course. In every course (theory/laboratory), student has to maintain a minimum of 75% attendance including the days of attendance in sports, games, NCC and NSS activities to be eligible for appearing in Semester End Examination of the course.

9.2. A candidate shall put in a minimum required attendance of 75 % in that semester. Otherwise, s/he shall be declared detained and has to repeat semester.

9.3. For cases of medical issues, deficiency of attendance in each course to the extent of 10% may be condoned by the College Academic Committee (CAC) on the recommendation of Head of the department if their attendance is between 75% and 65% in a semester, subjected to submission of medical certificates, medical case file and other needful documents to the concerned departments. The condonation is permitted maximum of two times during the entire course of study.

9.4. A prescribed fee shall be payable towards condonation of shortage of attendance.

9.5. A student shall not be promoted to the next semester unless he/she satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he/she shall not be eligible for readmission into the same class.

9.6. Any student against whom any disciplinary action by the institute is pending shall not be permitted to attend any SEE in that semester.

10. CONDUCT OF SEMESTER END EXAMINATIONS AND EVALUATION

10.1. Semester end examination shall be conducted by the Controller of Examinations (COE) by inviting Question Papers from the External Examiners of reputed institutions.

10.2. Question papers may be moderated for the coverage of syllabus, pattern of questions by a Semester End Examination Committee chaired by COE and senior subject expert before the commencement of semester end examinations. Internal Examiner shall prepare a detailed scheme of valuation.

10.3. The answer papers of semester end examination shall be evaluated by the first examiner immediately after the completion of exam and the award sheet shall be submitted to COE in a sealed cover. The same papers are kept for second evaluation by external examiner.

10.4. In case of difference is more than 15% of marks, the answer paper shall be re-evaluated by a third examiner appointed by the Examination Committee and the marks awarded by third examiner is compared with first and second evaluation marks and higher marks of minimum difference pair will be considered as final marks.

10.5. COE shall invite required number of external examiners to evaluate all the end-semester answer scripts on a prescribed date(s). Practical laboratory exams are conducted by both internal and external examiners.

10.6. Examination Cell shall consolidate the marks awarded by both the examiners and award grades.

11. SCHEME FOR THE AWARD OF GRADE

11.1. A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each theory course, if s/he secures

i. Not less than 35% marks for each theory course in the semester end examination, and

ii. A minimum of 40% marks for each theory course considering both internal and semester end examination.

11.2. A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each Lab / Comprehensive Examination / Mini Project / Project, if s/he secures

i. Not less than 40% marks for each Lab / Comprehensive Examination / Mini Project / Project course in the semester end examination,

ii. A minimum of 40% marks for each Lab / Comprehensive Examination / Mini Project / Project course considering both internal and semester end examination.

11.3. If a candidate fails to secure a pass in a particular course, it is mandatory that s/he shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. It is mandatory that s/he should continue to register and reappear for the examination till s/he secures a pass.

12.0 LETTER GRADES AND GRADE POINTS

12.1. Performances of students in each course are expressed in terms of marks as well as in Letter Grades based on absolute grading system. The UGC recommends a 10-point grading system with the following letter grades as given in the Table-6.

Table-6: Grade Points Scale (Absolute Grading)

Range of Marks	Grade Point	Letter Grade
90 – 100	10	S (Superior)
80 – 89	9	A+ (Excellent)
70 – 79	8	A (Very Good)
60 – 69	7	B+ (Good)
50 – 59	6	B (Average)
40 – 49	5	C (Pass)
Below 40	0	F (Fail)
Absent	0	AB (Absent)

12.2. A student is deemed to have passed and acquired to correspondent credits in particular course if s/he obtains any one of the following grades: “S”, “A+”, “A”, “B+”, “B”, “C”.

12.3. A student obtaining Grade F shall be considered Failed and will be required to reappearin the examination.

12.4. For non credit courses, „Satisfactory‟ or “Not Satisfactory” is indicated instead of theletter grade and this will not be counted for the computation of SGPA/CGPA.

12.5. At the end of each semester, the institute issues grade sheet indicating the SGPA and CGPA of the student. However, grade sheet will not be issued to the student if s/he has any outstanding dues.

13.0 COMPUTATION OF SGPA AND CGPA

The UGC recommends to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA). The credit points earned by a student are used for calculating the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA), bothof which are important performance indices of the student. SGPA is equal to the sum of all the total points earned by the student in a given semester divided by the number of credits registered by the student in that

n *n*

semester. CGPA gives the sum of all the total points earned in all the previous semesters and the current semester divided by the number of credits registered in all these semesters. Thus,

$$SGPA = \sum_{i=1} (C_i G_i) / \sum_{i=1} C_i$$

where, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course and n represent the number of courses in which a student is registered in the concerned semester.

$$CGPA = \sum_{j=1}^{m} (C_j S_j) / \sum_{j=1}^{m} C_j$$

where, S_j is the SGPA of the j^{th} semester and C_j is the total number of credits up to the semesterand m represent the number of semesters completed in which a student registered up to the semester.

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

14.0 ILLUSTRATION OF COMPUTATION OF SGPA AND CGPA

14.1 Illustration for SGPA

Course Name	Course Credits	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	3	A	8	3 x 8 = 24
Course 2	4	B+	7	4 x 7 = 28
Course 3	3	B	6	3 x 6 = 18
Course 4	3	S	10	3 x 10 = 30
Course 5	3	C	5	3 x 5 = 15
Course 6	4	B	6	4 x 6 = 24
	20			**139**

$$Thus, SGPA = 139 / 20 = 6.95$$

14.2 **Illustration** for CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit: 20 SGPA: 6.9	Credit: 22 SGPA: 7.8	Credit: 25 SGPA: 5.6	Credit: 26 SGPA: 6.0
Semester 5	**Semester 6**		
Credit: 26 SGPA: 6.3	Credit: 25 SGPA: 8.0		

$$Thus,\ CGPA = \frac{20x6.9\ +\ 22x7.8\ +\ 25x5.6\ +\ 26x6.0\ +\ 26x6.3\ +\ 25x8.0}{144} = 6.73$$

15.0 PHOTOCOPY / REVALUATION

A student, who seeks the re-evaluation of the answer script, is directed to apply for the photocopy of his/her semester examination answer paper(s) in the theory course(s), within 5 working days from the declaration of results in the prescribed format with prescribed fee to the Controller of Examinations through the Head of the department. On receiving the photocopy, the student can consult with a competent member of faculty and seek the opinion for revaluation. Based on the recommendations, the student can register for the revaluation with prescribed fee. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses.

16.0 PROMOTION POLICIES

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no. 10.

16.1 For students admitted into B.Tech (Regular) program.

16.1.1 A student will not be promoted from I Yar II semester to II Year I semester unless s/he fulfills the academic requirement of securing 40% of credits (17) from I Year I and II semesters examinations, whether or not the candidate takes the examinations.

16.1.2 A student will not be promoted from II Year II semester to III Year I semester unless s/he fulfills the academic requirement of securing 40% of credits (35) upto II Year II semester from all the examinations, whether or not the candidate takes the examinations.

16.1.3 A student will not be promoted from III Year II semester to IV Year I semester unless s/he fulfills the academic requirement of securing 40% of credits (55) up to III Year II semester from all the examinations, whether or not the candidate takes the examinations.

16.1.4 A student shall register for all the 180 credits and earn all the 180 credits. Marks obtained in all the 180 credits shall be considered for the award of the Grade.

16.2 For students admitted into B.Tech (lateral entry students)

16.2.1 A student will not be promoted from II Year II semester to III Year I semester unless s/he fulfills the academic requirement of securing 40% of credits(18) upto II Year II semester from all the examinations, whether or not the candidate takes the examinations.

16.2.2 A student will not be promoted from III Year II semester to IV Year I semester unless s/he fulfills the academic requirement of securing 40% of credits(37) upto III Year II semester from all the examinations, whether or not the candidate takes the examinations.

16.2.3 A student shall register for all the 138 credits and earn all the 138 credits. Marks obtained in all the 138 credits shall be considered for the award of the Grade.

17.0 GRADUATION REQUIREMENTS

The following academic requirements shall be met for the award of the B.Tech degree.

17.1 Student shall register and acquire minimum attendance in all courses and secure 180credits for regular program and 138 credits for lateral entry program.

17.2 A student of a regular program, who fails to earn 180 credits within eight consecutive academic years from the year of his/her admission with a minimum CGPA of 4.0, shall forfeit his/her degree and his/her admission stands cancelled.

17.3 A student of a lateral entry program who fails to earn 138 credits within six consecutive academic years from the year of his/her admission with a minimum CGPA of 4.0, shall forfeit his/her degree and his/her admission stands cancelled.

18.0 BETTERMENT OF MARKS IN THE COURSES ALREADY PASSED

Students who clear all the courses in their first attempt and wish to improve their CGPA shall register and appear for betterment of marks for one course of any theory courses within a period of subsequent two semesters. The improved marks shall be considered for classification / distinction but not for ranking. If there is no improvement in marks, there shall not be any change in the original marks already awarded.

19.0 AWARD OF DEGREE

19.1 Classification of degree will be as follows:

CGPA ≥ 7.5	CGPA ≥ 6.5 and < 7.5	CGPA ≥ 5.0 and < 6.5	CGPA ≥ 4.0 and < 5.0	CGPA < 4.0
First Class with Distinction	**First Class**	**Second Class**	**Pass Class**	**Fail**

19.2 In order to extend the benefit to the students with one/two backlogs after either III Year II semester or IV Year II semester, GRAFTING option is provided to the students enabling their placements and fulfilling graduation requirements. Following are the guidelines for the Grafting:

a. Grafting will be done among the courses within the semester shall draw a maximum of 7 marks from the any one of the cleared courses in the semester and will be grafted to the failed course in the same semester.

b. Students shall be given a choice of grafting only once in the four years program, either after II Year II semester (Option #1) or after IV Year II semester (Option #2).

c. Option#1: Applicable to students who have maximum of TWO theory courses in III Year I Semester and / or III Year II semesters.

Option#2: Applicable to students who have maximum of TWO theory courses in IV Year I and / or II semesters.

d. Eligibility for grafting:

i. Prior to the conduct of the supplementary examination after the declaration of III Year II semester or VI Year II semester results.

ii. S/he must appear in all regular or supplementary examinations as per the provisions laid down in regulations for the courses s/he appeals for grafting.

iii. The marks obtained by her/him in latest attempt shall be taken into account for grafting of marks in the failed course(s).

19.3 Student, who clears all the courses up to IV Year I semester, shall have a chance to appear for Quick Supplementary Examination to clear the failed courses of IV Year II semester.

19.4 By the end of III Year II semester, all the students (regular and lateral entry students) shall complete one of the audit course and mandatory course with acceptable performance.

All the candidates who register for the semester end examination will be issued grade sheet by the institute. Apart from the semester wise grade sheet, the institute will issue the provisional certificate and consolidated grade sheet subject to the fulfillment of all the academic requirements.

20.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

A candidate is normally not permitted to break the study. However, if a candidate intends to temporarily discontinue the program in the middle for valid reasons (such as accident or hospitalization due to prolonged ill health) and to rejoin the program after the break from the commencement of the respective semester as and when it is offered, s/he shall apply to the Principal in advance. Such application shall be submitted before the commencement of the semester in question and forwarded through the Head of the department stating the reasons for such withdrawal together with supporting documents and endorsement of his / her parent / guardian.

The institute shall examine such an application and if it finds the case to be genuine, it may permit the student to rejoin. Such permission is accorded only to those who do not have any outstanding dues like tuition fee etc.

The total period for completion of the program reckoned from the commencement of the semester to which the candidate was first admitted shall not exceed the maximum period specified in section 19.0. The maximum period includes the break period.

21.0 TERMINATION FROM THE PROGRAM

The admission of a student to the program may be terminated and the student is asked to leave the institute in the following circumstances:

a. The student fails to satisfy the requirements of the program within the maximum periodstipulated for that program.

b. A student shall not be permitted to study any semester more than three times during theentire Program of study.

c. The student fails to satisfy the norms of discipline specified by the institute from time totime.

22.0 WITH-HOLDING OF RESULTS

If the candidate has not paid any dues to the institute / if any case of indiscipline / malpractice is pending against him, the results of the candidate will be withheld. The issue of the degree is liableto be withheld in such cases.

23.0 GRADUATION DAY

The institute shall have its own annual Graduation Day for the award of Degrees to students completing the prescribed academic requirements in each case, in consultation with the University and by following the provisions in the Statute. The college shall institute prizes and medals to meritorious students and award them annually at the Graduation Day. This will greatly encourage the students to strive for excellence in their academic work.

24.0 DISCIPLINE

Every student is required to observe discipline and decorum both inside and outside the institute and not to indulge in any activity which will tend to bring down the honor of the institute. If a student indulges in malpractice in any of the theory / practical examination, continuous assessment examinations he/she shall be liable for punitive action as prescribed by the Institute from time to time.

25.0 GRIEVANCE REDRESSAL COMMITTEE

The institute shall form a Grievance Redressal Committee for each course in each department with the Course Teacher and the HOD as the members. This Committee shall solve all grievances related to the course under consideration.

26.0 TRANSITORY REGULATIONS

A candidate, who is detained or discontinued in a semester, on readmission shall be required to do all the courses in the curriculum prescribed for the batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed such courses in the earlier semester(s) s/he was originally admitted into and substitute subjects are offered in place of them as decided by the Board of Studies. However, the decision of the Board of Studies will be final.

a) Four Year B.Tech Regular course:

A student who is following Jawaharlal Nehru Technological University (JNTUA) curriculum and detained due to shortage of attendance at the end of the first semester shall join the autonomous batch of first semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUA curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses will be offered in place of them as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUA for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUA regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

b) Three Year B.Tech program under Lateral Entry Scheme:

A student who is following JNTUA curriculum and detained due to shortage of attendance at the end of the first semester of second year shall join the autonomous batch of third semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with Lateral Entry regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUA curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester of second year or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses are offered in place of them as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUA for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUA regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

c) Transfer candidates (from non-autonomous college affiliated to JNTUA):

A student who is following JNTUA curriculum, transferred from other college to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses are offered in their place as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUA for the award of degree. The total number of credits to be secured for the award of the degree will be the sum of the credits upto previous semester under JNTUA regulations and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

d) Transfer candidates (from an autonomous college affiliated to JNTUA):

A student who has secured the required credits upto previous semesters as per the regulations of other autonomous institutions shall also be permitted to be transferred to this institute. A student who is transferred from the other autonomous colleges to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The total number of credits to be secured for the award of the degree will be the sum of the credits upto previous semester as per the regulations of the college from which he is transferred and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

28.0 REVISION OF REGULATIONS AND CURRICULUM

The Institute from time to time may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary and on approval by the Academic Council and the Governing Body shall come into force and shall be binding on the students, faculty, staff, all authorities of the Institute and others concerned.

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

B.TECH - PROGRAM OUTCOMES (POS)

PO-1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems (**Engineering Knowledge**).

PO-2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences **(Problem Analysis).**

PO-3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations **(Design/Development of Solutions).**

PO-4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions **(Conduct Investigations of Complex Problems).**

PO-5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations **(Modern Tool Usage).**

PO-6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice **(The Engineer and Society).**

PO-7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development **(Environment and Sustainability).**

PO-8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **(Ethics).**

PO-9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **(Individual and Team Work).**

PO-10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions **(Communication).**

PO-11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO-12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change **(Life-long learning).**

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

1. Who grants Autonomy? UGC, Govt., AICTE or University

In case of colleges affiliated to a university and where statutes for grant of autonomy are ready, it is the respective University that finally grants autonomy but only after concurrence from the respective state Government as well as UGC. The State Government has its own powers to grant autonomy directly to Govt. and Govt. aided Colleges.

2 Shall CREC award its own Degree?

No. Degree will be awarded by Jawaharlal Nehru Technological University, Anantapur with a mention of the name CREC on the Degree Certificate.

3 What is the difference between a Deemed University and an Autonomy College?

A Deemed University is fully autonomous to the extent of awarding its own Degree. A Deemed University is usually a Non-Affiliating version of a University and has similar responsibilities like any University. An Autonomous College enjoys Academic Autonomy alone. The University to which an autonomous college is affiliated will have checks on the performance of the autonomous college.

4 How will the Foreign Universities or other stake – holders know that we are an Autonomous College?

Autonomous status, once declared, shall be accepted by all the stake holders. The Govt. of Andhra Pradesh mentions autonomous status during the First-Year admission procedure. Foreign Universities and Indian Industries will know our status through our website.

5 What is the change of Status for Students and Teachers if we become Autonomous?

An autonomous college carries a prestigious image. Autonomy is actually earned out of our continued past efforts on academic performances, our capability of self- governance and the kind of quality education we offer.

6 Who will check whether the academic standard is maintained / improved after Autonomy? How will it be checked?

There is a built in mechanism in the autonomous working for this purpose. An Internal Committee called Academic Programme Evaluation Committee, which will keep a watch on the academics and keep its reports and recommendations every year. In addition, the highest academic council also supervises the academic matters. The standards of our question papers, the regularity of academic calendar, attendance of students, speed and transparency of result declaration and such other parameters are involved in this process.

7 Will the students of CREC as an Autonomous College qualify for University Medals and Prizes for academic excellence?

No. CREC has instituted its own awards, medals, etc. for the academic performance of the students. However, for all other events like sports, cultural on co-curricular organized by the University the students shall qualify.

8 Can CREC have its own Convocation?

No. Since the University awards the Degree the Convocation will be that of the University, but there will be Graduation Day at CREC.

9 Can CREC give a provisional degree certificate?

Since the examinations are conducted by CREC and the results are also declared by CREC, the college sends a list of successful candidates with their final Grades and Grade Point Averages including CGPA to the University. Therefore, with the prior permission of the University the college will be entitled to give the provisional certificate.

10 Will Academic Autonomy make a positive impact on the Placements or Employability?

Certainly. The number of students qualifying for placement interviews is expected to improve, due to rigorous and repetitive classroom teaching and continuous assessment. Also, the autonomous status ismore responsive to the needs of the industry. As a result, therefore, there will be a lot of scope for industry oriented skill development built-in into the system. The graduates from an autonomouscollege will therefore represent better employability.

11 What is the proportion of Internal and External Assessment as an Autonomous College?

Presently, it is 70 % external and 30% internal. As the autonomy matures the internal assessment component shall be increased at the cost of external assessment.

12 Is it possible to have complete Internal Assessment for Theory or Practicals?

Yes indeed. We define our own system. We have the freedom to keep the proportion of external and internal assessment component to choose.

13 Why Credit based Grade System?

The credit based grade system is an accepted standard of academic performance the world over in all Universities. The acceptability of our graduates in the world market shall improve.

14 What exactly is a Credit based Grade System?

The credit based grade system defines a much better statistical way of judging the academic performance. One Lecture Hour per week of Teaching Learning process is assigned One Credit. One hour of laboratory work is assigned half credit. Letter Grades like S, A+, A, B+, B, C, F etc. are assignedfor a Range of Marks. (e.g. 90% and above is S, 80 to 89 % could be A+ etc.) in Absolute Grading System while grades are awarded by statistical analysis in relative grading system. We thus dispense with sharp numerical boundaries. Secondly, the grades are associated with defined Grade Points inthe scale of 1 to 10. Weighted Average of Grade Points is also defined Grade Points are weighted by Credits and averaged over total credits in a Semester. This process is repeated for all Semesters and a CGPA defines the Final Academic Performance

15 What are the norms for the number of Credits per Semester and total number of Credits for UG/PG programme?

These norms are usually defined by UGC or AICTE. Usually around 25 Credits per semester is the accepted norm.

16 What is a Semester Grade Point Average (SGPA)?

The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the semester.

$$SGPA = \sum_{i=1}^{n}(C_i \, G_i)/\sum_{i=1}^{n}C_i$$

Where, C_i is the number of credits of the i^{th} course and $G_i$is the grade point scored by the student in the i^{th} course and i represent the number of courses in which a student registered in the concerned semester. SGPA is rounded to two decimal places.

17 What is a Cumulative Grade Point Average (CGPA)?

An up-to-date assessment of overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is weighted average of the grade points obtained in all the courses registered by the students since he entered the Institute.

$$CGPA = \sum_{j=1}^{m}(C_j \, S_j)/\sum_{j=1}^{m}C_j$$

Where, S_j is the SGPA of the j^{th} semester and $C_j$is the total number of credits upto the semester and $m$represent the number of semesters completed in which a student registered upto the semester. CGPA is rounded to two decimal places.

18 Is there any Software available for calculating Grade point averages and converting the same into Grades?

Yes, the institute has its own MIS software for calculation of SGPA, CGPA, etc.

19 Will the teacher be required to do the job of calculating SGPAs etc. and convert the same into Grades?

No. The teacher has to give marks obtained out of whatever maximum marks as it is. Rest is all done by the computer.

20 Will there be any Revaluation or Re-Examination System?

No. There will double valuation of answer scripts. There will be a makeup Examination after a reasonable preparation time after the End Semester Examination for specific cases mentioned in the

Rules and Regulations. In addition to this, there shall be a "summer term" (compressed term) followed by the End Semester Exam, to save the precious time of students.

21 How fast Syllabi can be and should be changed?
Autonomy allows us the freedom to change the syllabi as often as we need.

22 Will the Degree be awarded on the basis of only final year performance?
No. The CGPA will reflect the average performance of all the semester taken together.

23 What are Statutory Academic Bodies?
Governing Body, Academic Council, Examination Committee and Board of Studies are the different statutory bodies. The participation of external members in every body is compulsory. The institute has nominated professors from IIT, NIT, University (the officers of the rank of Pro-vice Chancellor, Deans and Controller of Examinations) and also the reputed industrialist and industry experts on these bodies.

24 Who takes Decisions on Academic matters?
The Governing Body of institute is the top academic body and is responsible for all the academic decisions. Many decisions are also taken at the lower level like Boards of Studies. Decisions taken at the Board of Studies level are to be ratified at the Academic Council and Governing Body.

25 What is the role of Examination committee?
The Examinations Committee is responsible for the smooth conduct of internal, End Semester and makeup Examinations. All matters involving the conduct of examinations spot valuations, tabulations preparation of Grade Cards etc, fall within the duties of the Examination Committee.

26 Is there any mechanism for Grievance Redressal?
The institute has grievance redressal committee, headed by Dean - Student affairs and Dean - IQAC.

27 How many attempts are permitted for obtaining a Degree?
All such matters are defined in Rules & Regulation

28 Who declares the result?
The result declaration process is also defined. After tabulation work wherein the SGPA, CGPA and final Grades are ready, the entire result is reviewed by the Moderation Committee. Any unusual deviations or gross level discrepancies are deliberated and removed. The entire result is discussed in the Examinations and Result Committee for its approval. The result is then declared on the institute notice boards as well put on the web site and Students Corner. It is eventually sent to the University.

29 Who will keep the Student Academic Records, University or CREC?
It is the responsibility of the Dean, Academics of the Autonomous College to keep and preserve all the records.

30 What is our relationship with the JNT University?
We remain an affiliated college of the JNT University. The University has the right to nominate its members on the academic bodies of the college.

31 Shall we require University approval if we want to start any New Courses?
Yes, It is expected that approvals or such other matters from an autonomous college will receive priority.

32 Shall we get autonomy for PG and Doctoral Programmes also?
Yes, presently our PG programmes also enjoying autonomous status.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Controller of Examinations.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) alreadyappeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and

	the examination.	project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Controller of Examinations /Additional Controller of Examinations/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the COE or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the COE or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the Institute premises or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.

9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the college's expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

CHADALAWADA RAMANAMMA ENGINEERING COLLEGE
(AUTONOMOUS)
COURSE STRUCTURE

B.Tech I Year I Semester

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA52101	Functional English	HS	Foundation	3		-	3	30	70	100
17CA54101	Mathematics -I	BS	Foundation	2	2	-	3	30	70	100
17CA51101	Engineering Chemistry	BS	Foundation	3	-	-	3	30	70	100
17CA51102	Environmental Studies	HS	Foundation	3	-	-	3	30	70	100
17CA05101	Computer Programming	ES	Foundation	2	2	-	3	30	70	100
17CA50101	Foundation of Yoga (Audit Course)	AC	Perspective	-	-	-	-	-	-	-
PRACTICAL										
17CA52102	English Language Communications Laboratory	HS	Foundation	-	-	4	2	30	70	100
17CA51103	Engineering Chemistry Laboratory	BS	Foundation	-	-	4	2	30	70	100
17CA05102	Computer Programming Laboratory	ES	Foundation	-	-	4	2	30	70	100
TOTAL				**13**	**04**	**12**	**21**	**240**	**560**	**800**

B.Tech I Year II Semester

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA52201	English for Professional Communication	HS	Foundation	3	-	-	3	30	70	100
17CA54201	Mathematics –II	BS	Foundation	2	2	-	3	30	70	100
17CA55101	Engineering Physics	BS	Foundation	3	-	-	3	30	70	100
17CA03101	Engineering Drawing	ES	Foundation	1	-	4	3	30	70	100
17CA02203	Network Analysis	ES	Foundation	2	2	-	3	30	70	100
17CA50201	Clinical Physiology(Audit Course)	AC	Perspective	-	-	-	-	-	-	-
PRACTICAL										
17CA03203	Engineering & I.T. Workshop	ES	Foundation	-	-	4	2	30	70	100
17CA55102	Engineering Physics Laboratory	BS	Foundation	-	-	4	2	30	70	100
17CA02204	Network Analysis Laboratory	ES	Foundation	-	-	4	2	30	70	100
TOTAL				**11**	**04**	**16**	**21**	**240**	**560**	**800**

B.Tech II Year I Semester

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA54303	Complex analysis and Partial Differential equations	BS	Core	2	2	-	3	30	70	100
17CA04301	Electronic Devices & Circuits	PC	Core	3	-	-	3	30	70	100
17CA04302	Switching Theory and Logic Design	PC	Foundation	3	-	-	3	30	70	100
17CA04303	Probability Theory & Stochastic Processes	PC	Foundation	2	2	-	3	30	70	100
17CA04304	Signals and Systems	PC	Core	2	2	-	3	30	70	100
17CA02306	Basic Electrical Technology	ES	Foundation	3	-	-	3	30	70	100
PRACTICAL										
17CA04305	Electronic Devices and Circuits Laboratory	PC	Core	-	-	4	2	30	70	100
17CA02307	Electrical Technology and Simulation Laboratory	PC	Core	-	-	4	2	30	70	100
17CA56301	Mandatory Course	MC	Perspective	1	0	0	1	-	100	100
TOTAL				**16**	**06**	**08**	**23**	**240**	**660**	**900**

B.Tech II Year II Semester

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA04401	Electronic Circuit Analysis	PC	Core	2	2	-	3	30	70	100
17CA04402	Analog Communications	PC	Core	3	-	-	3	30	70	100
17CA04403	Linear IC Application	PC	Core	3	-	-	3	30	70	100
17CA02501	Control Systems	PC	Core	2	2	-	3	30	70	100
17CA04404	Electromagnetic Theory & Transmission Lines	PC	Core	2	2	-	3	30	70	100
17CA53301	Managerial Economics and Financial Analysis	HS	Foundation	3	-	-	3	30	70	100
PRACTICAL										
17CA04405	Electronic Circuit Analysis Lab	PC	Core	-	-	4	2	30	70	100
17CA04406	Analog Communications Lab	PC	Core	-	-	4	2	30	70	100
17CA57401-8	Value Added Course-I	AC	Perspective	-	-	-	1	-	100	100
TOTAL				**15**	**06**	**08**	**23**	**240**	**660**	**900**

B.Tech III Year I Semester

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA04501	Digital Communication systems	PC	Core	3	-	-	3	30	70	100
17CA04502	Digital System Design	PC	Core	2	2	-	3	30	70	100
17CA04503	Antennas & Wave Propagation	PC	Core	2	2	-	3	30	70	100
17CA04504	Electronic Measurements and Instrumentation	PC	Core	3	-	-	3	30	70	100
17CA05403	Computer Organization	PC	Core	3	-	-	3	30	70	100
17CA04505 to 17CA04508	**Professional Elective – I**	PE	Elective	3	-	-	3	30	70	100
PRACTICAL										
17CA04509	Linear & Digital IC Applications Lab	PC	Core	-	-	4	2	30	70	100
17CA04510	Digital Communication lab	PC	Core	-	-	4	2	30	70	100
17CA52501	Soft Skills Lab	HS	Foundation	-	-	4	2	30	70	100
TOTAL				**16**	**04**	**12**	**24**	**270**	**630**	**900**

B.Tech III Year II Semester

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA04601	Digital Signal Processing	PC	Core	2	2	-	3	30	70	100
17CA04602	VLSI System Design	PC	Core	2	2	-	3	30	70	100
17CA04603	Microwave Engineering	PC	Core	2	2	-	3	30	70	100
17CA04604	Microprocessors & Microcontrollers	PC	Core	3	-	-	3	30	70	100
17CA04605 to 17CA04608	**Professional Elective - II**	PE	Elective	3	-	-	3	30	70	100
	Open Elective	OE	Elective	3	-	-	3	30	70	100
PRACTICAL										
17CA04609	Digital Signal Processing lab	PC	Core	-	-	4	2	30	70	100
17CA04610	Microprocessors & Microcontrollers Lab	PC	Core	-	-	4	2	30	70	100
17CA04611	Mini Project	-	Skill	-	-	4	2	30	70	100
TOTAL				**15**	**06**	**12**	**24**	**270**	**630**	**900**

B.Tech IV Year I Semester (NON FSI)

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA04701	Embedded System	PC	Core	2	2	-	3	30	70	100
17CA04702	Optical Communications	PC	Core	2	2	-	3	30	70	100
17CA04703 to 17CA04706	**Professional Elective - III**	PE	Elective	3	-	-	3	30	70	100
17CA04707 To 17CA04709	**MOOC Course – I**	PC	MOOC	3	-	-	3	30	70	100
17CA04710 to 17CA04712	**MOOC Course – II**	PC	MOOC	3	-	-	3	30	70	100
PRACTICAL										
17CA04713	Microwave & Optical Communications Lab	PC	Core	-	-	4	2	30	70	100
17CA04714	VLSI & Embedded Systems lab	PC	Core	-	-	4	2	30	70	100
17CA04715	**Technical Seminar**	-	Skill	-	-	-	2	50	50	100
17CA57701-8	Value Added Course – II	AC	Skill	3	-	-	1	-	100	100
TOTAL				**16**	**04**	**08**	**22**	**260**	**640**	**900**

B.Tech IV Year I Semester (FSI)

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA04716	INTERNSHIP	-	Core	-	-	-	16	60	140	200
17CA04707 to 17CA04709	**MOOC Course – I**	-	MOOC	3	-	-	3	30	70	100
17CA04710 to 17CA04712	**MOOC Course – II**	-	MOOC	3	-	-	3	30	70	100
TOTAL				**06**	**-**	**-**	**22**	**120**	**280**	**400**

B.Tech IV Year II Semester (NON FSI)

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA04801	Digital Image Processing	PC	Core	2	2	-	3	30	70	100
17CA04802 to 17CA04805	**Professional Elective – IV**	PE	Core	3	-	-	3	30	70	100
17CA04806	Comprehensive Examination	-	Skills	-	-	-	1	-	100	100
17CA04807	Project Work	-	Core	-	-	4	15	60	140	200
TOTAL				**05**	**02**	**04**	**22**	**120**	**380**	**500**

B.Tech IV Year II Semester (FSI)

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA04701	Embedded System	PC	Core	2	2	-	3	30	70	100
17CA04702	Optical Communications	PC	Core	2	2	-	3	30	70	100
17CA04801	Digital Image Processing	PC	Core	2	2	-	3	30	70	100
17CA04703 to 17CA04706	**Professional Elective - III**	PE	Elective	3	-	-	3	30	70	100
17CA04802 to 17CA04805	**Professional Elective - IV**	PE	Elective	3	-	-	3	30	70	100
PRACTICAL										
17CA04713	Microwave & Optical Communications Lab	PC	Core	-	-	4	2	30	70	100
17CA04714	VLSI & Embedded systems lab	PC	Core	-	-	4	2	30	70	100
17CA04715	Technical Seminar	-	Skills			-	2	50	50	100
17CA04806	Comprehensive Examination	-	Skills	-	-	-	1	-	100	100
TOTAL				**12**	**06**	**08**	**22**	**260**	**640**	**900**

PROFESSIONAL ELECTIVE - I

Course Code	Course Title
17CA04505	TV Engineering
17CA04506	Artificial Neural Networks and Fuzzy Logic
17CA04507	Telecommunication Switching Theory And Applications
17CA04508	Industrial Electronics

PROFESSIONAL ELECTIVE -II

Course Code	Course Title
17CA04605	Satellite Communication
17CA04606	Field Programmable Gate Array (FPGA) Design
17CA04607	Data Communication & Networking
17CA04608	MATLAB Programming

PROFESSIONAL ELECTIVE - III

Course Code	Course Title
17CA04703	Radar Systems & Navigational Aids
17CA04704	Digital design Through Verilog
17CA04705	Adaptive Signal Processing
17CA04706	Wireless Communications And Networks

PROFESSIONAL ELECTIVE – IV

Course Code	Course Title
17CA04802	Wireless Sensor Networks And Architecture
17CA04803	Advanced Digital Signal Processing
17CA04804	Real Time Systems
17CA04805	Bio Medical Instrumentation

MOOC COURSE-I

Course Code	Course Title
17CA04707	Pattern Recognition & Applications
17CA04708	RF Integrated Circuits
17CA04709	Information Security

MOOC COURSE-II

Course Code	Course Title
17CA04710	MEMS & Microsystems
17CA04711	Advanced 3G & 4G Communication
17CA04712	Linux Programming & Scripting

OPEN ELECTIVE

S.No	Course Code	Course Title
1	17CA53601	Entrepreneurship
2	17CA02608	Renewable energy sources
3	17CA04506	Artificial Neural networks and Fuzzy Logic
4	17CA05405	JAVA Programming
5	17CA04701	Embedded Systems

6	17CA03802	Mechatronics
7	17CA05612	Information Security
8	17CA03609	Operations Research
9	17CA02609	Energy from Waste
10	17CA53602	Research Methodologies
11	17CA04801	Digital Image Processing
12	17CA05404	Data Base Management Systems
13	17CA052601	Soft Skills-II

AUDIT COURSE

S.No	Course Code	Course Title
1	17CA50101	Foundation of Yoga
2	17CA50201	Clinical Psychology

MANDATORY COURSE

S.No	Course Code	Course Title
1	17CA56301	Human Values and Professional Ethics

VALUE ADDED COURSE – I

S. No	Course Code	Course Title
1.	17CA57401	MATLAB
2.	17CA57402	PSPICE
3.	17CA57403	Lab view Certified Developer Course
4.	17CA57404	Embedded Systems
5.	17CA57405	Adriano Micro Controller
6.	17CA57406	Microsoft Certified Engineer

VALUE ADDED COURSE – II

S. No.	Course Code	Course Title
1.	17CA57701	CAD
2.	17CA57702	Introduction to SCADA Systems
3.	17CA57703	Advanced Digital Processing Using MATLAB
4.	17CA57704	Internet of Things
5.	17CA57705	CISCO Certified Network Engineer
6.	17CA57706	Cyber Security

CHADALAWADA RAMANAMMA ENGINEERING COLLEGE

(Autonomous)

(Approved by AICTE | NAAC Accreditation with 'A' Grade | Permanently Affiliated to JNTUA)
Chadalawada Nagar, Tirupati - 517506, Andhra Pradesh.

OUTCOME BASED EDUCATION
WITH
CHOICE BASED CREDIT SYSTEM

BACHELOR OF TECHNOLOGY

ACADEMIC REGULATIONS
UNDER AUTONOMOUS
STATUS

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech Regular Four Year Degree Programme

(for the batches admitted from the academic year 2017-

2018)&

B.Tech (Lateral Entry Scheme)

(for the batches admitted from the academic year 2018 - 2019)

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

CONTENTS

"Take up one idea.
Make that one idea your life-think of it, dream of it, live on that idea. Let the brain muscles, nerves, every part of your body be full of that idea and just leave every other idea alone.
This is the way to success"

Swami Vivekananda

VISION AND MISSION OF THE INSTITUTE

VISION

To impart academic training to students so that they become competent, motivated engineers and scientists. The institute celebrates freedom of thought, cultivates vision and encourages growth and also inculcates human values and concern for environment and country.

MISSION

- To provide state-of-art and world class quality of education to sharpen the intellect of thestudents.
- To produce full-fledged personalities who can contribute their knowledge and skills learnt forbenefit and development of the individual and state.
- To mould the students educationally, ethically, spiritually, physically and mentally splendid.

VISION AND MISSION OF THE DEPARTMENT

Vision of the Department

To produce globally competent professionals in the domain of Electronics and Communication Engineering by imparting quality education with ethical practices.

Mission of the Department

M1: To deliver quality education by continuously updating curricula and teaching learning process to make students technologically adept and responsible technocrats.

M2: To involve the students and faculty in research, innovation and development activities in Electronics and Communication technologies.

M3: To prepare the students to be continuous learners in a connected world and imbibe professional skills and ethical responsibilities.

PEOs OF THE DEPARTMENT

During the first few years after graduation, graduates shall be able to

PEO1: Analyze, design and create innovative products/solutions that are technically sound, economically feasible and socially acceptable.

PEO2: Exhibit professionalism, communication skills and ethical attitude in their profession and adapt to current trends by engaging in lifelong learning.

PEO3: Address societal needs through sustainable and ethical practices both in employment and/or entrepreneurial career.

PRELIMINARY DEFINITIONS AND NOMENCLATURES

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisionson all academic matters including academic research.

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two main semesters i.e., (one odd + one even) and one supplementary semester.

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Anantapuramu) and State Government.

Backlog Course: A course is considered to be a backlog course if the student has obtained a failure grade (F) in that course.

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry, Biology etc., are considered to be foundational in nature.

Betterment: Betterment is a way that contributes towards improvement of the student"s grade in any course(s). It can be done by either (a) re-appearing or (b) re-registering for the course.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

Branch: Means specialization in a program like B.Tech degree program in Mechanical Engineering, B.Tech degree program in Computer Science and Engineering etc.

Certificate Course: It is a course that makes a student gain hands-on expertise and skills required for holistic development in a specific area/field.

Choice Based Credit System: The credit based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Commission: Means University Grants Commission (UGC), New Delhi.

Continuous Internal Examination: It is an examination conducted towards sessional assessment.

Course: A course is a subject offered by a department for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course.The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture/tutorial hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student overall the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources, and processes for evaluating the attainment of Program Educational Objectives.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff and other resources in the process of study for a degree.

Dropping from the Semester: A student who doesn"t want to register for any semester can apply in writing in prescribed format before commencement of that semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and/or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 - point scale.

Institute: Means CHADALAWADA RAMANAMMA ENGINEERING COLLEGE, Tirupati unless indicated otherwise by the context.

Massive Open Online Course (MOOC): MOOC courses inculcate the habit of self learning. MOOCcourses would be additional choices in all the elective group courses.

Pre-requisite: A course, the knowledge of which is required for registration into higher level course.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Professional Elective: It indicates a course that is discipline centric. An appropriate choice of minimumnumber of such electives as specified in the program will lead to a degree with specialization.

Program: Means, Bachelor of Technology (B.Tech) degree program / PG degree program: M.Tech/MBA.

Program Educational Objectives: The broad career, professional and personal goals that every studentwill achieve through a strategic and sequential action plan.

Project work: It is a design or research based work to be taken up by a student during his/her final yearto achieve a particular aim. It is a credit based course and is to be planned carefully by the student.

Re-Appearing: A student can reappear only in the semester end examination for the theory component ofa course, subject to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester of a Program.

Regulations: The regulations, common to all B.Tech programs offered by Institute are designated as"CREC Regulations R-17" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally90 working days. The odd Semester starts usually in July and even semester in December.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at theend of the semester.

S/he: Means "she" and "he" both.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means the Jawaharlal Nehru Technological University Anantapur, Anantapuramu.

FOREWORD

The autonomy is conferred to CHADALAWADA RAMANAMMA ENGINEERING COLLEGE (CREC), Tirupati by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like J N T University Anantapuramu (JNTUA), Anantapuramu and AICTE. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own curriculum, examination system and monitoring mechanism, independent of the affiliating University but under its observance.

CREC is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for whichit has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUA to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute to order to produce a quality engineering graduate to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

CHADALAWADA RAMANAMMA ENGINEERING COLLEGE
(Autonomous)

ACADEMIC REGULATIONS

B.Tech. Regular Four Year Degree Programme
(For the batches admitted from the academic year 2017-18)&
B.Tech. (Lateral Entry Scheme)
(For the batches admitted from the academic year 2018 - 19)

For pursuing four year undergraduate Bachelor Degree programme of study in Engineering (B.Tech) offered by CHADALAWADA RAMANAMMA ENGINEERING COLLEGE under Autonomous status and herein after referred to as CREC.

1.0. CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions (HEI‟s) are changing from the conventional course structure to Choice Based Credit System (CBCS) along with introduction to semester system at first year itself. The semester system helps in accelerating the teaching-learning process and enables vertical and horizontal mobility in learning.

The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a „cafeteria‟ type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

Choice Based Credit System (CBCS) is a flexible system of learning and provides choice for students to select from the prescribed elective courses. A course defines learning objectives and learning outcomes and comprises of lectures / tutorials / laboratory work / field work / project work / comprehensive Examination / seminars / assignments / alternative assessment tools / presentations / self-study etc. or a combination of some of these.

Under the CBCS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.

The CBCS permits students to:

- Choose electives from a wide range of elective courses offered by the departments.
- Undergo additional courses of interest.
- Adopt an interdisciplinary approach in learning.
- Make the best use of expertise of the available faculty.

2.0 MEDIUM OF INSTRUCTION

The medium of instruction shall be English for all courses, examinations, seminar presentations and project work. The curriculum will comprise courses of study as given in course structure, in accordance with the prescribed syllabi.

3.0 TYPES OF COURSES

Courses in a programme may be of three kinds: **Foundation / Skill, Core and Elective.**

3.1 Foundation / Skill Course:

Foundation courses are the courses based upon the content leads to enhancement of skill and knowledge as well as value based and are aimed at man making education. Skill subjects are those areas in which one needs to develop a set of skills to learn anything at all. They are fundamental to learning any subject.

3.2 Core Course:

There may be a core course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

3.3 Elective Course:

Electives provide breadth of experience in respective branch and applications areas. Electivecourse is a course which can be chosen from a pool of courses. It may be:

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student‟s proficiency/skill.

An elective may be discipline centric (Professional Elective) focusing on those courses which add generic proficiency to the students or may be chosen from an unrelated discipline called as "Open Elective".

There are four professional elective groups; students can choose not more than two courses from each group. Overall, students can opt for four professional elective courses which suit their project work in consultation with the faculty advisor/mentor. Nevertheless, one course from each of the two open electives has to be selected.

4.0 SEMESTER STRUCTURE

Each academic year is divided into three semesters, TWO being MAIN SEMESTERS (one odd + one even) and ONE being a SUPPLEMENTARY SEMESTER. Main Semesters are for regular classwork. Supplementary Semester is primarily for failed students i.e. registration for a course for the first time is generally not permitted in the supplementary semester. However, the following cases areexempted:

4.1 Students admitted under Lateral Entry Scheme in the subjects „Audit Course‟, „mandatory course‟ and „Value Added Course‟.

4.2 Students admitted under Lateral Entry Scheme shall register „Environmental Studies‟ course in supplementary semester and pass the subject by the end of VI semester for the award of the degree. This is a mandatory course for students admitted under Lateral Entry Scheme.

4.3 Students admitted on transfer from JNTU affiliated institutes, Universities and other institutes in the subjects in which they are required to earn credits so as to be on par with regular students as prescribed by concerned „Board of Studies‟.

4.4 Each main semester shall be of 21 weeks (Table 1) duration and this period includes time for registration of courses, course work, examination preparation and conduct of examinations.

4.5 Each main semester shall have a minimum of 90 working days; out of which number of contact days for teaching / practical are 75 and 15 days for conduct of exams and preparation.

4.6 The supplementary semester shall be a fast track semester consisting of eight weeks and this period includes time for registration of courses, course work, examination preparation, conduct of examinations, assessment and declaration of final results.

4.7 All subjects may not be offered in the supplementary semester. The student has to pay a stipulated fee prescribed by the Institute to register for a course in the supplementary semester. The supplementary semester is provided to help the student in not losing an academic year. It is optional for a student to make use of supplementary semester. **Supplementary semester is a special semester and the student cannot demand it as a matter of right** and will be offered based on availability of faculty and other institute resources.

4.8 The institute may use **supplementary semester** to arrange add-on courses for regular students and / or for deputing them for practical training / FSI. A student can register for a maximum number of 12 credits during a supplementary semester.

4.9 The academic calendar shown in Table 1 is declared at the beginning of the academic year.

Table 1: Academic Calendar

<table>
<tr><td rowspan="6">FIRST SEMESTER (21 weeks)</td><td>I Spell Instruction Period</td><td>8 weeks</td><td rowspan="5">19 weeks</td></tr>
<tr><td>I Mid Examinations</td><td>1 week</td></tr>
<tr><td>II Spell Instruction Period</td><td>8 weeks</td></tr>
<tr><td>II Mid Examinations</td><td>1 week</td></tr>
<tr><td>Preparation and Practical Examinations</td><td>1 week</td></tr>
<tr><td colspan="2">Semester End Examinations</td><td>2 weeks</td></tr>
<tr><td colspan="3">Semester Break and Supplementary Exams</td><td>2 weeks</td></tr>
<tr><td rowspan="6">SECOND SEMESTER (21 weeks)</td><td>I Spell Instruction Period</td><td>8 weeks</td><td rowspan="5">19 weeks</td></tr>
<tr><td>I Mid Examinations</td><td>1 week</td></tr>
<tr><td>II Spell Instruction Period</td><td>8 weeks</td></tr>
<tr><td>II Mid Examinations</td><td>1 week</td></tr>
<tr><td>Preparation & Practical Examinations</td><td>1 week</td></tr>
<tr><td colspan="2">Semester End Examinations</td><td>2 weeks</td></tr>
<tr><td colspan="3">Summer Vacation, Supplementary Semester and Remedial Exams</td><td>8 weeks</td></tr>
</table>

5.0 REGISTRATION

5.1 Each student has to compulsorily register for course work at the beginning of each semester as per the schedule mentioned in the Academic Calendar. It is absolutely compulsory for the student to register for courses in time. The registration will be organized departmentally under the supervision of the Head of the Department.

5.2 IN ABSENTIA registration will not be permitted under any circumstance.

5.3 At the time of registration, students should have cleared all the dues of Institute and Hostel in the previous semesters, paid the prescribed fees for the current semester and not been debarred from institute for a specified period on disciplinary or any other ground.

6.0 UNIQUE COURSE IDENTIFICATION CODE

Every course of the B.Tech program will be placed in one of the four groups of courses as listed in the Table 2. The various courses and their two-letter codes are given below;

Table 2: Group of Courses

S. No	Branch	Code
1	Electrical and Electronics Engineering	02
2	Mechanical Engineering	03
3	Electronics and Communication Engineering	04
4	Computer Science and Engineering	05

7.0 CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Foundation / Skill Courses, Core Courses, Elective Courses, Laboratory Courses, Audit Courses, Mandatory Courses, Comprehensive Examination, Mini Project,Internship and Project work. The list of elective courses may include subjects from allied disciplines also.

Contact Periods: Depending on the complexity and volume of the course, the number of contact periods per week will be assigned. Each Theory and Laboratory course carries credits based on the number of hours/week as follows:

- Contact classes (Theory): 1credit per lecture hour per week.
- Tutorial Classes (Theory): 1credit per 2 lecture hours per week.
- Laboratory Hours (Practical): 1 credit for 2 Practical hours.

7.1 Credit distribution for courses offered is shown in Table 3.

Table 3: Credit distribution

S. No	Course	Hours	Credits
1	Theory Course (Core/Foundation/Elective)	3	3
2	Theory Course (Core/Foundation/Elective)	2+2	3
3	MOOC Courses	-	3
4	Laboratory Courses	2	2
5	Mandatory Course/Value added Course	-	1
6	Comprehensive Examination	-	1
7	Audit Course	1	-
8	Mini Project	-	2
9	Summer Internship	-	-
10	Technical Seminar	-	2
11	Full Semester Internship (FSI)	-	15
12	Project Work	-	15

7.2 Course Structure

Every program of study shall be designed to have 38 - 42 theory courses and 20 - 26 laboratory courses. Every course of the B.Tech program will be placed in one of the eight categories with minimum credits as listed in the Table 4.In addition, a student has to carry out a mini project, project work and comprehensive Examination.

Table 4: Category Wise Distribution of Credits

S. No	Category	Subject Area and % of Credits	Average No. of Credits
1	Humanities and Social Sciences (HS), including Management.	HS (05% to 10%)	**16**
2	Basic Sciences (BS) including Mathematics, Physics and Chemistry.	BS (10% to 15%)	**19**
3	Engineering Sciences (ES), including Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Computer Engineering.	ES (10% to 15%)	**18**
4	Professional Subjects - Core (PC), relevant to the chosen specialization/branch.	PC (45% to 50%)	**89**
5	Professional Subjects - Electives (PE), relevant to the chosen specialization/branch.	PE (05% to 10%)	**12**
6	Open Subjects - Electives (OE), from other technical and/or emerging subject areas.	OE (01% to 5%)	**03**
7	Project Work or Full Semester Internship, Mini Project, Comprehensive Examination.	10% to 15%	**20**
8	Mandatory Courses / Audit Courses/Value added course.	MC / AC	**03**
TOTAL			**180**

7.3 Semester-wise course break-up

Following are the **TWO** models of course structure out of which any student shall choose or will be allotted with one model based on their academic performance.

i. Full Semester Internship (FSI) Model and

ii. Non Full Semester Internship (NFSI) Model.

7.4 For Four year Regular program(FSI Model):

In the FSI Model, selected/eligible students shall undergo Full Semester Internship in VII semester. In the Non FSI Model, the remaining students shall carry out the course work and Project work as specified in the course structure. A student who secures a minimum CGPA of

upto IV semester with no current arrears and maintains the CGPA of 7.5 till VI Semester shall be eligible to opt for FSI.

For Four year Regular program (FSI Model):

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
I Semester	5 Foundation + Audit Course	3	21
II Semester	5 Foundation + Audit Course	3	21
III Semester	6 + Mandatory Course (3 Core + 3 Foundation)	2	23
IV Semester	6 +Value Added Course (5 Core + 1 Foundation)	2	23
V Semester	6(5 Core + 1 Professional Elective)	2 + Soft skills Lab	24
VI Semester	6 (4 Core + 1 Professional Elective + 1 Open Elective)	2 + Mini Project	24
VII Semester	**Full Semester Internship (FSI) +2 MOOC Courses+ 1 Value Added Course**		22
VIII Semester	5 (3 Core + 2 Professional Elective)	2+ Technical Seminar + Comprehensive Examination	22
Total	**46 (14 Foundation + 20 Core + 4 Professional Electives + 1 Open Elective+ 2 MOOC Courses) + 1 Mandatory Course +2 Audit courses +2 Value Added Courses)**	**16 + Comprehensive Examination + Mini Project + Technical Seminar+ Soft skills Lab+ Full Semester Internship**	**180**

7.5 For Four year Regular program(Non FSI Model):

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
I Semester	5 Foundation + Audit Course	3	21
II Semester	5 Foundation + Audit Course	3	21
III Semester	6 + Mandatory Course (3 Core + 3 Foundation)	2	23
IV Semester	6 + Value Added Course (5 Core + 1 Foundation)	2	23
V Semester	6(5 Core + 1 Professional Elective)	2 + Soft skills Lab	24
VI Semester	6 (4 Core + 1 Professional Elective + 1 Open Elective)	2 + Mini Project	24
VII Semester	5 (2 Core + 1 Professional Elective + 2 MOOC) + Value Added Course	2+ Technical Seminar	22
VIII Semester	2 (1 Core + 1 Professional Elective)	Project Work + Comprehensive Examination	22
Total	**46 (14 Foundation + 20 Core + 4 Professional Electives + 1 Open Elective+ 2 MOOC Courses)+ 1 Mandatory Course + 2 Audit Courses + 2 Value Added Courses**	**16 + Mini Project + Technical Seminar +Comprehensive Examination + Project work + Soft skills Lab**	**180**

7.6 For Three year lateral entry program(FSI Model):

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
III Semester	6 + Mandatory Course (3 Core + 3 Foundation)	2	23
IV Semester	6 +Value Added Course (5 Core + 1 Foundation)	2	23
V Semester	6(5 Core + 1 Professional Elective)	2 + Soft skills Lab	24
VI Semester	6 (4 Core + 1 Professional Elective + 1 Open Elective)	2 + Mini Project	24
VII Semester	**Full Semester Internship (FSI) +2 MOOC Courses + 1 Value Added Course**		22
VIII Semester	5 (3 Core + 2 Professional Elective)	2+ Technical Seminar + Comprehensive Examination	22
Total	**34 (4 Foundation + 20 Core + 4 Professional Electives + 1 Open Elective+ 2 MOOC) + Mandatory Course + 2 Value Added Courses**	**10 + Comprehensive Examination + Mini Project + Technical Seminar+ Soft skills Lab+ Full Semester Internship**	**138**

7.7 For Three year lateral entry program (Non FSI Model):

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
III Semester	6 + Mandatory Course (3 Core + 3 Foundation)	2	23
IV Semester	6 + Value Added Course (5 Core + 1 Foundation)	2	23
V Semester	6(5 Core + 1 Professional Elective)	2 + Soft skills Lab	24
VI Semester	6 (4 Core + 1 Professional Elective + 1 Open Elective)	2 + Mini Project	24
VII Semester	5+ Value Added Course (2 Core + 1 Professional Elective + 2 MOOC	2+ Technical Seminar	22
VIII Semester	2 (1 Core + 1 Professional Elective)	Project Work + Comprehensive Examination	22
Total	**34 (4 Foundation + 20 Core + 4 Professional Electives + 1 Open Elective+2 MOOC)+ Mandatory Course + 2 Value Added Courses**	**10 + Mini Project + Technical Seminar +Comprehensive Examination + Project work + Soft skills Lab**	**138**

7.8 Course wise break-up for Four year Regular program (FSI Model):

Total Theory Courses (46) (14 Foundation + 20 Core + 4 Professional Electives + 1 Open Elective+ 2 MOOC Courses) +1 Mandatory Course + 2 value added courses +2 Audit courses	14@3credits + 20 @ 3 credits + 04 @ 3 credits + 01 @3 credits + 02 @ 3 credits + 01 @ 1 credits + 02 @ 1 credits +02 @ 0 credits	126
Total Laboratory Courses (16)	16@2credits	32
Comprehensive Examination	1@ 1 credit	01
Mini Project	1 @ 2credits	02
Soft Skills Lab	1 @ 2credits	02
Full Semester Internship (FSI)	1 @15credits	15
Technical Seminar	1 @ 2credits	02
TOTAL CREDITS		**180**

7.9 Course wise break-up for Four year Regular program(Non FSI Model):

Total Theory Courses (46) (14 Foundation + 20 Core + 4 Professional Electives + 1 Open Electives+ 2 MOOCS)+ Mandatory Course + 2 Audit Course + 2 Value Added Course	14 @ 3credits + 20 @3 credits + 04 @ 3 credits + 01 @ 3 credits + 02 @ 3 credits + 01 @ 1 credits +02 @ 0 credits + 02 @ 1credits	126
Total Laboratory Courses (16)	16@2credits	32
Comprehensive Examination	1@1credit	01
Soft Skills Lab	1@2credit	02
Mini Project	1 @2credits	02
Project work	1 @15credits	15
Technical Seminar	1@2credit	02
TOTAL CREDITS		**180**

7.10 Course wise break-up for three year lateral entry program (FSI Model):

Total Theory Courses (34) (4 Foundation + 20 Core + 4 Professional Electives + 1 Open Electives+ 2 MOOC Courses) + Mandatory Course + 2 Value added course	04@3credits + 20 @ 3 credits + 04 @ 3 credits + 01 @3 credits + 02 @ 3 credits + 01 @ 1 credits + 02 @ 1 credits	96
Total Laboratory Courses (10)	10@2credits	20
Comprehensive Examination	1@ 1 credit	01
Mini Project	1 @ 2credits	02
Soft Skills Lab	1 @ 2credits	02
Full Semester Internship (FSI)	1 @15credits	15
Technical Seminar	1 @ 2credits	02
TOTAL CREDITS		**138**

7.11 Course wise break-up for three year lateral entry program(Non FSI Model):

Total Theory Courses (34) (4 Foundation + 20 Core + 4 Professional Electives + 1 Open Electives+ 2 MOOC Courses) + Mandatory Course + 2 Value added course	04@3credits + 20 @ 3 credits + 04 @ 3 credits + 01 @3 credits + 02 @ 3 credits + 01 @ 1 credits + 02 @ 1 credits	96
Total Laboratory Courses (10)	10@2credits	20
Comprehensive Examination	1@1credit	01
Soft Skills Lab	1@2credit	02
Mini Project	1 @ 2credits	02
Project work	1 @ 15credits	15
Technical Seminar	1@2credit	02
TOTAL CREDITS		**138**

8.0 EVALUATION METHODOLOGY

8.1 Theory Course:

Each theory course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, final marks for 25 shall be arrived by considering 80% weightage to the better internal exam and 20% to the other. The remaining 5 Marks will be considered through Alternative Assessment Tool (AAT) after second internal examination.

8.1.1 Semester End Examination (SEE):

The syllabus for each theory course consists of FIVE units and each unit carries equal weightage in terms of marks distribution. The semester end examination is conducted for 70 marks of 3 hours duration.

The Semester End Examination (SEE) consists of two parts i.e Part A and Part B. Part A consists of 12 short questions, student has to answer any ten questions, each question carries two marks. Part B consists of five questions with „either‟ „or‟ choice will be drawn from each unit. Each question carries 10 marks. There could be a maximum of three sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept
30 %	To test the analytical skill of the concept
20 %	To test the application skill of the concept

8.1.2 Continuous Internal Assessment (CIA):

For each theory course the CIA shall be conducted by the faculty/teacher handling the course as given in Table-5. CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Alternative Assessment Tool (AAT).

Table-5: Assessment pattern for Theory Courses

COMPONENT	THEORY		TOTAL MARKS
Type of Assessment	CIE Exam (Sessional)	AAT	
Max. CIA Marks	25	05	30

8.1.2.1 Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 9th and 17th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. The final CIE for 25 marks with weightage of 80% to better mid marks and 20% for the other. Thevaluation and verification of answer scripts of CIE exams shall be completed within a week after the conduct of the Internal Examination.

81.2.2 Alternative Assessment Tool (AAT)

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). This AAT enables faculty to design own assessment patterns during the CIA. The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. If properly applied, the AAT converts the classroom into an effective learning centre. The AAT may include seminars, assignments, micro- projects, five minutes video, etc.

However, it is mandatory for a faculty to obtain prior permission from the concerned HOD and spell out the teaching/assessment pattern of the AAT prior to commencementof the classes.

8.2 Laboratory Course:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment. The semester end labexamination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

All the drawing related courses are evaluated in line with theory courses. The distributionshall be 30 marks for internal evaluation (15 marks for day–to–day work, and 15 marks for internal tests) and 70 marks for semester end lab examination.

8.3 MOOC Courses:

Meeting with the global requirements, to inculcate the habit of self learning and incompliance with UGC guidelines, MOOC (Massive Open Online Course) courses have been introduced as electives.

The proposed MOOC courses would be additional choices in all the elective groups subject to the availability during the respective semesters and respective departments willdeclare the list of the courses at the beginning of the semester. Course content for the selected MOOC courses shall be drawn from respective MOOCs links or shall be supplied by the department. Course will be mentored by faculty members and Assessment &Evaluation of the courses shall be done by the department.

There shall be one Mid Continuous Internal Examination (Quiz exam for 30 marks) after 9 weeks of the commencement of the course and semester end examination (Descriptive exam for 70 marks) shall be done along with the other regular courses.

Three credits will be awarded upon successful completion of each MOOC courses havingminimum of 8 weeks duration .

Students interested in doing MOOC courses shall register the course title at their department office at the start of the semester against the courses that are announced by thedepartment.

8.4 Audit Courses (AC) / Mandatory Courses (MC):

These courses are among the compulsory courses.

a) Gender Sensitivity and Environmental studies are mandatory courses in III & IV semestersfor all the students.

b) The student has to choose one audit course at the beginning of I semester, and second audit course at the II semester under self study mode. By the end of VI semester, all the students (regular and lateral entry students) shall complete the audit course.

c) The students will have four chances in total to clear the audit/ value added / mandatory course. Further, the student has an option to change the audit course in case if s/he is unableto clear the audit course in the first two chances. However, the audit course should be completed by VI semester and its result will be given in the VI semester grade sheet.

d) Mandatory/Value added courses will carry one credit and a pass in each such course after attaining required CIE and SEE requirements during the programme shall be necessary requirement for the student to qualify for the award of Degree. Its result shall be declared with “Satisfactory” or “Not Satisfactory” performance.

8.5 Value Added Courses:

The value added courses are audit courses in nature offered through joint ventures with various organizations provide ample scope for the students as well as faculty to keep pace with the latest technologies pertaining to their chosen field of studies. A plenty of value added programs will be proposed by the departments one week before the commencement of class work. The students are given the option to choose the courses according to their desires and inclinations as they choose the desired items in a cafeteria. The expertise gained through the value added programs should enable them to face the formidable challenges of the future and also assist them in exploring new opportunities. These courses will carry one credit. Its result shall be declared with “Satisfactory” or “Not Satisfactory” performance.

8.6 Comprehensive Examination

The comprehensive Examination is aimed at assessing the students understanding of various Foundation, Skill and Core courses studied till the end of VIII semester and is intended to test the students‟ grasp of the chosen field of study.

The Comprehensive Examination consists of 50 multiple choice questions and shall carry 50marks. It will be conducted by the concerned department under the supervision of HOD through online or written examination of one hour duration.

8.7 Mini Project

The Mini Project shall be carried out during VI semester along with other lab courses by havingregular weekly slots. Students will take mini project batch-wise and the batches will be dividedas per the guidelines issued. The topic of mini project should be so selected that the students are enabled to complete the work in the stipulated time with the available resources in the respective laboratories. The scope of the mini project could be handling part of the consultancy work, maintenance of the existing equipment, development of new experiment setup or can be a prelude to the main project with a specific outcome. Mini project report will be evaluated for 100 marks in total. Assessment will be done by the supervisor/guide for 30 marks based on the work and presentation/execution of the mini project. Subdivision for the remaining 70 marks is based on report, presentation, execution and viva-voce. Evaluation shall be done by a committee comprising the mini project supervisor, Head of the department and an examiner nominated by the Principal from the panel of experts recommended by Chairman, BOS in consultation with Head of the department.

8.8Project work

In the non-FSI Model, the project work shall be evaluated for 200 marks out of which 60 marks for internal evaluation and 140 marks for semester end evaluation. The project work will be in VIII semester. The project work shall be somewhat innovative in nature, exploring the research bent of the mind of the student. A project batch shall comprise not more than four students.

In VIII semester, a first mid review is conducted by PRC (on the progress) for 30 marks. On completion of the project, a second evaluation is conducted for award of internal marks of another 30 marks before the report is submitted, making the total internal marks 60.

The end semester examination shall be based on the report submitted and a viva-voce exam for 140 marks by a committee comprising the Head of the department, project supervisor and an external examiner nominated by the Principal. A minimum of 60% of maximum marks shallbe obtained to earn the corresponding credits.

8.9 Full Semester Internship (FSI)

FSI is a full semester internship programme carries 16 credits. During the FSI, student has to spend one full semester in an identified industry /firm / organization and has to carry out the internship as per the stipulated guidelines of that industry / firm / organization and the institute.

Following are the evaluation guidelines:

- Profile and abstract –Student has to submit the industry profile and abstract of the projectwithin four weeks from date of commencement of internship through mail or post.

  Weightage: 10%.
- Seminar 1 -at 9th week from date of commencement of internship - weightage: 10%
- Seminar 2 -Pre submission at 17th week from date of commencement of internship–weightage: 10%
- Internship Diary, weightage: 15 %
- Project Report, weightage: 15%
- Viva-voce & Final Presentation, weightage: 40%

The internship shall be evaluated for 200 marks out of which 60 marks for internal evaluation and 140 marks for external evaluation.

The external evaluation based on the report submitted and viva-voce exam for 140 marks by a committee comprising the HOD, Project supervisor and external examiner (Industry/ Academia).A minimum of 60% of maximum marks shall be obtained to earn the corresponding credits.

FSI shall be open to all the branches in the VII semester. The selection procedure is:

- Choice of the students
- CGPA (> 7.5) upto IV semester with no current arrears and maintains the CGPA of 7.5 till VI Semester

9.0 MAKE-UP EXAMINATION

The make-up examination facility shall be available to students who may have missed to attend CIE exams in one or more courses in a semester for valid genuine reasons. The make-up examination shall have comprehensive online objective type questions. The syllabus for the make-up examination shall be the whole syllabus covered till the end of the semester under consideration and will be conducted at the end of the semester.

10.0 ATTENDANCE REQUIREMENTS AND DETENTION POLICY

It is desirable for a candidate to put on 100% attendance in each course. In every course (theory/laboratory), student has to maintain a minimum of 75% attendance including the days of attendance in sports, games, NCC and NSS activities to be eligible for appearing in Semester End Examination of the course.

A candidate shall put in a minimum required attendance of 75 % in that semester. Otherwise, s/he shall be declared detained and has to repeat semester.

For cases of medical issues, deficiency of attendance in each course to the extent of 10% may be condoned by the College Academic Committee (CAC) on the recommendation of Head of the department if their attendance is between 75% and 65% in a semester, subjected to submission of medical certificates, medical case file and other needful documents to the concerned departments. The condonation is permitted maximum of two times during the entire course of study.

A prescribed fee shall be payable towards condonation of shortage of attendance.

A student shall not be promoted to the next semester unless he/she satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he/she shall not be eligible for readmission into the same class.

Any student against whom any disciplinary action by the institute is pending shall not be permitted to attend any SEE in that semester.

11.0 CONDUCT OF SEMESTER END EXAMINATIONS AND EVALUATION

Semester end examination shall be conducted by the Controller of Examinations (COE) byinviting Question Papers from the External Examiners.

Question papers may be moderated for the coverage of syllabus, pattern of questions by a Semester End Examination Committee chaired by COE and seniorsubject expert before the commencement of semester end examinations. Internal Examiner shall prepare adetailed scheme of valuation.

The answer papers of semester end examination should be evaluated by the first examiner immediately after the completion of exam and the award sheet should be submitted to COE in a sealed cover before the same papers are kept for second evaluation by external examiner.

In case of difference is more than 15% of marks, the answer paper shall be re-evaluated by a third examiner appointed by the Examination Committee and the marks awarded by third examiner is compared with first and seccond evaluation marks and higher marks of minimum difference pair will be considered as final marks.

COE shall invite required number of external examiners to evaluate all the end-semester answer scripts on a prescribed date(s). Practical laboratory exams are conducted involving external examiners.

Examinations Control Committee shall consolidate the marks awarded by both the examiners and award grades.

12.0 SCHEME FOR THE AWARD OF GRADE

12.1 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each theory course, if s/he secures

- **i.** Not less than 35% marks for each theory course in the semester end examination, and
- **ii.** A minimum of 40% marks for each theory course considering both internal and semester end examination.

12.2 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each Lab / Comprehensive Examination / Mini Project / Project, if s/he secures

- **i.** Not less than 40% marks for each Lab / Comprehensive Examination / Mini Project / Project course in the semester end examination,
- **ii.** A minimum of 40% marks for each Lab / Comprehensive Examination / Mini Project / Project course considering both internal and semester end examination.

12.3 If a candidate fails to secure a pass in a particular course, it is mandatory that s/he shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. It is mandatory that s/he should continue to register and reappear for the examination till s/he secures a pass.

13.0 LETTER GRADES AND GRADE POINTS

13.1 Performances of students in each course are expressed in terms of marks as well as in Letter Grades based on absolute grading system. The UGC recommends a 10-point grading system with the following letter grades as given in the Table-6.

Table-6: Grade Points Scale (Absolute Grading)

Range of Marks	Grade Point	Letter Grade
90 – 100	10	S (Superior)
80 – 89	9	A+ (Excellent)
70 – 79	8	A (Very Good)
60 – 69	7	B+ (Good)
50 – 59	6	B (Average)
40 – 49	5	C (Pass)
Below 40	0	F (Fail)
Absent	0	AB (Absent)

13.2 A student is deemed to have passed and acquired to correspondent credits in particularcourse if s/he obtains any one of the following grades: “S”, “A+”, “A”, “B+”, “B”, “C”.

13.3 A student obtaining Grade F shall be considered Failed and will be required to reappearin the examination.

13.4 For non credit courses, „Satisfactory‟ or “Not Satisfactory” is indicated instead of theletter grade and this will not be counted for the computation of SGPA/CGPA.

13.5 “SA” denotes shortage of attendance (as per item 10) and hence prevention from writingSemester End Examination.

13.6 At the end of each semester, the institute issues grade sheet indicating the SGPA and CGPA of the student. However, grade sheet will not be issued to the student if s/he has any outstanding dues.

14.0 COMPUTATION OF SGPA AND CGPA

The UGC recommends to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA). The credit points earned by a student are used for calculating the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA), both of which are important performance indices of the student. SGPA is equal to the sum of all the total points earned by the student in a given semester divided by the number of credits registered by the student in that semester. CGPA gives the sum of all the total points earned in all the previous semesters and the current semester divided by the number of credits registered in all these semesters. Thus,

$$SGPA = \sum_{i=1}^{n}(C_i G_i)/\sum_{i=1}^{n} C_i$$

where, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course and n represent the number of courses in which a student is registered in the concerned semester.

$$CGPA = \sum_{j=1}^{m}(C_j S_j)/\sum_{j=1}^{m} C_j$$

where, S_j is the SGPA of the j^{th} semester and C_j is the total number of credits upto the semester and m represent the number of semesters completed in which a student registered upto the semester.

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

15.0 ILLUSTRATION OF COMPUTATION OF SGPA AND CGPA

15.1 Illustration for SGPA

Course Name	Course Credits	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	3	A	8	3 x 8 = 24
Course 2	4	B+	7	4 x 7 = 28
Course 3	3	B	6	3 x 6 = 18
Course 4	3	S	10	3 x 10 = 30
Course 5	3	C	5	3 x 5 = 15
Course 6	4	B	6	4 x 6 = 24
	20			**139**

$$Thus,\ SGPA = 139/20 = 6.95$$

15.2 Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit: 20 SGPA: 6.9	Credit: 22 SGPA: 7.8	Credit: 25 SGPA: 5.6	Credit: 26 SGPA: 6.0
Semester 5	**Semester 6**		
Credit: 26 SGPA: 6.3	Credit: 25 SGPA: 8.0		

$$Thus,\ CGPA = \frac{20x6.9\ +\ 22x7.8\ +\ 25x5.6\ +\ 26x6.0\ +\ 26x6.3\ +\ 25x8.0}{144} = 6.73$$

16.0 PHOTOCOPY / REVALUATION

A student, who seeks the re-evaluation of the answer script, is directed to apply for the photocopy of his/her semester examination answer paper(s) in the theory course(s), within 5 working days from the declaration of results in the prescribed format with prescribed fee to the Controller of Examinations through the Head of the department. On receiving the photocopy, the student can consult with a competent member of faculty and seek the opinion for revaluation. Based on the recommendations, the student can register for the revaluation with prescribed fee. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses.

17.0 PROMOTION POLICIES

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no. 10.

17.1 For students admitted into B.Tech (Regular) program

17.1.1 A student will not be promoted from II semester to III semester unless s/he fulfills the academic requirement of securing 40% of credits (17) from I and II semesters examinations, whether or not the candidate takes the examinations.

17.1.2 A student will not be promoted from IV semester to V semester unless s/he fulfills the academic requirement of securing 40% of credits (35) upto IV semester from all the examinations, whether or not the candidate takes the examinations.

17.1.3 A student will not be promoted from VI semester to VII semester unless s/he fulfills the academic requirement of securing 40% of credits (55) upto VI semester from all the examinations, whether or not the candidate takes the examinations.

17.1.4 A student shall register for all the 180 credits and earn all the 180 credits. Marks obtained in all the 180 credits shall be considered for the award of the Grade.

17.2 For students admitted into B.Tech (lateral entry students)

17.2.1 A student will not be promoted from IV semester to V semester unless s/he fulfills the academic requirement of securing 40% of credits(18) upto IV semester from all the examinations, whether or not the candidate takes the examinations.

17.2.2 A student will not be promoted from VI semester to VII semester unless s/he fulfills the academic requirement of securing 40% of credits(37) upto VI semester from all the examinations, whether or not the candidate takes the examinations.

17.2.3 A student shall register for all the 138 credits and earn all the 138 credits. Marks obtained in all the 138 credits shall be considered for the award of the Grade.

18.0 GRADUATION REQUIREMENTS

The following academic requirements shall be met for the award of the B.Tech degree.

18.1 Student shall register and acquire minimum attendance in all courses and secure 180credits for regular program and 138 credits for lateral entry program.

18.2 A student of a regular program, who fails to earn 180 credits within eight consecutive academic years from the year of his/her admission with a minimum CGPA of 4.0, shall forfeit his/her degree and his/her admission stands cancelled.

18.3 A student of a lateral entry program who fails to earn 138 credits within six consecutive academic years from the year of his/her admission with a minimum CGPA of 4.0, shall forfeit his/her degree and his/her admission stands cancelled.

19.0 BETTERMENT OF MARKS IN THE COURSES ALREADY PASSED

Students who clear all the courses in their first attempt and wish to improve their CGPA shall register and appear for betterment of marks for one course of any theory courses within a periodof subsequent two semesters. The improved marks shall be considered for classification / distinction but not for ranking. If there is no improvement in marks, there shall not be any change in the original marks already awarded.

20.0 AWARD OF DEGREE

20.1 Classification of degree will be as follows:

CGPA $\geq$ 7.5	CGPA $\geq$ 6.5 and < 7.5	CGPA $\geq$ 5.0 and < 6.5	CGPA $\geq$ 4.0 and < 5.0	CGPA < 4.0
First Class with Distinction	**First Class**	**Second Class**	**Pass Class**	**Fail**

20.2 In order to extend the benefit to the students with one/two backlogs after either VI semester or VIII semester, GRAFTING option is provided to the students enabling their placements and fulfilling graduation requirements. Following are the guidelines for the Grafting:

a. Grafting will be done among the courses within the semester shall draw a maximum of 7 marks from the any one of the cleared courses in the semester and will be graftedto the failed course in the same semester.

b. Students shall be given a choice of grafting only once in the 4 years program, either after VI semester (Option #1) or after VIII semester (Option #2).

c. Option#1: Applicable to students who have maximum of TWO theory courses in V and / or VI semesters.

   Option#2:Applicable to students who have maximum of TWO theory courses in VII and / or VIII semesters.

d. Eligibility for grafting:

   i. Prior to the conduct of the supplementary examination after the declaration of VIor VIII semester results.

   ii. S/he must appear in all regular or supplementary examinations as per the provisions laid down in regulations for the courses s/he appeals for grafting.

   iii. The marks obtained by her/him in latest attempt shall be taken into account for grafting ofmarks in the failed course(s).

20.3 Student, who clears all the courses up to VII semester, shall have a chance to appear for Quick Supplementary Examination to clear the failed courses of VIII semester.

20.4 By the end of VI semester, all the students (regular and lateral entry students) shall complete one of the audit course and mandatory course with acceptable performance.

All the candidates who register for the semester end examination will be issued grade sheet by theinstitute. Apart from the semester wise grade sheet, the institute will issue the provisional certificate and consolidated grade sheet subject to the fulfillment of all the academic requirements.

21.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

21.1 A candidate is normally not permitted to break the study. However, if a candidate intends to temporarily discontinue the program in the middle for valid reasons (such as accidentor hospitalization due to prolonged ill health) and to rejoin the program after the break from the commencement of the respective semester as and when it is offered , s/he shall apply to the Principal in advance. Such application shall be submitted before the commencement of the semester in question and forwarded through the Head of the department stating the reasons for such withdrawal together with supporting documents and endorsement of his / her parent / guardian.

21.2 The institute shall examine such an application and if it finds the case to be genuine, it may permit the student to rejoin. Such permission is accorded only to those who do not have any outstanding dues like tuition fee etc.

21.3 The total period for completion of the program reckoned from the commencement of the semester to which the candidate was first admitted shall not exceed the maximum period specified in clause 18.0. The maximum period includes the break period.

22.0 TERMINATION FROM THE PROGRAM

The admission of a student to the program may be terminated and the student is asked to leave theinstitute in the following circumstances:

a. The student fails to satisfy the requirements of the program within the maximum periodstipulated for that program.

b. A student shall not be permitted to study any semester more than three times during theentire Program of study.

c. The student fails to satisfy the norms of discipline specified by the institute from time totime.

23.0 WITH-HOLDING OF RESULTS

If the candidate has not paid any dues to the institute / if any case of indiscipline / malpractice is pending against him, the results of the candidate will be withheld. The issue of the degree is liableto be withheld in such cases.

24.0 GRADUATION DAY

The institute shall have its own annual Graduation Day for the award of Degrees to students completing the prescribed academic requirements in each case, in consultation with the University and by following the provisions in the Statute. The college shall institute prizes and medals to meritorious students and award them annually at the Graduation Day. This will greatly encourage the students to strive for excellence in their academic work.

25.0 DISCIPLINE

Every student is required to observe discipline and decorum both inside and outside the institute and not to indulge in any activity which will tend to bring down the honor of the institute. If a student indulges in malpractice in any of the theory / practical examination, continuous assessment examinations he/she shall be liable for punitive action as prescribed by the Institute from time to time.

26.0 GRIEVANCE REDRESSAL COMMITTEE

The institute shall form a Grievance Redressal Committee for each course in each department with the Course Teacher and the HOD as the members. This Committee shall solve all grievancesrelated to the course under consideration.

27.0 TRANSITORY REGULATIONS

A candidate, who is detained or discontinued in a semester, on readmission shall be required to doall the courses in the curriculum prescribed for the batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed such courses in the earlier semester(s) s/he was originally admitted into and substitute subjects are offered in place of them as decided by the Board of Studies. However, the decision of the Board of Studies will be final.

a) Four Year B.Tech Regular course:

A student who is following Jawaharlal Nehru Technological University (JNTUA) curriculum and detained due to shortage of attendance at the end of the first semester shall join the autonomous batch of first semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUA curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester or at the subsequent semesters shall join with theautonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses will be offered in place of them as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUA for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUA regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomouspattern.

b) Three Year B.Tech program under Lateral Entry Scheme:

A student who is following JNTUA curriculum and detained due to shortage of attendance at the end of the first semester of second year shall join the autonomous batch of third semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with Lateral Entry regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUA curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester of second year or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the awardof degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses are offered in place of them as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUA for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUA regulations and the credits prescribed forthe semester in which a candidate seeks readmission and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

c) Transfer candidates (from non-autonomous college affiliated to JNTUA):

A student who is following JNTUA curriculum, transferred from other college to this institutein third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses are offered in their place as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUA for the award of degree. The total number of credits to be secured for the award of the degree will be the sum of the credits upto previous semester under JNTUA regulations and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

d) Transfer candidates (from an autonomous college affiliated to JNTUA):
A student who has secured the required credits upto previous semesters as per the regulations of other autonomous institutions shall also be permitted to be transferred to this institute. A student who is transferred from the other autonomous colleges to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The total number of credits to be secured for the award of the degree will be the sum of the credits upto previous semester as per the regulations of the college from which he is transferred and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

28.0 REVISION OF REGULATIONS AND CURRICULUM

The Institute from time to time may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary and on approval by the Academic Council and the Governing Body shall come into force and shall be binding on the students, faculty, staff, all authorities of the Institute and others concerned.

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

B.TECH - PROGRAM OUTCOMES (POs)

Upon the successful completion of Programme, the graduate shall be able to

PO-1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems (**Engineering Knowledge**).

PO-2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences **(Problem Analysis).**

PO-3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations **(Design/Development of Solutions).**

PO-4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions **(ConductInvestigations of Complex Problems).**

PO-5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of thelimitations **(Modern Tool Usage).**

PO-6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice **(The Engineer and Society).**

PO-7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development **(Environment and Sustainability).**

PO-8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **(Ethics).**

PO-9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **(Individual and Team Work).**

PO-10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions **(Communication).**

PO-11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in ateam, to manage projects and in multidisciplinary environments.

PO-12: Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change **(Life-long learning).**

PROGRAM SPECIFIC OUTCOMES (PSOs)

Upon the successful completion of Programme, the graduate shall be able to

PSO1: Apply the acquired knowledge to analyze and design the products in the fields of Communications, Signal Processing, VLSI and Embedded Systems.

PSO2: Contribute for the betterment of sustainable organization, environment and society through effective leadership traits and technological advancements.

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

1. **Who grants Autonomy? UGC, Govt., AICTE or University**
   In case of Colleges affiliated to a university and where statutes for grant of autonomy are ready, it is the respective University that finally grants autonomy but only after concurrence from the respective state Government as well as UGC. The State Government has its own powers to grant autonomy directly to Govt. and Govt. aided Colleges.

2. **Shall CREC award its own Degree?**
   No. Degree will be awarded by Jawaharlal Nehru Technological University, Anantapuramu with a mention of the name CREC on the Degree Certificate.

3. **What is the difference between a Deemed University and an Autonomy College?**
   A Deemed University is fully autonomous to the extent of awarding its own Degree. A Deemed University is usually a Non-Affiliating version of a University and has similar responsibilities likeany University. An Autonomous College enjoys Academic Autonomy alone. The University to which an autonomous college is affiliated will have checks on the performance of the autonomous college.

4. **How will the Foreign Universities or other stake – holders know that we are an Autonomous College?**
   Autonomous status, once declared, shall be accepted by all the stake holders. The Govt. of Andhra Pradesh mentions autonomous status during the First Year admission procedure. Foreign Universities and Indian Industries will know our status through our website.

5. **What is the change of Status for Students and Teachers if we become Autonomous?**
   An autonomous college carries a prestigious image. Autonomy is actually earned out of our continuedpast efforts on academic performances, our capability of self- governance and the kind of quality education we offer.

6. **Who will check whether the academic standard is maintained / improved after Autonomy? Howwill it be checked?**
   There is a built in mechanism in the autonomous working for this purpose. An Internal Committee called Academic Programme Evaluation Committee, which will keep a watch on the academics and keep its reports and recommendations every year. In addition the highest academic council also supervises the academic matters. The standards of our question papers, the regularity of academic calendar, attendance of students, speed and transparency of result declaration and such other parameters are involved in this process.

7. **Will the students of CREC as an Autonomous College qualify for University Medals and Prizes for academic excellence?**
   No. CREC has instituted its own awards, medals, etc. for the academic performance of the students. However for all other events like sports, cultural on co-curricular organized by the University the students shall qualify.

8. **Can CREC have its own Convocation?**
   No. Since the University awards the Degree the Convocation will be that of the University, but there will be Graduation Day at CREC.

9. **Can CREC give a provisional degree certificate?**
   Since the examinations are conducted by CREC and the results are also declared by CREC, the college sends a list of successful candidates with their final Grades and Grade Point Averages including CGPA to the University. Therefore with the prior permission of the University the college will be entitled to give the provisional certificate.

10. **Will Academic Autonomy make a positive impact on the Placements or Employability?**
    Certainly. The number of students qualifying for placement interviews is expected to improve, due to rigorous and repetitive classroom teaching and continuous assessment. Also the

autonomous status ismore responsive to the needs of the industry. As a result therefore, there will be a lot of scope forindustry oriented skill development built-in into the system. The graduates from an autonomouscollege will therefore represent better employability.

11 What is the proportion of Internal and External Assessment as an Autonomous College?
Presently, it is 70 % external and 30% internal. As the autonomy matures the internal assessmentcomponent shall be increased at the cost of external assessment.

12 Is it possible to have complete Internal Assessment for Theory or Practicals?
Yes indeed. We define our own system. We have the freedom to keep the proportion of external andinternal assessment component to choose.

13 Why Credit based Grade System?
The credit based grade system is an accepted standard of academic performance the world over in all Universities. The acceptability of our graduates in the world market shall improve.

14 What exactly is a Credit based Grade System?
The credit based grade system defines a much better statistical way of judging the academic performance. One Lecture Hour per week of Teaching Learning process is assigned One Credit. One hour of laboratory work is assigned half credit. Letter Grades like S,A+,A, B+,B,C,F etc. are assignedfor a Range of Marks. (e.g. 90% and above is S, 80 to 89 % could be A+ etc.) in Absolute Grading System while grades are awarded by statistical analysis in relative grading system. We thus dispense with sharp numerical boundaries. Secondly, the grades are associated with defined Grade Points inthe scale of 1 to 10. Weighted Average of Grade Points is also defined Grade Points are weighted by Credits and averaged over total credits in a Semester. This process is repeated for all Semesters and a CGPA defines the Final Academic Performance

15 What are the norms for the number of Credits per Semester and total number of Credits forUG/PG programme?
These norms are usually defined by UGC or AICTE. Usually around 25 Credits per semester is the accepted norm.

16 What is a Semester Grade Point Average (SGPA)?
The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the semester.

$$SGPA = \sum_{i=1}^{n}(C_i\, G_i)/\sum_{i=1}^{n}C_i$$

Where, C_i is the number of credits of the i^{th} course and $G_i$is the grade point scored by the student inthe i^{th} course and i represent the number of courses in which a student registered in the concerned semester. SGPA is rounded to two decimal places.

17 What is a Cumulative Grade Point Average (CGPA)?
An up-to-date assessment of overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is weighted average of the grade points obtained in all the courses registered by the students since he entered the Institute.

$$CGPA = \sum_{j=1}^{m}(C_j\, S_j)/\sum_{j=1}^{m}C_j$$

Where, S_j is the SGPA of the j^{th} semester and $C_j$is the total number of credits upto the semester and $m$represent the number of semesters completed in which a student registered upto the semester. CGPA is rounded to two decimal places.

18 Is there any Software available for calculating Grade point averages and converting the same into Grades?
Yes, the institute has its own MIS software for calculation of SGPA, CGPA, etc.

19 Will the teacher be required to do the job of calculating SGPAs etc. and convert the same intoGrades?

No. The teacher has to give marks obtained out of whatever maximum marks as it is. Rest is all done by the computer.

20 Will there be any Revaluation or Re-Examination System?

No. There will double valuation of answer scripts. There will be a makeup Examination after a reasonable preparation time after the End Semester Examination for specific cases mentioned in the Rules and Regulations. In addition to this, there shall be a „summer term" (compressed term) followedby the End Semester Exam, to save the precious time of students.

21 How fast Syllabi can be and should be changed?

Autonomy allows us the freedom to change the syllabi as often as we need.

22 Will the Degree be awarded on the basis of only final year performance?

No. The CGPA will reflect the average performance of all the semester taken together.

23 What are Statutory Academic Bodies?

Governing Body, Academic Council, Examination Committee and Board of Studies are the different statutory bodies. The participation of external members in every body is compulsory. The institute has nominated professors from IIT, NIT, University (the officers of the rank of Pro-vice Chancellor, Deans and Controller of Examinations) and also the reputed industrialist and industry experts on thesebodies.

24 Who takes Decisions on Academic matters?

The Governing Body of institute is the top academic body and is responsible for all the academic decisions. Many decisions are also taken at the lower level like Boards of Studies. Decisions taken at the Board of Studies level are to be ratified at the Academic Council and Governing Body.

25 What is the role of Examination committee?

The Examinations Committee is responsible for the smooth conduct of internal, End Semester and makeup Examinations. All matters involving the conduct of examinations spot valuations, tabulationspreparation of Grade Cards etc, fall within the duties of the Examination Committee.

26 Is there any mechanism for Grievance Redressal?

The institute has grievance redressal committee, headed by Dean - Student affairs and Dean - IQAC.

27 How many attempts are permitted for obtaining a Degree?

All such matters are defined in Rules & Regulation

28 Who declares the result?

The result declaration process is also defined. After tabulation work wherein the SGPA, CGPA and final Grades are ready, the entire result is reviewed by the Moderation Committee. Any unusual deviations or gross level discrepancies are deliberated and removed. The entire result is discussed in the Examinations and Result Committee for its approval. The result is then declared on the institute notice boards as well put on the web site and Students Corner. It is eventually sent to the University.

29 Who will keep the Student Academic Records, University or CREC?

It is the responsibility of the Dean, Academics of the Autonomous College to keep and preserve allthe records.

30 What is our relationship with the JNT University?

We remain an affiliated college of the JNT University. The University has the right to nominate its members on the academic bodies of the college.

31 Shall we require University approval if we want to start any New Courses?

Yes, It is expected that approvals or such other matters from an autonomous college will receive priority.

32 Shall we get autonomy for PG and Doctoral Programmes also?

Yes, presently our PG programmes also enjoying autonomous status.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

S.No	**Nature of Malpractices/Improper conduct**	**Punishment**
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Controller of Examinations.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and

	the examination.	project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Controller of Examinations /Additional Controller of Examinations/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the COE or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the COE or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the Institute premises or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.

9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

CHADALAWADA RAMANAMMA ENGINEERING COLLEGE
(AUTONOMOUS)
COURSE STRUCTURE

B.Tech I Year I Semester

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA52101	Functional English	HS	Foundation	3		-	3	30	70	100
17CA54101	Mathematics -I	BS	Foundation	2	2	-	3	30	70	100
17CA51101	Engineering Chemistry	BS	Foundation	3	-	-	3	30	70	100
17CA51102	Environmental Studies	HS	Foundation	3	-	-	3	30	70	100
17CA05101	Computer Programming	ES	Foundation	2	2	-	3	30	70	100
17CA50101	Foundation of Yoga (Audit Course)	AC	Perspective	-	-	-	-	-	-	-
PRACTICAL										
17CA52102	English Language Communications Laboratory	HS	Foundation	-	-	4	2	30	70	100
17CA51103	Engineering Chemistry Laboratory	BS	Foundation	-	-	4	2	30	70	100
17CA05102	Computer Programming Laboratory	ES	Foundation	-	-	4	2	30	70	100
TOTAL				**13**	**04**	**12**	**21**	**240**	**560**	**800**

B.Tech I Year II Semester

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA52201	English for Professional Communication	HS	Foundation	3	-	-	3	30	70	100
17CA54201	Mathematics –II	BS	Foundation	2	2	-	3	30	70	100
17CA55101	Engineering Physics	BS	Foundation	3	-	-	3	30	70	100
17CA03101	Engineering Drawing	ES	Foundation	1	-	4	3	30	70	100
17CA02203	Network Analysis	ES	Foundation	2	2	-	3	30	70	100
17CA50201	Clinical Physiology(Audit Course)	AC	Perspective	-	-	-	-	-	-	-
PRACTICAL										
17CA03203	Engineering & I.T. Workshop	ES	Foundation	-	-	4	2	30	70	100
17CA55102	Engineering Physics Laboratory	BS	Foundation	-	-	4	2	30	70	100
17CA02204	Network Analysis Laboratory	ES	Foundation	-	-	4	2	30	70	100
TOTAL				**11**	**04**	**16**	**21**	**240**	**560**	**800**

B.Tech II Year I Semester

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA54303	Complex analysis and Partial Differential equations	BS	Core	2	2	-	3	30	70	100
17CA04301	Electronic Devices & Circuits	PC	Core	3	-	-	3	30	70	100
17CA04302	Switching Theory and Logic Design	PC	Foundation	3	-	-	3	30	70	100
17CA04303	Probability Theory & Stochastic Processes	PC	Foundation	2	2	-	3	30	70	100
17CA04304	Signals and Systems	PC	Core	2	2	-	3	30	70	100
17CA02306	Basic Electrical Technology	ES	Foundation	3	-	-	3	30	70	100
PRACTICAL										
17CA04305	Electronic Devices and Circuits Laboratory	PC	Core	-	-	4	2	30	70	100
17CA02307	Electrical Technology and Simulation Laboratory	PC	Core	-	-	4	2	30	70	100
17CA56301	Mandatory Course	MC	Perspective	1	0	0	1	-	100	100
TOTAL				**16**	**06**	**08**	**23**	**240**	**660**	**900**

B.Tech II Year II Semester

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA04401	Electronic Circuit Analysis	PC	Core	2	2	-	3	30	70	100
17CA04402	Analog Communications	PC	Core	3	-	-	3	30	70	100
17CA04403	Linear IC Application	PC	Core	3	-	-	3	30	70	100
17CA02501	Control Systems	PC	Core	2	2	-	3	30	70	100
17CA04404	Electromagnetic Theory & Transmission Lines	PC	Core	2	2	-	3	30	70	100
17CA53301	Managerial Economics and Financial Analysis	HS	Foundation	3	-	-	3	30	70	100
PRACTICAL										
17CA04405	Electronic Circuit Analysis Lab	PC	Core	-	-	4	2	30	70	100
17CA04406	Analog Communications Lab	PC	Core	-	-	4	2	30	70	100
17CA57401-8	Value Added Course-I	AC	Perspective	-	-	-	1	-	100	100
TOTAL				**15**	**06**	**08**	**23**	**240**	**660**	**900**

B.Tech III Year I Semester

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA04501	Digital Communication systems	PC	Core	3	-	-	3	30	70	100
17CA04502	Digital System Design	PC	Core	2	2	-	3	30	70	100
17CA04503	Antennas & Wave Propagation	PC	Core	2	2	-	3	30	70	100
17CA04504	Electronic Measurements and Instrumentation	PC	Core	3	-	-	3	30	70	100
17CA05403	Computer Organization	PC	Core	3	-	-	3	30	70	100
17CA04505 to 17CA04508	**Professional Elective – I**	PE	Elective	3	-	-	3	30	70	100
PRACTICAL										
17CA04509	Linear & Digital IC Applications Lab	PC	Core	-	-	4	2	30	70	100
17CA04510	Digital Communication lab	PC	Core	-	-	4	2	30	70	100
17CA52501	Soft Skills Lab	HS	Foundation	-	-	4	2	30	70	100
TOTAL				**16**	**04**	**12**	**24**	**270**	**630**	**900**

B.Tech III Year II Semester

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA04601	Digital Signal Processing	PC	Core	2	2	-	3	30	70	100
17CA04602	VLSI System Design	PC	Core	2	2	-	3	30	70	100
17CA04603	Microwave Engineering	PC	Core	2	2	-	3	30	70	100
17CA04604	Microprocessors & Microcontrollers	PC	Core	3	-	-	3	30	70	100
17CA04605 to 17CA04608	**Professional Elective - II**	PE	Elective	3	-	-	3	30	70	100
	Open Elective	OE	Elective	3	-	-	3	30	70	100
PRACTICAL										
17CA04609	Digital Signal Processing lab	PC	Core	-	-	4	2	30	70	100
17CA04610	Microprocessors & Microcontrollers Lab	PC	Core	-	-	4	2	30	70	100
17CA04611	Mini Project	-	Skill	-	-	4	2	30	70	100
TOTAL				**15**	**06**	**12**	**24**	**270**	**630**	**900**

B.Tech IV Year I Semester (NON FSI)

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA04701	Embedded System	PC	Core	2	2	-	3	30	70	100
17CA04702	Optical Communications	PC	Core	2	2	-	3	30	70	100
17CA04703 to 17CA04706	**Professional Elective - III**	PE	Elective	3	-	-	3	30	70	100
17CA04707 To 17CA04709	**MOOC Course – I**	PC	MOOC	3	-	-	3	30	70	100
17CA04710 to 17CA04712	**MOOC Course – II**	PC	MOOC	3	-	-	3	30	70	100
PRACTICAL										
17CA04713	Microwave & Optical Communications Lab	PC	Core	-	-	4	2	30	70	100
17CA04714	VLSI & Embedded Systems lab	PC	Core	-	-	4	2	30	70	100
17CA04715	**Technical Seminar**	-	Skill	-	-	-	2	50	50	100
17CA57701-8	Value Added Course – II	AC	Skill	3	-	-	1	-	100	100
TOTAL				**16**	**04**	**08**	**22**	**260**	**640**	**900**

B.Tech IV Year I Semester (FSI)

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA04716	INTERNSHIP	-	Core	-	-	-	16	60	140	200
17CA04707 to 17CA04709	**MOOC Course – I**	-	MOOC	3	-	-	3	30	70	100
17CA04710 to 17CA04712	**MOOC Course – II**	-	MOOC	3	-	-	3	30	70	100
TOTAL				**06**	**-**	**-**	**22**	**120**	**280**	**400**

B.Tech IV Year II Semester (NON FSI)

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA04801	Digital Image Processing	PC	Core	2	2	-	3	30	70	100
17CA04802 to 17CA04805	**Professional Elective – IV**	PE	Core	3	-	-	3	30	70	100
17CA04806	Comprehensive Examination	-	Skills	-	-	-	1	-	100	100
17CA04807	Project Work	-	Core	-	-	4	15	60	140	200
TOTAL				**05**	**02**	**04**	**22**	**120**	**380**	**500**

B.Tech IV Year II Semester (FSI)

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
17CA04701	Embedded System	PC	Core	2	2	-	3	30	70	100
17CA04702	Optical Communications	PC	Core	2	2	-	3	30	70	100
17CA04801	Digital Image Processing	PC	Core	2	2	-	3	30	70	100
17CA04703 to 17CA04706	**Professional Elective - III**	PE	Elective	3	-	-	3	30	70	100
17CA04802 to 17CA04805	**Professional Elective - IV**	PE	Elective	3	-	-	3	30	70	100
PRACTICAL										
17CA04713	Microwave & Optical Communications Lab	PC	Core	-	-	4	2	30	70	100
17CA04714	VLSI & Embedded systems lab	PC	Core	-	-	4	2	30	70	100
17CA04715	Technical Seminar	-	Skills			-	2	50	50	100
17CA04806	Comprehensive Examination	-	Skills	-	-	-	1	-	100	100
TOTAL				**12**	**06**	**08**	**22**	**260**	**640**	**900**

PROFESSIONAL ELECTIVE - I

Course Code	Course Title
17CA04505	TV Engineering
17CA04506	Artificial Neural Networks and Fuzzy Logic
17CA04507	Telecommunication Switching Theory And Applications
17CA04508	Industrial Electronics

PROFESSIONAL ELECTIVE -II

Course Code	Course Title
17CA04605	Satellite Communication
17CA04606	Field Programmable Gate Array (FPGA) Design
17CA04607	Data Communication & Networking
17CA04608	MATLAB Programming

PROFESSIONAL ELECTIVE - III

Course Code	Course Title
17CA04703	Radar Systems & Navigational Aids
17CA04704	Digital design Through Verilog
17CA04705	Adaptive Signal Processing
17CA04706	Wireless Communications And Networks

PROFESSIONAL ELECTIVE – IV

Course Code	Course Title
17CA04802	Wireless Sensor Networks And Architecture
17CA04803	Advanced Digital Signal Processing
17CA04804	Real Time Systems
17CA04805	Bio Medical Instrumentation

MOOC COURSE-I

Course Code	Course Title
17CA04707	Pattern Recognition & Applications
17CA04708	RF Integrated Circuits
17CA04709	Information Security

MOOC COURSE-II

Course Code	Course Title
17CA04710	MEMS & Microsystems
17CA04711	Advanced 3G & 4G Communication
17CA04712	Linux Programming & Scripting

OPEN ELECTIVE

S.No	Course Code	Course Title
1	17CA53601	Entrepreneurship
2	17CA02608	Renewable energy sources
3	17CA04506	Artificial Neural networks and Fuzzy Logic
4	17CA05405	JAVA Programming
5	17CA04701	Embedded Systems

6	17CA03802	Mechatronics
7	17CA05612	Information Security
8	17CA03609	Operations Research
9	17CA02609	Energy from Waste
10	17CA53602	Research Methodologies
11	17CA04801	Digital Image Processing
12	17CA05404	Data Base Management Systems
13	17CA052601	Soft Skills-II

AUDIT COURSE

S.No	Course Code	Course Title
1	17CA50101	Foundation of Yoga
2	17CA50201	Clinical Psychology

MANDATORY COURSE

S.No	Course Code	Course Title
1	17CA56301	Human Values and Professional Ethics

VALUE ADDED COURSE – I

S. No	Course Code	Course Title
1.	17CA57401	MATLAB
2.	17CA57402	PSPICE
3.	17CA57403	Lab view Certified Developer Course
4.	17CA57404	Embedded Systems
5.	17CA57405	Adriano Micro Controller
6.	17CA57406	Microsoft Certified Engineer

VALUE ADDED COURSE – II

S. No.	Course Code	Course Title
1.	17CA57701	CAD
2.	17CA57702	Introduction to SCADA Systems
3.	17CA57703	Advanced Digital Processing Using MATLAB
4.	17CA57704	Internet of Things
5.	17CA57705	CISCO Certified Network Engineer
6.	17CA57706	Cyber Security

I SEMESTER
FUNCTIONAL ENGLISH

B. Tech I Year I Semester								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
17CA52101	Foundation	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		3	**-**	**-**	**3**	**30**	**70**	**100**
Contact Classes:51	**Tutorial Classes: - Nil**		**Practical Classes: Nil**			**Total Classes:51**		

Course Objectives:
The course should enable the students to :

I. Communication in an intelligible English accent and pronunciation.
II. Introduce students‟ elements of Grammar and Composition of English language.
III. Maintain linguistic competence through training in vocabulary, sentence structures.

UNIT-I	**EMERGING TECHNOLOGIES**	**Classes:10**

TEXT: Solar Thermal Power-Cloud Computing-Nano Technology
GRAMMAR: Introduction to Parts of Speech, Types of Nouns and Pronouns
VOCABULARY: Synonyms and Antonyms

UNIT-II	**SPACE TREK**	**Classes:10**

TEXT: Hubble Telescope-Chandrayan II-Anusat-Living Quarters-Tourism
GRAMMAR: Adjectives-Kinds of verbs and adverbs
VOCABULARY: Affixes

UNIT-III	**GLOBAL ISSUES**	**Classes:10**

TEXT: Child labour-Food crises-Genetic modifications-E waste-Assistive Technology
GRAMMAR: Articles, Prepositions
VOCABULARY: Homographs, Homophones, Homonyms

UNIT-IV	**MEDIA MATTERS**	**Classes:10**

TEXT: History of Media-Language and media-Mile stone in media-Manipulation by media-Entertainment media-Interviews
GRAMMAR: Tenses
COMPOSITION: Official letter

UNIT-V	**MOKSHAGUNDAM VISVESVARAYA**	**Classes:11**

TEXT: Birth-Childhood-Education-Achievements-Awards-Diwan of Mysore
GRAMMAR: Modals, Subject – Verb Agreement
COMPOSITION: Paragraph writing and Essay writing

Text Books:
1.MIND SCAPES- ORIENT BLACK SWAN 2014
2. INSPIRING LIVES, MARUTHI PUBLICATIONS 2010

Reference Books:
1. English Grammar in use -Raymond Murphy.
2. Word power made Easy- Norman Lewis.

Web References:
1.https://www.edufind.com
2.https://www.myenglishpages.com
3. https://www. onestopenglish.com

E-Text Books:
1. https://www.e-bookboon.com/en/communication-ebooks-zip.
2. https://www. learning englishvocabularygrammar.com/filesidiomsandphraseswith meaningsandexamplespdf.pdf

COURSE OUTCOMES	
CO1	Demonstrate to overcome the barriers in communication process using non-verbal language suitable to different situations in professional life to become effective technical communicator.
CO2	Apply the knowledge on social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information.
CO3	Exhibit the knowledge on cohesive devices for better conversation in informal discussions and speak clearly on a specific topic using suitable discourse markers.
CO4	Apply the concepts of Entrepreneurship Skills and Analyze discourse markers to speak clearly on a specific topic in informal discussions and create coherent paragraph writing.
CO5	Apply the Knowledge to recognize the need of ability to engage in independent and life-long learning communication effectively in English over speech.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	2	3	-	-	3	3
CO2	3	2	-	-	-	-	-	-	3	3	-	-	3	2
CO3	3	-	-	-	-	-	-	-	2	3	-	-	3	3
CO4	3	2	-	-	-	-	-	-	3	3	-	-	2	3
CO5	3	-	-	-	-	-	-	-	-	3	-	2	3	3
CO*	**3**	**2**	-	-	-	-	-	-	**2.5**	**3**	-	**2**	**2.8**	**2.8**

MATHEMATICS – I

<table>
<tr><td colspan="10">B. Tech I Year I Semester</td></tr>
<tr><td rowspan="2">Course code</td><td rowspan="2">category</td><td colspan="3">Hours/week</td><td>credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td rowspan="2">17CA54101</td><td rowspan="2">Foundation</td><td>2</td><td>2</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:34</td><td>Tutorial Classes:34</td><td colspan="3">Practical Classes: NIL</td><td colspan="4">Total Classes:68</td></tr>
</table>

Course Objectives:

The course should enable the students to :

i. Analyze and solve linear system of equations by using elementary transformation
ii. Apply Differential Equations on engineering applications.

UNIT-I	**MATRICES**	**Classes:14**

Real Matrices: Symmetric, Skew-Symmetric and Orthogonal matrices and its properties. Elementary transformations-Rank: Echelon, Normal, PAQ forms. Finding inverse of a matrix using Gauss Jordan method. System of Linear equations- Cramer‟s rule , LU Decomposition and Gauss-Seidal method.

UNIT-II	**LINEAR TRANSFORMATIONS**	**Classes:14**

Cayley-Hamilton theorem-Finding inverse and powers of a matrix. Linear transformation-Eigen values and Eigen vectors of a matrix and its properties. Diagonalisation of a matrix-Quadratic Forms-Reduction of quadratic form to canonical form by Orthogonalisation, Diagonalisation and Lagrange‟s reduction.

UNIT-III	**DIFFERNENTION AND ITS APPLICATIONS**	**Classes:14**

Mean value theorems - Rolle‟s theorem, Lagrange‟s theorem and Cauchy‟**s** theorem (without proof) - Functions of several variables-partial differentiation, Jacobian transformation, Functional dependence, maxima and minima of functions of two variables without constraints and with constraints. Method of Lagrangian multipliers.

UNIT-IV	**DIFFERENTIAL EQUATIONS OF FIRST ORDER AND ITS APPLICATIONS**	**Classes:13**

Solution of first order linear differential equations by variable seperable, Exact, Non-Exact, Linear equations, Bernoulli‟s equation- Applications : Orthogonal trajectories, Newton‟s law of cooling, simple electric circuits

UNIT-V	**HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS AND APPLICATIONS**	**Classes:13**

Linear differential equations of second and higher order with constant coefficients-Non-Homogeneous terms of the type $f(x)=e^{ax}$, sinax , cosax , x^n , $e^{ax}.V(X)$, $X^n.V(x)$, method of variation of parameters. Applications of linear differential equations electrical oscillatory circuits and deflection of beams.

Text Books:

1. ” Advanced engineering mathematics”,by E. Kreyszig ,John wiley & Son‟s publishers, New Edition.
2. ”Higher engineering mathematics”, B. S. Grewal, Khanna publishers, New edition.
3. ”Engineering mathematics – I”,by E. Rukmangadhachari and E. Keshavareddy Pearson publisher.

Reference Books:

1. “Engineering mathematics volume-1 “,by T. K. V. Iyengar, B. Krishna Gandhi, S. Ranganathan and M. V. S. S.N. Prasad, S. Chand Publications.
2. “Engineering Mathematics volume-II “,by E. Rukmangadhachari, Pearson publishers.
3. “Higher Engineering Mathematics”, by B. V. Ramana, Mc Graw Hill publishers.

Web References:

1. https://www.efunda.com/math/math_home/math.cfm
2. https://www.ocw.mit.edu/resources/#mathematics.

COURSE OUTCOMES	
CO1	Analyze the system of Linear equations and matrices.
CO2	Analyze the Eigen values, Eigen vectors of a matrix and the nature of the Quadratic forms.
CO3	Apply Mean value theorem, Jacobian, maxima & minima for functions of single, two and three variables
CO4	Solve ODE of First order and First degree.
CO5	Demonstrate the basic knowledge and solve first and second order ODE in the field of engineering course.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

ENGINEERING CHEMISTRY

<table>
<tr><td colspan="12">B. Tech I Year I Semester</td></tr>
<tr><td>Course code</td><td>category</td><td colspan="3">Hours/week</td><td>credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">17CA51101</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:51</td><td colspan="2">Tutorial Classes:-</td><td colspan="3">Practical Classes: Nil</td><td colspan="3">Total Classes:51</td></tr>
</table>

Course Objectives:

The course should enable the students to :

I. The Engineering Chemistry course for undergraduate students is framed to strengthen the fundamentals of chemistry and then build an interface of theoretical concepts with their industrial/engineering applications.

II. The course main aim is to impart in-depth knowledge of the subject and highlight the role of chemistry in the field of engineering.

III. The lucid explanation of the topics will help students understand the fundamental concepts and apply them to design engineering materials and solve problems related to them. An attempt has been made to logically correlate the topic with its application.

IV. The extension of fundamentals of electrochemistry to energy storage devices such as commercial batteries and fuel cells is one such example.

UNIT-I	**WATER QUALITY AND TREATMENT**	**Classes:10**

Introduction: Impurities in water, Hardness of water and its Units, Numerical problems on hardness, Disadvantages of hard water, Water treatment for domestic purpose: Removal of suspended impurities – screening, plain sedimentation, sedimentation by coagulation and filtration, Sterilization or disinfection - Bleaching powder method, Chlorination, , Ozonisation).

Analysis of water: Estimation of hardness by EDTA method, Estimation of dissolved oxygen, BOD, COD and determination of pH.

Industrial Use of water: water for steam generation, Boiler troubles: Priming, Foaming, Scales and Sludges, Boiler Corrosion - Caustic Embrittlement.

Treatment of Boiler Feed water: Internal Treatment – Colloidal conditioning, Phosphate conditioning, Carbonate conditioning, Calgon conditioning and sodium aluminate conditioning.

External Treatment: Zeolite/Permutit and Ion-Exchange processes. Demineralisation of brackish water: Reverse Osmosis and Electrodialysis.

UNIT-II	**POLYMERS**	**Classes:11**

i) Introduction: Basic concepts of polymerisation, Types of poloymerisation (Chain Growth (Addition), Step growth (Condensation)), Mechanism: cationic, anionic, free radical and coordination covalent. Plastomers: Thermosetting and Thermoplastics, Preparation, properties and Engineering applications of PVC, Teflon, Bakelite and nylons.

Elastomers Natural Rubber; Processing of natural rubbers, Compounding of Rubber

Synthetic Rubber: Preparation, properties and engineering applications of Buna-S, Buna-N, Polyurethene, Polysulfide (Thiokol) rubbers

ii) Conducting polymers: Mechanism, synthesis and applications of polyacetyline, polyaniline (PANI).

iii) Inorganic Polymers: Basic Introduction, Silicones, Polyphospazins (-(R)2-P=N-) applications

UNIT-III	**ELECTROCHEMISTRY**	**Classes:10**

i) Introduction: Types of Electrodes (Standard Calomel electrode, Hydrogen electrode, Silver-Silver chloride electrode), Nernest Equation applications, Galvanic cells, Nafion membrane, Numerical calculations, Batteries: Types of batteries, Rechargeable batteries (Lead acid, Ni-Cd, Lithium Ion Batteries),Fuels cells: (Hydrogen-Oxygen and Methanol-Oxygen)

ii) Corrosion: Introduction, type of corrosion: Chemical corrosion (Dry) and Electrochemical corrosion (Wet). Concentration cell corrosion and Galvanic corrosion, Factors affecting the corrosion-Nature of metal and environment. Prevention: Cathodic protection - Sacrificial anode and impressed current, electroplating (Copper, nickel and chromium) and electroless plating (Copper and nickel)

UNIT-IV	FUELS AND COMBUSTION	Classes:10
Introduction - Classifications of Fuels, Characteristics of good Fuel, Solid Fuels: Coal-Classification and Analysis (proximate and ultimate). Liquid Fuels: Petroleum - Refining of Petroleum, Gasoline-Octane Number, Diesel -Cetane Number and Power Alcohol. Gaseous Fuels: Natural gas, Producer gas, Water gas, Coal gas and Biogas. Calorific Value: Definition, Units, Determination calorific value of Gases fuels by Junker‟s calorimeter. Lubricants: Introduction, Types and functions of lubricants, mechanism of lubrication, properties of Lubricants – viscosity, flash and fire points, cloud and pour points, aniline points, neutralization number and mechanical strength.		
UNIT-V	**CHEMISTRY OF ENGINEERING MATERIALS**	**Classes:10**
a) Cement: Composition, Classification, preparation (Dry and Wet processes), Setting and Hardening (Hydration and Hydrolysis). b) Refractories: Introduction, Classification, properties and applications. c) Nanomaterials: Fullerenes, Graphene and Carbon Nano Tubes (CNT) and applications. d) Ceramics and Composites (Fibers).		
Text Books: 1. Engineering Chemistry, First Edition, Jayaveera KN, Subba Reddy GVand Ramachandraiah C, McGraw Hill Higher Education, New Delhi, 2013. 2. A Text Book of Engineering Chemistry, 15th Edition, Jain and Jain, Dhanapathi Rai Publications, New Delhi, 2013. 3. A Text Book of Advanced Chemistry, Phillip Matthews, Cambridge University Press, 1991.		
Reference Books: 1. A Text book of Engineering Chemistry, 12th Edition, SS Dhara,Uma, S. Chand Publications, New Delhi, 2010. 2. Engineering Chemistry, First edition, K.B. Chandra Sekhar, UN.Das and Sujatha Mishra, SCITECH Publications India Pvt Limited, 2010. 3. Engineering Chemistry, First edition, Seshamaheswaramma K and Mridula Chugh, Pearson Education, 2013.		

COURSE OUTCOMES	
CO1	**Differentiate** hard and soft water. Analyze the disadvantages using hard water and apply suitable treatments domestically and industrially
CO2	**Apply the knowledge** of the various materials to construction of batteries and electrochemical sensors
CO3	**Demonstrate the knowledge** on preparation, properties of thermoplastic and thermo setting elastomers and conducting polymers
CO4	**Apply the knowledge** on the preparation fuels such as Petroleum - Refining of Petroleum, Gasoline- Octane Number, Diesel, Natural gas, Producer gas, Water gas, Coal gas and Biogas.
CO5	**Exhibits the knowledge** on synthesis of colloids, nano materials such as CNTs, graphene etc. and its industrial applications.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO2	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO3	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO4	3	3	-	-	-	2	2	-	-	-	-	-	-	-
CO5	3	3	-	-	-	2	2	-	-	-	-	-	-	-
CO*	**3**	**2.4**	-	-	-	**2**	**2**	-	-	-	-	-	-	-

ENVIRONMENTAL STUDIES

<table>
<tr><td colspan="9">B. Tech I Year I Semester</td></tr>
<tr><td>Course code</td><td>category</td><td colspan="3">Hours/week</td><td>credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">17CA51102</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:51</td><td colspan="2">Tutorial Classes:-</td><td colspan="3">Practical Classes: Nil</td><td colspan="3">Total Classes:51</td></tr>
</table>

Course Objectives:

The course should enable the students to :

- To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.
- To understand the impacts of developmental activities and mitigation measures along with the environmental policies and regulations.

UNIT-I	NATURAL RESOURCES	Classes:10

INTRODUCTION: – Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people –Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources.

UNIT-II	ECOSYSTEMS	Classes:11

Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems.

UNIT-III	BIODIVERSITY AND ITS CONSERVATION	Classes:10

Introduction, Definition, genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity, consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity, habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India –Conservation of biodiversity In-situ and Ex-situ conservation of biodiversity.

UNIT-IV	ENVIRONMENTAL POLLUTION AND GLOBAL ISSUES	Classes:10

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of: a. Air Pollution, b. Water pollution, c. Soil pollution, d. Marine pollution, e. Noise pollution, f. Thermal pollution, d. Nuclear hazards.

SOLID WASTE MANAGEMENT: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT-V	**HUMAN POPULATION AND THE ENVIRONMENT**	**Classes:10**

Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

RIELD WORK: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site- Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Text Books:

1. Text Book of Environmental Studies for Undergraduate Cources, Erach Bharucha, Universities Press Pvt Ltd, Hyderabad. 2nd Edition 2013.
2. Environmental Studies by Kaushik, New Age Pubilishers.

Reference Books:

1. Environmental Studies by Rajagopalan, Oxford Pubilishers.
2. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.

COURSE OUTCOMES	
CO1	**Demonstrate knowledge** on fundamentals of Environment and Analyze the availability of non-conventional energy resources.
CO2	**Identify** appropriate types of habitats in the surrounding.
CO3	**Analyze** the influence of habitats on survival.
CO4	**Identify** appropriate method of controlling of pollution and design the eco friendly techniques.
CO5	**Identify and analyze** environmental problems as well as the risks associated with these problems and efforts to be taken to protect the environment from getting polluted.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO2	3	2	-	-	-	2	3	-	-	-	-	-	-	-
CO3	3	2	-	-	-	2	3	-	-	-	-	-	-	-
CO4	3	3	-	-	-	2	3	-	-	-	-	-	-	-
CO5	3	3	-	-	-	2	3	-	-	-	-	-	-	-
CO*	**3**	**2.4**	-	-	-	**2**	**2.75**	-	-	-	-	-	-	-

COMPUTER PROGRAMMING

B. Tech I Year I Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
17CA05101	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		2	**2**	**-**	**3**	**30**	**70**	**100**
Contact Classes:34	**Tutorial Classes:34**		**Practical Classes: Nil**			**Total Classes:68**		

Course Objectives:

I. Understand problem solving techniques
II. Understand representation of a solution to a problem
III. Understand the syntax and semantics of C programming language
IV. Understand the significance of Control structures
V. Learn the features of C language

UNIT - I	**INTRODUCTION TO COMPUTERS AND C LANGUAGE**	**Classes:14**
Introduction to Computers, Introduction to Programming, Algorithms, Flowcharts, Software Development Method. Introduction to C Language, C Language Elements, Variables, Data Types, Operators and Expressions, Constants, Declarations, Operators, Type Conversions, Precedence and Order of Evaluation.		
UNIT - II	**CONTROL STATEMENTS, LOOPS AND ARRAYS**	**Classes:13**
Statements: Selection Statements, Iteration Statements, Jump statements: Break, Continue, goto, Arrays: Accessing Array Elements, Single & Multi Dimensional Arrays.		
UNIT - III	**STRINGS AND POINTERS**	**Classes:13**
Strings: Declaring, Initialization of a String, Reading and Writing Strings, String manipulation functions from the standard Library, String I/O Functions: gets(), puts(). Pointers: Pointer Variables, Pointer Expressions, Pointers And Arrays, Pointers to Strings. Problems with Pointers.		
UNIT - IV	**FUNCTIONS, STRUCTURES AND UNIONS**	**Classes:14**
Functions: Definition, Function Call- Call by Value, Call by Reference, Storage Class Specifiers, Understanding the scope of Functions with its Types, the Return Statement, Recursion, C"s Dynamic Allocation Functions.Command Line Arguments. Structures and Unions: Accessing structure members, Array of structures, Passing Structures to Functions, Structure Pointers, Structures within Structures, Bit Fields, Enumerations, Typedef.		
UNIT –V	**FILE I/O**	**Classes:14**
Streams and File, File System Basics: File pointer, opening a file using fopen(), closing a file, getc(), putc(), fclose(), feof(), fputs, fgets(), ferror(), fread(), fwrite(), fseek(), Formatted Console I/O: fprintf, fscanf, the Preprocessor Directives: #define and #include.		

Text Books:
1. The Complete Reference C, Fourth Edition, Herbert Schildt, McGraw-Hill Education. 2. The C Programming Language" Second Edition, Brain W. Kernighan, Dennis M. Ritchie, Prentice Hall, India.
References:
1. Programming with C Second Edition, Byron Gottfried, Schaum‟s outline, McGraw-Hill Education. 2. Computer Fundamentals and C programming, B. L Juneja, A Seth, Cengage Learning India. 3. Programming in C and Data Structures", Hanly, Koffman, Kamthane, Ananda Rao, Pearson. 4. A BOOK ON C, Kelly pohl, Pearson Education. 5. Computer Fundamentals and C Programming, By Dr. P. Chenna Reddy, Pothi.com (Self Publishing).
Web References
1. https://www.tutorialspoint.com/cprogramming/ 2. www.studytonight.com/c/ 3. fresh2refresh.com/c-programming/ 4. www.cprogramming.com/tutorial/c/
E-Text Books:
1. bookboon.com/en/c-cpp-csharp-ebooks 2. electronicsforu.com › Resources › Cool Stuff 3. https://en.wikibooks.org/wiki/C_Programming 4. www.e-booksdirectory.com › Computers & Internet

COURSE OUTCOMES	
CO1	Understand the Role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language.
CO2	Analyze the concepts of Arrays and Strings.
CO3	Decompose a problem into functions and synthesize complete program efficiency.
CO4	Use Pointer to increase efficiency of programs.
CO5	Understand the concepts of Structures and File handling using C Programming Language. parameters such as microwave frequency, VSWR, power, etc.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	1	-	-	-	-	-	3	-	-
CO2	2	3	-	2	-	1	-	-	-	-	-	3	-	-
CO3	2	2	3	2	-	1	-	-	-	-	-	3	-	-
CO4	3	2	3	-	-	1	-	-	-	-	-	3	-	-
CO5	3	2	2	-	-	1	-	-	-	-	-	3	-	-
CO*	**2.6**	**2.2**	**2.6**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

B. Tech I Year I Semester

Course code	Category	Hours/week			Credits	Maximum Marks		
17CA52102	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		-	**-**	**4**	**2**	**30**	**70**	**100**
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes:68**			**Total Classes:68**			

Course Objectives:

The course should enable the students to :

I. To enable students to learn better pronunciation through stress on word accent, intonation, and rhythm.
II. To help the second language learners to acquire fluency in spoken English and neutralize mother tongue influence.
III. To train students to use language appropriately for interviews, group discussion and public speaking

UNIT-I SOUNDS

1. Phonetics -Importance
2. Vowel and Consonant sounds
3. Phonetic Transcription

UNIT-II MODULATIONS

4. Word Stress
5. Syllabification
6. Intonation

UNIT-III ORAL ACTIVITIES

7. Situational Dialogues
8. Role Plays
9. JAM
10. Describing persons/objects/places

UNIT-IV GROUP ACTIVITIES

11. Debates
12. Group Discussions
13. Interview skills

UNIT-V TECHNICAL PRESENTATION

14. Power Point Presentation
15. Poster Presentation.

Minimum Requirements for ELCS Lab:

The English Language Lab shall have two parts:

1. Computer Assisted Language Learning (CALL) Lab: The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self study by learners.
2. The Communication Skills Lab with movable chairs and audio-visual aids with a P.A. system, Projector, a digital stereo-audio & video system and camcorder etc.

System Requirement (Hardware component):

Computer network with LAN with minimum 60 multimedia systems with the following specifications:

i) P – IV Processor
   a) Speed – 2.8 GHZ
   b) RAM – 512 MB Minimum
   c) Hard Disk – 80 GB
ii) Headphones of High quality

Suggested Software:

1. Clarity Pronunciation Power – Part I (Sky Pronunciation)
2. Clarity Pronunciation Power – part II
3. K-Van Advanced Communication Skills
4. Walden InfoTech Software.

References:

1. A Textbook of English Phonetics for Indian Students 2nd Ed T. Balasubramanian. (Macmillian), 2012.
2. A Course in Phonetics and Spoken English, Dhamija Sethi, Prentice-Hall of India Pvt .Ltd
3. Speaking English Effectively, 2nd Edition Krishna Mohan & NP Singh, 2011. (Mc Millan).
4. A Hand book for English Laboratories, E. Suresh Kumar, P. Sreehari, Foundation Books,2011
5. Spring Board Succes, Sharada Kouhik, Bindu Bajwa, Orient Black swan, Hyderabad, 2010.

COURSE OUTCOMES	
CO1	Exhibit the skills on the different aspects of the English Language proficiency with emphasis on LSRW skills.
CO2	Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking by group discussion.
CO3	Conduct investigation and Analyze communication ability
CO4	Use of modern computing facilities and suitable software tools to improve communication skills and elocution.
CO5	Follow ethical principles in listening, writing, presenting and communicative ability towards jobs.
CO6	Do experiments effectively as an individual and as a member in a group.
CO7	Communicate verbally and in written form, the understandings about the experiments.
CO8	Continue updating their written communication skills among learners for both academic and professional purposes during their life time.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO*	**3**	**3**	**-**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

ENGINEERING CHEMISTRY LAB

<table>
<tr><td colspan="10">B. Tech I Year I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">17CA51103</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CLA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>4</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td colspan="3">Tutorial Classes: Nil</td><td colspan="2">Practical Classes: 68</td><td colspan="3">Total Classes: 68</td></tr>
</table>

Course Objectives:

- Will learn practical understanding of the redox reaction
- Will learn the preparation and properties of synthetic polymers and other material that would provide sufficient impetus to engineer these to suit diverse applications
- Will also learn thehygiene aspects of water would be in a position to design methods to produce potable water using modern technology.

Any 10 of the following experiments has to be performed during the I year I Sem.

Expt. 1	Determination of total hardness of water by EDTA method.
Expt. 2	Determination of Copper by EDTA method
Expt. 3	Estimation of Dissolved Oxygen by Winkler"s method
Expt. 4	Estimation of iron (II) using diphenylamine indicator (Dichrometry – Internal indicator method).
Expt. 5	Determination of Alkalinity of Water
Expt. 6	Determination of acidity of Water
Expt. 7	Preparation of Phenol-Formaldehyde (Bakelite)
Expt. 8	Determination of Viscosity of oils using Redwood Viscometer I
Expt. 9	Determination of Viscosity of oils using Redwood Viscometer II
Expt. 10	Determination of calorific value of gaseous fuels by Junker"s Calorimeter
Expt. 11	Conductometric estimation of strong acid using standard sodium hydroxide solution
Expt. 12	Determination of Corrosion rate and inhibition efficiency of an inhibitor for mild steel in hydrochloric acid medium.
Expt. 13	Potentiometric determination of iron using standard potassium dichromate
Expt.14	Colorometric estimation of manganese.
Expt.15	pH meter calibration and measurement of pH of water and various other samples.

References:

1. Vogel"s Text book of Quantitative Chemical Analysis, Sixth Edition – Mendham J et al, Pearson Education, 2012.
2. Chemistry Practical– Lab Manual, First edition, Chandra Sekhar KB, Subba Reddy GV and Jayaveera KN, SM Enterprises, Hyderabad, 2014.

COURSE OUTCOMES	
CO1	Demonstrate knowledge on analytical chemistry techniques to address the water related problems technically.
CO2	Analyze and acquire practical skills to handle the chemistry experiments.
CO3	Investigate and analyze different chemistry experiments.
CO4	Analyze the impact of contamination of various chemicals for various experiments in environmental contexts, and need for sustainable development.

CO5	Follow ethical principles in preparation of various chemicals compositions related to the every experiment in the lab.
CO6	Do experiments effectively as an individual and as a member in a group
CO7	Communicate verbally and in written form, of the every experiment in the laboratory.
CO8	Continue updating their skill related to Various titrations for industrial application during their life time.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-		-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO*	**3**	**3**	-	**3**	-	-	**3**	**3**	**3**	**3**	-	**3**	-	-

COMPUTER PROGRAMMING LAB

B. Tech I Year I Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
17CA05102	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		–	**–**	**4**	**2**	**30**	**70**	**100**
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 68**				**Total Classes:68**		

Course Objectives:

- **I.** Learn C Programming language.
- **II.** To make the student solve problems, implement algorithms using C language.
- **III.** To write diversified solutions using C language.

List of Programs

Expt.1 BASIC C PROGRAMS

a) Practice DOS Commands
b) Write C program to
   I. Find the Sum of three numbers.
   II. Exchange (swap) of two numbers by using third variable.
   III. Exchange (swap) of two numbers without using third variable.
   IV. Print the size of all data types.

Expt. 2 BASIC C PROGRAMS

a) Write a C program to find the Priority and associativity of operators using expressions. Take the expressions with different operators.
b) Write a C program to swap two numbers using bitwise operators.

Expt. 3 CONTROL STATEMENTS

a) Write a C program to find whether the given number is odd or even.
b) Write a C program to find the Maximum of two numbers.
c) Write a C program to find the Maximum of three numbers.
d) Write a C program to print „hello world" without using semicolon.
e) Write a C program to find whether the given number is odd or even using bitwise operator.
f) Write a C program to find the maximum of two numbers using Conditional operator.
g) Write a program which takes two integers and one arithmetic operator from the user, and performs the operation and then prints the result by using **switch-case**.(Operators : +, -, *, /, %)

Expt.4 ITERATION STATEMENTS

a) Write a C program to generate the required multiplication table.
b) Write a C program to find the Factorial of a given number.
c) Write a C program to check whether the given number is prime or not.

Expt. 5 ITERATION STATEMENTS

a) Write a C program to find the sum of the digits of a number.
b) Write a C program to find whether the given integer is a Palindrome or not.
c) Write a C program to generate Fibonacci numbers in the given range.

Expt. 6 NESTED LOOPS

a) Write a C program to print the following pattern. 1 2 2 3 3 3 b) print multiplication tables upto the given table. c) Write a C program to print Series of prime numbers in the given range.	
Expt. 7	**NESTED LOOPS**
a) Write a C program to check given number is strong number or not. b) Write a C program to evaluate the sum of the following series up to „n" terms $e^x = 1 + x + x^2/2! + x^3 /3! + x^4 /4! +$ --------	
Expt. 8	**ARRAYS**
a) Write a C program to find the sum of positive and negative numbers in a given set(Array) of numbers. b) Write a C program to read two matrices and find i) Sum. ii) Product and display the result in the matrix form.	
Expt. 9	**ARRAYS**
a) Write a C program to read matrix and perform the following operations i) Find the sum of Diagonal Elements of a matrix. ii) Print Transpose of a matrix. iii) Print sum of even and odd numbers in a given matrix.	
Expt.10	**STRINGS**
a) Write a C program to read two strings and perform the following operations without using built-in string Library functions. i) String length determination. ii) Compare Two Strings. iii) Concatenate Two Strings. iv) String reversing b) Write a C program to accept a line of characters and print the number of Vowels, Consonants, blank spaces, digits and special characters. c) Write a C program to read a set of strings and sort them in alphabetical order.	
Expt.11	**POINTERS**
a) Write a C program to exchange two numbers using pointers. b) Write a program to print the elements of an array in reverse order using pointers.	
Expt.12	**FUNCTIONS**
a) Write a C program to illustrate the following types of functions i) Function with no arguments and no return values ii) Function with arguments and no return value iii) Function without arguments and with return value iv) Function with arguments and with return value	

Expt.13	FUNCTIONS
a) Write a C program to express a four digit number in words. For example 1546 should be written as one thousand five hundred and forty six b) Write a C program using recursion for finding Factorial of a number c) Write a C program to illustrate the Dynamic Memory allocation function malloc( )	
Expt.14	**STRUCTURES**
a) Declare a structure time that has three fields hr, min, secs. Create two structure variables start_time and end_time. Input there values from the user. Then if start_time is not equal to end_time then display HELLO CREC on the screen. b) Write a C program to read student roll no, name and marks in six subjects for n number of students and give class of each student by following the required conditions. c) Write a C program to demonstrate self referential structures.	
Expt.15	**FILES**
a) Write a program to create a file and write some text data on the file. Then display the contents of the file and also print number of characters, number of words, number of lines in the file. b) Write a C program to merge two files.	
Expt.16	**FILES**
a) Write a C program to create a text file and write data on it, then display every 5th character in that file. b) Write a program to read student records into a file. Record consists of rollno, name and marks of a student in six subjects and class. Class field is empty initially. Compute the class of a student. The calculation of the class is as per CREC rules. Write the first class, second class, third class and failed students lists separately to another file.	

REFERENCE BOOKS

1. How to Solve it by Computer, R.G. Dromey, Pearson.
2. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, Pearson.
3. Let us C, Yeswant Kanetkar, BPB publications
4. Pointers in C, Yeswant Kanetkar, BPB publications.
5. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A.AnandaRao, Pearson Education.

WEB REFERENCES

1. https://www.programiz.com/
2. https://www.programmingsimplified.com
3. https://www.techcrashcourse.com
4. https://www.sanfoundary.com/

COURSE OUTCOMES	
CO1	Apply the Knowledge to design the algorithm and flowchart for the given problem.
CO2	Analyze the concepts of control statements and arrays.

CO3	Design the programs for functions and strings.
CO4	Solve the memory access problems by using pointers and design the programs on structures and unions.
CO5	Select appropriate procedure to solve given problem.
CO6	Follow the ethical principles in implementing the programs
CO7	Do experiments effectively as an individual and as a team member in a group.
CO8	Communicate verbally and in written form, the understandings about the experiments.
CO9	Continue updating their skill related to loops, pointers and files Implementing programs in future.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3		-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	**3**		-	-	-	-	-
CO7	-	-	-	-	-	-	-	-	**3**	-	-	-	-	-
CO8	-	-	-	-	-	-	-	-		**3**	-		-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**-**	**-**

FOUNDATION OF YOGA (AUDIT COURSE)

B. Tech I Year I Semester

Course Code	Category	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA50101	Perspective	-	-	-	-	-	-	-

Course Objectives:

The subject entitled „Foundation of Yoga" has the following objectives:

I. Students of the UG course will have an understanding about origin, history and development of Yoga.

II. They will have an idea about the insights of Indian philosophy and Astika & Nastika Darshanas.

III. Introduction about Yoga according to various yogic texts.

UNIT-I **GENERAL INTRODUCTION TO YOGA**

Brief about origin of Yoga: Psychological aspects and Mythological concepts; History and Development of Yoga: prior to the Vedic period, Vedic period, Medival period, modern era; 6 Etymology and Definitions of Yoga, Aim and Objectives of Yoga, Misconceptions of Yoga; Brief about Streams of Yoga; Principles of Yoga, Importance of Yoga.

UNIT-II **GENERAL INTRODUCTION TO INDIAN PHILOSOPHY**

Philosophy: meaning, definitions and scope; Indian Philosophy: Salient features, Branches (Astika and Nastika Darshanas), Distinction from Religion and Science, Brief introduction to Prasthanatrayee and Purushartha Chatushtaya; Relationship between Yoga and Indian Philosophy

UNIT-III **BRIEF ABOUT YOGA IN TEXTS – I**

Brief to Upanishads and Yoga in Principal Upanishads, Yoga in Yogopanishad; Yogic perspective of Epics: Ramayana, Adhyatma Ramayana and Mahabharata; Yogic perspective: Bhagavad Gita, Yoga Vasishtha, Narada Bhakti Sutras.

UNIT-IV **BRIEF ABOUT YOGA IN TEXTS – II**

Yogic perspective: Smritis, Puranas with emphasis to Bhagavat Purana; Yogic perspective to Shad-darshanas; Emphasis to Vedantic approach of Shankara, Ramanuja, Madhva and Vallabha; Brief: Agamas, Tantras, Shaiva Siddhanta.

UNIT-V **GENERAL INTRODUCTION TO HATHA YOGA**

Hatha Yoga: Origin, Meaning, Definition, Aim, Objectives and Misconceptions, Philosophy and Foundations; Hatha Yoga Parampara, Natha Cult Hatha Yogis and their contribution; Ghatashudhi: its importance and relevance in Hatha Yoga sadhana; Inter-relation of Hatha Yoga and Raja Yoga.

Text Books:

1. Lal Basant Kumar : Contemporary Indian Philosophy, Motilal Banarsidas Publishers Pvt. Ltd, Delhi, 2013
2. Dasgupta S. N : History of Indian Philosophy, Motilal Banarsidas, Delhi, 2012
3. Singh S. P : History of Yoga, PHISPC, Centre for Studies in Civilization Ist, 2010
4. Singh S. P & Yogi Mukesh: Foundation of Yoga, Standard Publication, New Delhi, 2010

Reference Books:

1. Agarwal M M: Six systems of Indian Philosophy, Chowkhambha Vidya Bhawan, varanai, 2010.
2. Swami Bhuteshananda: Nararad Bhakti Sutra, Advaita Ashrama Publication-Dept. Kolkata, II Edition, 2009
3. Hiriyanna M: Outlines of Indian Philosophy, Motilal Banarsidas, Delhi, 2009
4. Hiriyanna M: Essentials of Indian Philosophy, Motilal Banarsidas, Delhi, 2008

II SEMESTER
ENGLISH FOR PROFESSIONAL COMMUNICATION

<table>
<tr><td colspan="11">B. Tech I Year II Semester</td></tr>
<tr><td>Course code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">17CA52201</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:51</td><td colspan="2">Tutorial Classes: -</td><td colspan="3">Practical Classes: Nil</td><td colspan="3">Total Classes:51</td></tr>
</table>

Course Objectives:
The course should enable the students to :

I. Communication in an intelligible English accent and pronunciation.
II. Introduce students‟ elements of Grammar and Composition of English language.
III. Maintain linguistic competence through training in Vocabulary, sentence structures.

UNIT-I	LESSONS FROM THE PAST	Classes:10

TEXT: Importance of History-Differing perspectives-Modern Corporatism-Lessons from the past.
GRAMMAR: Active and Passive voice – Adjectives-Degrees of Comparison.
VOCABULARY: Phrasal Verbs.

UNIT-II	ENERGY	Classes:11

TEXT: Renewable and Non-Renewable sources-Alternative Sources-Conservation-Nuclear Energy.
GRAMMAR: Direct and Indirect Speech
VOCABULARY: Idioms.

UNIT-III	TRAVEL AND TOURISM	Classes:10

TEXT: Advantages and disadvantages of Travel-Tourism-Atithi Devo Bhava-Tourism in India
GRAMMAR: Conditional Sentences.
COMPOSITION: Report Writing

UNIT-IV	GETTING JOB-READY	Classes:10

TEXT: SWOT analysis-Companies and Ways of Powering Growth-Preparing for Interviews
GRAMMAR: Connectives-Simple, Compound and Complex.
COMPOSITION: Curriculum Vitae with Covering Letter.

UNIT-V	GERTRUDE ELION	Classes:10

TEXT: Birth-Childhood-Education-Achievements-Awards.
GRAMMAR: Common Errors in English
COMPOSITION: Note-making and Note-taking.

Text Books:
1.MIND SCAPES- ORIENT BLACK SWAN 2014
2. INSPIRING LIVES, MARUTHI PUBLICATIONS 2010

Reference Books:
1. English Grammar in use - Raymond Murphy.
2. Word Power Made Easy- Norman Lewis

Web References:
1.https://www.edufind.com
2.https://www.myenglishpages.com
3. https://www.. onestopenglish.com

E-Text Books:
1. https://www.e-bookboon.com/en/communication-ebooks-zip.

2. https://www. learning englishvocabularygrammar.com/ filesidiomsandphraseswithmeaningsandexamplespdf.pdf
Outcomes: 1. The student will be able to get a thorough knowledge of various topics of grammar of English language. 2. The students will attain the abilities to communicate effectively and to write accurately using English language.

COURSE OUTCOMES	
CO1	Demonstrate to overcome the barriers in communication process using non-verbal language suitable to different situations in professional life to become effective technical communicator.
CO2	Apply the knowledge on social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information.
CO3	Exhibit the knowledge on cohesive devices for better conversation in informal discussions and speak clearly on a specific topic using suitable discourse markers.
CO4	Apply the concepts of Entrepreneurship Skills and Analyze discourse markers to speak clearly on a specific topic in informal discussions and create coherent paragraph writing.
CO5	Apply the Knowledge to recognize the need of ability to engage in independent and life-long learning communication effectively in English over speech.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	2	3	-	-	3	3
CO2	3	2	-	-	-	-	-	-	3	3	-	-	2	3
CO3	3	-	-	-	-	-	-	-	2	3	-	-	3	2
CO4	3	2	-	-	-	-	-	-	3	3	-	-	3	3
CO5	3	-	-	-	-	-	-	-	-	3	-	2	3	3
CO*	**3**	**2**	-	-	-	-	-	-	**2.5**	**3**	-	**2**	**2.8**	**2.8**

MATHEMATICS-II

<table>
<tr><td colspan="10">B. Tech I Year II Semester</td></tr>
<tr><td rowspan="3">Course code
17CA54201</td><td rowspan="3">Category
Foundation</td><td colspan="3">Hours/week</td><td>credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>2</td><td>2</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:34</td><td>Tutorial Classes:-34</td><td colspan="3">Practical Classes: NIL</td><td colspan="4">Total Classes:68</td></tr>
</table>

Course Objectives:

The course should enable the students to :

I. Analyze and solve algebraic and transcendental equations

II. Apply multiple integrals on engineering applications.

III. Determine the numerical solutions of ordinary differential equations.

UNIT-I	CURVE FITTING AND SOLUTIONS OF EQUATIONS	Classes:14

Curve Fitting-Fitting a straight line, fitting a second degree parabola, exponential curve, power curve. Solutions of Algebraic and transcendental equations-Bisection method, Regula-Falsi method,Newton Raphson method.

UNIT-II	INTERPOLATION	Classes:14

Interpolation-Newton‟s Forward and Backward interpolation formulae, Stirling‟s formula and Lagrange‟s formula.

Numerical differentiation and Integration-Newton‟s interpolation formulae, Trapezoidal rule, Simpson‟s 1/3 rd rule and Simpson‟s 3/8 th rule.

UNIT-III	NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS	Classes:13

Solution by Taylor‟s series-Picard‟s method of successive approximation, Euler‟s method, Modified Euler‟s method, Runge-Kutta Second order, third order and fourth order methods. Corrector method-Milne‟s predictor corrector method and Adam Bashforth predictor corrector method.

UNIT-IV	MULTIPLE INTEGRALS	Classes:13

Multiple integrals-Double integral and triple integrals, change of variables, change of order of integration.

Applications-Areas and volumes in Cartesian and polar form using double and triple integrals.

UNIT-V	VECTOR CALCULUS	Classes:14

Vetor calculus-Gradient, divergence, curl and their properties. Vector integration-Line integral, work done, area, surface and volume integrals.

Integral theorems- Green‟s theorem(without proof) , Stoke‟s theorem(without proof) and Gauss‟s divergence theorem (without proof) and its applications.

Text Books:

1.," Advanced engineering mathematics", by E.Kreyszig John wiley & Son‟s publishers ,New edition.

2.,"Higher engineering mathematics",by B.S.Grewal ,Khanna publishers, New edition.

3."Introductory methods of numerical analysis",by S.S.Sastry ,PHI publisher.

Reference Books:

1."Engineering mathematics volume-III",by T.K.V.Iyengar, B.Krishna Gandhi, S.Ranganathan and M.V.S.S.N.Prasad, S.Chand publications.

2. "Engineering mathematics volume-II", by E.Rukmangadhachari, pearson publishers.

3."Higher engineering mathematics ",by B.V.Ramana, Mc Graw Hill publishers.

Web References:

1.https://www.efunda.com/math/math_home/math.cfm.

2.https://www.ocw.mit.edu/resources/#mathematics.

E-Text Books:
1.https://www.e-booksdirectory.com/detais.php?ebook=10166.
2.https://www.e-booksdirectory.com/details.php?ebook=7400re

COURSE OUTCOMES	
CO1	Analyze and Calculate roots of algebraic and transcendental equations.
CO2	Analyze the techniques of Interpolation, Numerical differentiation and Numerical Integration.
CO3	Exhibit the knowledge of the Numerical differentiation on Taylor’s series-Picard’s method, Euler’s method, Modified Euler’s method and Runge-Kutta Second order.
CO4	Demonstrate the integration of lengths, volumes and surface area of double integrals and triple integrals.
CO5	Apply gradient, divergence and curl to scalar and the corresponding vector calculus theorems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

ENGINEERING PHYSICS

<table>
<tr><td colspan="9">B. Tech I Year II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">17CA55101</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:51</td><td colspan="3">Tutorial Classes: -Nil</td><td colspan="2">Practical Classes: Nil</td><td colspan="3">Total Classes: 51</td></tr>
</table>

Course Objectives:

- To develop strong fundamentals of modern engineering materials.
- To develop students with sufficient depth in both engineering and physics skills to produce engineers who can relate fundamental physics to practical engineering problems.
- To prepare students for careers in engineering where physics principles can be applied to the development of technology.

UNIT – I	**MODERN OPTICS**	**Classes: 11**

Wave Optics: Interference –Interference in thin film by reflection – Newton‟s rings– Diffraction – Fraunhofer diffraction at a single slit and double slit – Grating spectrum.

Lasers: Characteristics – Absorption, spontaneous and stimulated emission of radiation – Einstein‟s coefficients –Population of Inversion – Ruby laser, He-Ne laser and semiconductor diode laser – Applications.

Fiber optics: Optical fiber – Principle – Acceptance angle and numerical aperture – losses and attenuation – Block diagram of optical fiber communication system – Applications.

UNIT – II	**CRYSTAL PHYSICS & ULTRASONICS**	**Classes:10**

Crystallography: Space lattice –Unit cell – Lattice parameters –Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Directions and planes in crystals – Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction - Bragg‟s law – Powder method.

Ultrasonics: Introduction – Production of ultrasonics by piezoelectric method – Properties and detection – Applications in non-destructive testing.

UNIT – III	**QUANTUM PHYSICS AND FREE ELECTRON THEORY OF CONDUCTORS**	**Classes:10**

Quantum Mechanics: Matter waves – de‟Broglie hypothesis - Schrodinger‟s time independent wave equation – Physical significance of wave function - Particle in one dimensional infinite potential well.

Free electron theory of conductors: Classical free electron theory – Quantum free electron theory – Fermi-Dirac distribution – Source of electrical resistance – Kronig-Penny model (qualitative treatment) – Classification of solids into conductors, semiconductors and insulators.

UNIT – IV	**SEMICONDUCTOR AND MAGNETIC MATERIALS**	**Classes:10**

Semiconductors: Intrinsic and extrinsic semiconductors – Drift & diffusion current and Einstein‟s relation – Hall effect - Direct and indirect band gap semiconductors – Formation of p-n junction – pn junction diode – forward and reverse bias.

Magnetic materials: Origin of magnetic moment – Classification of magnetic materials (Qualitative treatment) – Hysteresis behavior - Soft and hard magnetic materials

UNIT – V	**MODERN ENGINEERING MATERIALS**	**Classes:10**

Superconductors: Introduction - Effect of magnetic field - Meissner effect – Type I and Type II superconductors – BCS theory (qualitative treatment) — AC and DC Josephson effect – Applications of superconductors.

Nanomaterials: Introduction - Significance of nanoscale - Types of nanomaterials – Physical properties: optical, thermal, mechanical and magnetic properties – Synthesis by top down and bottom up approaches: ball mill and chemical vapour deposition – Applications of nanomaterials.

Text Books:

1. Engineering Physics – K. Thyagarajan, 5th Edition, Mac Graw Hill Publishers, New Delhi, 2014.
2. Physics for Engineers - N. K Verma, 1st Edition, PHI Learning Private Limited, New Delhi, 2014.

References

1. Engineering Physics – Dr. M. N. Avadhanulu & Dr. P. G. Kshirsagar, 10th Edition, S. Chand and Company, New Delhi, 2014.
2. Engineering Physics – D. K Pandey, S. Chaturvedi, 2nd Edition, Cengage Learning, New Delhi, 2013.
3. Engineering Physics – D. K Bhattacharya, Poonam Tandon, 1nd Edition, Oxford University Press, New Delhi, 2015.

COURSE OUTCOMES	
CO1	Demonstrate **knowledge** and analyze the basic concepts of wave optics, fiber optics, and lasers.
CO2	Exhibit the knowledge on different types of crystal structures that occur in materials, **analyze** production of ultrasonics and application of ultrasonics.
CO3	Exhibit the **knowledge** and analyze the roots and founding principles of Quantum Mechanics and band theory of solids.
CO4	Apply and **analyze** the basic principles in the magnetic material, semiconductors. and
CO5	**Analyze** the basic concepts of superconducting materials, nonmaterial's and their applications.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	2	-	-	-	-	-	-	3	2
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	2	-	-	-	-	-	-	3	2
CO5	3	2	-	-	-	2	-	-	-	-	-	1	3	2
CO*	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**2**

ENGINEERING DRAWING

B. Tech I Year II Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA03101	Foundation	1	-	4	3	30	70	100

Contact Classes:-17	Tutorial Classes: Nil	Practical Classes: 68	Total Classes: 85

Course Objectives:

1. To know the basics of Engineering Drawing and its applications
2. To understand the projection of solids
3. To understand the Isometric Projections of Regular Solids
4. To analyze the orthographic projections

UNIT – I | INTRODUCTION TO ENGINEERING DRAWING & GEOMETRICAL CONSTRUCTIONS | Classes: 17

Introduction to drawing instruments & principles of Engineering Drawing - Conventions in Drawing-Lettering – BIS Conventions. Curves used in Engineering Practice. a) Parabola, Ellipse, Hyperbola and Rectangular Hyperbola (General method only) b) Cycloid, Epicycloid and Hypocycloid

UNIT – II | PROJECTION OF POINTS & LINES | Classes: 17

Projection of Points: Principles of orthographic projection – Convention – First angle projections, projections of points.

Projections of Lines: Lines parallel to both lines, perpendicular to any one of the planes, lines inclined to one or both planes, Problems on projections, Finding True lengths, True Inclinations and also Traces

UNIT – III | PROJECTIONS OF PLANES | Classes: 17

Projections of Planes: Introduction to planes, Projections of regular plane surfaces- plane surfaces inclined to one plane - plane surfaces inclined to both planes

UNIT – IV | PROJECTIONS OF SOLIDS | Classes: 17

Projections of Solids: Introduction to Solids, Projections of Regular Solids with axis inclined to one or both planes for regular solids - Prism, Cylinder, Pyramid and Cone

UNIT – V | ISOMETRIC PROJECTIONS | Classes: 17

Introduction to pictorial projections, Principles of isometric projection- Isometric Scale- Isometric Views- Conventions- Isometric Views of Planes, Simple solids (cube, cylinder and cone), Isometric projections of spherical parts.

Text Books:

1. Engineering Drawing, N.D. Bhatt, Charotar Publishers
2. Engineering Drawing, K.L. Narayana & P. Kannaih, Scitech Publishers, Chennai
3. Engineering Drawing, K. Venkata Reddy, B.S Publications, Koti

References

1. Engineering Drawing, Johle, Tata McGraw-Hill Publishers
2. Engineering drawing, K R Gopala Krishna, Subhas publications
3. Engineering Drawing and Graphics, K. Venugopal, New age Publishers
4. Engineering Graphics, K.C. John, PHI Publications

Web References:

1. https://www.nptel.ac.in/courses/112103019/

E-Text Books:

1. https://www.wiziq.com/tutorial/219645-ENGINEERING-DRAWING-BOOK

COURSE OUTCOMES	
CO1	Understand the concepts of Conic Sections, Cycloidal curves and the application of industry standards.
CO2	Understand the Orthographic Projections of Points and Lines and are able to improve their visualization skills so that they can apply these skills in developing the new products.
CO3	Understand and apply Orthographic Projections of Planes wherever necessary.
CO4	Understand and analyze the Orthographic Projections of Solids.
CO5	Employ freehand 3D pictorial sketching to aid in the visualization process and efficiently communicate ideas graphically.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	2	-	-	1	-	-	-	-	-
CO2	2	-	-	-	-	2	-	-	1	-	-	-	-	-
CO3	2	-	3	2	1	-	-	-	3	-	-	-	-	-
CO4	-	2	3	-	-	2	-	-	3	-	-	-	-	-
CO5	2	-	2	-	-	2	-	-	2	-	-	-	-	-
CO*	**2**	**2**	**2.66**	**2**	**1**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**

NETWORK ANANLYSIS

B. Tech I Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA02203	Foundation	2	2	-	3	30	70	100

Contact Classes: 34	Tutorial Classes: 34	Practical Classes: Nil	Total Classes: 68

Course Objectives:

The course should enable the students to:

I. Implement different circuits and verify circuit concepts.
II. Study the concepts of mesh and nodal analysis in electrical circuits.
III. Design electric circuits to verify network theorems.
IV. Gain knowledge about resonance and magnetic circuit.

UNIT - I	**INTRODUCTION TO ELECTRICAL CIRCUITS:**	**Classes: 14**

Circuit Concept: R, L, C Parameters, voltage and current sources, independent and dependent sources, Ohms law at constant temperature, voltage current relationship for passive elements (for different input signal Square, Ramp, Saw tooth and Triangular), source transformation, star to delta and delta to star transformation, network reduction techniques series, parallel and series parallel circuits.

UNIT - II	**ANALYSIS OF ELECTRICAL CIRCUITS & NETWORK THEOREMS:**	**Classes: 14**

Kirchhoff‟s laws - Mesh analysis using Kirchhoff‟s laws, mesh equations by inspection method, super mesh analysis, nodal analysis using KCL, nodal equations by inspection method, super node analysis; Theorems: Tellegen‟s, superposition, reciprocity, Thevenin‟s, Norton‟s, maximum power transfer, Milliman‟s and compensation theorems for DC & AC excitations, numerical problems.

UNIT - III	**SINGLE PHASE A.C. CIRCUIT:**	**Classes: 14**

RMS and average values and form factor for different periodic wave forms, steady state analysis of RL and RC (in series, parallel and series parallel combinations) with sinusoidal excitation; Phasor Relationship of R, L & C. Concept of Reactance: impedance, susceptance and admittance, phase and phase difference, concept of power factor, real, reactive and complex power, rectangular and polar forms of representation, steady state analysis of RLC circuits.

UNIT - IV	**RESONANCE AND MAGNETIC CIRCUITS:**	**Classes:13**

Series, parallel circuits, concept of band width and Q factor;
Magnetic circuits: Faraday‟s laws of electromagnetic induction, concept of self and mutual inductance, dot convention, coefficient of coupling, composite magnetic circuit, analysis of series and parallel magnetic circuits

UNIT - V	**Filters & Two Port Network**	**Classes: 13**

Filters: Introduction to nepers and decibal - Design Filter - Low pass, high pass,

band pass, band elimination filters, introduction to active filter.

Two port network parameters: Z, Y, ABCD, hybrid and inverse hybrid parameters, conditions for symmetry and reciprocity, inter relationships of different parameters. Series and parallel connection of two port networks

Text Books:

1. A Chakrabarthy, “Electric Circuits”, Dhanipat Rai & Sons, 6th Edition, 2010. 2. A Sudhakar, Shyammohan S Palli, “Circuits and Networks”, Tata McGraw Hill, 4th Edition, 2010. 3. M E Van Valkenberg, “Network Analysis”, PHI, 3 rd Edition, 2014.
Reference Books:
1. John Bird, “Electrical Circuit Theory and Technology”, Newnes, 2nd Edition, 2003. 2. C L Wadhwa, “Electrical Circuit Analysis Inclucing Passive Network Synthesis”, New Age International, 2nd Edition, 2009. 3. David A Bell, “Electric circuits”, Oxford University Press, 7th Edition, 2009.
Web References:
1. https://www.igniteengineers.com 2. https://www.ocw.nthu.edu.tw 3. https://www.uotechnology.edu.iq 4. https://www.crectirupati.com
E-Text Books :
1. https://www.bookboon.com/en/concepts-in-electric-circuits-ebook 2. https://www.www.jntubook.com 3. https://www.allaboutcircuits.com 4. https://www.archive.org

COURSE OUTCOMES	
CO1	**Demonstrate knowledge in** electrical circuits and **Analyze** network reduction techniques.
CO2	**Investigate and Analyze** network theroms.
CO3	**Investigate and Analyze** the study state response of R, L, C, R-L, R-C, R-L-C series and parallel circuits.
CO4	**Analyze** resonance and Magnetic circuits.
CO5	**Analyze and Design** the passive and active filters and two port network parameters.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

CLINICAL PSYCHOLOGY (AUDIT COURSE)

B. Tech I Year II Semester

Course Code	Category	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA50201	Perspective	-	-	-	-	-	-	-

Course Objectives:

The course should enable the students to:

I. Develop the knowledge pertinent to the organism, developmental, social and situational factors those are relevant to the initiation and maintenance of human behavior.
II. Understand the present and implement effective strategies to deal with these issues during work with patients.
III. Study the professional identity and practice as clinical psychologists through fundamental knowledge of psychology, commitment to professional ethics.
IV. Understand the multiculturalism, diversity and participation in life-long learning.

UNIT-I BASIC PSYCHOLOGY

Introduction: Psychology, definition, psychology as a science, early schools of psychology, modern perspectives, methods of psychology, experimental method, systematic observation, case study method, survey method, fields of psychology.

UNIT-II BIOLOGY OF BEHAVIOR AND SENSORY PROCESS

Neurons and synapses: Nervous system , peripheral and central nervous system: brain and sleep: importance of fore brain, association cortex, left and right hemisphere functions; Some general properties of senses, subliminal stimuli, the visual sense, auditory sense, the other senses; Consciousness, meaning, functions, divided consciousness, stages of sleep, dreams, meditation, hypnosis.

UNIT-III ATTENTION AND PERCEPTION

Selective attention; physiological correlates of attention, internal influences on perception, learning set, motivation and emotion, cognitive styles.External influences on perception, figure ground, movement, illusions, perceptual organization, constancy, depth perception, binocular and monocular cues.

UNIT-IV MOTIVATION AND EMOTION MOTIVES

Definitions, motivation cycle, theories of motivation, biological motivation, social motives, frustration and conflicts of motives, defense mechanism, emotion, expression and judgment of emotion, the physiology of emotion, theories of emotion.

UNIT-V CLINICAL PSYCHOLOGY & MENTAL HEALTH

History of clinical psychology and its role in understanding and alleviation of mental illness, promotion of mental health and rehabilitation of the mentally ill, role and functions of clinical psychologists in DMHP, professional code of conduct and ethical issues.

Text Books:

1. M S Bhatia, “Clinical Psychology”, B J Publishers,1st Edition, 2008.
2. Paul Bennett, “Abnormal and Clinical Psychology: An Introductory Textbook”, Pearson Publishers,2nd Edition, 2006.

Reference Books:

1. Robert A Baron, Girishwar Misra, “Psychology: Indian Subcontinent Edition”, Pearson Education, 5th Edition, 2009.
2. HillGard, E. R., C.A. Richard, L.A.Rita, “Introduction to Psychology”, Oxford & IBH, New Delhi, 6th Edition, 1976.

Web References:

1. https://www.amazon.com/Clinical-Psychology-Counseling-Books/b?ie=UTF8&node=11143
2. https://www.global.oup.com/academic/content/series/o/oxford-textbooks-in-clinical-psychology-otcp/?cc=in&lang=en&

E-Text Books:

1. https://www.amazon.com/Clinical-Psychology-Counseling-Books/b?ie=UTF8&node=11143
2. https://www.books.google.co.in/books/about/Clinical_Psychology.html?id=u4aDPdw0Fi4C&redir_esc=y

ENGINEERING & I.T. WORKSHOP

B. Tech I Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
17CA03203	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**4**	**2**	**30**	**70**	**100**
Contact Classes: Nil	**Tutorial Classes: Nil**		**Practical Classes: 68**			**Total Classes: 68**		

Course Objectives:

1. Identify and use of tools, types of joints in carpentry, fitting, tin smithy welding and foundry operations.
2. Understand of electrical wiring and components.

Any 10 of the following experiments has to be performed during the I year II Sem.

CARPENTRY	
Expt. 1	Preparation of dove tail joint as per given taper angle.
Expt. 2	Preparation of lap joint as per given dimensions.
Expt. 3	Preparation of Cross Lap joint as per given taper angle.
FITTING	
Expt. 4	Make a square fit for given sizes.
Expt. 5	Make a V Joint for given dimensions.
Expt. 6	Make a half round fit for given dimensions.
TIN SMITHY	
Expt. 7	Prepare the development of a surface and make a rectangular tray.
Expt. 8	Prepare the development of a surface and make a round tin.
FOUNDRY	
Expt. 9	Prepare a single pattern pattern.
Expt. 10	Prepare a double pattern pattern.
WELDING	
Expt. 11	Preparation of V butt joint
Expt. 12	Preparation of Lap joint
Expt. 13	Preparation of T fillet joint

References:

1. K. C. John, "Mechanical Workshop Practice", PHI, 2nd Edition, 2010.
2. H.S. Bawa, "Workshop Practice", Tata McGraw Hill Publishing Company Limited, 2nd Edition 2009.
3. S. K. Hajra Choudhury, A. K. Hajra Choudhury, "Elements of Workshop Technology", Media Promoters, 1st Edition, 2009.
4. Engineering Work shop practice for JNTU, V. Ramesh Babu, VRB Publishers Pvt. Ltd., 2009
5. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.

I.T. WORKSHOP

OBJECTIVES:

1. Learning about the Computer internal components.
2. Practice on operating system installation and configuration settings.
3. Prepare productivity tools like word processors, spreadsheets, presentations.

Task 1	Learn about computer internal parts & Peripherals.

Task 2	Assembling & Disassembling a Computer.
Task 3	Installation of various Operating Systems.
Task 4	Networking two or more computers and document the process.
Task 5	Browsing Internet and creating an email account: Studying various web browsers and their features.
Task 6	**Word Processor**: Introduction to Word: Importance of word as word processor, overview of toolbars, saving, accessing file, using help and resources; Creating project Certificate: Abstract features to be covered; Formatting Styles: Inserting table, bullets and numbering, changing text direction, cell alignment, footnote, hyperlink, symbols, spell check , images from files and clipart, drawing toolbar and Word Art, formatting images, textboxes and paragraphs.
Task 7	**Spreadsheet-I**: Spreadsheet basics, modifying worksheets, formatting cells, formulas and functions.
Task 8	**Spreadsheet-II**: Sorting and filtering, charts, renaming and inserting worksheets, hyper linking, count function, sorting, conditional formatting.
Task 9	**Presentations**: creating, opening, saving and running the presentations, Selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show.
Optional Tasks:	
Task 10	A report on specifications of Laboratory Equipment
Task 11	A report on different Antivirus softwares and their installation, usage.

References:

1. Introduction to Computers, Peter Norton, Mc Graw Hill
2. “MOS study guide for word, Excel, Powerpoint & Outlook Exams”, Joan Lambert, Joyce Cox, PHI.
3. Networking your computers and devices, Rusen, PHI
4. Trouble shooting, Maintaining & Repairing PCs”, Bigelows, TMH

COURSE OUTCOMES	
CO1	Understand and practice Carpentry tools and trade.
CO2	Student will be aware of the safety aspects in using the tools.
CO3	An ability to identify and apply suitable tools for manufacturing of components in workshop trades of Fitting, Carpentry, Foundry, Tin smithy, welding.
CO4	Identify various operations and its applications from the demonstration.
CO5	Understand the basic hardware of computer.
CO6	Follow **ethical** principles in designing circuits and measuring.
CO7	Do experiments effectively as an **individual** and as a member in a **group**.
CO8	**Communicate** verbally and in written form, the understandings about the experiments.
CO9	Continue updating their skill related to electronic devices and their applications during their **life time**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO7	-	-	-	-	-	-	3	-	3		-	-	-	-
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**3**	**3**	**3**	**-**	**3**	**-**	**-**

ENGINEERING PHYSICS LAB

<table>
<tr><td colspan="10">B. Tech I Year II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">17CA55102</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>4</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td colspan="3">Tutorial Classes: Nil</td><td colspan="2">Practical Classes: 68</td><td colspan="3">Total Classes: 68</td></tr>
</table>

Course Objectives:

- To understand the basic principles of interference, diffraction and total internal reflection.
- To enrich practical knowledge of laser characteristics.
- Enlighten the experimental knowledge on semiconductors and magnetic materials.

Out comes:

- Optical experiments, which will establish the interference, diffraction phenomena, the dispersive power of a prism which will be clearly visualized with the experiments.
- In fiber optics experiments, a student can learn propagation of light and bending losses in the fibers

Expt. 1	Determination of radius of curvature of plano-convex lens - Newton‟s rings
Expt. 2	Determination of wavelength of different colors using grating
Expt. 3	Numerical aperture and acceptance angle of optical fiber
Expt. 4	Wavelength of laser using grating
Expt. 5	Determination of particle size using laser
Expt. 6	Determination of thin object using wedge method
Expt. 7	Determination of Band gap of Si or Ge
Expt. 8	LED and LASER characteristics
Expt. 9	Field along the axis of coil carrying current – Stewart Gee„s method
Expt. 10	Study of B – H Curve.
Expt. 11	Determination of Charge density and Hall coefficient or magnetic flux density – Hall effect.
Expt. 12	Determination of Planck‟s constant using LED
Expt. 13	Ultrasonic interferometer
Expt.14	Equipotential surfaces
Expt.15	Oscilloscope - measurements

COURSE OUTCOMES	
CO1	**Demonstrate** Knowledge on measurement of various physical quantities using optical methods, fundamentals of magnetic fields and material properties.
CO2	**Analyze** different physical properties of materials, Magnetic field intensity and optical properties.
CO3	**Formulate** the properties of dielectric materials and optical fiber materials.
CO4	**Follow ethical** values during conducting of Experiments.
CO5	**Work individually** or in a team effectively.
CO6	**Communicate** verbally and in written form pertaining to results of the Experiments.
CO7	**Perform** experiments involving physical Phenomena in future years.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	-	3	-	-	-		-	-	-	-	3	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO*	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

NETWORK ANALYSIS LABORATORY

B. Tech I Year II Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
17CA02204	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	4	2	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 68**				**Total Classes: 68**		

Course Objectives:

The course should enable the students to:

I. Implement different circuits and verify circuit concepts.
II. Study the concepts of mesh and nodal analysis in electrical circuits.
III. Design electric circuits to verify network theorems.
IV. Gain knowledge about resonance and magnetic circuits.

LIST OF EXPERIMENTS

Expt. 1	**KIRCHOFF'S LAWS**
Verification of KCL & KVL for any network	
Expt. 2	**NETWORK THEOREM**
Verification of Superposition Theorem with analysis.	
Expt. 3	**NETWORK THEOREM**
Verification of Thevenin‟s Theorem with analysis.	
Expt. 4	**NETWORK THEOREM**
Verification of Norton‟s Theorem with analysis.	
Expt. 5	**NETWORK THEOREM**
Verification of Maximum Power Transfer Theorem with analysis.	
Expt. 6	**ANALYSIS OF NETWORKS**
Analysis of RL & RC circuits for pulse excitation	
Expt. 7	**RESONANCE CIRCUITS**
Frequency response of series resonance circuit with analysis and design.	
Expt. 8	**RESONANCE CIRCUITS**
Frequency response of parallel resonance circuit with analysis and design.	
Expt.9	**COMPENSATION THEOREM**
Verification of COMPENSATION THEOREM with analysis.	
Expt.10	**MILLIMAN'S THEOREM**
Verification of Milliman‟s theorem using hardware and digital simulation.	

Reference Books:

1. A Chakrabarti, "Circuit Theory", Dhanpat Rai Publications, 6th Edition, 2006.
2. William Hayt, Jack E Kemmerly S.M. Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 7th Edition, 2010.
3. K S Suresh Kumar, "Electric Circuit Analysis", Pearson Education, 1st Edition, 2013.

Web References:

1. https://www.ee.iitkgp.ac.in
2. https://www.citchennai.edu.in
3. https://www.crectirupati.com

COURSE OUTCOMES	
CO1	**Demonstrate the knowledge Network Theorems.**
CO2	**Analyze** the practical Network Theorems.
CO3	**Demonstrate the knowledge on series and parallel** resonances.
CO4	**Investigate and Analyze** the Network Theorems for future applications.
CO5	Follow **ethical** principles in designing circuits and measuring.
CO6	Do experiments effectively as an **individual** and as a member in a **group**.
CO7	**Communicate** verbally and in written form, the understandings about the experiments.
CO8	Continue updating their skill related to electronic devices and their applications during their **life time.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-		3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO*	**3**	**3**	**3**	**3**	-	-	-	**3**	**3**	**3**	-	**3**	**3**	**3**

III SEMESTER

COMPLEX ANALYSIS AND PARTIAL DIFFERENTIAL EQUATIONS

B. Tech II Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
17CA54303	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		2	**2**	**-**	**3**	**30**	**70**	**100**
Contact Classes: 34	**Tutorial Classes: 34**	**Practical Classes: Nil**				**Total Classes: 68**		

Course Objectives:

1. This course aims at providing the student with the concepts of ANLYSING the applications of P.D.E
2. Students achieve the knowledge to analyze the problem using special functions and complex variables.

UNIT-I	**SPECIAL FUNCTIONS AND SERIES SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS**	**Classes:14**

Special Functions: Gamma and Beta Functions – their properties – Evaluation of improper integrals. Series Solutions of ordinary differential equations (Frobenious method)

UNIT-II	**FUNCTIONS OF COMPLEX VARIABLE**	**Classes:13**

Functions of a complex variable – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thomson method.

Complex integration: Line integral – Cauchy"s integral theorem – Cauchy"s integral formula – Generalized integral formula.Complex power series: Radius of convergence –Taylor series, Maclaurin"s series and Laurent series.

UNIT-III	**CONFORMAL MAPPING**	**Classes:13**

Conformal mapping: Transformation ofe^z, Inz, z^2, Sin z, cos z, Bilinear transformation - Translation, rotation, magnification and inversion – Fixed point – Cross ratio – Determination of bilinear transformation. Singular point – Isolated singular point –Removable singular point- Pole of order m – Essential singularity.

UNIT-IV	**RESIDUE**	**Classes:14**

Residue – Evaluation of residue by formula and by Laurent"s series – Residue theorem.
Evaluation of integrals of the type

(a) $\int_{-\infty}^{\infty} f(x)dx$ (b) $\int_{c}^{c+2\pi} f(\cos\theta, \sin\theta)d\theta$ (c) $\int_{-\infty}^{\infty} e^{imx} f(x)dx$

UNIT-V	**PARTIAL DIFFERENTIAL EQUATIONS**	**Classes:14**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Method of separation of variables – Solutions of one dimensional wave equation,one dimensional heat equation and two-dimensional Laplace"s equation under initial and boundary conditions.

Text Books:

Reference Books:

1. „Mathematics III", by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publications.
2. „Advanced Engineering Mathematics", Peter V.O"Neil, CENGAGE publisher.
3. „Advanced Engineering Mathematics", by M.C. Potter, J.L. Goldberg, Edward F.Aboufadel,Oxford.

Web References:

E-Text Books:

1.https://www.e-booksdirectory.com/detais.php?ebook=10166.
2.https://www.e-booksdirectory.com/details.php?ebook=7400re

COURSE OUTCOMES	
CO1	Demonstrate the basic knowledge on special Functions and analyze the functions
CO2	Analyze the complex variable function with reference to their analyticity, integration using Cauchy's integral theorem and power series.
CO3	Demonstrate the basic knowledge on Conformal mapping and Bilinear transformation and analyze the functions
CO4	Evaluate the residue by formula and integrals of the types.
CO5	Solve the first and higher order Partial differential equations and Heat & Wave equations.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	1	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2.4**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

ELECTRONIC DEVICES AND CIRCUITS

B. Tech II Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
17CA04301	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**30**	**70**	**100**
Contact Classes: 51	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 51**		

Course Objectives:

I. Be acquainted with electrical characteristics of ideal and practical diodes under forward and reverse bias to analyze and design diode application circuits such as rectifiers and voltage regulators.
II. Utilize operational principles of bipolar junction transistors and field effect transistors to derive appropriate small-signal models and use them for the analysis of basic amplifier circuits.
III. Perform DC analysis (algebraically and graphically using current voltage curves with super imposed load line) and design of CB, CE and CC transistor circuits.
IV. Compare and contrast different biasing and compensation techniques

UNIT-I	**SEMICONDUCTOR DIODES**	**Classes: 11**

PN Junction Diode : Theory of PN diode, energy band diagram of PN diode, PN junction as a diode, operation and V-I characteristics , static and dynamic resistances, diode equivalent circuits, diffusion and transition capacitance, diode current equation, temperature dependence of V-I characteristic.
Rectifiers And Filters: Half wave rectifier, full wave rectifier, bridge rectifier, general filter consideration, harmonic components in a rectifier circuit , Inductor Filter, capacitor filter, L-Section filter, multiple L-C section, RC filter, comparison of filters.

UNIT-II	**SPECIAL PURPOSE ELECTRONIC DEVICES**	**Classes: 10**

Zener diode characteristics, Zener break down mechanism, Zener diode as a voltage regulator. Operation and characteristics of LDR, LED, Photo diode, PV Cell, Tunnel Diode, silicon controlled rectifier, varactor diode, Schottky diode, DIAC and TRAIC.

UNIT-III	**TRANSISTORS**	**Classes: 10**

Bipolar Junction Transistors: Construction of BJT, minority carrier distributions and current components, operation of BJT, configurations, characteristics, BJT specifications; Applications: Amplifier, switch.
Field Effect Transistors: Types of FET, FET construction, symbol, principle of operation, V-I characteristics, FET parameters, FET as voltage variable resistor, comparison of BJT and FET; MOSFET construction and operation.
Uni-Junction Transistor: Symbol, principle of operation, characteristics, applications (UJT as relaxation oscillator).

UNIT-IV	**BIASING AND COMPENSATION TECHNIQUES**	**Classes: 10**

Need for biasing, BJT operating point, DC and AC load lines, types of biasing circuits, bias stability, stabilization factors, stabilization against variations in V_{BE} and β; Bias compensation techniques, thermal runaway, thermal stability, Comparison between FET and MOSFET, FET biasing methods.

UNIT-V	**BJT AND FET AMPLIFIERS**	**Classes: 10**

BJT small signal analysis, BJT hybrid model, determination of h-parameters from transistor characteristics, transistor amplifiers analysis using h- parameters.
Generalized FET amplifier FET small signal model, FET as common source amplifier.

Text Books:

1. J. Millman, C.C.Halkias, “Millman‟s Integrated Electronics”, Tata McGraw Hill, 2nd edition, 2001.
2. R.L. Boylestad, Louis Nashelsky, “Electronic Devices and Circuits”, PEI/PHI, 9th edition, 2006.
3. S. Salivahanan, N. Suresh Kumar,A. Vallavaraj, “Electronic Devices and Circuits”, Tata McGraw Hill, 2nd edition, 2011

Reference Books:
1. Sedha.R.S, “A Text Book of Applied Electronics”, Sultan Chand Publishers,1st Edition, 2008. 2. J. Millman, C.C.Halkias, Satyabrata Jit, “Millman‟s Electronic Devices and Circuits”, Tata McGrawHill, 2nd edition, 1998 3. David A. Bell, “Electronic Devices and Circuits”, Oxford University Press ,5th edition,2008. 4. Gupta.J.B, “Electron Devices and Circuits”, S.K.Kataria & Sons, 2nd Edition, 2012. 5. Anil K. Maini, Varsha Agarwal, “Electronic Devices and Circuits”, Wiley India Pvt. Ltd, 1st edition, 2009. 6. Floyd, “Electron Devices” Pearson Asia, 5th Edition, 2001. 7. Mohammad Rashid, “Electronic Devices and Circuits”, Cengage learning ,1st Edition, 2014.
Web References:
1. http://www-mdp.eng.cam.ac.uk/web/library/enginfo/electrical/hong1.pdf 2. https://archive.org/details/ElectronicDevicesCircuits 3. http://nptel.ac.in/courses/Webcourse-contents/IIT-ROORKEE/BASIC ELECTRONICS/home_page.htm 4. http://www.vidyarthiplus.in/2011/11/electronic-device-and-circuits-edc.html 5. http://www.satishkashyap.com/2013/03/video-lectures-on-electron-devices-by.html
E-Text Books:
1. http://services.eng.uts.edu.au/pmcl/ec/Downloads/LectureNotes.pdf 2. http://nptel.ac.in/courses/122106025/ 3. http://www.freebookcentre.net/electronics-ebooks-download/Electronic-Devices-and-Circuits-(PDF-313p).html 4. https://www.jntubook.com/electronic-device-circuits-textbook-free-download/ 5. http://www.faadooengineers.com/threads/32735-Electronic-Devices-And-Circuits-(EDC)-by-J-B-Gupta-full-book-pdf.

COURSE OUTCOMES	
CO1	**Demonstrate the knowledge** on PN junction operation and **analyze** the PN junction Diode circuits.
CO2	**Analyze** various special purpose devices and **their applications.**
CO3	**Demonstrate the knowledge** on BJT, FET & UJT operations and **analyze** basic circuits with these transistors.
CO4	**Exhibit the knowledge** on basic concepts of biasing and **analyze** the biasing circuits using BJT & FET.
CO5	**Investigate and analyze** the small signal analysis of different transistor configurations and design the basic amplifiers.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	2	-	-	-	-	-	-	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2.6**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**

SWITCHING THEORY & LOGIC DESIGN

B. Tech II Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA04302	Foundation	3	-	-	3	30	70	100
Contact Classes: 51	Tutorial Classes:Nil	Practical Classes: Nil				Total Classes: 51		

Course Objectives:

I. Formulate and solve problems involving number systems and operations related to them and generate different digital codes.
II. Describe and analyze functions of logic gates and optimize the logic functions using K -map and Quine - McClusky methods.
III. Demonstrate knowledge of combinational and sequential logic circuits elements like Adders, Multipliers, flip-flops and use them in the design of latches, counters, sequence detectors, and similar circuits.
IV. Design a simple finite state machine from a specification and be able to implement this in gates and edge triggered flip-flops.

UNIT-I | FUNDAMENTALS OF DIGITAL SYSTEMS | Classes:10

Review of Number systems: Binary, Octal, Decimal, and Hexa decimal, Number Base Conversions methods, Complements of Numbers, Signed Binary Numbers binary codes: Binary coded decimal, excess-3, gray codes, error detecting and error correcting codes.

UNIT-II | BOOLEAN ALGEBRA AND MINIMIZATION | Classes:10

Boolean algebra: Postulates and theorems, Logic gates and truth tables, Representation of switching functions, sum of products and product of sums forms, NAND & NOR Implementation, karnaugh map representation, simplification of logic functions using Karnaugh maps, Don‟t Care Conditions, Quine - McClusky method.

UNIT-III | COMBINATIONAL CIRCUITS | Classes: 10

Introduction and Design of Combinational Circuits using conventional logic gates, Half adder, full adder, Subtractor, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers and DeMultiplexers.

UNIT-IV | SEQUENTIAL CIRCUITS | Classes: 11

Introduction to sequential circuits, Flip Flops: SR flip flop, JK flip flop, D flip flop, T flip flop, excitation tables, race around condition, master slave flip flop.

Counters: Design of synchronous and asynchronous counters; Shift registers: Modes of operation.

Synchronous sequential circuits: State table, state diagram, state assignment, state minimization; Mealy and Moore machines.

UNIT-V | PROGRAMMABLE LOGIC DEVICES | Classes:10

Memory and Programmable Logic: Introduction to Random Access Memory, Memory Decoding, Read Only Memory, Programmable Logic Array, Programmable Array Logic and Sequential Programmable Devices.

Text Books:

1. M. Morris Mano, Michael D. Ciletti, "Digital Design", Pearson Education/PHI, 3rd Edition, 2008.
2. Zvi. Kohavi, "Switching and Finite Automata Theory", Tata McGraw Hill, 3rd Edition, 2004.
3. A. Anand Kumar, "Switching Theory and Logic Design", Prentice Hall of India, 1st Edition, 2014.

Reference Books:

1. Roth, "Fundamentals of Logic Design", Cengage learning, 5th edition, 2004.
2. John M. Yarbrough, "Digital logic applications and design", Thomson publications, 2nd Edition, 2006.

Web References:

1. mcsbzu.blogspot.com
2. http://books.askvenkat.com
3. http://worldclassprogramme.com
4. http://www.daenotes.com
5. http://nptel.ac.in/courses/117106086/1

E-Text Books:
1. https://books.google.co.in/books/about/Switching_Theory_and_Logic_Design 2. https://www.smartzworld.com/notes/switching-theory-and-logic-design-stld 3. https://www.researchgate.net/.../295616521_Switching_Theory_and_Logic_Design 4. https://books.askvenkat.com/switching-theory-and-logic-design-textbook-by-anand-kumar/ 5. http://www.springer.com/in/book/9780387285931

COURSE OUTCOMES	
CO1	**Exhibit the knowledge** on number systems and **analyze** different coding techniques.
CO2	**Apply the basic knowledge** on the fundamental postulates and theorems and **analyze** various minimization techniques. Design the minimized circuits with gates.
CO3	**Analyze** various combinational logic circuits and **design** different circuits with combinational logic principles.
CO4	**Analyze** SR, JK, D and T flip-flops and **design** synchronous sequential circuits with flipflops.
CO5	**Investigate and analyze** various Programmable Logic Devices and **design** combinational circuits with the Programmable Logic Devices.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	-
CO5	3	2	2		-	-	-	-	-	-	-	-	2	-
CO*	**3**	**2.6**	**2.75**	**2.25**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.80**	**-**

PROBABILITY THEORY AND STOCHASTIC PROCESSES

<table>
<tr><th colspan="11">B. Tech II Year I Semester</th></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">17CA04303</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>2</td><td>2</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 34</td><td>Tutorial Classes: 34</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 68</td></tr>
</table>

Course Objectives:

I. Know the theoretical formulation of probability, random variables and stochastic processes

II. Be familiar with the basic concepts of the theory of random variables in continuous and discrete time domains and analyze various analytical properties such as statistical averages.

III. Understand the concept of stationarity in random processes and study various properties such as auto - correlation, cross -correlation and apply them for signal analysis.

IV. Relate time domain and frequency domain representations of random processes and model different scenarios of random environment in signal processing and applications.

UNIT-I	PROBABILITY AND RANDOM VARIABLE	Classes:13

Introduction to probability through sets and probability: Relative frequency; Experiments and sample spaces, discrete and continuous sample spaces; Events; Probability definitions and axioms; Mathematical model of experiments; Probability as a relative frequency; Joint probability; Conditional probability, total probability; Baye‟s theorem and independent events.

Random variable: Definition of random variable, conditions for a function to be a random variable, discrete , continuous and mixed random variable.

UNIT-II	DISTRIBUTION AND DENSITY FUNCTIONS	Classes:14

Distribution and density functions: Distribution and density functions definitions and properties; Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional distribution, methods of defining conditioning on an event, conditional density, properties. Operation on one random variable expectations: Introduction, expected value of a random variable, function of a random variable, moments about the origin, central moments, variance and skew, Characteristic function; Moment generating function.

Transformations of a random variable: Monotonic transformations for a continuous random variable; Non monotonic transformations of continuous random variable; Transformation of a discrete random variable.

UNIT-III	MULTIPLE RANDOM VARIABLES AND OPERATIONS	Classes: 14

Multiple random variables: Vector random variables, joint distribution function, properties of joint distribution; Marginal distribution functions, conditional distribution and density: Point conditioning, conditional distribution and density: Interval conditioning, statistical independence, sum of two random variables, sum of several random variables; Central limit theorem.

Operations on multiple random variables: Expected value of functions of random variables: Joint moments about the origin, joint central moments, joint characteristic functions and jointly Gaussian random variables: Two random variables case and N random variable case, properties; Transformations of multiple random variables; Linear transformations of Gaussian random variables.

UNIT-IV	STOCHASTIC PROCESSES:TEMPORAL	Classes: 14

The random process concept, classification of processes, deterministic and non deterministic processes, distribution and density functions, concept of stationary and statistical independence; First order stationary processes; Second order and wide sense stationarity, N Order and strict sense stationarity, time averages and ergodicity, mean ergodic processes, correlation ergodic processes; Autocorrelation function and its properties; Cross correlation function and its properties; Covariance functions; Gaussian random processes; Poisson random process.

UNIT-V	STOCHASTIC PROCESSES: SPECTRAL CHARACTERISTICS	Classes: 13

Power spectrum: Properties, relationship between power spectrum and auto-correlation function; The cross power density spectrum, properties, relationship between cross power spectrum and cross correlation function. Spectral characteristics of system response: Power density spectrum of response; cross-power density spectrum of input and output of a linear system. Introduction to white Gaussian noise process and its properties.

Text Books:
1. Peyton Z. Peebles, "Probability, Random Variables & Random Signal Principles", Tata McGraw Hill, 4th Edition, 2001. 2. S.P. Eugene Xavier, "Statistical Theory of Communication", New Age Publications, 1st Edition, 2003.

Reference Books:
1. Henry Stark, John W. Woods, "Probability and Random Processes with Application to Signal Processing", Pearson Education, 3rd Edition, 2014. 2. George R. Cooper, Clave D. MC Gillem, "Probability Methods of Signal and System Analysis", Oxford, 3rd Edition, 1999. 3. Scott Miler, Donald Childers, "Probability and random process", Elsevier, 2nd Edition, 2012. 4. Athanasius Papoulis, S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", PHI, 4th Edition, 2002.

Web References:
1. www.britannica.com/topic/probability-theory 2. www.math.uiuc.edu/~r-ash/BPT.html 3. https://www.ma.utexas.edu/users/gordanz/.../introduction_to_stochastic_processes.pdf 4. nptel.ac.in/courses/111102014/ 5. http://vceece2k10.blogspot.in/p/semester-2-1.html

E-Text Books:
1. http://freecomputerbooks.com/mathProbabilityBooks.html 2. http://www.springer.com/in/book/9780387878584 3. http://www.e-booksdirectory.com/listing.php?category=15

COURSE OUTCOMES	
CO1	**Demonstrate the knowledge** on probability concepts and **analyze** of Probability theory.
CO2	**Demonstrate the basic concepts** of random variables and **analyze** Monotonic and Non–Monotonic transformations of random variables.
CO3	**Exhibit the knowledge** on multiple random variables and **analyze** the operations on multiple random variables.
CO4	**Investigate and analyze** the concepts of Stochastic process in time domain.
CO5	**Investigate and analyze** the concepts of Stochastic process in frequency domain.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

SIGNALS AND SYSTEMS

B. Tech II Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
17CA04304	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		2	**2**	**-**	**3**	**30**	**70**	**100**
Contact Classes: 34	**Tutorial Classes: 34**	**Practical Classes: Nil**			**Total Classes: 68**			

Course Objectives:

1. To study about signals and systems.
2. To do analysis of signals & systems (continuous and discrete) using time domain & frequency domain methods.
3. To understand the stability of systems through the concept of ROC.
4. To know various transform techniques in the analysis of signals and systems.

UNIT - I | INTRODUCTION TO SIGNALS & SYSTEMS | Classes: 13

Definition and classification of Signal and Systems (Continuous time and Discrete time), Elementary signals such as Dirac delta, unit step, ramp, sinusoidal and exponential and operations on signals. Analogy between vectors and signals-orthogonality-Mean Square error-Fourier series: Trigonometric & Exponential, concept of discrete spectrum.

UNIT - II | FOURIER TRANSFORM | Classes: 13

CONTINUOUS TIME FOURIER TRANSFORM: Definition, Computation and properties of Fourier Transform for different types of signals. Statement and proof of sampling theorem of low pass signals.
DISCRETE TIME FOURIER TRANSFORM: Definition, Computation and properties of Fourier Transform for different types of signals.

UNIT - III | SIGNAL PROCESSING THROUGH LINEAR SYSTEMS | Classes: 14

Linear system, impulse response, Response of a linear system, linear time-invariant (LTI) system, linear time variant (LTV) system, Transfer functions of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, Relationship between bandwidth and rise time. Energy and Power Spectral Densities

UNIT - IV | LAPLACE TRANSFORM | Classes: 14

Definition, ROC, ROC-Properties, Inverse Laplace transforms: S-plane, BIBO stability, Transfer functions, System Response to standard signals, Solution of differential equations with initial conditions.

UNIT - V | Z–TRANSFORM | Classes: 14

Derivation and definition, ROC, ROC-Properties.
Z-TRANSFORM PROPERTIES: Linearity, time shifting, change of scale, Z-domain differentiation, differencing, accumulation, convolution in discrete time, initial and final value theorems.
Poles and Zeros in Z –plane, The inverse Z-Transform.
System analysis: Transfer function, BIBO stability, System Response to standard signals, Solution of difference equations with initial conditions.

Text Books:

1. Signals, Systems & Communications - B.P. Lathi, 2009,BS Publications.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn.
3. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2nd Edition.

Reference Books:

1. Signals and Systems – A. Ramakrishna Rao - 2008, TMH.
2. Linear Systems and Signals – B. P. Lathi, Second Edition, Oxford University press, 2008.
3. Fundamentals of Signals and Systems Michel J. Robert, MGH International Edition, 2008.
4. Signals, Systems and Transforms - C. L. Philips, J. M. Parr and Eve A. Riskin, Pearson education.3rd Edition.

COURSE OUTCOMES	
CO1	**Demonstrate the knowledge** on the basic concepts of signals and systems and **analyze** various types of signals and systems.
CO2	**Investigate and analyze** the Continuous-time & discrete –time FT of various signals.
CO3	**Exhibit the knowledge** on LTI systems and **analyze** various filters, Causality and Poly-Wiener criterion.
CO4	**Apply the knowledge** on the basic concepts of Laplace Transforms. **Analyze** Laplace Transforms and inverse Laplace Transforms of different functions.
CO5	**Demonstrate the knowledge** on the basic concepts of Z Transforms. **Analyze** Z Transforms and inverse Z Transforms of different functions.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	2	-	-	-	-	-	-	3	2
CO2	3	3	-	2	-	2	-	-	-	-	-	-	3	2
CO3	3	3	-		-	2	-	-	-	-	-	-	3	2
CO4	3	3	-	2	-	2	-	-	-	-	-	-	3	2
CO5	3	3	-	2	-	2	-	-	-	-	-	-	3	2
CO*	**3**	**3**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**

BASIC ELECTRICAL TECHNOLOGY

B. Tech II Year I Semester

Course code	Category	Hours/week			credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
17CA02306	Foundation	3	0	0	3	30	70	100
Contact Classes:51	Tutorial Classes:-	Practical Classes: Nil				Total Classes:51		

Course Objectives:

The course should enable the students to :

1. The student can able to learn Basic Electrical Technology like Single phase transformers, Induction motors, Synchronous Machines, DC generators and motors.
2. The objective is to study their performance aspects of all machines and their applications.

UNIT-I	DC GENERATORS	Classes:11

D.C. Generators – Principle of Operation – Constructional Features – E. M.F Equation– Numerical Problems – Methods of Excitation – Separately Excited and Self Excited Generators – Build-Up of E.M.F –Magnatisation characteristics Critical Field Resistance and Critical Speed - Load Characteristics of Shunt, Series and Compound Generators and their Applications

UNIT-II	D.C. MOTORS	Classes:10

D.C Motors – Principle of Operation – Back E.M.F. –Torque Equation – Characteristics and Application of Shunt, Series and Compound Motors-Speed Control of D.C. Motors: Armature Voltage and Field Flux Control Methods. Three Point Starter-Losses – Constant & Variable Losses – Calculation of Efficiency - Swinburne‟s Test.

UNIT-III	SINGLE PHASE TRANSFORMERS	Classes:10

Single Phase Transformers - Constructional Details- Emf Equation - Operation on No Load and on Load - Phasor Diagrams-Equivalent Circuit - Losses and Efficiency-Regulation-OC and SC Tests – Sumpner‟s Test - Predetermination of Efficiency and Regulation.

UNIT-IV	3-PHASE INDUCTION MOTORS	Classes:10

Polyphase Induction Motors-Construction Details of Cage and Wound Rotor Machines- - Principle of Operation – Slip- Rotor Emf and Rotor Frequency- Losses and efficiency - Torque Equation- Torque Slip Characteristics.

UNIT-V	SYNCHRONOUS MACHINES	Classes:10

Principle and Constructional Features of Salient Pole and Round Rotor Machines – Distribution(K_d) and coil span(Kc) factors- E.M.F Equation- Voltage Regulation by Synchronous Impedance Method- Theory of Operation of Synchronous Motor.

Text Books:

1. Basic Electrical Engineering, V. N. Mittle and Arvind Mittle, Mc Graw Hill (India) Pvt. Ltd., 2nd Edition, 2005.
2. Basic Electrical Engineering, T.K.Nagsarkar and M.S. Sukhija, Oxford University Press, 2nd Edition.

Reference Books:

1. Basic Electrical Engineering, M.S.Naidu and S. Kamakshiah, Tata Mc Graw Hill, 3rd Edition, 2009.
2. Electrical and Electronic Technology, Hughes, Pearson Education.

COURSE OUTCOMES	
CO1	**Investigate and Analyze the** DC Generators.
CO2	**Investigate and Analyze** the DC motors.
CO3	**Exhibit** the knowledge on Single Phase Transformers and analyze its tests.
CO4	Apply the knowledge on 3-Phase Induction Motors and analyze its loses & Characteristics.
CO5	Demonstrate the knowledge on Synchronous Machines and analyze its Voltage Regulation.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-	-

ELECTRONIC DEVICES AND CIRCUITS LABORATORY

B. Tech II Year I Semester								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04305	Core	L	T	P	C	CIA	SEE	Total
		-	-	4	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 68				Total Classes: 68		

Course Objectives:

The course should enable the students to:

I. Implement and study the characteristics of Diodes and Transistors.
II. Illustrate the concept of rectification using half wave and full wave rectifiers.
III. Design and Construct different amplifier circuits.

LIST OF EXPERIMENTS

PART-A(COMPULSARY)

EXP-1	**ELECTRONIC WORKSHOP PRACTICE -DEVICES**
Identification, specifications, testing of R, L, C components (Color Codes), potentiometers, switches (SPDT, DPDT and DIP), coils, gang condensers, relays, bread boards, PCBs, identification, specifications and testing of active devices, diodes, BJTs, low power JFETs, MOSFETs, power transistors, LEDs, LCDs, optoelectronic devices, SCR, UJT,DIACs.	
EXP-2	**ELECTRONIC WORKSHOP PRACTICE-INSTRUMENTS**
Study and operation of a. Multimeters (Analog and Digital) b. Function Generator c. Regulated Power Supplies d. Study and Operation of CRO e.Spectrum Analyzer	

PART-B(ANY TEN EXPERIMENTS)

EXP-1	**PN DIODE CHARACTERISTICS**
Verification of V-I characteristics of PN diode and calculate static and dynamic resistance using hardware and digital simulation.	
EXP-2	**ZENER DIODE CHARACTERISTICS AND VOLTAGE REGULATOR**
Verification of V-I characteristics of Zener diode and perform Zener diode as a Voltage regulator using hardware and digital simulation.	
EXP-3	**HALF WAVE RECTIFIER**
Verification of half wave rectifier without and with filters using hardware and digital simulation.	
EXP-4	**FULL WAVE RECTIFIER**
Verification of Full Wave Rectifier without and with filters using hardware and digital simulation**.**	
EXP-5	**TRANSISTOR CB CHARACTERISTICS**
Verification of Input and Output characteristics of CB configuration using hardware and digital simulation.	
EXP-6	**TRANSISTOR CE CHARACTERISTICS**
Verification of Input and Output Characteristics of CE configuration using hardware and digital simulation.	
EXP-7	**TRANSISTOR CC CHARACTERISTICS**
Verification of Input and Output Characteristics of CC configuration using hardware and digital simulation.	
EXP-8	**FREQUENCY RESPONSE OF CE AMPLIFIER**
Determine the Gain and Bandwidth of CE amplifier using hardware and digital simulation.	
EXP-9	**FREQUENCY RESPONSE OF CC AMPLIFIER**
Determine the Gain and Bandwidth of CC amplifier using hardware and digital simulation.	
EXP-10	**UJT CHARACTERISTICS**
Verification of V-I Characteristics of UJT using hardware and digital simulation.	

EXP-11	SCR CHARACTERISTICS
Verification of V-I Characteristics of SCR using hardware and digital simulation.	
EXP-12	**FET CHARACTERISTICS**
Verification of V-I Characteristics of FET using digital simulation.	
EXP-13	**FREQUENCY RESPONSE OF CS AMPLIFIER**
Determine the Gain and Bandwidth of CS amplifier using digital simulation.	

Reference Books:

1. J. Millman, C.C.Halkias, "Millman‟s Integrated Electronics",Tata McGraw Hill, 2nd edition, 2001.
2. J. Millman, C.C.Halkias and Satyabrata Jit, "Millman‟s Electronic Devices and Circuits", Tata McGraw Hill, 2nd edition, 1998.
3. Mohammad Rashid, "Electronic Devices and Circuits", Cengage learning, 1st edition, 2014.
4. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th edition, 2009.

Web References:

1. https://archive.org/details/ElectronicDevicesCircuits
2. http://www.tedpavlic.com/teaching/osu/ece327/

LIST OF EQUIPMENT REQUIRED FOR A BATCH

S. No	Name of the Equipment	Range
1	Regulated Power Supply	0-30V DC
2	Cathode Ray Oscilloscope	0-20 MHz
3	Digital voltmeter	0-1V, 0-20 V
4	Digital ammeter	0-200 mA, 0-200 µA
5	Resistors	1KΩ, 100KΩ, 470 Ω, 150 Ω,10KΩ, 47K Ω,1MΩ, 2.2k Ω, 220KΩ
6	Capacitors	0.01µF, 0.01µF, 100 µF(Electrolytic) , 10µF (Electrolytic)
7	Diodes	1N4007, 4V7, 6V2.
8	Transistors	BC107, 2N2646, C106MG /XL084.
9	Semiconductor Trainer Kit	--
10	Connecting Wires and Patch cords	--
11	Decade resistance box	10 Ω -100k Ω
12	Decade Capacitance box	10µF-100 µF
13	Function Generator	10Hz-1M Hz
14	Digital Multimeters	0-20V/ 0-200mA/10 Ω -10k Ω
15	Bread Board	--

COURSE OUTCOMES	
CO1	**Demonstrate the knowledge** on identification & testing of passive components along with active devices.
CO2	**Analyze** the practical characteristics of diodes and transistors with different configurations
CO3	**Design** various amplifier circuits and verify the results.
CO4	**Investigate and Analyze** the amplifiers for future applications
CO5	Follow **ethical** principles in designing circuits and mesuring
CO6	Do experiments effectively as an **individual** and as a member in a **group**.
CO7	**Communicate** verbally and in written form, the understandings about the experiments.
CO8	Continue updating their skill related to electronic devices and their applications during their **life time**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO*	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

ELECTRICAL TECHNOLOGY AND SIMULATION LABORATORY

B. Tech II Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
17CA02307	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**4**	**2**	**30**	**70**	**100**
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 68**				**Total Classes: 68**		

ELECTRICAL TECHNOLOGY LABORATORY

Course Objectives:

1. Conduct various tests on DC shunt machines to calculate the efficiency and to control speed.
2. Determine the performance characteristics, voltage regulation and efficiency of single phase transformer by conducting various tests.

LIST OF EXPERIMENTS(Any Six Experiments)

EXP - 1	**OPEN CIRCUIT CHARACTERISTICS OF DC SHUNT GENERATOR**
Plot the Magnetization characteristics of a DC shunt generator.	
EXP - 2	**LOAD TEST ON DC SHUNT GENERATOR**
Determination of efficiency by conducting load test on DC shunt generator.	
EXP - 3	**NO LOAD TEST ON DC SHUNT MACHINE (SWINBURNE'S TEST)**
Predetermination of efficiency of a DC shunt machine.	
EXP- 4	**BREAK TEST ON DC SHUNT MOTOR**
Study the performance characteristics of DC shunt motor on load.	
EXP- 5	**SPEED CONTROL OF DC SHUNT MOTOR**
Study the speed characteristics of a DC shunt motor.	
EXP- 6	**OC AND SC TEST ON SINGLE PHASE TRANSFORMER**
Determination of equivalent circuit parameters and plot the performance characteristics of a single phase	
EXP- 7	**LOAD TEST ON SINGLE PHASE TRANSFORMER**
Plot the efficiency of single phase transformer for various loads.	
EXP- 8	**DIRECT TEST ON DC SHUNT GENERATOR**
Load test on DC shunt generator using SIMSCAPE power systems.	

Reference Books:

1. V K Mehta, "Principles of Electrical Engineering", S Chand Publications, Re print, 2005.
2. I J Nagarath, D P Kothari, "Theory and Problems of basic electrical engineering", PHI Publications, 1st Edition, 2013.
3. N C Jagan and C Lakhminaraya, "Network Analysis", BS Publications 2nd Edition, 2011.
4. Sudhakar and Shyam Mohan, "Electrical Circuits", Mc Graw Hill Publication, 3rd Edition, 2015

Web References:

1. https://www.ee.iitkgp.ac.in
2. https://www.citchennai.edu.in
3. https://www.iare.ac.in

SIMULATION LABORATORY

OBJECTIVES:

I. Understand the basics of MATLAB.
II. Simulate the generation of signals and operations on them.
III. Illustrate Gibbs phenomenon.
IV. Analyze the signals using Fourier, Laplace and Z transforms.

LIST OF EXPERIMENTS (Any Six Experiments)

EXP-1	**GENERATING AND PLOTTING OF VARIOUS SIGNALS**
A. Generation of various signals and sequences such as unit impulse, sinc, Gaussian, exponential, saw tooth, triangular, sinusoidal by using MATLAB. B. Plotting and display of various real-time signals like Speech, Image and ECG	
EXP-2	**OPERATION ON SIGNALS AND SEQUENCES**
Operation on signals and sequences such as addition, subtraction, multiplication, scaling, shifting, folding by using MATLAB.	

EXP-3	FOURIER TRANSFORMS AND INVERSE FOURIER TRANSFORM
Finding the Fourier Transform and inverse Fourier transform of a given signal/sequence and plotting its magnitude and phase spectrum by using MATLAB.	
EXP-4	**LAPLACE TRANSFORMS**
Finding the Laplace transform of a given signal and locate its zeros and poles in s-plane.	
EXP-5	**Z-TRANSFORMS**
Finding the z - transform of a given sequence and locate its zeros and poles in z-plane.	
EXP-6	**CONVOLUTION BETWEEN SIGNALS AND SEQUENCES**
Finding convolution between two signals /sequences by using MATLAB.	
EXP-7	**AUTO CORRELATION AND CROSS CORRELATION**
Finding auto correlation and cross correlation between signals and sequences by using MATLAB.	
EXP-8	**DISTRIBUTION AND DENSITY FUNCTIONS OF STANDARD RANDOM**
Finding distribution and density functions of standard random variables and plot them by using MATLAB	
EXP-9	**WIDE SENSE STATIONARY RANDOM PROCESS**
Checking a random process for stationary in wide sense by using MATLAB.	

Reference Books:

1. S. Varadarajan , M. M. Prasada Reddy , M. Jithendra Reddy , “Signals and systems introduces MATLAB programs”, I K International Publishing House Pvt. Ltd,2016.
2. Scott L. Miller, Donald G. Childers, “Probability and Random Processes: With Applications to Signal Processing and communications”, Elsevier, 2004.

Web References:

1. http://in.mathworks.com/help/matlab
2. http://web.mit.edu/acmath/matlab/course16/16.62x/16.62x_Matlab.pdf

BASIC SIMULATION LAB SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH:
HARDWARE: Desktop Computer Systems 36 nos
SOFTWARE: MATLAB

ELECTRICAL TECHNOLOGY LAB LIST OF EQUIPMENTS REQUIRED FOR A BATCH

S. No	Name of the Equipment	Range
1	Regulated Power Supply	0-30V
2	Digital volt meter	0-20V
3	Digital Ammeter	0-200 mA
4	Resistive load	4A
5	DC Shunt Motor coupled with DC Generator	3KW
6	DC Shunt Motor	5HP
7	Digital Multimeter	--
8	Tachometers	(0-9999 RPM)
9	1-ϕ Variac	0-230/270V, 8A
10	1-ϕ Transformers	3KVA
11	Ammeter	0-2MC
12	Ammeter	0-10/20A MC
13	Voltmeter	0-150/300V MC
14	Ammeter	0-2.5/5A MI
15	Ammeter	0-10/20A MI
16	Voltmeter	0-150/300V MI

17	Voltmeter	0-300/600V MI
18	Wattmeter	5/10A, 75/150/300V LPF
19	Wattmeter	10/20A, 150/300/600V UPF
20	Rheostat	300 Ohms / 2A
21	Rheostat	50 Ohms / 5A
22	Resistors	(47Ω, 82 Ω, 100 Ω, 150 Ω, 220 Ω, 470 Ω, 560 Ω, 1k Ω, 2.2k Ω, 3.3k Ω.5k Ω,10k Ω)
23	Inductors	0.01mH, 0.1mH,10mH, 50mH
24	Capacitors	0.01μF, 0.1μF, 0.47μF, 470μF, 33μF
25	Bread boards	--
26	Probes / Connecting wires	--

COURSE OUTCOMES	
CO1	**Demonstrate the basic knowledge** on the fundamental concepts of DC Generators, Motors, transformers and MATLAB programs.
CO2	**Analyze** the DC Generators, transformers, Motors and MATLAB programs on signals analysis.
CO3	Develop a MATLAB program to analyze various systems with different signals.
CO4	**Investigate and** analyze different Tests on DC Generators, Motors, transformers and MATLAB programs on signal analysis.
CO5	Follow the **ethical** values in connecting the circuit and Developing a MATLAB program
CO6	Do experiments effectively as an **individual** and as a member in a **group**.
CO7	**Communicate** verbally and in written form, the understandings about the experiments.
CO8	Continue updating their analysis and skills related to various machines and programs based on application during their **life time**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

HUMAN VALUES & PROFESSIONAL ETHICS (MANDATORY COURSE)

B. Tech II Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA56301	Perspective	1	-	-	1	-	-	-

Course Objectives:

The course should enable the students to:

I. Understand the fundamental theoretical and historic graphical topics of professional ethics and human values.
II. Study independence and self-evaluation professional ethics and human values, so that they can grasp the core values as independent thinkers.
III. Develop their analytical and pragmatic abilities & situational reasoning aligned towards right and wrong.

UNIT – I ENGINEERING ETHICS

Senses of „Engineering Ethics" – Variety of Moral Issues – Types of Inquiry – Moral Dilemmas – Moral Autonomy – Kohlberg"s Theory – Gilligan"s Theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories

UNIT - II ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation – Engineers as Responsible Experimenters – Research Ethics – Codes of Ethics – Industrial Standards – A Balanced Outlook on Law – The Challenger Case Study

UNIT - III ENGINEER'S RESPONSIBILITY FOR SAFETY

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator"s Approach to Risk – Chernobyl Case Studies and Bhopal

UNIT - IV RESPONSIBILITIES AND RIGHTS

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality– Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights –Intellectual Property Rights (IPR) – Discrimination.

UNIT - V GLOBAL ISSUES

Multinational Corporations – Business Ethics – Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty –Moral Leadership – Sample Code of Conduct

Text Books:

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York 2005.
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, 2000.

Reference Books:

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003.
3. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, 2004.
4. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, 2003.

COURSE OUTCOMES	
CO1	Apply the knowledge on Kohlberg's theory, Gilligan's theory to analyze professions and professionalism.
CO2	Analyze the core values that shape the ethical behaviour of an engineer.

CO3	Demonstrate the knowledge on risk possibilities and analyze the safety measures to avoid risk.
CO4	Exhibit the knowledge on the responsibilities, rights and IPR.
CO5	Demonstrate the knowledge on various ethics, qualities of moral leadership, Management patterns and code of conduct.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	3	-	-	-	-	3	3
CO2	3	2	-	-	-	-	-	3	-	-	-	-	3	3
CO3	3	2	-	-	-	-	-	3	-	-	-	-	3	3
CO4	3	2	-	-	-	-	-	3	-	-	-	-	3	3
CO5	3	2	-	-	-	-	-	3	-	-	-	-	3	3
CO*	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**3**

IV SEMESTER

ELECTRONIC CIRCUIT ANALYSIS

B. Tech II Year II Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
17CA04401	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		2	**2**	**-**	**3**	**30**	**70**	**100**
Contact Classes: 34	**Tutorial Classes: 34**	**Practical Classes: Nil**				**Total Classes**: 68		

Course Objectives:

1. Analyze and design of single stage and multistage amplifiers.
2. Demonstrate the ability to analyze the frequency response of different types of amplifiers.
3. Interpret the concept of feedback and classify various types of feedback amplifiers.
4. Analyze and design the oscillator, power amplifiers and tuned amplifiers.

UNIT-I	**SINGLE STAGE AND MULTISTAGE AMPLIFIERS**	**Classes: 13**

Single Stage Amplifiers: Classification of amplifiers, Design of Single stage RC coupled amplifier using BJT, Low frequency response of Bipolar Junction Transistor amplifier, Analysis at low frequency, Effect of coupling and Bypass capacitor.

Multistage Amplifiers: Different coupling schemes used in amplifiers, Analysis of RC coupled amplifiers, Transformer coupled amplifiers and Direct Coupled amplifiers, Analysis of Cascode amplifiers, Darlington pair, Analysis of multistage amplifiers using FET.

UNIT-II	**HIGH FREQUENCY RESPONSE OF TRANSISTOR**	**Classes: 13**

BJT: Transistor at High frequencies, Hybrid-π Common Emitter Transistor model, Hybrid π conductance, Hybrid π capacitances, Common Emitter short circuit current gain, Frequency response and Gain Bandwidth product, Current gain with resistive load, Cut-off frequencies.

FET: Analysis of Common Source and Common Drain Amplifier Circuits at High frequencies.

UNIT-III	**FEEDBACK AMPLIFIERS AND OSCILLATORS**	**Classes: 14**

Feedback amplifiers: Concept of feedback, Classification of Feedback Amplifiers, General characteristics of Negative Feedback Amplifiers, Analysis of voltage series, voltage shunt, current series and current shunt feedback configurations.

Oscillators: Classification of oscillators, Conditions for oscillations, Types of Oscillators: Generalized analysis of LC oscillators, Hartley and Colpitts oscillators, RC phase shift oscillators, Wien - bridge and Crystal oscillators, Frequency and amplitude stability of oscillators.

UNIT-IV	**POWER AMPLIFIERS**	**Classes: 14**

Class A large signal amplifiers, Second harmonic Distortion, Higher order harmonic Distortion, Transformer coupled Class A audio power amplifier, Efficiency of Class A amplifier, Class B amplifier, Class B push-pull amplifier, Complementary symmetry Class B push-pull amplifier, Efficiency of Class B amplifier, Class D amplifier, Class S amplifier, Thermal stability and Heat sink.

UNIT-V	**TUNED AMPLIFIERS**	**Classes: 14**

Introduction, Q-factor, Small Signal Tuned amplifier – Capacitance Single tuned amplifier, Double tuned amplifier, Effect of Cascading Single and Double tuned amplifiers on Bandwidth, Staggered tuned amplifiers, Stability of tuned amplifiers.

Text Books:

1. S.Salivahana, N. Suresh kumar, "Electronic circuit analysis", McGraw Hill education, 4th Edition, 2011.
2. Jacob Millman, Christor C Halkias, "Integrated Electronics", Tata McGraw Hill, 1st Edition, 2008.
3. Sedra A.S., K.C. Smith, "Micro Electronic Circuits", Oxford University Press, 6th Edition, 2013.

Reference Books:

1. Donald A Neamen, " Electronic Circuits Analysis and Design" , Tata McGraw Hill , 3rd Edition, 2007.
2. David A. Bell "Electronic Devices & Circuits" 5th Edition,. Oxford university press, 7th Edition, 2009.
3. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuits Theory", Pearson education, 9th Edition, 2008.
4. K. Lal Kishore, "Electronic Circuit Analysis", BS Publications,1st Edition, 2004.

Web References:

1. http://www.igniteengineers.com 2. http://www.ocw.nthu.edu.tw 3. http://www.uotechnology.edu.iq 4. http://www.iare.ac.in
E-Text Books:
1. https://www.jntubook.com/electronic-circuit-analysis-textbook 2. http://tradownload.com/results/neamen-electronic-circuit-analysis-and-design-.html 3. http://www.allaboutcircuits.com 4. http://www.te.kmutnb.ac.th/~msn/225301reports156-2.pdf

COURSE OUTCOMES	
CO1	**Demonstrate** the concept of single stage and multistage amplifiers and **analyze** various parameters using frequency response of transistor in CE configuration.
CO2	**Apply** hybrid-Π model on CE configuration of a transistor to **formulate** the gain, bandwidth and gain bandwidth product and **Analyze** its frequency response at higher frequencies **.**
CO3	**Analyze** the concept of feedback in amplifiers using negative feedback and frequency of oscillators for audio and radio frequency ranges.
CO4	**Analyze** various power amplifiers to measure the efficiency with given specifications.
CO5	**Demonstrate** different types of tuned amplifiers and **formulate** the Q-factor, Bandwidth.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

ANALOG COMMUNICATIONS

B. Tech II Year II Semester									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
17CA04402	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**30**	**70**	**100**
Contact Classes: 51	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 51**		

Course Objectives:

1. Develop skills for analyzing different types of signals in terms of their properties such as energy, power, correlation and apply for analysis of linear time invariant systems.
2. Analyze various techniques of generation and detection of amplitude modulation (AM), frequency modulation (FM) and phase modulation (PM) signals.
3. Differentiate the performance of AM, FM and PM systems in terms of Power, Bandwidth and SNR (Signal-to-Noise Ratio).
4. Evaluate Analog Communication system in terms of the complexity of the transmitters and receivers.

UNIT-I	**AMPLITUDE MODULATION**	**Classes: 11**

Review of Fourier series, Fourier transform and its properties, Introduction to communication system, need for modulation, frequency division multiplexing; Amplitude modulation, definition; Time domain and frequency domain description, single tone modulation, power relations in amplitude modulation waves; Generation of amplitude modulation wave using, square law and switching modulators; Detection of amplitude modulation waves using square law and envelope detectors; Double side band modulation: Double side band suppressed carrier time domain and frequency domain description; Generation of double side band suppressed carrier waves using balanced and ring modulators; Coherent detection of double side band suppressed carrier modulated waves; Costas loop; Noise in amplitude modulation, noise in double side band suppressed carrier.

UNIT-II	**SINGLE SIDE BAND MODULATION**	**Classes: 10**

Frequency domain description, frequency discrimination method for generation of amplitude modulation single side band modulated wave; time domain description; Phase discrimination method for generating amplitude modulation single side band modulated waves; Demodulation of single side band waves.
Noise in single side band suppressed carrier; Vestigial side band modulation: Frequency description, generation of vestigial side band modulated wave; Time domain description; Envelope detection of a vestigial side band modulation wave pulse carrier; Comparison of amplitude modulation techniques; applications of different amplitude modulation systems.

UNIT-III	**ANGLE MODULATION**	**Classes: 10**

Basic concepts, frequency modulation: Single tone frequency modulation, spectrum analysis of sinusoidal frequency modulation wave, narrow band frequency modulation, wide band frequency modulation, transmission bandwidth of frequency modulation wave, phase modulation, comparison of frequency modulation and phase modulation; Generation of frequency modulation waves, direct frequency modulation and indirect frequency modulation,
Detection of frequency modulation waves: Balanced frequency discriminator, Foster Seeley discriminator, ratio detector, zero crossing detector, phase locked loop, comparison of frequency modulation and amplitude modulation; Noise in angle modulation system, threshold effect in angle modulation system, pre-emphasis and de-emphasis.

UNIT-IV	**PULSE MODULATION**	**Classes: 10**

Pulse amplitude modulation – Natural sampling, flat top sampling and Pulse amplitude modulation (PAM) & demodulation, Pulse-Time Modulation – Pulse Duration and Pulse Position modulations and demodulation schemes, PPM spectral analysis, Illustrative Problems. Radio Receiver measurements: Sensitivity, Selectivity, and fidelity.

UNIT-V	**RECEIVERS**	**Classes: 10**

Receivers: Introduction, tuned radio frequency receiver, super heterodyne receiver, radio frequency amplifier, mixer, local oscillator, intermediate frequency amplifier, automatic gain control; Receiver characteristics: Sensitivity, selectivity, image frequency rejection ratio, choice of intermediate frequency, fidelity; Frequency modulation receiver, amplitude limiting, automatic frequency control, comparison with amplitude modulation receiver.
Text Books:
1. B.P. Lathi, "Signals, Systems and Communications", BS Publications, 5th Edition, 2009. 2. S. S. Haykin, "Communication Systems", Wiley Eastern, 2nd Edition, 2006. 3. Taub, Schilling, "Principles of Communication Systems", Tata McGraw-Hill, 4th Edition, 2013.
Reference Books:
1. B.P. Lathi, "Communication Systems", BS Publication,2nd Edition, 2006. 2. John G. Proakis, Masond, Salehi, "Fundamentals of Communication Systems", PEA, 1st Edition, 2006. 3. George Kennedy,Bernard Davis, "Electronics and Communication System", Tata McGraw Hill , 5th Edition, 2011. 4. B.P. Lathi, Zhi Ding, "Modern analog and digital Communication Systems", Oxford Publication, 4th Edition, 2011.
Web References:
1. http://www.web.eecs.utk.edu 2. https://everythingvtu.wordpress.com 3. http://nptel.ac.in/ 4. http://www.iare.ac.in
E-Text Books:
1. http://www.bookboon.com/ 2. http://www.jntubook.com 3. http://www.smartzworld.com 4. http://www.archive.org

COURSE OUTCOMES	
CO1	**Demonstrate** the basic concepts, need of modulation and fundamental elements to introduce analog communication systems and **Formulate** the power relations of various modulation and demodulation techniques.
CO2	**Analyze** the generation and detection techniques and **Formulate** the power relations of AM used in broadcasting systems.
CO3	**Analyze** the generation and detection techniques of FM and **formulate** the bandwidth, modulation index and power requirements.
CO4	**Analyze** the generation and detection of PM for analog communication systems and **formulate** their required parameters.
CO5	**Demonstrate** the different characteristics of transmitter and receivers and **Analyze** the different types of noise and f**ormulate** the SNR and figure of merit for different AM, FM and PM.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**3**	-	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

LINEAR IC APPLICATIONS

B. Tech II Year II Semester								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04403	Core	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 51	Tutorial Classes:Nil	Practical Classes: Nil				Total Classes: 51		

Course Objectives:

1. Be acquainted to principles and characteristics of op-amp and apply the techniques for the design of comparators, instrumentation amplifier, integrator, differentiator, multivibrators, waveform generators, log and anti-log amplifiers
2. Analyze and design filters, timer, analog to digital and digital to analog Converters.
3. Understand the functionality and characteristics of commercially available digital integrated circuits

UNIT-I	INTEGRATED CIRCUITS	Classes: 11

Integrated Circuits: Classification of integrated circuits, Package types and temperature ranges; **Differential Amplifier**: DC and AC analysis of Dual input Balanced output Configuration; Properties of differential amplifier configuration: Dual Input Unbalanced Output, Single Ended Input, Balanced/ Unbalanced Output; DC Coupling and Cascade Differential Amplifier Stages, Level translator.

Characteristics of OP-Amps: Op-amp Block Diagram, ideal and practical Op-amp specifications, DC and AC characteristics, 741 op-amp & its features; Op-Amp parameters & Measurement: Input & Out put Off set voltages & currents, slew rate, CMRR, PSRR, drift. Introduction to dual op-amp TL082 as a general purpose JFET input operational amplifier.

UNIT-II	APPLICATIONS OF OP- AMPS	Classes: 10

Linear applications of Op- Amps: Inverting and non-inverting amplifier, integrator, differentiator, instrumentation amplifier, AC amplifier; Non-linear applications of Op-Amps: Comparators, multivibrators, triangular and square wave generators, non- linear function generation, log and anti log amplifiers. Analog multiplier, attenuators.

UNIT-III	ACTIVE FILTERS AND WAVE SHAPING CIRCUITS	Classes: 10

Wave Shaping Circuits : Clippers, Clampers

Passive Filter : Rc Response

Active Filters: Classification of filters, 1st order low pass and high pass filters, 2nd order low pass, high pass, band pass, band reject and all pass filters.

UNIT-IV	TIMERS	Classes: 10

Timers: Introduction to 555 timer, functional diagram, mono-stable, astable operations and applications, Schmitt Trigger.

PLL: Introduction, block schematic, principles and description of individual blocks, 565 PLL. Application of PLL.

UNIT-V	DATA CONVERTERS	Classes: 10

Data converters: Introduction, classification, need of data converters.

DAC techniques: Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, DAC characteristics.

ADC techniques: Integrating, successive approximation, flash converters, A/D characteristics.

Text Books:

1. D. Roy Chowdhury, "Linear Integrated Circuits", New age international (p) Ltd, 2nd Edition, 2003.
2. Ramakanth A. Gayakwad, "Op-Amps & linear ICs", PHI, 3rd Edition, 2003.

Reference Books:

1. Salivahanan, "Linear Integrated Circuits and Applications", TMH, 1st Edition, 2008.

Web References:
1. https://www.nptel.ac.in 2. https://www.svecw.edu.in 3. https://www.smartzworld.com 4. https://www.crectirupati.com
E-Text Books:
1. https://books.google.co.in/books?isbn=8122414702 2. https://books.google.co.in/books?isbn=013186389

COURSE OUTCOMES	
CO1	**Demonstrate** the concept of operational amplifiers and **formulate** its DC and AC characteristics.
CO2	**Analyze and Design** various linear and non-linear application circuits using op-amp operating with negative feedback in closed loop configuration.
CO3	**Analyze and Design** frequency selective circuits and wave shaping circuits using op-amp.
CO4	**Apply the knowledge** on Timers and PLLs using IC555 and **Analyze** the timers by measuring their frequency of oscillation and **Design** the multivibrators using IC555 timer.
CO5	**Investigate** the working principles of data converters for data processing applications.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	2	-	-	-	-	-	-	3	2
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	2	-	-	-	-	-	-	3	2
CO5	3	3	2	3	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2.8**	**2**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**

CONTROL SYSTEMS

B. Tech II Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA02501	Core	L	T	P	C	CIA	SEE	Total
		2	2	-	3	30	70	100
Contact Classes: 34	Tutorial Classes:34	Practical Classes: Nil				Total Classes: 68		

Course Objectives:

The course should enable the students to:

1. Organize modeling and analysis of electrical and mechanical systems.
2. Analyse control systems by block diagrams and signal flow graph technique.
3. Demonstrate the analytical and graphical techniques to study the stability.
4. Illustrate the frequency domain and state space analysis.

UNIT-I	INTRODUCTION AND MODELING OF PHYSICAL SYSTEMS	Classes: 13

Control systems: Introduction, open loop and closed loop systems, examples, mathematical models and differential equations of physical systems, concept of transfer function, translational and rotational mechanical systems, electrical systems, force voltage and force current analogy. Block Diagrams: Block diagram representation of various systems, block diagram algebra, characteristics of feedback systems DC servomotors, signal flow graph, Mason‟s gain formula;

UNIT - II	TIME RESPONSE ANALYSIS	Classes: 13

Time response analysis: Standard test signals, shifted unit step, ramp and impulse signals, shifting theorem, convolution integral, impulse response, unit step response of first and second order systems, time domain specifications, steady state errors and error constants effects of proportional, derivative and proportional derivative, proportional integral and PID controllers.

UNIT - III	CONCEPT OF STABILITY AND ROOT LOCUS TECHNIQUE	Classes: 14

Concept of stability: Necessary and sufficient conditions for stability, Routh‟s and Routh Hurwitz stability criterions and limitations.

Root locus technique: Introduction, root locus concept, construction of root loci, graphical determination of „k‟ for specified damping ratio, relative stability, effect of adding zeros and poles on stability.

UNIT - IV	FREQUENCY DOMAIN ANALYSIS	Classes: 14

Frequency domain analysis: Introduction, frequency domain specifications, stability analysis from Bode plot, polar plot, Nyquist plot, calculation of gain margin and phase margin, determination of transfer function from bode plot, correlation between time and frequency responses. Compensators: Lag, lead, lag lead networks.

UNIT - V	STATE SPACE ANALYSIS AND COMPENSATORS	Classes: 14

State Space Analysis: Concept of state, state variables and state model, derivation of state models from block diagrams, diagonalization, solving the time invariant state equations, state transition matrix and properties, concept of controllability and observability;

Text Books:

1. I J Nagrath, M Gopal, "Control Systems Engineering", New Age International Publications, 3rd Edition, 2007.
2. K Ogata, "Modern Control Engineering", Prentice Hall, 4th Edition, 2003.
3. N C Jagan, "Control Systems", BS Publications, 1st Edition, 2007.

Reference Books:

1. A Anand Kumar, "Control Systems", PHI Learning, 1st Edition, 2007.
2. S Palani, "Control Systems Engineering", Tata McGraw Hill Publications,1st Edition, 2001.
3. N K Sinha, "Control Systems", New Age International Publishers, 1st Edition, 2002.

Web References:

1.	https://www.researchgate.net
2.	https://www.aar.faculty.asu.edu/classes
3.	https://www.facstaff.bucknell.edu/
4.	https://www.electrical4u.com
5.	https://www.crectirupati.com
E-Text Books:	
1.	https://www.jntubook.com/
2.	https://www.freeengineeringbooks.com

COURSE OUTCOMES	
CO1	**Demonstrate** the basic concepts of Control Systems and **Analyze** block diagram reduction technique and Mason's gain formula to find the transfer function of a system.
CO2	**Demonstrate** different standard test input signals for the performance analysis of second order systems and steady state errors and **Analyze** the time domain analysis to predict transient response specifications of the system for system stability.
CO3	**Analyze** and **Design** the time response of the system for system stability using root locus technique and Controllers.
CO4	**Analyze** the stability of second order systems using frequency domain concept and **Design** the compensators in time domain and frequency domains specifications to increases the steady state of the system.
CO5	**Demonstrate and Analyze** the stability of second order system and state space analysis.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**3**	**2.5**	**2.66**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

B. Tech II Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA04404	Foundation	2	2	-	3	30	70	100
Contact Classes: 34	Tutorial Classes: 34	Practical Classes: Nil				Total Classes: 68		

Course Objectives:

1. Familiarize about 3D vector co-ordinate systems and electromagnetic field concepts.
2. Have skills in selecting appropriate Maxwell‟s equations in electromagnetic theory for a given application and analyze the problem.
3. Investigate the propagation characteristics of electromagnetic waves at boundary of different media.
4. Demonstrate the ability to compute various parameters for transmission lines using smith chart and classical theory.

UNIT-I ELECTROSTATICS — **Classes: 13**

Review of Vector algebra, Co-ordinate systems & transformation, Vector calculus, Coulomb‟s Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Maxwell‟s Two Equations for Electrostatic Fields, Electric dipole, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson‟s and Laplace‟s Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.

UNIT-II MAGNETOSTATICS — **Classes: 13**

Biot-Savart Law, Ampere‟s Circuital Law and Applications, Magnetic Flux Density, Maxwell‟s Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Magnetic torque and moment, Magnetic dipole, Inductances and Magnetic Energy, Illustrative Problems.

UNIT-III MAXWELL'S EQUATIONS (FOR TIME VARYING FIELDS) — **Classes: 14**

Faraday‟s Law and Transformer e.m.f, Inconsistency of Ampere‟s Law and Displacement Current Density, Maxwell‟s Equations in Different Final Forms and Word Statements. Boundary Conditions of Electromagnetic fields: Dielectric-Dielectric and Dielectric-Conductor Interfaces, Illustrative Problems.

UNIT-IV EM WAVE CHARACTERISTICS — **Classes: 14**

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization, Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector, and Poynting Theorem – Applications, Power Loss in a Plane Conductor, Illustrative Problems.

UNIT-V TRANSMISSION LINES — **Classes: 14**

Types, Transmission line parameters (Primary and Secondary), Transmission line equations, Input impedance, Standing wave ratio & power, Smith chart & its applications, Applications of transmission lines of various lengths, Micro-strip transmission lines – input impedance, Illustrative Problems.

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetic", Oxford University Press, 4th edition, 2009.
2. E.C. Jordan, K.G. Balmain, "Electromagnetic waves and Radiating Systems", PHI learning, 2nd Edition, 2000.
3. Umesh Sinha, Satya Prakashan, "Transmission lines and Networks", Tech India Publications, 1st edition, 2010.

Reference Books:

1. Nathan Ida, "Engineering Electromagnetic", Springer (India) Pvt. Ltd, 2nd Edition, 2005
2. William H. Hayt Jr., John A. Buck, "Engineering electromagnetic", Tata McGraw Hill, 7th Edition, 2006.
3. G. Sashibushana Rao, "Electromagnetic Field theory and Transmission Lines, Wiley India, 2013.
4. John D. Ryder, "Networks, Lines and Fields", PHI learning, 2nd Edition, 1999.

Web References:

1. http:// web.stanford.edu/class 2. http://www.electronicagroup.com 3. http://www.cpri.in/about-us/departmentsunits/library-and-information-centre/digital-library-links.html 4. http://nptel.ac.in/courses/antennas 5. http://www.tutorialspoint.com/discrete_mathematics
E-Text Books:
1. http://www.bookboon.com/en/concepts-in-electrostatics-ebook 2. http://www.www.jntubook.com 3. http://www.allaboutcircuits.com 4. http://www.archive.org

COURSE OUTCOMES	
CO1	**Apply the knowledge** on different coordinate systems and **Analyze** the fundamental laws of electrostatic fields to **Solve** the Field intensity and Flux density of various charge distributions and **Design** the models of capacitors.
CO2	**Demonstrate** Biot-Savart's law and Ampere's Circuit law to determine forces due to magnetic fields and **Formulate** the energy relations for electric and magnetic fields.
CO3	**Demonstrate** the Maxwell's equations and their application to time varying fields and boundary conditions.
CO4	**Demonstrate and analyze** the propagation of electromagnetic waves in different media and its interfaces.
CO5	**Exhibit the knowledge** on transmission lines and **Analyze** them under Loss less/Distortion less condition to get minimum attenuation by using Smith chart.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

B. Tech II Year II Semester								
Course Code	**Category**	**Hours /**			**Credit**	**Maximum Marks**		
17CA53301	**Skill**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**30**	**70**	**100**
Contact Classes: 51	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 51**		

Course Objectives:

1. Understand the market dynamics namely demand, elasticity of demand and pricing in different market structures.
2. Explain how the production function is carried out to achieve least cost combination of inputs and cost analysis.
3. Analyze how capital budgeting decisions are carried out.
4. Develop the frame work for both manual and computerized accounting process.
5. Acquire the basics of how to analyze and interpret the financial statements through ratio analysis.

UNIT-I	**INTRODUCTION AND DEMAND ANALYSIS**	**Classes : 10**

Introduction of Managerial Economics-Definition, nature and scope of business economics.
Demand analysis: Concepts of demand- Demand Function-law of demand - Elasticity of demand: Definition, types, Significances - measurement of elasticity –Methods of Demand forecasting, factors governing demand forecasting.

UNIT-II	**PRODUCTION AND COST ANALYSIS**	**Classes : 11**

Production function-Least cost combination –Short run and long run production functions
cost analysis: Cost concept and behavior -Break even analysis (BEA)-determination of break-even point (simple problems)-managerial significance and limitations of break even point.

UNIT-III	**MARKETS AND NEW ECONOMIC ENVIRONMENT**	**Classes: 10**

Market structure- Types of market- perfect and imperfect competition- Futures of perfect competition- monopoly and monopolistic competition- oligopoly- price-output determination- Pricing methods-joint stock company, public enterprises and their types.

UNIT-IV	**FINANCIAL ACCOUNTING AND ANALYSIS**	**Classes: 10**

Introduction of Financial accounting- objectives, functions; Single -double-entry book keeping, Principles of accounting- journal, ledger, trial balance.
Financial analysis: Ratio Analysis- liquidity, Leverage, profitabilities and active ratio(Problems)

UNIT-V	**CAPITAL BUDGETING**	**Classes : 10**

Concepts of Capital and its significance, types of capital- methods and evaluation of capital budgeting projects -Payback methods- accounting rate of return(ARR)- net present value(NPV) method and internal rate of return method (simple problems).

Text Books:

1. Aryasri, “Managerial Economics and Financial Analysis”, TMH, 2012.
2. M.Kasi Reddy, Saraswathi, “Managerial Economics and Financial Analysis”, PHI, 2012.
3. Varshney, Maheswari, “Managerial Economics”, Sultan Chand, 2009.

Reference Books:

1. S.A.Siddiqual, A.S. Siddiqual, “Managerial Economics and Financial Analysis”, New Age International Publishers, 2013.
2. S.N.Maheswari, S.K.Maheswari, “Financial Accounting”, Vikas publications, 2012.
3. J.V.Prabhakar Rao & P.V.Rao, “Managerial Economics and Financial Analysis”,Maruthi Publishers, 2011.
4. Vijay Kumar, Appa Rao, “Managerial Economics and Financial Analysis”, Cengage 2011.

Web References:

1. https:// www.scribd.com/doc/37684926
2. https:// www.slideshare.net/glory1988/managerial-economics-and- financial analysis
3. http:// www.cs.utah.edu/~devnani/2-2.pdf
4. https:// thenthata.web4kurd.net/mypdf/managerial-economics-and- financial analysis
5. https:// bookshallcold.link/pdfread/managerial-economics-and-financial analysis
6. https:// www.gvpce.ac.in/syllabi/Managerial Economics and financial analysis

E-Text Book:

1. https:// books.google.co.in/books/about/Managerial economics and financial analysis 2. http://www. ebooktake.in/pdf/title/managerial-economics-and-financial analysis 3. http://all4ryou.blogspot.in/2012/06/mefa-managerial-economics and financial analysis 4 http://books.google.com/books/about/Managerial economics and financial analysis 5. http://www.scribd.com/doc/37684926

COURSE OUTCOMES	
CO1	**Demonstrate** microeconomic factors in related to demand analysis and its forecasting.
CO2	**Apply the Knowledge** on the theory of production function and Cost concepts to determine the Break Even Analysis.
CO3	**Demonstrate** different market structures, pricing strategies and different forms business organization.
CO4	**Analyze** the investment, capital budgeting decisions and Strategies of organizations.
CO5	**Exhibit the Knowledge** about fundamental accounting concept and **Analyze** the financial statement using ratio analysis.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO4	2	3	-	-	2	-	-	-	-	-	2	-	-	-
CO5	3	3	-	2	2	-	-	-	-	-	2	-	-	-
CO*	**2.8**	**3**	-	**2**	**2**	-	-	-	-	-	**2**	-	-	-

ELECTRONIC CIRCUIT ANALYSIS LABORATORY

<table>
<tr><td colspan="10">B. Tech II Year II Semester</td></tr>
<tr><td rowspan="1">Course Code</td><td>Category</td><td colspan="3">Hours /Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">17CA04405</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>4</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes:</td><td colspan="4">Practical Classes: 68</td><td colspan="3">Total Classes: 68</td></tr>
</table>

Course Objectives:

1. Simulate and analyze single stage and multi stage amplifiers and oscillators.
2. Demonstrate the principles of feedback amplifiers and oscillators through simulation.
3. Implementation of circuits for linear and non linear wave shaping.
4. Analyze the characteristics of different multivibrators.

LIST OF EXPERIMENTS

Note: ALL THE EXPERIMENTS TO BE PERFORMED IN H/W AS WELL AS SIMULATED

EXP-1	**BASIC AMPLIFIERS**
Study of frequency response of common emitter amplifier and common base amplifier.	
EXP -2	**BASIC AMPLIFIERS**
Study of frequency response of common collector amplifier.	
EXP -3	**FET COMMON SOURCE AMPLIFIER**
Study of Frequency response of FET CS amplifier.	
EXP - 4	**TWO STAGE RC COUPLED AMPLIFIER**
Study of frequency response of two stage RC coupled amplifier.	
EXP -5	**SINGLE STAGE TUNED AMPLIFIERS**
Study of single stage tuned amplifier.	
EXP-6	**TRANSISTOR AS A SWITCH**
Study of transistor as a switch and to plot DC Load Line.	
EXP -7	**FEEDBACK AMPLIFIERS**
Study of voltage series feedback amplifier and current shunt feedback amplifier.	
EXP -8	**RC PHASE SHIFT OSCILLATOR USING TRANSISTOR**
Study of sine wave generated for a particular frequency by an RC phase shift oscillator.	
EXP-9	**OSCILLATORS/ SCHMIT TRIGGER**
Study of sine wave generated for a particular frequency by Colpitts and Hartley oscillator.	
EXP-10	**POWER AMPLIFIERS**
Study of class A power amplifier (transformer less) and class B power amplifier.	

Reference Books:

1. J. Millman, C. C. Halkias, “Integrated Electronics”, Tata McGraw Hill. 1st edition, 2008.
2. B. P. Singh, Rekha Singh, “Electronic Devices and Circuits”, Pearson, 1st edition, 2006.
3. Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, Tata McGraw Hill, 1st edition, 2002.

Web References:

1. http://www.tedpavlic.com/teaching/osu/ece327/

SOFTWARE AND HARDWARE REQUIREMENTS
HARDWARE: Desktop Computer Systems
SOFTWARE : NI Multisim /Pspice

LIST OF EQUIPMENT REQUIRED FOR A BATCH

S. No	Name of the Equipment	Range
1	Dual Dc Regulated Power Supply	0-30V DC
2	Cathode Ray Oscilloscope	0-20 MHz
3	Function Generator	0-10 MHz
4	Semiconductor Kits	0-15 V
5	Resistors	100Ω,150 Ω,820 Ω,1k Ω,1.5k Ω 2.2k Ω,10k Ω,22k Ω,47k Ω

6	Capacitors	0.1µF,0.001µF,0.022µF,0.0022µF 0.0033µF,100pF,1000µF,22µF
7	Diode	1N4007,4148
8	UJT	2N2646
9	Transistors	BC107,2N2222
10	Inductors	1mH,5mH
12	Probes/ Connecting wires	--

COURSE OUTCOMES	
CO1	**Demonstrate** the concepts of Small, large signal amplifiers and oscillators.
CO2	**Analyze** various amplifiers and oscillators in hardware and verify the results through simulation.
CO3	**Design** and test various amplifiers and oscillators results through simulation.
CO4	**Conduct investigation** and test the functionality on implementation of amplifiers and oscillators.
CO5	**Select appropriate tools** as Multisim PSPICE simulation package tool and procedure to simulate and implement amplifiers and oscillators.
CO6	Follow **ethical** principles in designing, simulating and implementing circuits.
CO7	Do experiments effectively as an **individual** and as a member in a **group**.
CO8	**Communicate** verbally and in written form, the understandings about the experiments.
CO9	Continue updating their skill related to implementation for various application during their **life time.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3		-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

ANALOG COMMUNICATIONS LABORATORY

B. Tech II Year II Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
17CA04406	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**4**	**2**	**30**	**70**	**100**
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 68**				**Total Classes: 68**		

Course Objectives:

1. Implement various modulation techniques in communications.
2. Analyze various spectrum's of analog modulation using spectrum analyzer.
3. Understand the importance of automatic gain control and Phase locked loop.
4. Explore receiver characteristics.

LIST OF EXPERIMENTS

EXP-l	**LTI SYSTEM AND ITS RESPONSE**
a) Verification of linearity, time invariance, stability properties of a given system b) Computation of impulse, step, sinusoidal response of a given linear time invariant system using MATLAB	
EXP-2	**AMPLITUDE MODULATION AND DEMODULATION**
Generation of amplitude modulation and demodulation using hardware and MATLAB	
EXP-3	**BALANCED MODULATOR AND SYNCHRONOUS DETECTOR**
Generation of double side band suppressed carrier modulation and demodulation using hardware and MATLAB	
EXP-4	**SINGLE SIDE BAND MODULATION AND DEMODULATION**
Generation of single side band suppressed carrier modulation and demodulation using hardware and MATLAB	
EXP-5	**FREQUENCY MODULATION AND DEMODULATION**
Generation of frequency modulation and demodulation using hardware and MATLAB	
EXP-6	**PRE-EMPHASIS AND DE-EMPHASIS**
Verification of pre-emphasis and de-emphasis to boost high frequency modulating signal using hardware and MATLAB	
EXP-7	**FREQUENCY DIVISION MULTIPLEXING**
Verification of frequency division multiplexing using hardware and MATLAB	
EXP-8	**TIME DIVISION MULTIPLEXING**
Verification of Time division multiplexing using hardware and MATLAB	
EXP-9	**AUTOMATIC GAIN CONTROL CHARACTERISTICS**
Verification of automatic gain control characteristics using hardware and MATLAB	
EXP-l0	**CHARACTERISTICS OF MIXER**
Verification of characteristics of mixer using hardware	
EXP-l1	**PHASE LOCKED LOOP**
Verification of phase locked loop using hardware and MATLAB	
EXP-l2	**GENERATION OF DOUBLE SIDE BAND SUPPRESSED USING RING MODULATION, OBSERVATION OF OUTPUT WAVEFORM**
Generation of double side band suppressed modulation using hardware	
EXP-l3	**FREQUENCY SYNTHESIZER**
Frequency synthesizer using hardware kit	

Reference Books:

1. B.P. Lathi, "Signals, Systems and Communications", BS Publications, 5th Edition, 2009.
2. S.S.Haykin, "Communication Systems", Wiley Eastern, 2nd Edition, 2006.
3. Taub, Schilling, "Principles of Communication Systems", Tata McGraw-Hill, 4th edition, 2013.

Web References:

1. https://everythingvtu.wordpress.com
2. http://www.iare.ac.in
3. http://www.igniteengineers.com

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH
HARDWARE: Desktop Computer Systems 18 nos
SOFTWARE : MATLAB

LIST OF EQUIPMENT REQUIRED FOR A BATCH

S. No	Name of the Equipment	Range
1	Cathode ray oscilloscope	0-25 MHz
2	RF generator	0-300 MHz
3	Function generator	0-1 MHz
4	Function generator	0-2 MHz
5	Amplitude modulation and demodulation kit	--
6	Frequency modulation and demodulation kit	--
7	Single side band & suppressed carrier kit	--
8	Balanced modulator kit	--
9	Double side band and suppressed carrier kit	--
10	Pre-emphasis and de-emphasis kit	--
11	Time division multiplexing and demultiplexing kit	--
12	Frequency division multiplexing and demultiplexing kit	--
13	Synchronous detector kit	--
14	Characteristics of mixer kit	--
15	Frequency Synthesizer kit	--
16	Phase locked loop kit	--
17	Automatic gain control kit	--
18	Digital multimeter	0-20V/ 0-200mA/10 Ω -10k Ω
19	Spectrum analyzer	0-500 MHz

COURSE OUTCOMES	
CO1	**Demonstrate** the **knowledge** on analog communication systems and **Analyze** the performance of amplitude and frequency modulation techniques.
CO2	**Analyze** the functionality of modulation and demodulation of various analog communication systems.
CO3	**Design** the circuits which are used to improve the SNR in Frequency modulation.
CO4	**Conduct investigation** and test the functionality on implementation of modulation and demodulation circuits.
CO5	Select **appropriate trainer tool** kit to analyze and implement various analog modulation techniques.
CO6	Follow **ethical** principles in designing, simulating and implementing circuits.
CO7	Do experiments effectively as an **individual** and as a member in a **group**.
CO8	**Communicate** verbally and in written form, the understandings about the experiments.
CO9	Continue updating their skill related to implementation for various application during their **life time.**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3		-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

V SEMESTER

DIGITAL COMMUNICATION SYSTEMS

B. Tech III Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
17CA04501	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**1**	**-**	**3**	**30**	**70**	**100**
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

Course Objectives:

1. Understand the building blocks of digital communication system.
2. Understand various digital modulation techniques and able to analyze various systems for their performance in terms of probability of error.
3. To discuss Inter Symbol Interference problem in digital communication and to derive the Nyquist Criteria for zero ISI in data transmission.
4. To discuss about principles of block codes and convolution codes.

UNIT-I	**SOURCE CODING SYSTEMS**	**Classes: 15**

Introduction, sampling process, quantization, quantization noise, conditions for optimality of quantizer, encoding, Pulse-Code Modulation (PCM), Line codes, Differential encoding, Regeneration, Decoding & Filtering, Noise considerations in PCM systems, Time-Division Multiplexing (TDM), Synchronization, Delta modulation (DM), Differential PCM (DPCM), Processing gain, Adaptive DPCM (ADPCM), Comparison of the above systems.

UNIT-II	**BAND LIMITED CHANNELS**	**Classes: 11**

Pulse Shaping: Inter-symbol Interference (ISI), Nyquist's criterion for distortion less baseband binary transmission, Ideal Nyquist channel, Raised cosine filter & its spectrum, Correlative coding – Duo binary & Modified duo binary signaling schemes, Eye diagrams.

UNIT-III	**SIGNAL SPACE ANALYSIS**	**Classes: 10**

Introduction, Geometric representation of signals, Gram-Schmidt orthogonalization procedure, Conversion of the Continuous AWGN channel into a vector channel, Coherent detection of signals in noise, Correlation receiver, Equivalence of correlation and Matched filter receivers, Probability of error, Signal constellation diagram.

UNIT-IV	**PASS BAND DATA TRANSMISSION**	**Classes: 12**

Introduction, Passband transmission model, Binary phase shift keying (BPSK), Quadrature shift keying (QPSK), Binary Frequency shift keying (BFSK), Probability of error for PSK, FSK and QPSK, Non-coherent orthogonal modulation schemes -Differential PSK, Binary FSK, Comparison of all the above schemes.

UNIT-V	**LINEAR BLOCK CODES AND CONVOLUTION CODES**	**Classes: 12**

Linear Block Codes: Introduction to Error control coding, Matrix Description of linear block codes, error detection and correction capabilities of linear block codes, Hamming Code, Binary cyclic codes, algebraic structure, encoding, syndrome calculation and decoding, Convolution codes: Introduction, Encoding of Convolutional Codes, Time domain approach, Transform domain approach, General approach, State, Tree and Trellis Diagram, Decoding using viterbi algorithm

Text Books:

1. Simon Haykin, "Communication Systems," Wiley India Edition, 4th Edition, 2011.
2. B.P. Lathi, &Zhi Ding, "Modern Digital & Analog Communication Systems", Oxford University Press, International 4th edition, 2010.

Reference Books:

1. Sam Shanmugam, "Digital and Analog Communication Systems", John Wiley, 2005.
2. A. Bruce Carlson, & Paul B. Crilly, "Communication Systems – An Introduction to Signals & Noise in Electrical Communication", McGraw-Hill International Edition, 5th Edition, 2010
3. Bernard Sklar, "Digital Communications", Prentice-Hall PTR, 2nd edition, 2001.
4. Herbert Taub& Donald L Schilling, "Principles of Communication Systems", Tata McGraw-Hill, 3rd Edition, 2009.

5. J. G. Proakis, M Salehi, Gerhard Bauch, “Modern Communication Systems Using MATLAB,” CENGAGE, 3rd Edition, 2013.

Web References:

1. http://nptel.ac.in/courses/117101051/
2. https://ocw.mit.edu/courses/electrical.../6...digital-communications.../lecture-notes
3. https://everythingvtu.wordpress.com

COURSE OUTCOMES	
CO1	Demonstrate the elements of digital communications systems; analyze the concepts of sampling theorem, quantization and coding.
CO2	Apply the knowledge of ISI to reduce its impact in transmission of digital data through a baseband channel and analyze characteristics of pulse shaping.
CO3	Exhibit the geometric representation of signals of finite energy for the study of data transmission and analyze the maximum likelihood procedure for the detection of a signal in AWGN channel.
CO4	Demonstrate different pass band modulation schemes like BPSK, BFSK, QPSK etc. and analyze its error probability.
CO5	Apply and analyze the linear block codes and convolution codes for the channel coding.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	2	-	-	-	-	-	-	-	-	2	-
CO4	3	3	1	2	-	-	-	-	-	-	-	-	2	-
CO5	2	2		2	-	-	-	-	-	-	-	-	2	-
CO*	**2.8**	**2.2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.4**	**-**

DIGITAL SYSTEM DESIGN

B. Tech III Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA04502	Elective	3	0	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

- To be able to use computer-aided design tools for development of complex digital logic circuits
- To be able to model, simulate, verify, analyze, and synthesize with hardware description languages
- To be able to design and prototype with standard cell technology and programmable logic
- To be able to design tests for digital logic circuits, and design for testability

UNIT-I — CMOS LOGIC — Classes: 11

Introduction to logic families, CMOS logic, CMOS steady state electrical behavior, CMOS dynamic electrical behavior, CMOS logic families.
Bipolar Logic and Interfacing; Bipolar logic, Transistor logic, TTL families, CMOS/TTL interfacing, low voltage CMOS logic and interfacing, emitter coupled logic, comparison of logic families, Familiarity with standard 74-series and CMOS 40- series-ICs - specifications.

UNIT-II — HARDWARE DESCRIPTION LANGUAGE — Classes: 09

Hardware Description Language: Design flow, Program Structure, Types and constants, functions and procedures, Libraries and Packages.
The VHDL design elements: Structural design elements, data flow design elements, behavioral design elements, time dimension and simulation synthesis.

UNIT-III — COMBINATIONAL LOGIC DESIGN — Classes: 08

Decoders, Encoders, Multiplexers and demultiplexers, Code Converters, EX-OR gates and parity circuits, comparators, adders and subtractors, ALUs, combinational multipliers. VHDL modes for the above ICs.
Design examples - Barrel shifter, comparators, floating-point encoder, dual parity encoder.

UNIT-IV — SEQUENTIAL LOGIC DESIGN — Classes: 08

Latches and Flip-flops, PLDs, Counters, Shift registers and their VHDL models, Synchronous Design methodology.

UNIT-V — MEMORY DEVICES — Classes: 09

ROMs: Internal Structure, 2D – decoding commercial types, timing and applications.
Static RAMs: Internal Structure, timing and standard SRAMs, Synchronous SRAMs.
Dynamic RAMs: Internal Structure, timing and standard DRAMs, Synchronous DRAMs.

Text Books:

1. John F.Wakerly ,"Digital Design Principles and Practices" 4th edition, Pearson Education., 2009
2. Charles H.Roth,Jr., "Fundamentals of Logic Design" 5th edition , CENGAGE Learning 2012.

Reference Books:

1. M.Morris Mano and Michael D. Cilleti., "Digital Logic Design" 4th edition Pearson Education., 2013
2. Stephen Brown and ZvonkoVranesic, "Fundamentals of digital logic with VHDL design" 2nd edition McGraw Hill Higher Education.
3. J. Bhasker, "A VHDL PRIMER" 3rd edition Eastern Economy Edition, PHI Learning,2010.

E-Text Books:

1. www.jntubook.com
2.www.ebookgalaxy.in

COURSE OUTCOMES	
CO1	Apply the knowledge on Various digital logic families and Analyze the structural description and electrical characteristics.
CO2	Demonstrate the fundamental concepts of HDL and Programming models of VHDL.
CO3	Analyze the Combinational logic circuits and **design** using IC's. Develop the programs for Combinational logic circuits using VHDL code.
CO4	Analyze the Sequential logic circuits and **design** using IC's. Develop the programs for Sequential logic circuits using VHDL code.
CO5	Analyze and Design different types of memory elements.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO5	2	3	2	-	-	-	-	-	-	-	-	-	3	-
CO*	**2.8**	**3**	**2.75**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

ANTENNAS & WAVE PROPAGATION

B. Tech III Year I Semester								
Course Code	Category	Hours /			Credit	Maximum Marks		
17CA04503	Core	L	T	P	C	CIA	SEE	Total
		3	1	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

Course Objectives:

1. Be Proficient in the radiation phenomena associated with various types of antennas and understand basic terminology and concepts of antennas along with emphasis on their applications.
2. Analyze the electric and magnetic field emission from various basic antennas with mathematical formulation of the analysis.
3. Explain radiation mechanism of different types of antennas and their usage in real time field.
4. Justify the propagation of the waves at different frequencies through different layers in the existing layered free space environment structure.

UNIT-I	Antenna Basics & Thin wire Antennas	Classes: 13

Antenna Basics: Introduction, Basic antenna parameters- patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective height, Fields from oscillating dipole, Field Zones, Shape-Impedance considerations, Polarization – Linear, Elliptical, & Circular polarizations, Antenna temperature, Antenna impedance, Front–to-back ratio, Antenna theorems.

Thin Wire Antennas: Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipoles, Field Components, Radiated power, Radiation Resistance, Beam width, Natural current distributions, far fields and patterns of Thin Linear Center-fed Antennas of different lengths, Illustrative problems.

UNIT-II	LOOP ANTENNAS AND ANTENNA ARRAYS	Classes: 13

Loop Antennas: Introduction, small loop, Comparison of Far fields of small loop and short dipole, Radiation resistances and directivities of small and large loops.

Antenna Arrays: Point sources, definition, patterns; Arrays of 2 isotropic sources, different cases, Principle of pattern multiplication, Uniform linear arrays - Broadside arrays; End-fire arrays; EFA with increased directivity, Derivation of their characteristics and comparison; BSAs with non-uniform amplitude distributions, General considerations and Binomial arrays, Folded Dipoles and their characteristics, Arrays with parasitic elements, Yagi-Uda array, Helical antennas-Helical geometry, Helix modes, Practical design considerations for monofilar Helical antenna in axial and normal modes.

UNIT-III	VHF,UHF AND MICROWAVE ANTENNAS	Classes: 12

Horn antennas: Types, Fermat's principle, optimum horns, design considerations of pyramidal horns, Illustrative problems.

Lens antennas: Introduction, types of lens antennas, geometry of metallic and Non-metallic dielectric lenses, zoning, tolerances, applications.

Slot & Microstrip antennas: Introduction, features, advantages and limitations, its pattern, Babinet's principle, impedance of slot antennas, Rectangular patch antennas- geometry and parameters, characteristics of microstrip antennas, Impact of different parameters on characteristics.

UNIT-IV	REFLECTOR ANTENNAS AND ANTENNA MEASUREMENTS	Classes: 12

Reflector Antennas: Introduction, flat sheet and corner reflectors, Paraboloidal reflectors- Geometry, pattern characteristics, feed methods, Related features, Illustrative problems.

Antenna Measurements: Introduction, concepts, reciprocity near and far fields, sources of errors patterns to be measured, Pattern measurement arrangement, directivity measurement, Gain measurements- Comparison method, absolute and 3-antenna methods.

UNIT-V	RADIO WAVE PROPAGATION	Classes: 10

Introduction, definitions, general classifications, different Modes of Wave Propagation, Ground wave propagation- Introduction, plane earth reflections, space and surface waves, wave tilt, curved earth reflections, Space wave propagation- Introduction, field strength variation with distance and height, effect of earth's curvature, absorption, super refraction, duct propagation, scattering phenomena, tropospheric propagation, Sky wave propagation- Introduction, structure of ionosphere, refraction and reflection of sky waves by ionosphere, Ray path, critical frequency, MUF, LUF, OF, virtual height and skip distance, Relation between MUF and skip distance, Multi-hop propagation.
Text Books:
1. John D. Kraus, Ronald J. Marhefka, Ahmad S. Khan, "Antennas and Wave Propagation", TMH, 4th Edition, 2010. 2. C.A. Balanis, "Antenna Theory", John Wiley and Sons, 2nd Edition, 2001.
Reference Books:
1. E.C. Jordan, K.G. Balmain, "Electromagnetic Waves and Radiating Systems", PHI, 2nd Edition, 2000. 2. E.V.D. Glazier, H.R.L. Lamont, "Transmission and Propagation", Her Majesty's Stationery Office, 1958. 3. F.E. Terman, "Electronic and Radio Engineering", McGraw-Hill, 4th Edition, 1955. 4. K.D. Prasad, Satya Prakashan, "Antennas and Wave Propagation", Tech India Publications, 1st Edition, 2001.
Web References:
1. http:// web.stanford.edu/class 2. http://www.electronicagroup.com 3. http://www.cpri.in/about-us/departmentsunits/library-and-information-centre/digital-library-links.html 4. http://nptel.ac.in/courses/antennas
E-Text Books:
1. http://www.ebookgalaxy.in/2016/01/antennas-and-wave-propagation-by-g-s-n.html#. WBGI7NJ97IU 2. https://www.jntubook.com/antennas-wave-propagation-textbook 3. http://117.55.241.6/library/E-Books/Antennas_mcgraw-hill_2nd_ed_1988-john_d_kraus.pdf

COURSE OUTCOMES	
CO1	Apply the concept of mechanism of radiation, analyze various types of antennas with field components and configure their current distributions.
CO2	Demonstrate the concepts on the loop antennas and antenna arrays, analyze their characteristic parameters and design yagi-uda and helical antenna for real time applications.
CO3	Exhibit the knowledge on High frequency Antennas, Analyze their characteristics and design with relevant parameters.
CO4	Demonstrate the concepts on reflector antennas, identify the requirements and carry out the design with suitable precautions and familiarize with the procedure to enable antenna measurements.
CO5	Apply the concept of wave propagation theory and Analyze critical frequency, MUF, Skip distance in various applications.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	2	-	-	-	-	-	-	3	2
CO3	3	2	2	-	-	-	-	-	-	-	-	-	2	-
CO4	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO5	2	1	2	-	-	2	-	-	-	-	-	-	2	2
CO*	**2.8**	**2.4**	**1.8**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2.4**	**2**

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

B. Tech III Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum**		
17CA04504	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**-**	**3**	**30**	**70**	**100**
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

Course Objectives:

1. Acquire a sound understanding theory and performance characteristics of instruments and errors in measurement and apply to DC voltmeters, ammeters, ohmmeters.
2. Provide concepts and operation of different signal generators and wave form analyzers.
3. Compare and contrast different types of oscilloscopes.
4. Select different types of D.C and A.C bridges for measurement of passive components and physical parameters.

UNIT-I	**INTRODUCTION TO MEASURING INSTRUMENTS**	**Classes: 10**

Introduction, Performance characteristics of Instruments, Static characteristics, Accuracy, resolution, precision, Sensitivity, Dynamic characteristics: Repeatability, Reproducibility, fidelity, lag, Static and Dynamic Errors.

Analog measuring instruments: D'Arsonval movement, DC voltmeters and ammeter, AC voltmeters and current meters, ohmmeters, multimeters, meter protection, extension of range.

UNIT-II	**OSCILLOSCOPES**	**Classes: 10**

Oscilloscopes: Block Diagram of CRO, CRT features, Time base circuits, Derivation of Deflection sensitivity, delay lines, high frequency CRO considerations, applications, specifications, CRO probes. Special purpose oscilloscopes: Dual trace, Dual beam CRO, Sampling oscilloscopes, Storage oscilloscopes, Digital storage CRO.

Applications of CROs: Lissajous figures, frequency measurement, phase measurement, Digital frequency counters, Time and Period measurements.

UNIT-III	**SIGNAL GENERATOR AND SIGNAL ANALYZERS**	**Classes: 09**

Signal generator-fixed and variable, AF oscillators, function generators, pulse, random noise, sweep, and arbitrary waveform generators, their standards, specifications and principles of working (Block diagram approach).Wave analyzers, Harmonic distortion analyzers, Spectrum analyzers, and Logic analyzers

UNIT-IV	**AC AND DC BRIDGES**	**Classes: 08**

Review of DC Bridges: Wheatstone bridge, Wein Bridge, errors and precautions in using bridges, AC bridges: Measurement of inductance-Maxwell's bridge, Anderson Bridge. Measurement of capacitance- Schearing Bridge. Kelvin Bridge, Q-meter, EMI and EMC, Interference and noise reduction techniques.

UNIT-V	**SENSORS AND TRANSDUCERS**	**Classes: 08**

Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance, LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples, and thermistors), Velocity, Acceleration, Vibration, pH measurement Signal Conditioning Circuits.

Text Books:

1. H.S.Kalsi, "Electronic Instrumentation" , TMH, 2nd Edition, 2004.
2. A.D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 5th Edition, 2002.

Reference Books:
1. Ernest O Doebelin and Dhanesh N Manik, “Measurement Systems Application and Design”, TMH, 5th Edition, 2009. 2. Oliver and Cage, “Electronic Measurement and Instrumentation”, TMH. Robert A.Witte, “Electronic Test Instruments, Analog and Digital Measurements”, Pearson Education, 2nd Ed., 2004. 3. David A. Bell, “Electronic Instrumentation & Measurements”, PHI, 2nd Edition, 2003
Web References:
1. https://www.scribd.com/ 2. https://www.worldcat.org/ 3. https://www.infibeam.com/
E-Text Books:
1. https://www.vssut.ac.in/lecture_notes/lecture1423813026.pdf 2. fmcet.in/ECE/EC2351_uw.pdf 3. https://www.jntubook.com/electronics-measurements-instrumentation-textbook-free-d

COURSE OUTCOMES	
CO1	Apply the knowledge on Measuring instruments and analyze the performance characteristics of each instrument, Illustrate basic meters such as voltmeters and ammeters.
CO2	Demonstrate various types of oscilloscopes and its applications.
CO3	Demonstrate different types of signal generators and analyzers, analyze their performance.
CO4	Analyze and Design suitable DC and AC bridges for the measurement of R,L and C.
CO5	Exhibit the knowledge on working principle; analyze the criteria and applications of various sensor and transducers used in measurement systems.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	1	-	-	3	-	-	-	-	-	-	2	3
CO3	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO4	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO5	3	3	1	-	-	2	-	-	-	-	-	-	2	3
CO*	**3**	**2.8**	**1**	**-**	**-**	**2.5**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**

COMPUTER ORGANIZATION

B. Tech III Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA05403	Core	3	0	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

1. Understand the Organization of Computer Systems.
2. Study the Assembly Language Program Execution, Instruction format and Instruction Cycle.
3. Design a simple Computer using Hardwired and Micro Programmed Control methods.
4. Study the basic Components of Computer Systems besides the Computer Arithmetic.
5. Understand Input-Output Organization, Memory Organization and Management and Pipelining.

UNIT-I | **Introduction to Computer Organization** | **Classes: 10**

Basic Computer Organization, CPU Organization, Memory Subsystem Organization and Interfacing, Input or Output Subsystem Organization and Interfacing, A simple Computer Levels of Programming Languages, Assembly Language Instructions, Instruction Set Architecture Design, A simple Instruction Set Architecture.

UNIT-II | **Organization of a Computer** | **Classes: 10**

Register Transfer: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro Operations.
Control unit: Control Memory, Address Sequencing, Micro Program Example, and Design of Control Unit.

UNIT-III | **CPU and Computer Arithmetic** | **Classes: 08**

C**PU design:** Instruction cycle, Data representation, Memory reference instructions, Input-Output, and Interrupt, Addressing Modes, Data Transfer and Manipulation, Program Control.
Computer Arithmetic: Addition and Subtraction, Floating Point Arithmetic Operations, Decimal Arithmetic unit.

UNIT-IV | **Input-Output Organization and Memory Organization** | **Classes: 09**

Input or Output Organization: Input or Output Interface, Asynchronous data transfer, Modes of transfer, Priority Interrupt, Direct Memory Access.
Memory organization: Memory hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

UNIT-V | **Multiprocessors** | **Classes: 08**

Pipeline: Parallel processing, Pipelining-Arithmetic pipeline, Instruction Pipeline.
Multiprocessors: Characteristics of Multi Processors, Inter Connection Structures, Inter Processor Arbitration, Inter Processor Communication and Synchronization.

Text Books:

1. M. Morris Mano, “Computer Systems Architecture”, Pearson, 3rd Edition, 2007.
2. John D. Carpinelli, “Computer Systems Organization and Architecture”, Pearson, 1st Edition, 2001.
3. Patterson, Hennessy, “Computer Organization and Design: The Hardware/Software Interface”, Morgan Kaufmann, 5th Edition, 2013.

Reference Books:
1. John. P. Hayes, "Computer System Architecture", McGraw Hill, 3rd Edition, 1998. 2. Carl Hamacher, Zvonko G Vranesic, Safwat G Zaky, "Computer Organization", McGraw Hill, 5th Edition, 2002. 3. William Stallings, "Computer Organization and Architecture", Pearson Edition, 8th Edition, 2010.
Web References:
1. https://www.tutorialspoint.com/computer_logical_organization/ 2. https://www.courseera.org/learn/comparch 3. https://www.cssimplified.com/.../computer-organization-and-assembly-language-programming
E-Text Books:
1. https://www.groupes.polymtl.ca/inf2610/.../ComputerSystemBook.pdf 2. https://www.cse.hcmut.edu.vn/~vtphuong/KTMT/Slides/TextBookFull.pdf

COURSE OUTCOMES	
CO1	Exhibit the knowledge on the Organization of Computer Systems and analyze the Assembly Language Program Execution, Instruction format and Instruction Cycle.
CO2	Apply the fundamental concepts of register transfer logic, arithmetic operations and summarize the type of micro operations.
CO3	Identify and manipulate representations of numbers stored in digital computers and perform Basic arithmetic Operations.
CO4	Demonstrate the concepts of Input-Output Organization, Memory Organization and Management and analyze the memory access.
CO5	Demonstrate the pipeline for consistent execution of instructions and analyze the characteristics of multi processors.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO*	**2.8**	**2.6**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

TV ENGINEERING (PROFESSIONAL ELECTIVE-I)

<table>
<tr><td colspan="10">B. Tech III Year I Semester</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">17CA04505</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 45</td></tr>
</table>

Course Objectives:

1. To understand working principles of Monochrome and color television
2. To gain sufficient knowledge regarding different modules present in the TV transmitter and receiver and their design considerations
3. To get adequate knowledge regarding functioning of modern televisions system such as DTH

UNIT-I	**FUNDAMENTALS OF TELEVISION**	**Classes: 10**

Geometry form and Aspect Ratio , Image Continuity , Number of scanning lines , Interlaced scanning, Picture resolution, Camera tubes, Image orthicon–vidiconplumbicon, silicon diode array vidicon, solid state image scanners, monochrome picture tubes composite video signal, video signal dimension, horizontal sync, Composition, vertical sync, functions of vertical pulse train – scanning sequence details, Picture signal transmission – positive and negative modulation – VSB transmission sound signal transmission – standard channel bandwidth.

UNIT-II	**MONOCHROME TELEVISION TRANSMITTER AND RECEIVER**	**Classes: 10**

TV transmitter, TV signal propagation, Interference – TV transmission Antennas, Monochrome TV receiver, RF tuner, UHF & VHF tuner, Digital tuning techniques, AFT, IF subsystems, AGC – Noise cancellation, Video and sound inter carrier detection, vision IF subsystem, video amplifiers requirements and configurations , DC reinsertion , Video amplifier circuits, Sync separation – typical sync processing circuits, Deflection current waveform, Deflection Oscillators, Frame deflection circuits, requirements, Line Deflection circuits, EHT generation, Receiver Antennas.

UNIT-III	**ESSENTIALS OF COLOUR TELEVISION**	**Classes: 08**

Compatibility–colour perception, Three colour theory, luminance, hue and saturation, colour television cameras, values of luminance and colour difference signals colour television display tubes, delta – gun, precision – in-line and Trinitron colour picture tubes purity and convergence- purity and static and dynamic convergence adjustments, pincushion correction techniques, automatic degaussing circuit, grey scale tracking, colour signal transmission bandwidth, modulation of colour difference signals, eighting factors, Formation of chrominance signal.

UNIT-IV	**COLOUR TELEVISION SYSTEMS**	**Classes: 09**

NTSC colour TV system, NTSC colour receiver, limitations of NTSC system, PAL colour TV system – cancellation of phase errors, PAL –D colour system, PAL coder, Pal, Decolour receiver, chromo signal amplifier, separation of U and V signals, colour burst separation – Burst phase Discriminator, ACC amplifier, Reference Oscillator, Ident and colour killer circuits, U and V demodulators, Coloursignal matrixing, merits and demerits of the PAL system, SECAM system – merits and demerits of SECAM system.

UNIT-V	**ADVANCED TELEVISION SYSTEMS**	**Classes: 08**

Satellite TV technology, Cable TV – VCR, Video Disc recording and playback, Tele Text broadcast receiver, digital television, Transmission and reception projection Television, Flat panel display TV receiver, Stereo sound in TV – 3D TV – EDTV – Digital equipment for TV studios.

Text Books:

1. R.R.Gulati, “ Monochrome Television Practice, Principles, Technology and servicing, New age International Publishes, Second edition, 2004.
2. R.R.Gulati “Monochrome and colour television “, New age International Publisher, 2003

Reference Books:

1. A.M Dhake, “Television and Video Engineering”, TMH, Second edition, 2003.
2. S.P.Bali, “Color Television, Theory and Practice”, TMH, 1994.

COURSE OUTCOMES	
CO1	Exhibit the knowledge regarding the working principles involved in both Monochrome and Color Television.
CO2	Demonstrate different modules present in the TV transmitter and receiver and their design considerations.
CO3	Analyze the essentials of color televisions.
CO4	Analyze the essentials of color television standards.
CO5	Demonstrate the concepts of Advanced Televisions.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	-	-	-	3	-	-	-	-	-	-	-	3	-
CO*	**3**	**1.75**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

ARTIFICIAL NEURAL NETWORKS AND FUZZY LOGIC
(PROFESSIONAL ELECTIVE-I)

B. Tech III Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA04506	Elective	3	0	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

The course should enable the students to:

I. Meliorate the knowledge of fundamentals and types of neural networks.
II. Develop the different Algorithms for neural networks.
III. Meliorate the knowledge in Fuzzy logic principles.
IV. Correlate the principles with applications of neural networks and fuzzy logic.

UNIT-I	INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS AND LEARNING LAWS	Classes: 11

Artificial neural networks and their biological motivation, terminology, models of neuron, topology, characteristics of artificial neural networks, types of activation functions,
Learning methods: Error correction learning, Hebbian learning, perception, XOR problem, perceptron learning rule convergence theorem, adaline.

UNIT-II	FEEDFORWARD AND RECURRENT NEURAL NETWORKS	Classes: 08

Multilayer perception, back propagation learning algorithm, universal function approximation, associative memory, auto association, hetero association, recall and cross talk, linear auto associator, bi-directional associative memory, Hopfield neural network.

UNIT-III	UNSUPERVISED LEARNING AND SELF ORGANISING NETWORKS	Classes: 09

Competitive learning neural networks, max net, mexican hat, hamming net.
Kohonen self-organizing feature map, counter propagation, learning vector quantization, applications of neural networks in image processing, signal processing, modeling and control.

UNIT-IV	FUZZY SETS AND FUZZY RELATIONS	Classes: 08

Introduction, classical sets and fuzzy sets, classical relations and fuzzy relations, Fuzzy set theory and operations, Properties of fuzzy sets, membership functions, fuzzy to crisp conversion, fuzzy arithmetic

UNIT-V	FUZZY SYSTEMS	Classes: 09

Fuzzy Logic - Fuzzy Membership, Rules: Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications.

Text Books:

1. LaureneFausett, “Fundamentals of Neural Networks-Architectures, algorithms and applications, Pearson Education Inc., 2004.
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, John Wiley and sons, 2004
3. S.Haykin,"Neural Networks,A Comprehensive Foundation", Pearson Education Inc., 2004.

Reference Books:
1. Jacek.M.Zuruda,"Introduction to Artificial Neural Systems ",Jaico Publishing House ,2001. 2. J.S.R. Jang, C.T. Sun, E. Mizutani,, “Neuro Fuzzy and Soft Computing - A computational Approach to Learning and Machine Intelligence”, Pearson Education Inc., 2002. 3. Freeman J.A. and Skapura B.M., “Neural Networks, Algorithms Applications and Programming Techniques”, Addison-Wesely, 1991.
Web References:
1. http://www.willamette.edu/~gorr/classes/cs449/intro.html 2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine -learning 3. http://ocw.mit.edu/courses/sloan-school-of-management/15-062-datamining-spring-2003/lecture-notes/NeuralNet2002.pdf
E-Text Books: 1. http://www.e-booksdirectory.com 2. http://www.ebooks.com/subjects/computer-science-neural-networks-ebooks/ 3. http://en.wikibooks.org/wiki/Artificial_Neural_Networks 4. http://jntu-ebooks.blogspot.in

COURSE OUTCOMES	
CO1	Apply the Fundamental knowledge and analyze types of neural networks.
CO2	Exhibit the concepts of feed forward neural networks and Recurrent Neural Networks and analyze its characteristics.
CO3	Demonstrate different generative models through unsupervised learning and analyze the application of fuzzy logic control to real time systems.
CO4	Exhibit the knowledge of fuzziness involved in various systems and analyze fuzzy set theory.
CO5	Demonstrate the knowledge on Fuzzy Membership, fuzzy Rules and analyze fuzzy algorithms and its applications.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	2	-	-	-	-	-	-	3	2
CO4	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO5	3	3	3	-	-	2	-	-	-	-	-	-	3	2
CO*	**3**	**2.8**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2.8**	**2**

TELECOMMUNICATION SWITCHING THEORY AND APPLICATIONS (PROFESSIONAL ELECTIVE-I)

B. Tech III Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA04507	Elective	3	0	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

The course should enable the students to:

1. Learn to consider tele-traffic demands, quality of service, scalability, performance and cost into consideration to develop requirements and architectures.
2. Underlying technologies and applications including wireless communications, including mobility, optical communications, wavelength routing, packet networks and the Internet.
3. Coordinated with CS 440, computer networks, where communications protocols and the TCP/IP protocols suite are addressed.

UNIT-I	INTRODUCTION	Classes: 09

Introduction: Evolution of telecommunications, simple telephone communication, manual switching system, major telecommunication networks, strowger switching system, crossbar switching; Electronic Space Division Switching: Stored program control, centralized SPC, distributed SPC, enhanced services, two stage networks, three stage network n-stage networks.

UNIT-II	TIME DIVISION SWITCHING	Classes: 10

Time Division Switching: Time multiplexed space switching, time multiplexed time switching, combination Switching, three stage combination switching, n-stage combination switching; Traffic Engineering: Network traffic load and parameters, grade of service and blocking probability, modeling switching systems, incoming traffic and service time characterization, blocking models and loss estimates, delay systems.

UNIT-III	DATA NETWORKS	Classes: 10

Data networks: Block diagram, features, working of EPABX systems, Data transmission in PSTNs, data rates in PSTNs, modems, switching techniques for data transmission, circuit switching, store and forward switching data communication architecture. ISO-OSI reference model, link to link layers, physical layer, data link layer, network layer, end to end layers, transport layer, session layer, presentation layer, Satellite based data networks, LAN, metropolitan area network, fiber optic networks, and data network standards.

UNIT-IV	TELEPHONE NETWORKS	Classes: 08

Telephone Networks: Subscriber loop systems, switching hierarchy and routing, transmission plan, transmission systems, numbering plan, charging plan, signaling techniques, in channel signaling, common channel signaling, cellular mobile telephony.

UNIT-V	INTEGRATED SERVICES DIGITAL NETWORKS	Classes: 08

Integrated Services Digital Networks: Motivation for ISDN, new services, network and protocol architecture, transmission channels, user network interface, signaling, numbering and addressing, service characterization, interworking, ISDN standards, broadband ISDN ,voice data Integration.

Text Books:

1. Thiagarajan Vishwanathan, “Telecommunication Switching Systems and Networks”; PHI Publications, 1992.
2. John C. Bellamy, “Digital Telephony”, Wiley Publications, 3rd Edition, 2000.

Reference Books:
1. Wayne Tomasi, "Electronic Communications Systems", Pearson Education, 5th Edition, 2009. 2. William C.Y.Lec, Mobile Cellular Telecommunication, Analog and Digital Systems, McGraw Hill Inc, 2nd Edition, 1995. 3. KavehPahlavan, Allen H. Levesque" Wireless Information Networks", Wiley Series, John Wiley and Sons Inc, 1st Edition, 2005.
Web References:
1. http://www.ie.itcr.ac.cr/ 2. http://www.neduet.edu.pk/ 3. http://www.researchgate.net 4. http://www.mitpress.mit.edu
E-Text Books: 1. http://www.e-booksdirectory.com/listing.php?category=292 2. link.springer.com/book/10.1007%2F978-1-4899-2215 3. www.ie.itcr.ac.cr/acotoc/Maestria_en_Computacion/Sistemas_de 4. https://www.crcpress.com/...Communications-Theoretical...Applications

COURSE OUTCOMES	
CO1	Demonstrate about functioning of Manual and cross bar automatic switching systems
CO2	Analyze the time division and multiplexed switching in combination switching
CO3	Demonstrate the technologies and applications including wireless communications, including mobility, optical communications, wavelength routing, packet networks and the Internet.
CO4	Analyze the concepts of voice and data transmission techniques
CO5	Exhibits the knowledge on architecture and services of ISDN

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	2	-	-	-	-	-	-	3	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	3	-
CO*	**2.8**	**2**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

INDUSTRIAL ELECTRONICS

B. Tech III Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA04508	Core	3	0	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

- Understand the constructional details of SCR.
- Study the applications of all power electronics devices.
- Understand the working of converters, AC regulators and Choppers
- Understand the Inverters and Speed control of DC/AC motors.

UNIT-I	POWER ELECTRONICS DEVICES	Classes: 10

Types of power semiconductor devices – SCR, Triac, Power BJT, IGBT Construction, Working principle of all devices, symbol. Two transistor analogy for SCR – V-I characteristics, Forward break over voltage, latching current, holding current, turn on triggering time, turn off time - triggering of SCR using UJT – protection of power devices-Applications.

UNIT-II	CONVERTERS AC REGULATORS & CHOPPERS	Classes: 09

Classification of converters, single phase half wave fully controlled converter, freewheeling diode, single phase fully controlled converter, three phase half wave, three phase full wave controlled converter, battery charger, single phase ac regulator, choppers- modes, operation - Applications.

UNIT-III	INVERTERS & SPEED CONTROL AC/DC OF MOTORS	Classes: 10

Classification of invertors-basic series inverter- parallel inverter- single-phase bridge inverter using MOSFET- voltage source inverter- PWM inverter- single, multiple and Sinusoidal – Three phase bridge inverter- Applications. DC motor control Introduction-Speed control of DC shunt motor by using converters and choppers speed control of induction motor by using AC voltage controllers – V / F control (Converters and invertors control).

UNIT-IV	TRANSDUCERS & ULTRASONICS	Classes: 08

Introduction, classification of transducers, strain gauge, variable resistance transducer, capacitive, inductive, piezoelectric, LVDT. Thermocouples, Transducer applications - accelerometers, Tacho generators, Servomotors Ultrasonic- generation –Pulsed echo ultrasonic flaw detector.

UNIT-V	SOLID STATE CONTROLS	Classes: 08

Introduction, universal motor and its speed control, stepper motor – construction, working and its applications, synchros – construction, working and its applications. Programmable logic control – block diagram, working, advantages, applications.

Text Books:

1. S.K. Bhattacharya & S. Chatterjee, “Industrial Electronics and Control”, TTTI, Chandigarh.
2. M.H. Rashid, “Power Electronics Circuits Devices and Applications”, PHI, Pearson.

Reference Books:

1. Practical Programming in Tcl and Tk by Brent Welch , Updated for Tcl 7.4 and Tk 4.0
2. Teach Yourself Perl 5 in 21 days by David Till.Red Hat Enterprise Linux 4: System Administration Guide Copyright © 2005 Red Hat,Inc

COURSE OUTCOMES	
CO1	Apply the fundamental concepts on various power semiconductor devices and analyze its characteristics.
CO2	Analyze and Design power converter circuits, Regulators, Choppers and learn to select suitable power electronic devices by assessing the requirements of application fields.
CO3	Identify the critical areas in application levels and derive typical alternative solutions, select suitable power converters to control Electrical Motors and other industry grade apparatus.
CO4	Demonstrate different types of Transducers and Ultrasonic’s in relevant applications.
CO5	Demonstrate the concepts of solid state controls.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	1	-	-	-	-	-	-	3	-
CO3	2	3	1	-	-	1	-	-	-	-	-	-	3	-
CO4	3	1	-	-	-	2	-	-	-	-	-	-	3	-
CO5	3	1	-	-	-	-	-	-	-	-	-	-	3	-
CO*	**2.8**	**2.2**	**1.66**	**-**	**-**	**1.33**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

LINEAR & DIGITAL IC APPLICATIONS LABORATORY

B. Tech III Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
17CA04509	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	**-**	**3**	**2**	**30**	**70**	**100**
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes: 45**		

Course Objectives:

1. To implement different circuits and verify circuit concepts.
2. To Study the concepts of multivibrators and filters.
3. To verify the operations of the timers and PLLs and their applications.
4. To design and verify combinational and sequential circuits

LIST OF EXPERIMENTS	
MINIMUM OF TEN EXPERIMENTS TO BE CONDUCTED (FIVE FROM EACH PART)	
EXP-l	**INVERTING, NON-INVERTING AND DIFFERENTIAL AMPLIFIERS**
To construct and test the performance of an Inverting, Non-inverting amplifier and Differential amplifier.	
EXP-2	**INTEGRATOR AND DIFFERENTIATOR**
To construct and test the performance of an Integrator and Differentiator.	
EXP-3	**FIRST ORDER ACTIVE BANDPASS FILTERS**
To design and verify the operation of the Active Band Pass filter.	
EXP-4	**ASTABLE MULTIVIBRATOR**
To design and construct an Astable multivibrator	
EXP-5	**PHASE LOCKED LOOP (PLL)**
To verify characteristics of PLL	
EXP-6	**INSTRUMENTATION AMPLIFIER**
To design and verify the operation of instrumentation amplifier	
EXPERIMENTS CAN BE PERFORMED USING HARDWARE OR SOFTWARE TOOLS.	
EXP-7	**MULTIPLEXER AND DEMULTIPLEXER**
To verify functionality of Multiplexer (1:4) and Demultiplexer (4:1)	
EXP-8	**ENCODER AND DECODER**
To Verify Functionality of Encoder (4:2) and Decoder (2:4)	
EXP-9	**REALISATION OF DIFFERENT FLIP-FLOPS USING LOGIC GATES**
To Verify functionality of Flip-flops using Universal Logic Gates.	
EXP-l0	**4 BIT COUNTERS (Asynchronous or Synchronous)**
To verify functionality of counters using JK Flip Flops.	
EXP-l1	**REALISATION OF SHIFT REGISTERS**
To verify functionality of 4 bit Shift Registers in SISO,SIPO,PISO,PIPO modes using D Flip-Flop	
EXP-l2	**DECADE COUNTER**
To verify functionality of decade counter using J-K/T Flip-Flop	

Reference Books:

1. D. Roy Chowdhury, "Linear Integrated Circuits", New age international (p) Ltd, 2nd Edition, 2003.
2. Ramakanth A. Gayakwad, "Op-Amps & linear ICs", PHI, 3rd Edition, 2003.
3. John F. Wakerly, "Digital Design Principles and Practices", Prentice Hall, 3rd Edition, 2005.

LIST OF EQUIPMENT REQUIRED		
S. No	**Name of the Equipment**	**Range**
1	REGULATED POWER SUPPLY	0-30V DC
2	CRO	0-20 MHz
3	FUNCTION GENERATOR	20 MHZ
4	DIGITAL IC TRAINER KIT	--
5	RESISTORS	47Ω, 82 Ω, 100 Ω, 150 Ω, 220 Ω, 470 Ω, 560 Ω, 1k Ω, 2.2k Ω, 3.3k Ω.5k Ω,10k Ω
6	INDUCTORS	0.01mH, 0.1mH,10mH, 50mH
7	CAPACITORS	0.01µF, 0.1µF, 0.47µF, 470µF, 33µF
8	DECADE COUNTER	IC 7490
9	OP-AMP	741 IC
10	TIMER IC	555 IC
11	LED'S	Different Colors
12	7 SEGMENT DISPLAY UNIT	-----

COURSE OUTCOMES	
CO1	Apply the concepts of Operational Amplifiers in Linear and Non-linear applications, PLL, Combinational & Sequential Logic circuits.
CO2	Analyze the Operational Amplifiers in Linear and Non-linear applications, PLL, Combinational & Sequential Logic circuits.
CO3	Analyze and Design the characteristics of Operational Amplifiers in Linear and Non-linear applications, PLL, Combinational & Sequential Logic circuits.
CO4	Conduct investigation and test the functionality on design of VariousOperational Amplifiers in Linear and Non-linear applications, PLL, Combinational & Sequential Logic circuits.
CO5	Select appropriate tools and simulate various encoding and decoding techniques using VHDL.
CO6	Follow ethical principles in designing circuits.
CO7	Do experiments effectively as an **individual** and as a member in a group.
CO8	Communicate verbally and in written form, the understandings about the experiments.
CO9	Continue updating their skill related to implementation for various applications during their life time**.**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	3	-	-	3	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO9	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

DIGITAL COMMUNICATION LABORATORY

B. Tech III Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
17CA04510	**Core**	**-**	**-**	**3**	**2**	**30**	**70**	**100**
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes: 45**		

Course Objectives:

1. Understand the sampling theorem for different rates.
2. Experience real time behavior of different digital modulation schemes.
3. Understand the spectra of different digital modulation schemes

LIST OF EXPERIMENTS

MINIMUM OF TEN EXPERIMENTS TO BE CONDUCTED (FIVE FROM EACH PART)

EXP-l	**TIME DIVISION MULTIPLEXING.**
To design Time Division Multiplexing using hard ware.	
EXP-2	**PULSE CODE MODULATION.**
To design Pulse Code Modulation using hard ware.	
EXP-3	**DIFFERENTIAL PULSE CODE MODULATION.**
To design Differential Pulse Code Modulation using hard ware.	
EXP-4	**DELTA MODULATION.**
To design Delta Modulation using hard ware.	
EXP-5	**FREQUENCY SHIFT KEYING.**
To design Frequency Shift Keying using hard ware.	
EXP-6	**DIFFERENTIAL PHASE SHIFT KEYING.**
To design Differential Phase Shift keying using hard ware.	

EXPERIMENTS CAN BE PERFORMED USING HARDWARE OR SOFTWARE TOOLS.

EXP-7	**SAMPLING THEOREM – VERIFICATION.**
To verify Sampling Theorem using MATLAB	
EXP-8	**PULSE CODE MODULATION.**
To verify Pulse Code Modulation using MATLAB	
EXP-9	**DIFFERENTIAL PULSE CODE MODULATION**.
To verify Differential Pulse Code Modulation using MATLAB	
EXP-l0	**FREQUENCY SHIFT KEYING**.
To verify Frequency Shift Keying using MATLAB	
EXP-l1	**PHASE SHIFT KEYING.**
To verify Phase Shift Keying using MATLAB	
EXP-l2	**DIFFERENTIAL PHASE SHIFT KEYING.**
To verify Differential Phase Shift keying using MATLAB	

Reference Books:

1. John Proakis, “Digital Communications”, TMH, 2^{nd} Edition 1983.
2. B.P.Lathi, “Modern Analog and Digital Communication”, Oxford reprint, 3^{rd} Edition, 2004
3. Singh,Sapre, “Communication Systems Analog and Digital”, TMH, 2^{nd} Edition

LIST OF EQUIPMENT REQUIRED		
S. No	**Name of the Equipment**	**Range**
1	REGULATED POWER SUPPLY	0-30V DC
2	CRO	0-20 MHz
3	FUNCTION GENERATOR	0-1 MHZ
4	RF GENERATORS (3 Nos)	0-1000 MHZ
5	MULTIMETERS	---
6	ARBITRARY WAVE FORM GENERATORS/ PNS GENERATORS	2 Nos
7	LICENSED MATLAB SOFTWARE	30 USERS

COURSE OUTCOMES	
CO1	Demonstrate time division multiplexing scheme, base band and Pass band modulation & demodulation techniques.
CO2	Analyze the characteristics of Time division Multiplexing & Demultiplexing, different base band and Pass band modulation & demodulation techniques.
CO3	Design various base band & pass band modulation and demodulation techniques.
CO4	Conduct investigation and test the functionality on implementation of base band and pass band modulation techniques.
CO5	Select appropriate tools as MATLAB simulation software and procedure to simulate the sampling theorem, different base band modulation and pass band modulation schemes.
CO6	Follow ethical principles in designing, simulating and implementing circuits.
CO7	Do experiments effectively as an individual and as a member in a group.
CO8	Communicate verbally and in written form, the understandings about the experiments.
CO9	Continue updating their skill related to implementation for various application during their life time.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-		3		-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

SOFT SKILLS LAB

B. Tech III Year I Semester								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
17CA52501	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		-	-	3	2	-	-	-
Contact Classes: Nil	**Tutorial Classes: Nil**		**Practical Classes:45**			**Total Classes:45**		

Course Objectives:

The course should enable the students to :

1. This Lab focuses on using multi-media instruction for language development to meet the following targets:
2. To improve the students’ fluency in English, through a well-developed vocabulary and enable them to listen the English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
3. Further, they would be required to communicate their ideas relevantly and coherently in writing.
4. To prepare all the students for their placements.

UNIT-I	**COMMUNICATIVE COMPETENCE**	**Classes:09**

1. Reading Comprehension
2. Listening Comprehension
3. Vocabulary Development
4. Communication Styles and Competencies

UNIT-II	**WRITING SKILLS**	**Classes:09**

1. Report Writing
2. Resume Preparation
3. E-mail Writing

UNIT-III	**PRESENTATION SKILLS**	**Classes:12**

1. Oral presentation
2. Power point presentation
3. Informative presentation

UNIT-IV	**GETTING READY FOR JOB**	**Classes:09**

1. SWOT/C Analysis
2. Group Discussions
3. Interview skills

UNIT-V	**INTERPERSONAL SKILLS**	**Classes:06**

1. Time Management
2. Problem Solving & Decision Making
3. Etiquettes

Minimum Requirements for SOFT SKILLS Lab:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infra-structural facilities to accommodate at least 60 students in the lab:

1. Spacious room with appropriate acoustics.
2. Round Tables with movable chairs
3. Audio-visual aids
4. LCD Projector
5. Public Address system
6. P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
7. T. V, a digital stereo & Camcorder
8. Headphones of High quality

Suggested Software:

The software consisting of the prescribed topics elaborated above should be procured and G

1. Walden Infotech: Advanced English Communication Skills Lab

2. K-VAN SOLUTIONS-Advanced English Language Communication Skills lab

3. DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.
4. TOEFL & GRE(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
5. Train2success.com

References:
1. Objective English for Competitive Exams, Hari Mohana Prasad, 4th edition, Tata Mc Graw Hill.
2. Technical Communication by Meenakshi Raman & Sangeeta Sharma, O U Press 3rdEdn. 2015.
3. Essay Writing for Exams, AudroneRaskauskiene, Irena Ragaisience & Ramute Zemaitience, OUP, 2016
4. Soft Skills for Everyone, Butterfield Jeff, Cengage Publications, 2011.
5. Management Shapers Series by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. Campus to Corporate, Gangadhar Joshi, Sage Publications, 2015
7. Communicative English,E Suresh Kumar &P.Sreehari, Orient Blackswan, 2009.
8. English for Success in Competitive Exams, Philip Sunil Solomon OUP, 2015

COURSE OUTCOMES	
CO1	Demonstrate the skill to write in English without grammatical error, accomplishment in tone and pitch of voice in student's communication.
CO2	Relate the importance of speaking with effective communication through academic and professional presentations by applying skills.
CO3	Formulate and exhibit acceptable etiquette essential in social and professional settings.
CO4	Create awareness on Time and Stress management in order to improve Problem solving technique, Enhanced job prospects and better sustainability skills.
CO5	Choose appropriate methods of learning advanced vocabulary and grammar competently for use in real life context.
CO6	Follow ethical principles in listening, writing, presenting and communicative ability towards jobs.
CO7	Do experiments effectively as an individual and as a member in a group.
CO8	Communicate verbally and in written form, the understandings about the experiments.
CO9	Continue updating their written communication skills among learners for both academic and professional purposes during their life time.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

VI SEMESTER
DIGITAL SIGNAL PROCESSING

<table>
<tr><td colspan="10">B. Tech III Year II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum</td></tr>
<tr><td rowspan="2">17CA04601</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 45</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 45</td></tr>
</table>

Course Objectives:

1. Develop skills for analyzing discrete signals and systems also apply discrete fourier transform for frequency domain analysis along with the implementation of FFT.
2. Provide concepts and skills for the design and realization of IIR and FIR filters, with given specifications, using different techniques.
3. Investigate the effect of finite word length in the design of digital filters.
4. Tackle the design of multirate filters using DSP concepts and use for real time applications.

UNIT-I	**REVIEW OF DISCRETE TIME SIGNALS AND SYSTEMS**	**Classes: 09**

Discrete time signal: Definition, Classification, Elementary Signals.
Discrete time Systems: Definition, Classification, Linear time invariant (LTI) System, Properties of LTI system, Time and Frequency domain analysis of discrete time signals and systems, Methods of evaluating the convolution sum, Filtering using overlap-save and overlap-add method.

UNIT-II	**COMPUTATIONS OF DFT & FFT**	**Classes: 09**

Introduction to Discrete Fourier transform (DFT), Properties of DFT, Linear and Circular Convolution using DFT. Direct computation of DFT, Need for efficient computation of the DFT, Radix-2 FFT algorithm for the computation of DFT and IDFT is using decimation-in-time and decimation-in-frequency algorithms, General Radix-N FFT.

UNIT-III	**IIR FILTERS**	**Classes: 10**

Analog filters: Butterworth and Chebyshev filters, Analog transformation of LPF to HPF/BPF/BSF.
Implementation of IIR filter: Concept of IIR filter, Realization structures for IIR filter using Direct form-I and Direct form-II, Cascade, Lattice and Parallel.Transformation of analog filters into equivalent digital filters using impulse invariant method and bilinear transform method.

UNIT-IV	**FIR FILTERS**	**Classes: 09**

Implementation of FIR filter: Concept of FIR filter, Realization structures for FIR filter using Direct form-I and Direct form-II, Cascade, Lattice and Parallel.
Design of linear phase FIR filters using windows and frequency sampling methods, Comparison of FIR & IIR filters.

UNIT-V	**MULTIRATE SIGNAL PROCESSING & APPLICATIONS**	**Classes: 08**

Multirate signal processing; Decimation, Interpolation, Sampling rate conversion by a rational factor, Implementation of sampling rate conversion, Structures for rational sampling rate conversion, Polyphase structures for decimation and interpolation filters, Applications of multirate signal processing.

Text Books:

1. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, Principles, Algorithms and Applications", Prentice Hall, 4th Edition, 2007.
2. Sanjit K Mitra, "Digital signal processing, A computer base approach", McGraw-Hill Higher Education, 4th Edition, 2011.

Reference Books:
1. Li tan, “Digital signal processing: fundamentals and applications” Elsevier Science &. Technology Books, 2nd Edition, 2008. 2. Robert J.schilling, Sandra. L.harris, “Fundamentals of Digital signal processing using Matlab”, Thomson Engineering, 2nd Edition, 2005. 3. Salivahanan, Vallavaraj, Gnanapriya, “Digital signal processing”, McGraw-Hill Higher Education, 2nd Edition, 2009.
Web References:
1. https://www.coursetalk.com/providers/coursera/courses/digital-signal-processing 2. https://www.edx.org/course/discrete-time-signal-processing-mitx-6-341x-1
E-Text Books:
1. http://www.dspguide.com/pdfbook.htm 2. http://dspguru.com/dsp/books/favorites 3. http://onlinevideolecture.com/ebooks 4. http://www.freebookcentre.net/SpecialCat/Free-Signal-Processing-Books

COURSE OUTCOMES	
CO1	Analyze the various discrete time signals and systems.
CO2	Implement DFT, FFT using Radix-2 in frequency and time domains.
CO3	Analyze and Design IIR filters using realization structures.
CO4	Analyze and Design IIR filters using Window techniques.
CO5	Exhibit the knowledge on multirate signal processing to meet the real time applications.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO5	3	2	2	2	-	1	-	-	-	-	-	-	3	1
CO*	**3**	**2.4**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**

VLSI SYSTEM DESIGN

VI Semester: ECE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum**		
17CA04602	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**-**	**3**	**30**	**70**	**100**
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

Course Objectives:

1. To understand the concepts of MOS devices for the fabrication of integrated chips.
2. To understand VLSI circuit design processes.
3. To understand basic circuit concepts and designing Arithmetic Building Blocks.
4. To have an overview of Low power VLSI.

UNIT-I	INTRODUCTION TO MOS CHARACTERISTICS	Classes: 08

Introduction: Basic steps of IC fabrication, PMOS, NMOS, CMOS & BiCMOS and SOI process technologies, MOS transistors - MOS transistor switches – Basic gate using switches.
Basic Electrical Properties of MOS and BiCMOS Circuits: Working of MOS transistors – threshold voltage; MOS design equations: $\mathbf{I_{ds}}$–$\mathbf{V_{ds}}$ relationships, Threshold Voltage, Body effect, Channel length modulation , $\mathbf{g_m}$, $\mathbf{g_{ds}}$, figure of merit $\boldsymbol{\omega_0}$; Pass transistor, NMOS Inverter, CMOS Inverter analysis and design, Various pull ups loads, Bi-CMOS Inverters.

UNIT-II	VLSI CIRCUIT DESIGN PROCESSES VLSI DESIGN STYLES	Classes: 10

Basic Circuit Concepts: Capacitance, resistance estimations- Sheet Resistance $R_{s,}$ MOS Device Capacitances, routing Capacitance, Analytic Inverter Delays, Driving large Capacitive Loads, Fan-in and fan-out.
VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2μm CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

UNIT-III	DESIGN AND IMPLEMENTATION STRATEGIES	Classes: 10

Gate level Design: Logic gates and other complex gates, Switch logic, Alternate gate circuits.
Physical Design: Floor-Planning, Placement, routing, Clock and Power routing.

UNIT-IV	SUB SYSTEM DESIGN & STYLES	Classes: 08

Subsystem Design: Shifters, Adders, ALUs, Multipliers, High Density Memory Elements.
VLSI Design styles: Full-custom, Standard Cells, FPGAs, CPLDs and Design Approach for Full-custom and Semi-custom devices.

UNIT- V	VHDL SYNTHESIS AND TESTING	Classes: 09

VHDL Synthesis: VHDL Synthesis, Circuit Design Flow, Circuit Synthesis, Simulation, Layout, Design capture tools, Design Verification Tools.
Test and Testability: Fault-modeling and simulation, test generation, design for testability, Built-in-self-test.

Text Books:

1. Kamran Eshraghian, Eshraghian Douglas and A. Pucknell, "Essentials of VLSI circuits and systems", PHI, 2013 Edition.
2. K.Lal Kishore and V.S.V. Prabhakar, "VLSI Design", IK Publishers, 2009.

Reference Books:
1. Weste and Eshraghian, “Principles of CMOS VLSI Design”, Pearson Education, 1999. 2. Wayne Wolf, “Modern VLSI Design”, Pearson Education, 3rd Edition, 1997. 3. John P. Uyemura, “Introduction to VLSI Circuits and Systems”, John wiley, 2003. 4. John M. Rabaey, “Digital Integrated Circuits”, PHI, EEE, 1997.
Web References:
1. http://www.nptel.ac.in/downloads/117101058/ 2. https://www.tutorialspoint.com/vlsi_design/vlsi_design_digital_system.htm

COURSE OUTCOMES	
CO1	Demonstrate the knowledge on MOS devices for the fabrication of integrated chips.
CO2	Analyze the various VLSI circuit design processes and their styles.
CO3	Implement Gate level design and physical design strategies.
CO4	Analyze the various subsystem design and VLSI design styles.
CO5	Investigate and Analyze VHDL Synthesis and testing.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2.6**	**2**	-	-	-	-	-	-	-	-	-	**2.8**	**-**

MICOWAVE ENGINEERING

B. Tech III Year II Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum**		
17CA04603	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**1**	**-**	**3**	**30**	**70**	**100**
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

Course Objectives:

- To develop the knowledge on transmission lines for microwaves, cavity resonators and wave guide components and applications.
- To understand the scattering matrix parameters and its use.
- To introduce the student the microwave test bench for measure different parameters like attenuation, VSWR, etc.

UNIT-I	MICROWAVE TRANSMISSION LINES	Classes: 14

MICROWAVE TRANSMISSION LINES: Introduction, Microwave spectrum and bands, applications of Microwaves. Rectangular Waveguides-Solution of Wave Equation in Rectangular Coordinates, TE/TM mode analysis, Expressions for fields, Characteristic equation and cutoff frequencies, dominant and degenerate modes, sketches of TE and TM mode fields in the cross-section. Mode characteristics- Phase and Group velocities, wavelengths and impedance relations.
Rectangular Waveguides– Power Transmission and Power Losses, Impossibility of TEM Modes, Micro strip lines-introduction, Z_0 relations, effective dielectric constant, losses, Q-factor

UNIT-II	WAVEGUIDE COMPONENTS AND APPLICATIONS	Classes: 13

Coupling mechanisms: Probe, loop, coupling to a cavity resonator, waveguide discontinuities, waveguide irises, tuning screws and posts, matched loads; Waveguide attenuators; Waveguide phase shifters; waveguide multiport junctions: Properties and s-matrix calculations of E plane Tee, H plane Tee, Magic Tee, Directional Coupler, Hybrid ring,
Ferrites: Faraday rotation principle, gyrator, isolator, circulator.

UNIT-III	MICROWAVE TUBES	Classes: 12

Microwave linear beam tubes: Limitations of conventional tubes at microwave frequencies; Klystron: Velocity modulation process, bunching process, output Power, Multicavity Klystron amplifiers: Beam current density, output current, Reflex Klystron: Velocity modulation, power output and efficiency.
Helix Traveling Wave tube: Slow wave structures, amplification process, conventional current; **Microwave cross field tubes (M type):** Introduction, cross-field effects; Magnetrons: Different types, 8-cavity cylindrical travelling wave Magnetron, Hull cut-off and Hartree conditions.

UNIT-IV	MICROWAVE SOLID-STATE DEVICES	Classes: 10

Microwave solid-state devices: Microwave tunnel diode; Transferred electron devices: Gunn-effect diodes, RWH theory, modes of operations; Avalanche transit time devices: IMPATT diode, TRAPATT diode, BARITT diode, Pin diodes, varactor diodes, crystal detectors.

UNIT-V	MICROWAVE MEASUREMENTS	Classes: 11

Description of microwave bench: Different blocks and their features, precautions; Microwave power measurement: Bolometers; Measurement of attenuation; Frequency standing wave measurements: measurement of low and high VSWR; Cavity Q; Impedance measurements.

Text Books:

1. Samuel Y. Liao, “Microwave Devices and Circuits”, Pearson, 3rd Edition, 2003.
2. Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, “Microwave Principles” ,CBS Publishers and Distributors, New Delhi, 1st Edition, 2004.

Reference Books:
1. R.E. Collin, "Foundations for Microwave Engineering" IEEE Press, John Wiley, 2nd Edition, 2002. 2. Peter A. Rizzi, "Microwave Engineering Passive Circuits" PHI, 3rd Edition, 1999. 3. M.L. Sisodia, G.S.Raghuvanshi, "Microwave Circuits and Passive Devices" Wiley Eastern Ltd., New Age International Publishers Ltd, 1st Edition, 1995.
Web References:
1. http://nptel.ac.in/courses/117101119/1 2. http://www-group.slac.stanford.edu/kly/Lecture_Series/slac_klystron_lecture_series.htm 3. https://books.google.co.in/books?id=ZU19Uemy83YC&printsec=frontcover&dq=microwave+ engineering & hl=en & redir_esc=y#v=onepage & q&f = false
E-Text Books:
1. https://ecedmans.files.wordpress.com/2014/10/microwave-devices-and-circuits-samuel-liao.pdf 2. http://www.faadooengineers.com/threads/11621-Microwave-engineering-ebook-pdf-Free-Download 3. http://www2.electron.frba.utn.edu.ar/~jcecconi/Bibliografia/Ocultos/Libros/Microwave_Engineering_David_M_Pozar_4ed_Wiley_2012.pdf.

COURSE OUTCOMES	
CO1	**Exhibit the knowledge** on transmission lines for microwave circuits, cavity resonators and wave guide components.
CO2	**Analyze and design** various microwave circuits and devices using S-matrix parameters.
CO3	**Investigate and analyze** different microwave tubes such as klystron, Reflex klystron, and M type tubes.
CO4	**Exhibit the knowledge** on various transit time devices.
CO5	**Demonstrate the basic knowledge** on various microwave metrics.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2**	**1.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

MICROPROCESSORS AND MICROCONTROLLERS

B. Tech III Year II Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum**		
17CA04604	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**1**	**-**	**3**	**30**	**70**	**100**
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

Course Objectives:

1. To understand the architecture of 8086 MICROPROCESSOR.
2. To learn various 8086 Instruction set and Assembler Directives.
3. To learn basics of MSP430 design and programming.

UNIT-I	**INTRODUCTION**	**Classes: 14**
8086 Architecture-Block Diagram, Pin Diagram, Register Organization, Flag Register, Timing and Control Signals, System Timing Diagrams, Memory Segmentation, Interrupt structure of 8086 and Interrupt Vector Table, Memory organization and memory banks accessing.		
UNIT-II	**INSTRUCTION SET & PROGRAMMING**	**Classes: 13**
Addressing Modes-Instruction Set of 8086, Assembler Directives- Macros and Procedures- Sorting, Multiplication, Division and multi byte arithmetic code conversion. String Manipulation instructions-Simple ALPs.		
UNIT-III	**LOW POWER RISC MSP430**	**Classes: 12**
Block diagram, features and architecture, Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, MSP430x5x series block diagram, Addressing modes, Instruction set Memory address space, on-chip peripherals (analog and digital), and Register sets. Sample embedded system on MSP430 microcontroller		
UNIT-IV	**I/O PORTS**	**Classes: 12**
I/O ports pull up/down resistors concepts, Interrupts and interrupt programming. Watchdog timer. System clocks. Low Power aspects of MSP430: low power modes, Active vs Standby current consumption, FRAM vs Flash for low power & reliability Timer & Real Time Clock (RTC), PWM control, timing generation and measurements. Analog interfacing and data acquisition: ADC and Comparator in MSP430, data transfer using DMA		
UNIT-V	**SERIAL COMMUNICATION**	**Classes: 09**
Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and I2C). UART protocol, I2C protocol, SPI protocol. Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices. Implementing Embedded Wi-Fi using CC3100		

Text Books:

1. "Microprocessor and Microcontrollers", N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Oxford Publishers. 1st Edition, 2010.
2. "The X86 Microprocessors , Architecture, Programming and Inerfacing" , Lyla B. Das, Pearson Publications, 2010.
3. MSP430 microcontroller basics. John H. Davies, Newnes Publication, 1st Edition, 2008.

Reference Books:

1. http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode
2. http://processors.wiki.ti.com/index.php/MSP430_16-Bit_Ultra-Low_Power_MCU_Training

COURSE OUTCOMES	
CO1	Demonstrate the knowledge on 8086 microprocessor and its timing and control signals.
CO2	Analyze the instruction set of 8086 microprocessor and program it.
CO3	Demonstrate the knowledge on MSP430 microcontroller and it's on chip peripherals to build an embedded system.

CO4	Exhibit the knowledge on I/O Ports of MSP430 microcontroller and analyze the system clocks to operate in low power modes.
CO5	Analyze the various serial communication protocols to program them using MSP430 microcontroller and implement an embedded Wi-Fi.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	1	-	-	1	1	-	-	-	-	-	3	1
CO*	**3**	**2.2**	**1**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**2.6**	**1**

SATELLITE COMMUNICATION (PROFESSIONAL ELECTIVE-II)

B. Tech III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04605	Core	L	T	P	C	CIA	SEE	Total
		3	0	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

1. To introduce the basic principles of Satellite Communication systems, orbital mechanics, launchers.
2. To introduce the basic concepts and designing of Satellite links.
3. To introduce the basic concepts of earth station transceiver.
4. To know the basic concepts of various multiple access techniques and GPS systems.

UNIT-I	INTRODUCTION TO SATELLITE COMMUNICATIONS	Classes: 10

Origin of satellite communications, Historical background, basic concepts of satellite communications, frequency allocations for satellite services, applications, future trends of satellite communications. Orbital Mechanics look angle determination, orbital perturbations, orbit determination, launches and launch vehicles, orbital effects in communication systems performance.

UNIT-II	SATELLITE SUBSYSTEMS AND LINK DESIGN	Classes: 10

Attitude and orbital control system, Telemetry, Tracking, command and monitoring, power systems, communication subsystems, satellite antenna equipment reliability and space qualification. Basic transmission theory, system noise temperature and G/T ratio, design of down links, uplink design, design of satellite links for specified C/N, system design example.

UNIT-III	EARTH STATION TECHNOLOGY, LOW EARTH ORBIT AND GEO-STATIONARY SATELLITE SYSTEMS	Classes: 08

Introduction, transmitters, receivers, Antennas, tracking systems, terrestrial interface, primary power test methods. Orbit consideration, coverage and frequency considerations, delay and throughput considerations, system considerations, operational NGSO constellation designs.

UNIT-IV	MULTIPLE ACCESS TECHNIQUES	Classes: 08

Introduction to Multiple Access, Frequency Division Multiple Access, Intermodulation, Time Division Multiple Access, TDMA Frame Structure, Code Division Multiple Access, Demand Assigned Multiple Access, difference between FDMA, TDMA and CDMA.

UNIT-V	SATELLITE NAVIGATION & GLOBAL POSITIONING SYSTEM	Classes: 09

Radio and satellite navigation, GPS position location principles, GPS receivers and codes, satellite signal acquisition, GPS navigation message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, Differential GPS.

Text Books:

1. Timothi Pratt, Charles Bostian and Jeremy Allnutt, “Satellite communications”, WSE, Wileypublications, 2nd Edition, 2003.
2. Wilbur L.Prichard, Robert A. Nelson & Henry G.Suyderhoud, “Satellite communicationsEngineering”, Pearson Publications, 2nd Edition, 2003.

Reference Books:

1. Dennis Roddy, “Satellite communications”, McGraw Hill, 2nd Edition, 1996.
2. M. Richharia, “Satellite communications: Design principles”, BS publications, 2nd Edition, 2003.
3. D.C.Agarwal, “Satellite communications”, Khanna publications, 5th Ed.
4. K.N.Raja rao, “Fundamentals of Satellite communications”, PHI, 2004.

COURSE OUTCOMES	
CO1	**Demonstrate the knowledge** on basics of satellite communication.
CO2	**Analyze and design** satellite links.
CO3	**Exhibit the knowledge** on earth station transmitter, receiver, and antenna systems.
CO4	**Demonstrate the knowledge** on various types of multiple access techniques.
CO5	**Investigate and analyze** the concepts of satellite navigation and GPS.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2.6**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

FIELD PROGRAMMABLE GATE ARRAY (FPGA) DESIGN
(PROFESSIONAL ELECTIVE-II)

B. Tech III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04606	Elective	L	T	P	C	CIA	SEE	Total
		3	0	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

The course should enable the students to:

1. Meliorate the knowledge of fundamentals and types of neural networks.
2. Develop the different Algorithms for neural networks.
3. Meliorate the knowledge in Fuzzy logic principles.
4. Correlate the principles with applications of neural networks and fuzzy logic.

UNIT-I	INTRODUCTION TO FIELD-PROGRAMMABLE GATE ARRAYS	Classes: 10

Programmability and DSP: A Short History of the Microchip, Challenges of FPGAs, DSP System Basics, DSP System Definitions, DSP Transforms, Filter Structures, Adaptive Filtering , Basics of Adaptive Filtering.

UNIT-II	ARITHMETIC BASICS	Classes: 09

Number Systems, Fixed-point and Floating-point, Arithmetic Operations, Fixed-pointversus Floating-point, Technology Review: Introduction, Architecture and Programmability, DSP Functionality Characteristics. Processor Classification, Microprocessors, DSP processors.

UNIT-III	CURRENT FPGA TECHNOLOGIES	Classes: 08

Introduction, Toward FPGA, Altera FPGA Technologies, Xilinx FPGA Technologies, Detailed FPGA Implementation Issues: Introduction, Various Forms of the LUT, Memory Availability, Fixed Coefficient Design Techniques, Distributed Arithmetic, Reduced Coefficient Multiplier, Rapid DSP System Design Tools and Processes for FPGA: Introduction, Design Methodology Requirements for FPGA DSP, System level Design Tools for FPGA.

UNIT-IV	THE IRIS BEHAVIORAL SYNTHESIS	Classes: 08

Introduction of Behavioral Synthesis Tools, Hierarchical Design Methodology, Hardware Sharing Implementation (Scheduling Algorithm) for IRIS.DECISION ANALYSIS AND SUPPORT: Decision Making., Modeling throughout System Development, Modeling for Decision.

UNIT-V	COMPLEX DSP CORE DESIGN FOR FPGA	Classes: 10

Motivation for Design for Reuse, Intellectual Property (IP) Cores, Evolution of IP Cores. Model-based Design for Heterogeneous FPGA: Dataflow Modeling and Rapid Implementation for FPGA DSP Systems, Rapid Synthesis and Optimization of Embedded Software from DFGs, System-level Modeling for Heterogeneous Embedded DSP Systems, System level Design and Exploration of Dedicated Hardware Network, Adaptive Beam former Example, Low Power FPGA Implementation.

Text Books:

1. Roger Woods, John McAllister, Gaye Light body, Ying Yi, FPGA-based Implementation of Signal Processing Systems, Wiley, 2008.
2. John V. Old Field, Richrad C. Dorf, Field Programmable Gate Arrays, Wiley, 2008.

Reference Books:
1. Michel John Sebastian Smith, Application Specific Integrated Circuits,Addison Wesley Professional, 2008. 2. Stephen D. Brown, Robert J. Francis, Jonathan Rose, Zvonko G. Vranesic,Field Programmable Gate Arrays, 2nd Edition, Springer, 1992.
Web References:
1. http://www.willamette.edu/~gorr/classes/cs449/intro.html 2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine -learning 3. http://ocw.mit.edu/courses/sloan-school-of-management/15-062-datamining-spring-2003/lecture-notes/NeuralNet2002.pdf 4. http://www.cs.stir.ac.uk/~lss/NNIntro/InvSlides.html
E-Text Books:
1. http://www.e-booksdirectory.com 2. http://www.ebooks.com/subjects/computer-science-neural-networks-ebooks/ 3. http://en.wikibooks.org/wiki/Artificial_Neural_Networks 4. http://jntu-ebooks.blogspot.in

COURSE OUTCOMES	
CO1	Demonstrate the Knowledge on Field Programmable Gate Arrays and DSP transforms structures and filtering.
CO2	Exhibit the knowledge on DSP processors architecture, operations and programmability.
CO3	Design and develop various current FPGA technologies using system level design tools.
CO4	Investigate and analyze behavioral synthesis tools for IRIS decision analysis and support.
CO5	Design various complex DSP core for FPGA.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2.2**	**1.4**	-	-	-	-	-	-	-	-	-	**3**	-

DATA COMMUNICATION AND NETWORKING

(PROFESSIONAL ELECTIVE-II)

B. Tech III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04607	Elective	L	T	P	C	CIA	SEE	Total
		3	0	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

1. Study the evolution of computer networks and future directions.
2. Study the concepts of computer networks from layered perspective.
3. Study the issues open for research in computer network protocols suite are addressed.

UNIT-I	INTRODUCTION	Classes: 10

Network and Network Types, Internet History, Standards and Administration.
Network Models: Protocol Layering, TCP/IP Protocol Suite, The ISO Model.
The Physical layer: Data and Signals, Transmission impairment, Data rate limits, Performance,
Transmission media: Introduction, Guided Media, Unguided Media, Switching: Introduction, Circuit Switched Networks, Packet switching.

UNIT-II	DATA LINK LAYER	Classes: 09

Introduction, Link layer addressing, Error detection and Correction: Cyclic codes, Checksum, Forward error correction,
Data link control: DLC Services, Data link layer protocols, HDLC, Point to Point Protocol,
Media Access control: Random Access, Controlled Access, channelization, Connecting devices and virtual LANs.

UNIT-III	MULTI ACESS AND DATA NETWORKS	Classes: 08

Multiple access: RANDOH, CDMA, CSMA/CD, CSMA/CA, Wired LANs: IEEE standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LANs: IEEE 802.11, Bluetooth IEEE 802.16.
The Network Layer: Network layer design issues, Routing algorithms, Congestion control algorithms, Quality of service, Internetworking,
The network layer in the Internet: IPV4 Addresses, IPV6, Internet Control protocol, OSPF, BGP, IP, ICMPv4, IGMP.

UNIT-IV	TRANSPORT LAYER	Classes: 08

Transport Services, Elements of Transport Protocols, Congestion Control.
Internet transport protocols: UDP, TCP, Performance problems in computer networks, Network performance measurement.

UNIT-V	APPLICATION LAYER	Classes: 10

Introduction, Client Server Programming, WWW and HTTP, FTP, e-mail, TELNET, Secure Shell, Domain Name System, SNMP.

Text Books:

1. Behrouz A. Forouzan, “Data communications and networking”, Mc Graw Hill Education, 5th edition, 2012.
2. Andrew S. Tanenbaum, Wetherall, “Computer Networks”, Pearson, 5th edition, 2010.

Reference Books:

1. Data Communication and Networks, Bhushan Trivedi, Oxford
2. Internetworking with TCP/IP – Principles, protocols, and architecture- Volume 1, Douglas E. Comer, 5th edition, PHI
3. Computer Networks‖, 5E, Peterson, Davie, Elsevier.
4. Introduction to Computer Networks and Cyber Security‖, Chawan- Hwa Wu, Irwin, CRC Publications.
5. Computer Networks and Internets with Internet Applications‖, Comer.

Web References:

1. http://www.ie.itcr.ac.cr/
2. http://www.neduet.edu.pk/
3. http://www.researchgate.net
4. http://www.mitpress.mit.edu

E-Text Books:

1. http://www.e-booksdirectory.com/listing.php?category=292
2. link.springer.com/book/10.1007%2F978-1-4899-2215
3. www.ie.itcr.ac.cr/acotoc/Maestria_en_Computacion/Sistemas_de
4. https://www.crcpress.com/...Communications-Theoretical...Applications

COURSE OUTCOMES	
CO1	Demonstrate the concepts of the Network Protocols, Network models, Physical layer, and Transmission media.
CO2	Analyze the concepts of Data Link Layer for error detection and correction and also use their Media Access Control.
CO3	Demonstrate the concepts of Multiple Access of Networks and Network Layers.
CO4	Demonstrate Knowledge on Transport Protocols in computer networks
CO5	Demonstrate the concepts of different protocols in application layers.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	2	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	2	3	2
CO*	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

MATLAB PROGRAMMING (PROFESSIONAL ELECTIVE-II)

B. Tech III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA04608	Core	3	0	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

1. Understand the MATLAB Desktop, Command window and the Graph Window
2. Able to do simple and complex calculation using MATLAB
3. Able to carry out numerical computations and analysis
4. Understand the mathematical concepts upon which numerical methods rely
5. Understand the tools that are essential in solving engineering problems

UNIT-I	INTRODUCTION TO MATLAB	Classes: 10

MATLAB Interactive Sessions, Menus and the toolbar, computing with MATLAB, Script files and the Editor Debugger, MATLAB Help System, Programming in MATLAB

UNIT-II	ARRAYS	Classes: 08

Arrays, Multidimensional Arrays, Element by Element Operations, Polynomial Operations Using Arrays, Cell Arrays, Structure Arrays.

UNIT-III	FUNCTIONS & FILES	Classes: 08

Elementary Mathematical Functions, User Defined Functions, Advanced Function Programming, Working with Data Files.

UNIT-IV	PROGRAMMING TECHNIQUES	Classes: 09

Program Design and Development, Relational Operators and Logical Variables, Logical Operators and Functions, Conditional Statements, Loops, the Switch Structure, Debugging Matlab Programs. XY-plotting functions, Subplots and Overlay plots, Special Plot types, Interactive plotting, Function Discovery, Regression, 3-D plots.

UNIT-V	LINEAR ALGEBRAIC EQUATIONS	Classes: 10

Elementary Solution Methods, Matrix Methods for (Linear Equations), Cramer’s Method, Undetermined Systems, Order Systems.

Text Books:

1. G. H. Golub and C. F. Van Loan, “Matrix Computations”, 3rd Edition, Johns Hopkins University Press, 1996.
2. L. Elden, “Matrix Methods in Data Mining and Pattern Recognition”, SIAM Press, 2007

Reference Books:

1. NA-digest, http://www.netlib.org/na-digest-html
2. Society for Industrial and Applied Mathematics (SIAM), see http://www.siam.org
3. Google “MATLAB Primer” or “MATLAB Tutorial” and you should be able to access lots of free MATLAB

COURSE OUTCOMES	
CO1	Able to use Matlab for interactive computations.
CO2	Demonstrate the concepts of arrays.
CO3	Demonstrate the concepts of Functions and Files.
CO4	Able to generate plots and export this for use in reports, able to program scripts and functions using the Matlab.
CO5	Able to write basic mathematical, electronic problems in MATLAB.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	2	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	2	3	2
CO*	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

SOFT SKILLS-II (OPEN ELECTIVE)

B. Tech III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA052601	Foundation	L	T	P	C	CIA	SEE	Total
		3	1	-	3	30	70	100

Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**	**Total Classes: 45**

Course Objectives:

- To enhance employability skills through Group discussions and Mock Interviews.
- To enable the students collectively in organizational skills.
- To train the students to meet communicative competence.

UNIT – I	**VERBAL ABILITY & COMMUNICATION SKILLS**	**Classes:09**

Communication: Verbal and Non-Verbal Communication, Barriers to effective Communication, Types of Communication - Oral, Aural, Writing and Reading

Grammar:- usage of Articles, Preposition, Verb, Tenses, Adverbs, If-Conditionals, Adjectives, Degrees of Comparison, Conjunction, Simple, Compound & Complex, Active & Passive voice, Reported Speech and Common Errors in English.

Word Power: - Synonyms, Antonyms, Affixes, One word substitutions and Idioms & Phrases.

UNIT- II	**EMPLOYABILITY SKILLS**	**Classes:09**

COMPREHENSIONS:-Listening Comprehension, Reading Comprehension, Technical Reports, Resume Writing, E-mail Writing and Essay Writing

SVAR (Accent): Phonetics, Inflections, Stress and Intonation.

GROUP ACTIVITIES: Just-A-Minute (JAM), Debate, Group Discussion and Interview Skills

UNIT - III	**Arithmetic III**	**Classes:09**

Number System, Averages, Percentages, Simple Interest & Compound Interest, Problems on Ages, Profit & Loss, Probability, Permutation & Combinations, Logarithms

UNIT - IV	**Arithmetic IV**	**Classes:10**

Time & work, Time and Distance, Allegation and Mixtures, Mesuration2D, Mensuration3D, Data Interpretation.

UNIT –V	**Reasoning II**	**Classes:08**

Analogy, Classification, Number series, Coding Decoding, Direction & Distance,Blood Relation.
Critical Reasoning – Syllogism, Statements & Assumptions, Statements & Arguments, Data sufficiency, Seating Arrangement, Puzzles.

Text Books:

1. Rizvi M. Ashraf Effective Technical Communication, Tata McGraw-Hill Publishing Company Limited, 2006.
2. R.S Aggarwal, Quantitative Aptitude for Competitive Examinations, S. Chand Publications
3. R.S.Aggarwal, Verbal and Non Verbal Reasoning, S.Chand Publications.

References:

1. Bovee Courtland and Throill John, Business Communication Essentials: A skills-Based Approach to Vital Business English. Pearson Education Inc., 2011. 106 CS-Engg&Tech-SRM-2013
2. Dhanavel, S.P., English & Communication Skills for Students of Science and Engineering. Orient Black Swan, 2009.

Web References

https://www.englishclub.com/
https://www.onestopenglish.com/
https://www.englishgrammar.org/

E-Text Books:

Campus Recruitment Complete Reference by Praxis groups

COURSE OUTCOMES	
CO1	Apply grammatical structures to formulate correct sentences and communicate fluently
CO2	Analyze the correct production of sounds and LSRW skills to perform any situation in their career.
CO3	Get knowledge on Simple Arithmetic Calculations for real time Applications
CO4	Get knowledge on to calculate complex Arithmetic Operations in real time Applications
CO5	Analyze on Reasoning, Analytical and Logical thinking methods.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO4	3	3	-	3	-	-	-	-	-	-	-	3	3	3
CO5	3	3	-	-	3	-	-	3	3	-	-	3	3	3
CO*	**3**	**3**	**-**	**3**	**3**	**-**	**-**	**3**	**3**	**-**	**-**	**3**	**3**	**3**

DIGITAL SIGNAL PROCESSING LABORATORY

<table>
<tr><td colspan="10">B. Tech III Year II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours /</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">17CA04609</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>3</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 45</td><td colspan="3">Total Classes: 45</td></tr>
</table>

Course Objectives:

1. Implementation of convolution in MATLAB.
2. Implementation of digital signal processing algorithms in MATLAB and C.
3. Understand the real-time operation of digital filters.
4. Analyze the Multirate signal processing algorithms.

<table>
<tr><td colspan="2">Minimum of 5 experiments are to be conducted from each part</td></tr>
<tr><td colspan="2">PART -A</td></tr>
<tr><td>WEEK-1</td><td>GENERATION OF POWER AND ENERGY SIGNAL USING MATLAB</td></tr>
<tr><td colspan="2">Finding Power and (or) Energy of a given signal.</td></tr>
<tr><td>WEEK-2</td><td>GENERATION OF CONVOLUTION AND CORRELATION USING MATLAB</td></tr>
<tr><td colspan="2">Convolution and Correlation (auto and cross correlation) of discrete sequences without using built in functions for convolution and correlation operations</td></tr>
<tr><td>WEEK -3</td><td>GENERATION OF DTFT SIGNAL USING MATLAB</td></tr>
<tr><td colspan="2">DTFT of a given signal</td></tr>
<tr><td>WEEK -4</td><td>DESIGN OF FFT ALGORITHM USING MATLAB</td></tr>
<tr><td colspan="2">N – point FFT algorithm</td></tr>
<tr><td>WEEK -5</td><td>DESIGN OF FIR FILTER USING MATLAB</td></tr>
<tr><td colspan="2">Design of FIR filter using windowing technique and verify the frequency response of the filter</td></tr>
<tr><td>WEEK -6</td><td>DESIGN OF IIR FILTER USING MATLAB</td></tr>
<tr><td colspan="2">Design of IIR filter using any of the available methods and verify the frequency response of the filter.</td></tr>
<tr><td colspan="2">PART -B</td></tr>
<tr><td>WEEK-7</td><td>GENERATION OF RANDOM SIGNAL USING CODE COMPOSER STUDIO</td></tr>
<tr><td colspan="2">Generation of random signal and plot the same as a waveform showing all the specifications using Code Composer Studio</td></tr>
<tr><td>WEEK-8</td><td>GENERATION OF POWER AND ENERGY SIGNAL USING CCS</td></tr>
<tr><td colspan="2">Finding Power and (or) Energy of a given signal using Code Composer Studio</td></tr>
<tr><td>WEEK-9</td><td>GENERATION OF CONVOLUTION AND CORRELATION USING CCS</td></tr>
<tr><td colspan="2">Convolution and Correlation (auto and cross correlation) of discrete sequences without using built in functions for convolution and correlation operations using Code Composer Studio</td></tr>
<tr><td>WEEK-l0</td><td>GENERATION OF DTFT SIGNAL USING CCS</td></tr>
<tr><td colspan="2">DTFT of a given signal using Code Composer Studio</td></tr>
<tr><td>WEEK-l1</td><td>DESIGN OF FIR FILTER USING CCS</td></tr>
<tr><td colspan="2">N – point FFT algorithm using Code Composer Studio</td></tr>
<tr><td>WEEK-12</td><td>DESIGN OF IIR FILTER USING CCS</td></tr>
<tr><td colspan="2">Design of IIR filter using any of the available methods and verify the frequency using Code Composer</td></tr>
</table>

Reference Books:

1. John G. Proakis, Dimitris G. Manolakis, “Digital signal processing, Principles, Algorithms and Applications”, Prentice Hall, 4th Edition, 2007.
2. B. Preetham Kumar, “Digital Signal Processing Laboratory”, CRC Press, 2nd Edition, 2010
3. B.Venkata Ramani, M.Bhaskar, “ Digital Signal Processors- Architecture, Programming and applications”, TMH, 2nd Edition, 2002

Web References:

1. http://eceweb1.rutgers.edu/~orfanidi/ece348/
2. http://www.eecs.umich.edu/courses/eecs452/refs.html
3. http://www.dsp.sun.ac.za/lab-reference-guide/

SOFTWARE AND HARDWARE REQUIRED FOR A BATCH OF 36 STUDENT		
HARDWARE: 36 numbers of Desktop Computer Systems with 2 GB RAM		
SOFTWARES:	a) MATLAB	b) C6713 DSK Code Composer Studio

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS

S.No	Name of the Equipment	Range
1	TMS320C6713 DSP Starter Kit (DSK)	225 MHz device delivering up to 1800 million instructions per second (MIPs)
2	USB Cable	--
3	Universal Power Supply	+5V
4	AC Power Cord(s)	--

COURSE OUTCOMES	
CO1	Demonstrate the knowledge on CC Studio and Analyze the DSP Systems programming through CCS.
CO2	Analyze the various DSP processor kits for floating point operations.
CO3	Design and develop programming on DSP tool kits using CCS.
CO4	Conduct investigation and test the functionality on implementation of CCS through DSP programming.
CO5	Select appropriate tool kit to analyze and implement DSP Processor.
CO6	Follow **ethical** principles in designing and programming DSP processors.
CO7	Do experiments effectively as an **individual** and as a member in a **group**.
CO8	**Communicate** verbally and in written form, the understandings about the programming.
CO9	Continue updating their skill related to implementation for various applications during their **life time.**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-		3	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3		-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

B. Tech III Year II Semester

Course Code	Category	Hours / Week			Credi	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA04610	Core	-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes:Nil	Practical Classes: 45				Total Classes: 45		

Course Objectives:

The course should enable the students to:

1. Develop assembly level programs and providing the basics of the microprocessors.
2. Understanding the interfacing of external devices to the processor and controller for various applications.
3. Learn Embedded C programming using MSP430 microcontroller.
4. Develop ability in programming using microprocessor and microcontroller.

LIST OF EXPERIMENTS

WEEK – l DESIGN A PROGRAM USING WIN862

Design and develop an Assembly language program using 8086 microprocessor and to show the following aspects.

a) Programming b) Execution c) Debugging

To Demonstrate the MASM/TASM software and Trainer kit for 8086 Microprocessor

WEEK-2 16 –BIT ARITHMETIC AND LOGICAL OPERATIONS

Write an ALP program to perform 16 Bit arithmetic and logical operations.

WEEK-3 MULTIBYTE ADDITION AND SUBRACTION

Write an ALP program to perform multi byte addition and subtraction.

WEEK -4 PROGRAMS TO SORT NUMBERS

a) Write an ALP program to perform ascending order using 8086
b) Write an ALP program to perform descending order using 8086

WEEK -5 PROGRAMS FOR STRING MANIPULATIONS OPERATIONS

a) Write an ALP program to insert or delete a byte in the given string
b) Write an ALP program to search a number/character in a given string
c) Write an ALP program to move a block of data from one memory location to the other
d) Write an ALP program for reverse of a given string

WEEK -6 CODE CONVERSIONS

Write an ALP program to convert packed BCD to Unpacked BCD

WEEK -7 INTERFACING AND PROGRAMMING GPIO PORTS IN Embedded C USING MSP430

Interfacing and programming GPIO ports in Embedded C using MSP430 (blinking LEDs)

WEEK -8 INTERFACING AND PROGRAMMING GPIO PORTS IN Embedded C USING MSP430

Interfacing and programming GPIO ports in Embedded C using MSP430 (LED blink using push button)

WEEK-9 USAGE OF LOW POWER MODES

a) Measure the active mode current
b) Standby mode current using MSPEXP430FR5969 as hardware

WEEK-l0 USING ULP ADVISOR

Using ULP advisor in Code Composer Studio on MSP430

WEEK-l1 LOW POWER MODES AND ENERGY TRACE++

a) Enable Energy Trace and Energy Trace ++ modes in CC Studio
b) Compute Total Energy, and Estimated lifetime of an AA battery.

WEEK-l2 PWM GENERATION

PWM generation using Timer on MSP430 GPIO

Reference Books:

1. Ray A.K, Bhurchandi K.M, “Advanced Microprocessor and Peripherals”, 2/e TMH, 2012 2. Muhammad Ali Mazidi, J.G. Mazidi and R.D McKinlay, “The 8051 Microcontroller and Embedded systems using Assembly and C”, 2nd Edition, Pearson education, 2009.
Web References:
1. http://www.nptel.ac.in/downloads/106108100 2. http://www.the8051microcontroller.com/web-references

HARDWARE AND SOFTWARE REQUIRED FOR A BATCH OF 36 STUDENTS

HARDWARE: Desktop Computer Systems 36 nos
SOFTWARES: MASM/TASM and CC Studio

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS

S. No	Name of the Equipment	Range
1	Regulated Power Supply	0-5V & 12V DC
2	CRO	0-20 MHz
3	8086 Trainer Kits with keyboard	8MHz/ 5V
4	MSP430 Trainer kits	12 MHz/5V
5	Serial Interface cable	--
6	Stepper Motors	--
7	A/D Device	--
8	A/D and Dual D/A Devices	--
9	Dual D/A Devices	--
10	DMA Controller	--
11	LCD Display	--
12	Timer/Counter, UART and Interrupt	--
13	Keyboard	--

COURSE OUTCOMES	
CO1	Demonstrate the knowledge on MASM Programming and Analyze the 8086 programming through MASM
CO2	Analyze the various instruction set of 8086 microprocessor
CO3	Design and develop an ALP for string operations.
CO4	Conduct investigation and test the functionality on implementation of MASM through 8086 programming
CO5	Select appropriate tool kit to analyze and implement MSP430 Microcontroller.
CO6	Follow **ethical** principles in designing, and programming microprocessors And Microcontrollers.
CO7	Do experiments effectively as an **individual** and as a member in a **group**.
CO8	**Communicate** verbally and in written form, the understandings about the programming .
CO9	Continue updating their skill related to implementation for various applications during their **life time.**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-		3	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3		-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9 E	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

VII SEMESTER

EMBEDDED SYSTEMS

B. Tech IV Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04701	Core	L	T	P	C	CIA	SEE	Total
		3	1	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

Course Objectives:

The course should enable the students to:

1. To understand the fundamental concepts of embedded systems.
2. To learn the kernel of RTOS, architecture of ARM processor.
3. To understand the addressing and interfacing of ARM processor
4. To understand the concepts of Internet of Things

UNIT-I	INTRODUCTION TO EMBEDDED SYSTEMS	Classes: 12

Embedded system introduction, host and target concept, embedded applications, features and architecture considerations for embedded systems- ROM, RAM, timers; data and address bus concept, Embedded Processor and their types, Memory types, overview of design process of embedded systems, programming languages and tools for embedded design.

UNIT-II	EMBEDDED PROCESSOR ARCHITECTURE	Classes: 11

Introduction to processor architecture, CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture. Introduction to ARM architecture and Cortex – M series, Introduction to the TM4C family viz. TM4C123x & TM4C129x and its targeted applications. TM4C block diagram, address space, on-chip peripherals (analog and digital) Register sets, Addressing modes and instruction set basics.

UNIT-III	OVERVIEW OF MICROCONTROLLER AND EMBEDDED SYSTEMS	Classes: 13

Embedded hardware and various building blocks, Processor Selection for an Embedded System , Interfacing Processor, Memories and I/O Devices, I/O interfacing concepts, Timer and Counting Devices, Serial Communication and Advanced I/O, Buses between the Networked Multiple Devices. Embedded System Design and Co-design Issues in System Development Process, Design Cycle in the Development Phase for an Embedded System, Uses of Target System or its Emulator and In-Circuit Emulator (ICE), Use of Software Tools for Development of an Embedded System, Design metrics of embedded systems.

UNIT-IV	MICROCONTROLLER FUNDAMENTALS FOR BASIC PROGRAMMING	Classes: 11

I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on TM4C, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. Basic Timer, Real Time Clock (RTC), Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).

UNIT-V	EMBEDDED COMMUNICATIONS PROTOCOLS AND INTERNET OF THINGS	Classes: 13

Embedded Networking fundamentals, Synchronous/Asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, Implementing and programming UART, SPI and I2C, SPI interface using TM4C.
Internet of Things: IoT overview and architecture, Overview of wireless sensor networks and design examples. Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications Building IoT applications using CC3100 user API.
Case Study: Tiva based embedded system application using the interface protocols with “Sensor Hub Booster Pack” for communication with external devices.

TEXT BOOKS:

1. Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, Create space publications.2014.
2. Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition , Jonathan W Valvano, Createspace publications, 2012.
3. Embedded Systems 2E Raj Kamal, Tata McGraw-Hill Education, 2011.

REFERENCE BOOKS:

1. CC3100/CC3200 Simple Link™ Wi-Fi® Internet-on-a-Chip User Guide Texas Instruments Literature Number: SWRU368A April 2014–Revised August 2015.
2. Embedded Systems architecture, Tammy Noergaard, Newnes publications,2005.
3. Embedded Systems handbook, Richard Zurawski,
4. The Art of Designing Embedded Systems by Jack Ganssle, 2nd edition, Newnes publications,2008.

WEBREFERENCES:

1. http://processors.wiki.ti.com/index.php/HandsOn_Training_for_TI_Embedded_Processors
2. http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_ Workshop
3. http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html

COURSE OUTCOMES	
CO1	Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.
CO2	Analyze various examples of embedded systems based on TM4C123x & TM4C129x processor
CO3	Apply the knowledge of software development for the embedded hardware and bus protocols.
CO4	Apply the knowledge of programming to writing the program to configure and interface the various peripherals with the TM4C processor.
CO5	Identify IoT technologies, analyze and evaluate the data received through sensors in IoT.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	2	-	-	-	-	2	3	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
CO3	2	2	-	-	2	-	-	-	-	-	-	-	2	2
CO4	3	-	-	-	3	-	-	-	-	-	-	-	3	3
CO5	2	2	2	-	-	-	2	-	-	-	-	-	2	-
CO*	**2.4**	**2**	**2**	**-**	**2.5**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**2.4**	**2.25**

OPTICAL COMMUNICATION

B. Tech IV Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
17CA04702	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**1**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes: 60**		

Course Objectives:

The course should enable the students to:

1. The course gives an account of optical Communication starting with the basic of fiber optics.
2. To give clear understanding of various components such as Optical fibers, Photo detectors, connectors, coupling devices and optical amplifiers Knowledge of various components used in optical networks.
3. Knowledge about Various topologies used to construct optical networks.

UNIT-I	INTRODUCTION TO OPTICAL FIBERS	Classes: 12

Evolution of fiber optic system, Element of an Optical Fiber Transmission link, Ray Optics, Optical Fiber Modes and Configurations, Mode theory of Circular Wave guides, Overview of Modes, Key Modal concepts, Linearly Polarized Modes, Single Mode Fibers, Graded Index fiber structure.

UNIT-II	SIGNAL DEGRADATION OPTICAL FIBERS	Classes: 12

Attenuation, Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides, Information Capacity determination, Group Delay, Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers, Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers, Mode Coupling, Design Optimization of SM fibers, RI profile and cut-off wavelength.

UNIT-III	FIBER OPTICAL SOURCES AND COUPLING	Classes: 12

Direct and indirect Band gap materials, LED structures, Light source materials, Quantum efficiency and LED power, Modulation of a LED, lasers Diodes, Modes and Threshold condition, Rate equations, External Quantum efficiency, Resonant frequencies, Temperature effects, Introduction to Quantum laser, source-to-fiber Power Launching, Lensing schemes, Fiber–to- Fiber joints, Fiber splicing.

UNIT-IV	FIBER OPTICAL RECEIVERS	Classes: 12

PIN and APD diodes, Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise, Comparison of Photo detectors, Fundamental Receiver Operation, preamplifiers, Error Sources, Receiver Configuration, Probability of Error, Quantum Limit.

UNIT-V	SYSTEM DESIGN AND APPLICATIONS	Classes: 12

Introduction to design of Analog Systems, System Specification, Power budget, Bandwidth budget, Introduction to design of Digital Systems, System specification, Rise time budget, power budget, Receiver sensitivity.

Text Books:

1. Gerd Keiser, "Optical Fiber Communication" McGraw –Hill International, Singapore, 3rd edition, 2000.
2. J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 1994.

Reference Books:

1. Max Ming-Kang Liu, "Principles and Applications of Optical Communications", TMH, 2010.
2. S.C.Gupta, "Text book on optical fiber communication and its applications", PHI, 2005.
3. Satish Kumar, "Fundamentals of Optical Fiber communications", PHI, 2009.

COURSE OUTCOMES	
CO1	Be familiar with Optical Fiber Communication System, recognize and classify the structures of Optical fiber and types.
CO2	Discuss the channel impairments like losses and dispersion and analyze various Coupling losses.
CO3	Demonstrate the characteristics of optical sources and detectors.
CO4	Measure the properties of optical sources, detectors and receivers.
CO5	Design and construct a basic optical fiber communication link/system and test its performance.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2.6**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

RADAR SYSTEMS & NAVIGATIONAL AIDS
(PROFESSIONAL ELECTIVE-III)

B. Tech IV Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA04703	ELECTIVE	3	-	-	3	30	70	100
Total Contact Hours: 45	Total Tutorials: Nil	Practical Classes: Nil				Total Hours: 45		

Course Objectives:

The course should enable the students to:

1. Explain principles of navigation, in addition to approach and landing aids as related to navigation.
2. Derive and discuss the Range equation and the nature of detection.
3. Describe about the navigation systems using the satellite.

UNIT-I INTRODUCTION TO RADAR **Classes: 9**

Introduction to radar, principle, Simple form of Radar equation, Radar block diagram and operation, classification, Radar frequencies, Applications of Radar. Minimum Detectable signal, Receiver noise, Probability Density functions, signal-to-noise ratio, Radar cross section of targets, cross-section fluctuations system losses.

UNIT-2 RADAR COMPONENTS **Classes: 10**

RF amplifier, TWT, CFA, Modulators, mixers, Conversion loss, Noise figure, Balanced mixer, Image recovery mixer, Duplexers: Branch type, Balanced type and solid state duplexers, limiters, Displays: CRT displays, A,B,C,D: Scopes PPI and RHI.

UNIT-3 RADAR SYSTEMS **Classes: 8**

Radar systems: CW radar, frequency-modulates CW radar, Multiple Frequency CW radar. MTI radar, Delay line cancellers, Pulse repetition frequencies, Range-gated Doppler filters tracking radar, Range and angle tracking sequential lobing and conical scanning.

UNIT-4 RADIO DIRECTION AND RANGES **Classes: 9**

Radio direction finding and radio ranges, the loop antenna, the goniometer, errors in direction finding the LF/MF four-course radio range, VHF-VOR, VOR receiving equipment.

Hyperbolic systems of navigation & DME: TACAN: Loran-A, Loran-C, The decca navigation system, Decca receivers. DMA-operation, TACAN STACAN equipment.

UNIT-5 SATELLITE NAVIGATION SYSTEM **Classes: 9**

Aids to approach and Landing: Instrument Landing System, Ground Controlled Approach System, Microwave Landing System (MLS),

Doppler Navigation: The Doppler Effect, Beam Configurations, Doppler Frequency Equations, Track Stabilization, Doppler Spectrum, Components of the Doppler Navigation System, Doppler range Equation, Accuracy of Doppler Navigation Systems.

Inertial Navigation: Principles of Operation, Navigation Over the Earth, Components of an Inertial Navigation System – Earth Coordinate Mechanization, Strapped-Down Systems, Accuracy of Inertial Navigation Systems. **Satellite Navigation System**: The Transit System, Navstar Global Positioning System (GPS).

TEXT BOOKS:

1. Merrill I. Skolnik ," Introduction to Radar Systems", 3rd Edition Tata Mc Graw-Hill 2003
2. N.S.Nagaraja, "Elements of Electronic Navigation Systems", 2nd Edition, TMH, 2000.

REFERENCE BOOKS:

1. Peyton Z. Peebles:, "Radar Principles", John Wiley, 2004 2. J.C Toomay, " Principles of Radar", 2nd Edition –PHI, 2004.
2. Radar Principals, Technology, Applications – Byron Edde, Pearson Education, 2004.
   Radar Principles – Peebles, Jr., P.Z.Wiley, NweYork, 1998.

COURSE OUTCOMES	
CO1	Demonstrate the radar performance affected by the factor with radar range equation.
CO2	Analyze the principles used in the MTI, Doppler and tracking radars and their comparison.
CO3	Analyze the techniques employed for detection of signals in the presence of noise for radar receivers.
CO4	Analyze the statistical parameters of Noise and Radar cross section of targets.
CO5	Demonstrate the basic knowledge on Satellite Navigation System and Analyze the system components or process as per needs & specifications.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	2	-	2	-	-	-	-	-	-	3	-
CO*	**3**	**2.4**	**-**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

DIGITAL SYSTEM DESIGN THROUH VERILOG
(PROFESSIONAL ELECTIVE-III)

B. Tech IV Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA04704	ELECTIVE	3	-	-	3	30	70	100
Total Contact Hours:45	Total Tutorials: Nil	Practical Classes: Nil				Total Hours: 45		

Course Objectives:

The course should enable the students to:

1. Designing digital circuits, behavior and RTL modeling of digital circuits using Verilog HDL.
2. Verify the models and synthesizing RTL models to standard libraries.
3. Gain practical experience by designing, modeling, implementing and verifying several digital circuits.

UNIT-I INTRODUCTION TO VERILOG AND LANGUAGE CONSTRUCTS AND CONVENTIONS — Classes: 9

Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Functional Verification, System Tasks, Programming Language Interface (PLI), Module, Simulation and Synthesis Tools, Test Benches.

Introduction to Language constructs and conventions, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Memory, Operators, System Tasks.

UNIT-II GATE LEVEL MODELING AND DATA FLOW LEVEL MODELING — Classes: 8

Gate Level Modeling: Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tri-State Gates, Array of Instances of Primitives, Additional Examples, Design of Flip flops with Gate Primitives, Delays, Strengths and Contention Resolution, Net Types, Design of Basic Circuits.

Data Level Modeling: Introduction, Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators.

UNIT-III BEHAVIORAL MODELING AND SWITCH LEVEL MODELING — Classes: 10

Behavioral Modeling: Introduction, Operations and Assignments, Functional Bifurcation, Initial Construct, Always Construct, Examples, Assignments with Delays, Wait construct, Multiple Always Blocks, Designs at Behavioral Level, Blocking and Non-blocking Assignments, The case statement, Simulation Flow, if and if-else constructs, assign-deassign construct, repeat construct, for loop, the disable construct, While loop, Forever loop.

Switch Level Modeling: Introduction, Basic Transistor Switches, CMOS Switch, Bi-directional Gates, Time Delays with Switch Primitives, Instantiations with Strengths and Delays, Strength Contention with Tri-reg Nets.

UNIT-IV SYSTEM TASKS,FUNCTIONS, COMPILER DIRECTIVES AND USER DFEFINED PRIMITIVES — Classes: 10

Parameters, Path Delays, Module Parameters, System Tasks and Functions, File-Based Tasks and Functions, Compiler Directives, Hierarchical Access, General Observations.

Function, Tasks, User- Defined Primitives (UDP), FSM Design (Moore and Mealy Machines).

UNIT-V VERILOG MODELS — Classes: 8

Static RAM Memory, A Simplified 486 Bus model, Interfacing memory to a microprocessor bus, UART Design, Design of Microcontroller CPU.

TEXT BOOKS:

1. T.R. Padmanabhan and B. Bala Tripura Sundari, “Design through Verilog HDL’’, WSE, IEEE Press 2004.
2. J. Bhaskar, “A Verilog Primer’’, BSP, 2nd edition 2003.

REFERENCE BOOKS:

1. Samir Palnitkar, “Verilog HDL”, Pearson Education, 2nd Edition, 2003.
2. Thomas and Moorby, “The Verilog Hardware Description Language”, kluwer academic publishers, 5th edition, 2002.
3. Stephen Brown and Zvonko Vranesic, “Fundamentals of Logic Design with Verilog”, TMH publications, 2005.
4. Charles.H.Roth,Jr., Lizy Kurian John “Digital System Design using VHDL” , Thomson, 2nd Edition, 2008
5. “Advanced Digital Design with Verilog HDL”-Michael D.Ciletti, PHI, 2005.

COURSE OUTCOMES	
CO1	Demonstrate the combinational circuits, using discrete gates and programmable logic devices.
CO2	Demonstrate how arithmetic operations can be performed for each kind of code, and also combinational circuits that implement arithmetic operations.
CO3	Design a semiconductor memory for specific chip design.
CO4	Design embedded systems using small microcontrollers, larger CPUs/ DSPs, or hard or soft processor cores.
CO5	Demonstrate different types of I/O controllers that are used in embedded system.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2.6**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.8**	**-**

ADAPTIVE SIGNAL PROCESSING (PROFESSIONAL ELECTIVE-III)

B. Tech IV Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04705	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

The course should enable the students:

1. To study in detail about adaptive Systems.
2. To study about various Linear optimum filtering techniques.
3. To study about various techniques related Linear and Non Linear adaptive filtering.

UNIT-I INTRODUCTION TO ADAPTIVE SYSTEMS Classes: 8

Eigen Analysis - Eigen Value problem, Properties of Eigen values and Eigen vectors, Eigen filters, Eigen value computations, Adaptive Systems - Definitions, Characteristics, Applications and Examples of Adaptive systems, The adaptive linear combiner – Description, weight vectors, Desired response Performance function, Gradient and Mean square error (MSE).

UNIT-II LINEAR OPTIMUM FILTERING Classes: 10

Wiener Filters – Linear optimum filtering, Principle of Orthogonality, Wiener-Hopf equations, Error performance surface, Channel Equalization, Linearly constrained minimum variance filter, Linear Prediction – Forward and Backward linear prediction, Levinson-Durbin Algorithm, Properties of prediction error filters, AR modeling of stationary stochastic process, Lattice predictors, Joint process estimation, Kalman Filters - Recursive mean square estimation for scalar random variables, Kalman filtering problem, The innovations process, Estimation of the state using innovations process.

UNIT-III LINEAR ADAPTIVE FILTERING-I Classes: 9

Method of Steepest descent algorithm and its stability, Least Means Square (LMS) algorithm – Structure & operation of LMS algorithm, Examples, Stability & performance analysis of the LMS algorithm, Simulations of Adaptive equalization using LMS algorithm, Convergence aspects, Method of Least Squares (LS) - Statement, Data windowing, Minimum sum of error squares, Normal equations and linear least squares filters, Properties.

UNIT-IV LINEAR ADAPTIVE FILTERING-II Classes: 10

Recursive Least Squares (RLS) Algorithm – Matrix inversion lemma, The exponentially weighted RLS algorithm, Update recursion for the sum of weighted error squares, Example, Convergence Analysis, Simulation of adaptive equalization using RLS algorithm, Order Recursive Adaptive Filters – Adaptive forward and backward linear prediction, Least squares Lattice predictor, QR-Decomposition based Least squares Lattice filters & their properties, Simulation of Adaptive Equalization using Lattice Filter.

UNIT-V NONLINEAR ADAPTIVE FILTERING Classes: 9

Blind Deconvolution – Theoretical and practical considerations, Bussgang algorithm for blind equalization for real base band channels, Special cases of Bussgang algorithm, Simulation studies of Bussgang algorithms, SVD, Problem solving.

TEXT BOOKS:

1. Simon Haykins, “Adaptive Filter Theory”, PHI, 4th Edition, 2002.
2. Bernard Widrow and Samuel D. Stearns, “Adaptive Signal Processing”, Person Education, 2nd Edition, 2009.

REFERENCE BOOKS:

1. Paulo S.R. Diniz, Adaptive Filtering Algorithms and Practical Implementation, Third Edition,Springer, Kluwer Academic Publishers
2. Alexander D Poularikas, Zayed M Ramadan, Adaptive Filtering Primer with MATLAB, CRC Press Taylor & Francis Group, 2008 Indian Edition
3. Ali H. Sayed, Adaptive filters, IEEE Press, Wiley-Interscience, A john Wiley & Sons, INC.,Publication.
4. S. Thomas Alexander, “Adaptive Signal Processing-Theory & Applications,” Springer –Verlag, 1986

COURSE OUTCOMES	
CO1	Demonstrate filtering solutions for optimising the cost function indicating error in estimation of parameters and appreciate the need for adaptation in design.
CO2	Analyze the performance of various methods for designing adaptive filters through estimation of different parameters of stationary random process clearly considering practical application specifications.
CO3	Analyse convergence and stability issues associated with adaptive filter design and come up with optimum solutions for real life applications taking care of requirements in terms of complexity and accuracy.
CO4	Design and implement filtering solutions for applications such as channel equalisation, interference cancelling and prediction considering present day challenges.
CO5	Demonstrate applications of adaptive systems to sample problems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO5	3	-	-	-	3	-	-	-	-	-	-	-	3	-
CO*	**3**	**3**	**3**	-	**3**	-	-	-	-	-	-	-	**3**	-

WIRELESS COMMUNICATIONS AND NETWORKS
(PROFESSIONAL ELECTIVE-III)

B. Tech IV Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
17CA04706	**ELECTIVE**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**3**	**30**	**70**	**100**
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

Course Objectives:

The course should enable the students to:

1. To provide the students with the fundamental treatment about many practical and theoretical concepts that forms basic of wireless communications.
2. To prepare students to understand the concept of frequency reuse, and be able to apply it in the design of mobile cellular system.
3. To prepare students to understand various modulation schemes and multiple access techniques that are used in wireless communications,
4. To prepare students to understand the emerging technique OFDM and its importance in the wireless communications.

UNIT-I INTRODUCTION TO WIRELESS COMMUNICATION Classes: 10

Introduction to wireless communication systems: Evaluation of mobile radio communications, examples of wireless communication systems, paging systems, cordless telephone systems, compression of various wireless systems.

Mobile wireless communication systems: second generation cellular networks, third generation wireless networks, wireless in local loop, wireless local area networks, Bluetooth and personal area networks.

Cellular system design fundamentals: spectrum allocation, basic cellular system, frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, trucking and grade off service, improving coverage and capacity, cell splitting

UNIT-II MULTIPLE ACCESS TECHNIQUES Classes: 8

Multiple access technique for warless communications: introduction to multiple accesses, FDMA, TDMA, spread spectrum multiple access, SDMA, packet radio, capacity of cellular systems.

Orthogonal Frequency Division Multiplexing: Basic principles of orthogonality, single versus multi channel systems, OFDM block diagram, OFDM signal mathematical representation.

UNIT-III MOBILE RADIO PROPAGATION Classes: 9

Introduction to Radio Wave Propagation, Free Space Propagation Model, Basic Propagation Mechanisms, Reflection- Reflection from Dielectrics, Brewster Angle, Reflection from prefect conductors, Ground Reflection (Two-Ray) Model, Diffraction-Fresnel Zone Geometry, Knife-edge Diffraction Model, Multiple knife-edge Diffraction, Scattering, Outdoor Propagation Models-Okumura Model, Hata Model. lndoor Propagation Models, Fading Mechanisms.

UNIT-IV EQUALIZATION AND DIVERSITY Classes: 10

Introduction, Fundamentals of Equalization, Training A Generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Non-linear Equalization-Decision Feedback Equalization (DFE), Algorithms for adaptive equalization-Zero Forcing Algorithm, Least Mean Square Algorithm, Recursive least squares algorithm.

Diversity Techniques-Derivation of selection Diversity improvement, Derivation of Maximal Ratio Combining improvement, Practical Space Diversity Consideration-Selection Diversity, Feedback or Scanning Diversity, Maximal Ratio Combining, Equal Gain Combining, Polarization Diversity, Frequency Diversity, Time Diversity, RAKE Receiver.

UNIT-V WIRELESS NETWORKS Classes: 8

Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks,

WLAN Topologies, WLAN Standard IEEE 802.11 ,IEEE 802.11 Medium Access Control, Comparision of IEEE 802.11 a,b,g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, Hiper Lan, WLL.
Text Books:
1. Wireless Communications, Principles, Practice — Theodore, S.Rappaport, 2nd Edition, 2002, PHI 2. Wireless Communications-Andrea Goldsmith, Cambridge University Press, 2005. 3. Mobile Cellular Communication — Gottapu Sasibhushana Rao, Pearson Education, 2012.
Reference Books:
1. Principles of Wireless Networks — Kaveh Pah Laven and P. Krishna Murthy, 2002, PE 2. Wireless Digital Communications — Kamilo Feher, 1999, PHI. 3. Wireless Communication and Networking — William Stallings, 2003,PHI. 4. Wireless Communication — Upen Dalal, Oxford Univ. Press 5. Wireless Communications and Networking — Vijay K. Gary, Elsevier.

COURSE OUTCOMES	
CO1	Demonstrate the functioning, evolution and standards of Wireless Communication Systems and express the concepts of cellular system design.
CO2	Analyze the multiple access techniques used in Wireless Communication systems.
CO3	Analyze the wireless signal propagation mechanisms and models.
CO4	Apply various equalization and diversity techniques to improve the performance of radio link in wireless communication systems.
CO5	Analyze the architecture, functioning, protocols, capabilities and application of various wireless communication networks.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	3	1
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	-	2	-	-	2	-	-	-	-	-	2	2
CO4	3	3	2	2			2	-	-	-	-	-	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	2	3	-
CO*	**2.6**	**2.4**	**2**	**2.5**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**1.5**	**3**	**2**

PATTERN RECOGNITION & APPLICATIONS (MOOC COURSE-I)

B. Tech IV Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04707	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:45		

Course Objectives:

The course should enable the students to:

1. To learn the fundamentals of pattern recognition and its relevance to classical and modern problems.
2. To be able to identify where, when and how pattern recognition can be applied.
3. To understand the Several applications of pattern recognition on classical computer and electrical engineering problems (e.g. word/sentence-based searches, signal analysis, speech and visual processing, engineering system design, medical diagnosis, etc.)

UNIT-I	INTRODUCTION TO ADHOC NETWORKS	Classes: 9

Introduction: Feature extraction and Pattern Representation Concept of Supervised and Unsupervised classification Introduction to Application Areas

UNIT-II	STATISTICAL PATTERN RECOGNITION	Classes: 9

Bayes Decision Theory, Minimum Error and Minimum Risk Classifiers, Discriminant Function and Decision Boundary Normal Density, Discriminant Function for Discrete Features, Parameter estimation

UNIT-III	DIMENSIONALITY PROBLEM AND NONPARAMETRIC PATTERN CLASSIFICATION	Classes: 9

Dimension and accuracy, Computational Complexity, Dimensionality Reduction, Fisher Linear Discriminant, Multiple Discriminant Analysis, Density Estimation, Nearest Neighbour Rule, Fuzzy Classification

UNIT-IV	LINEAR DISCRIMINANT FUNCTION AND NEURAL NETWORK CLASSIFIER	Classes: 9

Separability, Two Category and Multi Category Classification, Linear Discriminators, Perceptron Criterion, Relaxation Procedure, Minimum Square Error Criterion, Widrow-Hoff Procedure, Ho-Kashyap Procedure, Kesler"s Construction. Single and Multilayer Perceptron, Back Propagation Learning, Hopfield Network, Fuzzy Neural Network.

UNIT-V	TIME VARYING PATTERN RECOGNITION AND UNSUPERVISED CLASSIFICATION	Classes: 9

First Order Hidden Markov Model, Evaluation, Decoding, Learning Clustering, Hierarchical Clustering, Graph Based Method, Sum of Squared Error Technique Iterative Optimization

TEXT BOOKS:

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", JohnWiley& Sons, 2001.
2. 2. Earl Gose, Richard Johsonbaugh and Steve Jost, "Pattern Recognition and Image Analysis", Prentice Hall, 1999.

REFERENCE BOOKS:

1. Robert J.Schalkoff, Pattern Recognition Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 1992
2. Tou and Gonzales, Pattern Recognition Principles, W esley Publication Company, London, 1974.
3. Duda R.O., and Har P.E., Pattern Classification and Scene Analysis, Wiley, New York, 1973.
4. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley Sons, New York, 1993.

COURSE OUTCOMES	
CO1	Explain and compare a variety of pattern classification, structural pattern recognition, and pattern classifier combination techniques.
CO2	Summarize, analyze, and relate research in the pattern recognition area verbally and in writing.
CO3	Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature.
CO4	Apply pattern recognition techniques to real-world problems such as document analysis and recognition.
CO5	Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-	-

RF INTEGRATED CIRCUITS (MOOC COURSE-I)

B. Tech IV Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04708	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes:45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

The course should enable the students to:

1. To Analysis the Radio Frequency Integrated Circuits, from block diagram concept sketch through circuit analysis.
2. To be able to design Radio Frequency Integrated Circuits from the concept of circuit analysis.
3. To be identify the various noises in circuits.

UNIT-I	INTRODUCTION RF SYSTEMS	Classes: 10

Basic architectures, Transmission media and reflections, Maximum power transfer , Passive RLC Networks, Parallel RLC tank, Q, Series RLC networks, matching, Pi match, T match, Passive IC Components Interconnects and skin effect, Resistors, capacitors Inductors.

UNIT-II	REVIEW OF MOS DEVICE PHYSICS	Classes: 09

MOS device review, Distributed Systems, Transmission lines, reflection coefficient, the wave equation, examples, Lossy transmission lines, Smith charts – plotting Gamma, High Frequency Amplifier Design, Bandwidth estimation using open-circuit time constants, Bandwidth estimation, using short-circuit time constants, Rise time, delay and bandwidth, Zeros to enhance bandwidth, Shunt-series amplifiers, tuned amplifiers, Cascaded amplifiers.

UNIT-III	NOISE	Classes: 08

Thermal noise, flicker noise review, Noise figure, LNA Design, Intrinsic MOS noise parameters, Power match versus, noise match, large signal performance, design examples & Multiplier based mixers. Mixer Design, Subsampling mixers.

UNIT-IV	RF POWER AMPLIFIERS	Classes: 08

Class A, AB, B, C amplifiers, Class D, E, F amplifiers, RF Power amplifier design examples, Voltage controlled oscillators, Resonators, Negative resistance oscillators, Phase locked loops, Linearized PLL models, Phase detectors, charge pumps, Loop filters, and PLL design examples

UNIT-V	TIME VARYING PATTERN RECOGNITION AND UNSUPERVISED CLASSIFICATION	Classes: 10

Frequency division, integer-N synthesis, Fractional frequency, synthesis, Phase noise, General considerations, and Circuit examples, Radio architectures, GSM radio architectures, CDMA, UMTS radio architectures

TEXT BOOKS:

1. The design of CMOS Radio frequency integrated circuits by Thomas H. Lee Cambridge university press, 2004.
2. RF Micro Electronics by BehzadRazavi, Prentice Hall, 1997.

COURSE OUTCOMES	
CO1	**Interpret** the design of RF systems including the circuits, blocks and architectures.
CO2	**Summarize** MOS device and estimate the bandwidth using amplifiers.
CO3	**Implement** the RF functional blocks (such as low noise amplifiers, mixers and oscillators) for a wireless system.
CO4	**Infer** RF device models including power amplifiers and PLL models.
CO5	**Interpret** different types of frequency synthesizers and architectures like GSM Radio architectures, CDMA, UMTS in RF systems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	2	-	-	-	-	-	-	-	-	2	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	2	-
CO*	**3**	**2.4**	**2.5**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.60**	**-**

INFORMATION SECURITY (MOOC COURSE-I)

B. Tech IV Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04709	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

The course should enable the students to:

1. Learn the basic categories of threats to computers and networks.
2. Understand various cryptographic algorithms and be familiar with public-key cryptography.
3. Apply authentication functions for providing effective security.
4. Analyze the application protocols to provide web security.
5. Discuss the place of ethics in the Information Security Area.

UNIT-I	ATTACKS ON COMPUTERS	Classes: 08

Attacks on computers and computer security: Introduction, the need for security, security approaches, types of security attacks and security services.

UNIT-II	SYMMETRIC KEY CIPHERS	Classes: 10

Symmetric key ciphers: Block cipher principles and algorithms (DES, AES), differential and linear cryptanalysis, block cipher modes of operation, stream ciphers; Asymmetric key ciphers: Principles of public key cryptosystems, algorithms (RSA Diffie – Helman).

UNIT-III	MESSAGE AUTHENTICATION AND CRYPTOGRAPHY	Classes: 08

Message authentication algorithm and hash functions: Authentication requirements, functions, message, authentication codes, hash functions, secure hash algorithm, whirlpool, digital signatures.
Cryptography: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography.

UNIT-IV	E-MAIL SECURITY	Classes: 10

E-mail security: Pretty good privacy; S/MIMI IP Security: IP security overview, IP security architecture, authentication header, encapsulating security payload, combining security associations, key management.

UNIT-V	WEB SECURITY	Classes: 09

Web security: Web security considerations, secure electronic transaction intruders; Virus and firewalls: Intruders, intrusion detection password management, virus and related threats, firewall design principles; Types of firewalls.

TEXT BOOKS:

1. WilliamStallings, "Cryptography and Network Security", Pearson Education, 4th Edition, 2005.
2. AtulKahate, "Cryptography and Network Security", McGraw-Hill, 2nd Edition, 2009.

REFERENCE BOOKS:

1. C K Shymala, N Harini, Dr. T R Padmanabhan, " Cryptography and Network Security", Wiley India, 1st Edition, 2016.
2. Behrouz A. Forouzan, Debdeep Mukhopadhyay , "Cryptography and Network Security", McGraw- Hill, 2nd Edition, 2010.

COURSE OUTCOMES	
CO1	Understand and explain the risks faced by computer systems and networks.
CO2	Identify and analyze security problems in computer systems and networks.
CO3	Develop security mechanisms to protect computer systems and networks.
CO4	Illustrate how standard security mechanisms work and Write programs that are more secure.
CO5	Demonstrate cryptography algorithms and protocols to achieve computer security.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	-	-	-	-	-	-	-	-	-	-	-

MEMS & MICRO SYSTEMS (MOOC COURSE-II)

B. Tech IV Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04710	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

1. To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
2. To educate on the rudiments of Micro fabrication techniques.
3. To introduce various sensors and actuators
4. To introduce different materials used for MEMS
5. To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

UNIT-I INTRODUCTION TO MEMS & MICRO SYSTEMS — Classes: 09

Introduction to MEMS & Microsystems, Introduction to Microsensors, Evaluation of MEMS,Market Survey, Application of MEMS, MEMS Materials, MEMS Materials Properties, MEMS Materials Properties

UNIT-II MICROELECTRONIC TECHNOLOGY FOR MEMS — Classes: 09

Microelectronic Technology for MEMS, Micromachining Technology for MEMS, Micromachining Process, Etch Stop Techniques and Microstructure, Surface and Quartz Micromachining, Fabrication of Micro machined Microstructure, Micro stereo lithography.

UNIT-III MICRO SENSORS — Classes: 09

MEMS Micro sensors, Thermal Micro sensors, Mechanical Micro machined Micro sensors, MEMS Pressure Sensor, MEMS Flow Sensor, Micro machined Flow Sensors, MEMS Inertial Sensors, MEMS Gyro Sensor

UNIT-IV MEMS ACCELEROMETERS — Classes: 08

Micro machined Micro accelerometers for MEMS, MEMS Accelerometers for Avionics, Temperature Drift and Damping Analysis, Piezo resistive Accelerometer Technology, MEMS Capacitive Accelerometer, MEMS Capacitive Accelerometer Process, MEMS for Space Application

UNIT-V MEMS APPLICATIONS — Classes: 10

Polymer MEMS & Carbon Nano Tubes CNT, Wafer Bonding & Packaging of MEMS, Interface Electronics for MEMS, Introduction to BioMEMS and Micro Fluidics, Introduction to Bio Nano Technology, Bio Sensors, Fluidics, MEMS for Biomedical Applications (Bio-MEMS)

TEXT BOOKS:

1. Chang Liu, ‘Foundations of MEMS’, Pearson Education Inc., 2012.
2. Stephen D Senturia, ‘Microsystem Design’, Springer Publication, 2000.
3. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2002.

REFERENCE BOOKS:

1. Nadim Maluf,“ An Introduction to Micro Electro Mechanical System Design”, Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, “ The MEMS Handbook”, CRC press Baco Raton, 2001.
3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, JohnWiley & Son LTD, 2002.

4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.
6. Varadan, V KandVaradan "Microsensors, actuators, MEMS, and electronics for smart structures" Rai-Choudhury P (ed.) Handbook of Microlithography, Micromachining, and Microfabrication, SPIE OpticalEngineeringPress

COURSE OUTCOMES	
CO1	Apply the knowledge on MEMS & Microsystems, identify different materials used for MEMS.
CO2	Exhibit the knowledge on the Microelectronic Technology and analyze the rudiments of Micro fabrication techniques.
CO3	Apply the fundamental knowledge on various sensors and actuators
CO4	Exhibit the concept of MEMS Accelerometers.
CO5	Exhibit the knowledge on the applications of MEMS to discipline of Bio-Medical Engineering.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	-	3	-	-	-	-	-	-	3	3
CO*	**3**	**2**	**1**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2.8**	**3**

ADVANCED 3G & 4G WIRELESS COMMUNICATIONS (MOOC COURSE-II)

B. Tech IV Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04711	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

The course should enable the students to:

1. Build an understanding of the fundamental concepts of communications
2. Familiarize the student with the basic taxonomy and terminology of the Mobile communications.
3. Introduce the student to advanced wireless communication concepts, preparing the student for entry Advanced courses in wireless communications.
4. Allow the student to gain expertise in some specific areas of communications such as 3G & 4G.

UNIT-I	WIRELESS COMMUNICATIONS AND DIVERSITY	Classes: 8

Introduction to 3G/4G Standards, Wireless Channel and Fading, Rayleigh Fading and BER of Wired Communication, BER for Wireless Communication, Introduction to Diversity, Multi-antenna Maximal Ratio Combiner, BER with Diversity, Spatial Diversity and Diversity Order

UNIT-II	BROADBAND WIRELESS CHANNEL MODELLING AND CELLULAR COMMUNICATION	Classes: 10

Wireless Channel and Delay Spread, Coherence Bandwidth of the Wireless Channel, ISI and Doppler in Wireless Communications, Doppler Spectrum and Jakes Model, Introduction to Cellular Communications, Frequency reuse, Multiple Access Technologies, Cellular Processes - Call Setup, Handover etc., Teletraffic Theory.

UNIT-III	CDMA AND OFDM	Classes: 8

Introduction to CDMA, Walsh codes, Variable tree OVSF, PN Sequences, Multipath diversity, RAKE Receiver, CDMA Receiver Synchronization. Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues – PAPR, Frequency and Timing Offset Issues.

UNIT-IV	MIMO AND UWB (ULTRA WIDE BAND)	Classes: 10

Introduction to MIMO, MIMO Channel Capacity, SVD and Eigenmodes of the, MIMO Channel , MIMO Spatial Multiplexing – BLAST, MIMO Diversity – Alamouti, OSTBC, MRT, MIMO - OFDM. UWB Definition and Features, UWB Wireless Channels, UWB Data Modulation, Uniform Pulse Train, Bit-Error Rate Performance of UWB.

UNIT-V	3G AND 4G WIRELESS STANDARDS	Classes: 9

GSM, GPRS, WCDMA, WiFi, UMTS, LTE, LTE-A, WiMAX.

TEXT BOOKS:

1. Principles of Modern Wireless Communication Systems-Aditya K. Jagannatham, Publisher-McGraw Hill,2015.
2. Fundamentals of Wireless Communications – David Tse and PramodViswanath, Publisher - Cambridge University Press,2005.

REFERENCE BOOKS:
1. Wireless Communications: Principles and Practice –Theodore Rappaport - Prentice Hall,2014. 2. MIMO Wireless Communications – EzioBiglieri – Cambridge University Press,2010. 3. Wireless Communications: Andrea Goldsmith, Cambridge University Press,2005.

COURSE OUTCOMES	
CO1	To **perceive and analyze** the concepts of advanced 3G and 4G wireless communication and diversity
CO2	**Analyze** the wireless channel and different multiple access technologies.
CO3	**Investigate and analyze** Multiuser Systems, CDMA, WCDMA network planning and OFDM Concepts.
CO4	**Investigate and analyze** concepts of MIMO and UWB.
CO5	**Interpret** and describe the 3G and 4G wireless standards, LTE, LTE-A, WiMAX.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	3	-	-	-	-	-	-	-	2	3	2
CO2	3	3	-	3	-	-	-	-	-	-	-	2	3	2
CO3	3	3	-	3	-	-	-	-	-	-	-	2	3	2
CO4	3	3	-	3	-	-	-	-	-	-	-	2	3	2
CO5	3	2	-	3	-	-	-	-	-	-	-	2	3	2
CO*	**3**	**2.8**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

LINUX PROGRAMMING & SCRIPTING (MOOC COURSE-II)

B. Tech IV Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04712	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

The course should enable the students to:

1. The goal of the course is the study of scripting languages such as PERL, TCL/TK , Python.
2. Creation of programs in the Linux environment
3. The study of the principles of scripting languages
4. The study of usage of scripting languages in IC design flow

UNIT-I	LINUX BASICS	Classes: 9

Introduction to Linux , File System of the Linux, General usage of Linux kernel & basic commands, Linux users and group , Permissions for file , directory and users, Searching a file & directory, zipping and unzipping concepts

UNIT-II	LINUX NETWORKING	Classes: 9

Introduction to Networking in Linux, Network basics & tools, File transfer protocol in Linux, Network file system, Domain Naming Services, Dynamic hosting configuration Protocol & Network information Services.

UNIT-III	PERL SCRIPTING	Classes: 9

Introduction to Perl Scripting ,Working with Simple Values, Lists and Hashes, Loops and Decisions, Regular Expressions, Files and Data in Perl Scripting ,References &Subroutines , Running and Debugging Perl, Modules.

UNIT-IV	TCL/ TK SCRIPTING	Classes: 9

Tcl Fundamentals, String and Pattern Matching, Tcl Data Structures ,Control Flow Commands, Procedures and Scope, Evel, Working With UNIX, Reflection and Debugging, Script Libraries, Tk Fundamentals, Tk by Examples, The Pack Geometry Manager, Binding Commands to X Events, Buttons and Menus, Simple Tk Widgets, Entry and Listbox Widgets Focus, Grabs and Dialogs.

UNIT-V	PYTHON SCRIPTING	Classes: 9

Introduction to Python, Using the Python Interpreter, More Control Flow Tools, Data Structures, Modules, Input and Output, Errors and Exceptions, Classes, Brief Tour of the Standard Library.

TEXT BOOKS:

1. Python Tutorial by Guido van Rossum, and Fred L. Drake, Jr., editor, Release 2.6.4 3.
2. Practical Programming in Tcl and Tk by Brent Welch , Updated for Tcl 7.4 and Tk 4.0.

REFERENCE BOOKS:

1. Teach Yourself Perl 5 in 21 days by David Till.
2. Red Hat Enterprise Linux 4: System Administration Guide Copyright © 2005 Red Hat,

COURSE OUTCOMES	
CO1	Demonstrate various Linux commands that are used to manipulate system operations at admin level and a prerequisite to pursue job as a Network administrator.
CO2	Illustrate Shell Programming using Linux commands.
CO3	Analyze and design and write application to manipulate internal kernel level Linux File System
CO4	Develop IPC-API's that can be used to control various processes for synchronization.
CO5	Develop Network Programming that allows applications to make efficient use of resources available on different machines in a network.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	-	-	-	-	-	-	-	-	-	-	-

MICROWAVE AND OPTICAL COMMUNICATION LABORATORY

<table>
<tr><td colspan="10">B. Tech IV Year I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">17CA04713</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>3</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 45</td><td colspan="3">Total Classes: 45</td></tr>
</table>

Course Objectives:

1. Understand the working principle of Optical sources, detectors, fibers and microwave components.
2. Understand the simple optical communication link.
3. To learn about the characteristics and measurements in optical fiber
4. To Practice microwave measurement procedures.

<table>
<tr><td colspan="2">LIST OF EXPERIMENTS</td></tr>
<tr><td colspan="2">MINIMUM OF TEN EXPERIMENTS TO BE CONDUCTED</td></tr>
<tr><td colspan="2">Microwave Lab (PART – A) --- Any Six (6) Experiments</td></tr>
<tr><td>Exp-1</td><td>Reflex Klystron Characteristics.</td></tr>
<tr><td>Exp-2</td><td>Gunn Diode Characteristics.</td></tr>
<tr><td>Exp-3</td><td>Attenuation Measurement.</td></tr>
<tr><td>Exp-4</td><td>Directional Coupler Characteristics.</td></tr>
<tr><td>Exp-5</td><td>VSWR Measurement.</td></tr>
<tr><td>Exp-6</td><td>Impedance Measurement.</td></tr>
<tr><td>Exp-7</td><td>Frequency and Wavelength measurements using slotted section.</td></tr>
<tr><td>Exp-8</td><td>Impedance Matching and Tuning</td></tr>
<tr><td>Exp-9</td><td>Scattering parameters of Magic Tee.</td></tr>
<tr><td>Exp-10</td><td>Radiation Pattern Measurement of horn Antennas (at least two antennas).</td></tr>
<tr><td colspan="2">Optical Fiber Lab (PART – B) --- Any Four (4) Experiments</td></tr>
<tr><td>Exp-11</td><td>Characterization of LED</td></tr>
<tr><td>Exp-12</td><td>Characterization of Laser Diode</td></tr>
<tr><td>Exp-13</td><td>Intensity modulation of Laser output through an optical fiber.</td></tr>
<tr><td>Exp-14</td><td>Measurement of Data rate for Digital Optical link.</td></tr>
<tr><td>Exp-15</td><td>Measurement of Numerical Aperture of the given fiber.</td></tr>
<tr><td>Exp-16</td><td>Measurement of losses for Analog Optical link.</td></tr>
</table>

Equipment required for Laboratories:

S. No	Name of the Equipment	Quantity
1	Regulated Klystron Power Supply	6 nos.
2	VSWR Meter	6 nos.
3	Milli/Micro Ammeters	10 nos.
4	Multi meters	10 nos.
5	CROs	8 nos.
6	GUNN Power Supply, Pin Moderator	4 nos.
7	Relevant Microwave components	------
8	Fiber Optic Analog Trainer based LED	3 nos.
9	Fiber Optic Analog Trainer based laser	2 nos.
10	Fiber Optic Digital Trainer	1 nos.
11	Fiber cables	(Plastic,

COURSE OUTCOMES	
CO1	Demonstrate the knowledge on the basics of waveguides, waveguide components, microwave & optical sources, etc.
CO2	Apply a proper waveguide component and its ports to get required output signal.
CO3	Analyze and design different waveguide components and microwave sources.
CO4	Conduct investigation to conduct various experiments.
CO5	Select appropriate tool/hardware to analyze and implement experiments.
CO6	Follow ethical principles in designing and implementing various measuring circuits.
CO7	Do experiments effectively as an individual and as a member in a group.
CO8	Communicate verbally and in written form, the understandings about the experiments.
CO9	Continue updating their skill related to microwave sources Optical fiber for various applications during their life time.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

VLSI & EMBEDDED SYSTEMS LABORATORY

<table>
<tr><td colspan="10">B. Tech IV Year I Semester</td></tr>
<tr><th rowspan="1">Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">17CA04714</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>3</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 45</td><td colspan="3">Total Classes: 45</td></tr>
</table>

Course Objectives:

The course should enable the students to:

1. To design and draw the internal structure of the various digital integrated circuits
2. To develop VHDL/Verilog HDL source code, perform simulation using relevant simulator and analyze the
   obtained simulation results using necessary synthesizer.
3. To verify the logical operations of the digital ICs (Hardware) in the laboratory.

LIST OF EXPERIMENTS

MINIMUM OF TEN EXPERIMENTS TO BE CONDUCTED
(ALL EXPERIMERNTS SHOULD BE CONDUCTED FROM PART-A AND SIX FROM PART-B)

Part-A (Use VHDL/ Verilog HDL)

Exp-1	Realization of Logic Gates.
Exp-2	Combinational Logic Circuits
Exp-3	Sequential Logic Circuits
Exp-4	ALU Design

Embedded C Experiments using TM4C processor (PART – B)

Exp-**5**	**Learn and understand how to configure EK-TM4C123GXL Launch pad digital I/O pins. Write a C program for configuration of GPIO ports for Input and output operation (blinking LEDs, push buttons interface)**
a) Modify the code to make the red LED of EK-TM4C123GXL Launch pad blink. b) Modify the code to make the green and red LEDs blink: I. Together II. Alternately	
Exp-**6**	**Learn and understand Timer based interrupt programming. Write a C program for EK-TM4C123GXL Launch pad and associated Timer ISR to toggle onboard LED using interrupt programming technique**
a) Modify the code for a different timer toggling frequency. b) Write the code to turn on interrupt globally.	
Exp-**7**	**Configure hibernation module of the TM4C123GH6PM microcontroller to**
Write a program to configure hibernation mode and wake up	
Exp-**8**	**Configure in-build ADC of TM4C123GH6PM microcontroller and interface**
Tabulate ten different positions of the Potentiometer and note down the Digital value and calculate the equivalent analog value.	
Exp-**9**	**Learn and understand the generation of Pulse Width Module (PWM) signal by configuring and programming the in-build PWM module of TM4C123GH6PM microcontroller**
a) Change the software to output a set Duty Cycle, which can be user programmed. b) Change the frequency of the PWM Output from 6.25 KHz to 10 KHz and do the tabulation again.	
Exp-**10**	**Learn and understand to connect EK-TM4C123GXL Launchpad to PC terminal and send an echo of the data input back to the PC using UART.**
a) Change the baud rate to 19200 and repeat the experiment. b) What is the maximum baud rate that can be set in the UART peripheral of TIVA? c) Modify the software to display "Switch pressed" by pressing a user input switch on the Launchpad	
Exp-**11**	**USB bulk transfer mode: Learn and understand to transfer data using bulk transfer mode with the USB2.0 peripheral of the TM4C123GH6PM device**
a) What are the different modes offered by USB 2.0? b) What are the typical devices that use Bulk transfer mode?	
Exp-**12**	**Learn and understand to find the angle and hypotenuse of a right angle triangle using IQmath library of TivaWare**

a) Change the base and adjacent values in the program to other values, build the program and observe the values in the watch window. b) Open IQmathLib.h and browse through the available functions. What function is to be used if the IQ number used in the program is to be converted to a string?

COURSE OUTCOMES	
CO1	Demonstrate knowledge on VLSI and ES experiments.
CO2	Analyze the functionality of VLSI and ES experiments.
CO3	Develop the program for successful implementation of VLSI and ES experiments.
CO4	Conduct investigation to conduct VLSI and ES experiments.
CO5	Select appropriate tool/hardware to analyze and implement labs.
CO6	Follow ethical principles in analyzing and implementing functionalities of various programs.
CO7	Do experiments effectively as an individual and as a member in a group.
CO8	Communicate verbally and in written form, the understandings about the experiments.
CO9	Continue to update the skills related to the program for various applications during the life time.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

VIII SEMESTER

DIGITAL IMAGE PROCESSING

B. Tech IV Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04801	Core	L	T	P	C	CIA	SEE	Total
		3	1	0	3	30	70	100
Contact Classes: 45	Tutorial Classes:15	Practical Classes: Nil				Total Classes: 60		

Course Objectives:

The course should enable the students:

1. To know the fundamentals of Image Processing.
2. To know the transformation on images.
3. To know about various techniques of image enhancement and reconstruction.
4. To understand different redundancies related to images.

UNIT-I	INTRODUCTION TO DIGITAL IMAGE PROCESSING	Classes: 12

Introduction, Image sensing and Acquisition, Image Modeling, Sampling, Quantization and Digital Image representation, Basic relationships between pixels, Mathematical tools/ operations applied on images, Imaging geometry.

UNIT-II	IMAGE TRANSFORMATIONS	Classes: 12

Fast Algorithms, Discrete Fourier Transform, Discrete Cosine Transforms, Walsh Transforms, Hadamard Transforms- Hoteling Transforms, Comparison of properties of the above transforms.

UNIT-III	IMAGE ENHANCEMENT	Classes: 12

Background enhancement by point processing, Histogram processing, Spatial filtering, Enhancement in frequency Domain, Image smoothing, Image sharpening, Color image Enhancement.

UNIT-IV	DEGRADATION MODEL AND IMAGE SEGMENTATION	Classes: 12

Degradation model, Algebraic approach to restoration, Inverse filtering, Least Mean Square filters, Constrained Least square restoration, Blind Deconvolution.

Image Segmentation: Edge detection, Edge linking, Threshold based segmentation methods, Region based Approaches, Template matching Use of motion in segmentation.

UNIT-V	REDUNDANCIES	Classes: 12

Redundancies in Images, Compression models, Information theoretic perspective, Fundamental coding theorem, Huffman Coding, Arithmetic coding, Bit plane coding, Run length coding, Transform coding, Image Formats and Compression Standards.

TEXT BOOKS:

1. R.C .Gonzalez & R.E. Woods, “Digital Image Processing”, Addison Wesley/Pearson education, 3rd Edition, 2010.
2. A .K. Jain, “Fundamentals of Digital Image processing”, PHI, 2010.

REFERENCE BOOKS:

1. Rafael C. Gonzalez, Richard E woods and Steven L.Eddins, “Digital Image processing using MATLAB”, Tata McGraw Hill, 2010.
2. S Jayaraman, S Esakkirajan, T Veerakumar, “Digital Image processing”, Tata McGraw Hill
3. William K. Pratt, “Digital Image Processing”, John Wilely, 3rd Edition, 2004, Instruments Literature Number: SWRU368A April 2014–Revised August 2015.

COURSE OUTCOMES	
CO1	Demonstrate knowledge on Identification, formulate & solve problems involving images.
CO2	Analyze and Apply various transformation techniques to process images of any context.
CO3	Analyze image enhancement and Develop algorithm.
CO4	Analyze image segmentation and Develop restoration algorithm applied for images.
CO5	Demonstrate knowledge on compression technique and skills to use modern engineering tools, software & equipment to analyze problems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2.8**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

WIRELESS SENSOR NETWORKS AND ARCHITECTURE
(PROFESSIONAL ELECTIVE-IV)

B. Tech IV Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04802	ELECTIVE	L	T	P	C	CIA	SEE	Total
		3	0	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

The course should enable the students to:

1. Understand the basic WSN technology and supporting protocols with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology.
2. Understand the medium access control protocols and address physical layer issues.
3. Learn key routing protocols for sensor networks and main design issues.
4. Learn transport layer protocols for sensor networks, and design requirements.
5. Understand the Sensor management, sensor network middleware, operating systems.

UNIT-I	OVERVIEW OF WIRELESS SENSOR NETWORKS	Classes:9

Introduction to wireless sensor networks, Characteristic Requirements of wireless sensor networks, nabling technologies for wireless sensor networks, Advantages and applications of sensor networks. **Architectures:** Single-node architecture, Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments, Network architecture, Sensor network scenarios, Optimization goals and figures of merit, Gateway concepts.

UNIT-II	NETWORK TECHNOLOGIES	Classes: 8

Physical layer and Transceiver design considerations, PANs, Hidden node and exposed node problem, Topologies of PANs, MANETs and WANETs.

UNIT-III	MAC AND ROUTING PROTOCOLS	Classes: 10

MAC protocols for wireless sensor networks: Issues in Designing a MAC Protocol for Ad Hoc Wireless sensor networks, Classification of MAC Protocols, Directional Antenna MAC Protocol.
Routing protocols: Classification of Routing Protocols, Routing Protocols with efficient flooding mechanisms, Hierarchical Routing Protocols.

UNIT-IV	SECURITY IN WIRELESS SENSOR NETWORKS	Classes: 8

Security in Ad Hoc Wireless Networks, Network Security requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.

UNIT-V	SENSOR NETWORK PLATFORMS AND TOOLS	Classes: 10

Sensor node hardware, Berkeley motes, programming challenges, Node-level software platforms, Node-level simulators, State-centric programming, Applications of wireless sensor networks: S Ultra wide band radio communication, Wireless fidelity systems, Future directions, Home automation and Smart metering applications.

TEXT BOOKS:

1. Holger Karl, Andreas Willig, “Protocols And Architectures for Wireless Sensor Networks",John Wiley, 1st Edition, 2005.
2. C.Siva Ram Murthy and B.S.Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols”, PHI, 2004.

REFERENCE BOOKS:
1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks Technology, Protocols, And Applications", John Wiley, 1st Edition 2007. 2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 1st Edition 2003. 3. Waltenegus Dargie , Christian Poellabauer, "Fundamentals of Wireless Sensor Networks", John Wiley & Sons, 1st Edition, 2010.

COURSE OUTCOMES	
CO1	Demonstrate the concepts of wireless sensor networks to evaluate network architectures for improving the performance of the networks.
CO2	Analyze and evaluate varying routing protocols for wireless sensor networks to overcome the problems of transmission.
CO3	Interpret and Analyze routing protocols for sensor networks and main Design issues.
CO4	Interpret and Analyze on network security mechanism and QoS metric.
CO5	Demonstrate knowledge on Sensor management, sensor network middleware, operating systems and applications of wireless sensor networks.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	-	2	-	-	-	-	-	-	3	2
CO*	**3**	**2.8**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**

ADVANCED DIGITAL SIGNAL PROCESSING
(PROFESSIONAL ELECTIVE-IV)

B. Tech IV Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04803	ELECTIVE	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

The course should enable the students to:

1. Design optimum filtering algorithms and apply them to various signals.
2. Modeling of spectrum analysis using nonparametric as well as parametric approaches.
3. Introduce spectrum estimation for nonparametric methods to understand power spectral density, autocorrelation and transfer functions
4. Demonstrate estimation techniques to digital signals such as signal separation, detection, estimation and imaging.

UNIT-I	DISCRETE RANDOM SIGNAL PROCESSING	Classes: 08

Discrete Random Processes, Ensemble averages, Stationary processes, Autocorrelation and Auto covariance matrices, Parseval's Theorem, Wiener-Khintchine Relation, Power spectral density, Periodogram, Spectral Factorization, Filtering random processes, Low Pass Filtering of White Noise, Parameter estimation, Bias and consistency.

UNIT-II	NON-PARAMETRIC SPECTRUM ESTIMATION	Classes: 9

Estimation of spectra from finite duration signals, Non-parametric methods, Correlation method, Periodogram estimator, Performance analysis of estimators, Unbiased, Consistent estimators, Modified periodogram, Bartlett and Welch methods, Blackman and Tukey method, Performance comparisons.

UNIT-III	PARAMETRIC SPECTRUM ESTIMATION	Classes: 10

Parametric Methods: AR, MA, and ARMA, Stochastic models and spectrum estimation. Parameter Estimation, Yule-Walker equations, Solutions using Durbin's algorithm.

UNIT-IV	MULTIRATE SYSTEMS	Classes: 8

Elements of multi-rate systems and two-band filter bank design for dyadic wavelets.
Families of wavelets: Orthogonal and biorthogonal wavelets, Daubechies' family of wavelets, Conjugate Quadrature Filter Banks (CQF) and their design, Dyadic MRA more formally, Data compression and standards, The Continuous Wavelet Transform (CWT), Condition of admissibility and implications, Application of the CWT in wideband correlation processing.

UNIT-V	APPLICATIONS OF WAVELETS IN SIGNAL PROCESSING	Classes: 9

Biomedical signal processing applications, Geophysical signal analysis applications, Efficient signal design and realization, wavelet based modulation and demodulation, Applications in mathematical approximation, Applications to the solution of some differential equations, Applications in computer graphics and computer vision, Relation to the ideas of fractals and fractal phenomena.

Text Books:

1. Monson H.Hayes, Statistical Digital Signal Processing and Modelling, John Wiley and Sons, Inc., Singapore, 2009.
2. Howard L. Resnikoff, Raymond O.Wells, "Wavelet Analysis: The scalable Structure Information," Springer, India edition, 1998.

Reference Books:

1. John G. Proakis, Dimitris G..Manolakis, Digital Signal Processing, Pearson Education, 2012.
2. Dimitris G. Manolakis, Statistical and adaptive signal Processing, McGraw Hill, Newyork, 2005.
3. Emmanuel C.Ifeachor, Barrie W.Jervis, Digital Signal Processing A Practical Approach, Addison Wesley, 2002.
4. A.V. Oppenheim , Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.

COURSE OUTCOMES	
CO1	Demonstrate knowledge on fundamental concepts of Discrete Random Processes and parameter estimation.
CO2	Analyze errors and Estimate power spectrum using non-parametric spectrum estimation.
CO3	Analyze the parametric spectrum estimation methods by using suitable Durbin's algorithm methods.
CO4	Analyze different wavelets and design suitable filter banks and algorithms for wavelets.
CO5	Demonstrate knowledge on wavelet in signal processing and analyze its applications of Biomedical.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	2	-	-	-	-	-	-	3	2
CO*	**3**	**3**	**2.5**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**

REAL TIME SYSTEMS (PROFESSIONAL ELECTIVE-IV)

B. Tech IV Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA04804	ELECTIVE	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

The objective of this course is to

1. Develop an understanding of various Real Time systems Applications.
2. Obtain a broad understanding of the technologies for the emerging and exciting domain of real-time systems.
3. Get in-depth hands-on experience in designing and developing a real operational system.

UNIT-I	INTRODUCTION	Classes: 8

Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Dead-lines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

UNIT-II	REAL TIME SCHEDULING	Classes: 9

Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

UNIT-III	RESOURCES SHARING	Classes: 10

Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Module Resources, Controlling Concurrent Accesses to Data Objects.

UNIT-IV	REAL TIME COMMUNICATION	Classes: 8

Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols.

UNIT-V	REAL TIME OPERATING SYSTEMS AND DATABASES	Classes: 10

Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Con-currency Control, Overview of Commercial Real Time databases.

TEXT BOOKS:

1. Real-Time Systems by Jane W. S. Liu Prentice Hall; Perarson Education.
2. C.M.Krishna, Kang G.Shin, “Real Time Systems” Tata Mc-Graw Hill Publication.

REFERENCE BOOKS:

1. Hermann Kopetz, “Real Time Systems Series: Design Principles for Distributed Embedded Applications”, Springer 2nd Edition,.
2. Rob Williams, “Real Time Systems Development”, VH Publications, 2006.

COURSE OUTCOMES	
CO1	Demonstrate the knowledge on concepts of Real-Time systems and modeling.
CO2	Analyze the characteristics of a real time system.
CO3	Analyze the architectural design of a real time system.
CO4	Demonstrate the knowledge on various handle task scheduling, resource management and fault tolerant applications of Real time systems.
CO5	Apply the knowledge on the concepts of computer control, operating system and the suitable computer hardware requirements for real -time applications.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	2	-	-	-	-	-	-	3	-
CO2	3	2	-	-	2	2	-	-	-	-	-	-	3	-
CO3	3	2	-	-	2	2	-	-	-	-	-	-	3	-
CO4	3	2	-	-	2	2	-	-	-	-	-	-	3	-
CO5	3	2	-	-	2	2	-	-	-	-	-	-	3	-
CO*	**3**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

BIO MEDICAL INSTRUMENTATION (PROFESSIONAL ELECTIVE-IV)

B. Tech IV Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04805	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

1. To understand the functioning of Human Cell and its electrical characteristics.
2. To get sufficient knowledge about cardiovascular measurement and circulatory System of heart.
3. To get familiarize with pace makers and Defibrillators.
4. To understand about the electrical hazards that may occur during the usage of medical instruments.

UNIT-I MEDICAL INSTRUMENTATION — Classes: 8

Human cell and its Electrical characteristics neuron and impulses, Recording Electrodes, Electrode- Electrolyte interface, Polarizable and Non-polarizable Electrodes, Body surface recording Electrodes, Internal Electrodes, Micro Electrodes, Electrode array & Practical hints in using Electrodes.

UNIT-II MEASUREMENT SYSTEMS — Classes: 9

Bioelectric potential and cardiovascular measurement circulatory system of heart, ECG Anatomy & Function of heart abnormal cardiac Rhythms, Arrhythmias, Einthoven triangle. EEG recording system (10- 20 electrode System) Biorhythms, Sleep pattern.

UNIT-III PACE MAKERS AND DEFIBRILLATOR — Classes: 10

Therapeutic and prosthetic devices, Cardiac pace maker, Asynchronous and Synchronous modes of operation (Demand). Asynchronous pace maker – Working principle and Function demand PM – Working principle – QRS triggered and atrioventricular Synchronized PM lead wires and Electrodes, Cardioverter. **Defibrillator:** Working principle of DC Defibrillation Electrodes used. Infant incubator and Lithotripry.

UNIT-IV BIOMEDICAL INSTRUMENTATION SAFETY — Classes: 8

Electrical Hazards in medical instruments macro and micro shock, Devices to protect against electrical hazards, Ground fault interrupter, Isolation transformer, Line isolation monitor, Receptacle tester, Electrical safety analyzer equipment, Preventive maintenance.

UNIT-V PATIENT MONITORING SYSTEMS — Classes: 10

Image Systems: Introduction, Basic principle and block diagram of x-ray machine, x-ray computed topography (C.T. Scanner) and Nuclear Magnetic resonance (NMR) Short-wave Diathermy, Microwave Diathermy, Ultrasound Therapy unit.

Recent trends: Ultrasonography-Introduction, medical ultrasound, Block diagram of pulse ecosystem, A- Scan, M-mode, B-scanner and real time ultrasound imaging systems, Lasers-Principle, Operation and Types, Laser safety.

TEXT BOOKS:

1. John G.Webser, “Medical Instrumentation Applications and Design” John Wiley & Sons, 1998.
2. Seslie Cromwell, Fred J.Weibell and Esich A.Plefittes, “BioMedical Instrumentation & measurements”, Pearson Education, 9th edition.

REFERENCE BOOKS:

1. RS Khandpur, “Handbook of BioMedical Instrumentation”, Tata Mc Graw Hill.
2. Walter Welko- Witiz and Sid Doutsch, “Biomedical Instruments: Theory and Design”, Wiley.

COURSE OUTCOMES	
CO1	Demonstrate knowledge on the functioning of Human Cell and analyze its electrical characteristics.
CO2	Exhibit the knowledge on cardiovascular measurement and analyze circulatory System of heart.
CO3	Demonstrate knowledge on pace makers and analyze different Defibrillators electrodes.
CO4	Demonstrate knowledge on electrical hazards that may occur during the usage of medical instruments and analyze safety equipment.
CO5	Demonstrate knowledge on Basic principles and analyze x-ray machine, x-ray computed topography (C.T. Scanner) and apply different recent tools for scan.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	1	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	1	3	-	-	-	-	-	-	-	3	-
CO*	**3**	**3**	**-**	**1.5**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

ENTREPRENEURSHIP (OPEN ELECTIVE)

B. Tech III Year II Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
17CA53601	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**-**	**-**	**-**	**30**	**70**	**100**
Contact Classes: 51	**Tutorial Classes: Nil**		**Practical Classes: Nil**			**Total Classes: 51**		

Course Objectives:

The course should enable the students to:

I. Identify and apply the elements of entrepreneurship and to entrepreneurial processes;

II. Recognize the importance of entrepreneurship and identify the profile of entrepreneurs and their role in economic growth.

III. Analyze the business environment, opportunity recognition, and the business idea-generation process;

IV. Develop an idea on the legal framework and also understand strategic perspectives in entrepreneurship.

UNIT - I	**UNDERSTANDING ENTREPRENEURIAL MINDSET**	**Classes: 10**

The revolution impact of entrepreneurship the evolution of entrepreneurship ,Approaches to entrepreneurship, process approach, twenty first centaury trend s in entrepreneurship.

UNIT-II	**THE INDIVIDUAL ENTREPRENEURIAL MINDSET**	**Classes: 10**

The individual entrepreneurial mind set and personality, the entrepreneurial journey, stress and the entrepreneur, the entrepreneurial ego, entrepreneurial motivation, corporate entrepreneurial mindset the nature of corporate entrepreneur, conceptualization of corporate entrepreneurship strategy sustaining corporate entrepreneurship

UNIT - III	**LAUNCHING ENTREPRENEURIAL VENTURES**	**Classes: 12**

Opportunities identification, entrepreneurial imagination and creativity, the nature of the creativity process, innovation and entrepreneurship, methods to initiate ventures.

Creating new ventures acquiring an established entrepreneurial venture, franchising-hybrid disadvantage of franchising.

UNIT - IV	**LEGAL CHALLENGES OF ENTREPRENEURSHIP**	**Classes: 10**

Intellectual property protection, patents, copyrights trademarks and trade secrets-avoiding trademark pitfalls, formulation of the entrepreneurial plan, the challenges of new venture start-ups, poor financial understanding, and critical factors for new venture development-the evaluation process-feasibility criteria approach.

UNIT - V	**STRATEGIC PERSPECTIVES IN ENTREPRENEURSHIP**	**Classes: 09**

Strategic planning, strategic actions, strategic positioning business stabilization, building the adaptive firmsunderstanding the growth stage, unique managerial concern of growing ventures.

Text Books:

1. DFKuratko,TVRao, "Entrepreneurship: ASouth AsianPerspective", CengageLearning, 1st Edition,2012.
2. Gordon, KNatarajan, "Entrepreneurship Development", Himalaya, 4th Edition, 2008.
3. Coulter, "Entrepreneurship in Action", PHI, 2ndEdition, 2002.
4. SS Khanka, "Entrepreneurial Development", S Chand & Co. Ltd, 5th Edition, 2007

Reference Books:

1. Vijay Sathe, "Corporate Entrepreneurship", Cambridge, 1st Edition, 2009.

2. Vasanth Desai, "Dynamics of Entrepreneurial Development and Management", HPH,Millenium Edition, 2007.
3. P Narayana Reddy, "Entrepreneurship – Text and Cases", Cengage Lerning", 1st Edition, 2010.
4. David H. Hott, "Entrepreneurship New Venture Creation", PHI, 1st Edition,2004.

Web References:

1. https//www.tutorialspoint.com/entrepreneurship_development/entrepreneurship_development_tutorial.pdf
2. https://www.advalue-project.eu/content_files/EN/33/AdValue_Personal_Effectiveness_EN.pdf

E-Text Books:

1. https://www.freebookcentre.net/Business/Entrepreneurship-Books.html
2. https://www.e-booksdirectory.com/listing.php?category=390
3. https://www.bookboon.com/en/entrepreneurship-ebooks

COURSE OUTCOMES	
CO1	Demonstrate and develop Entrepreneurial mindset among Higher Secondary School children.
CO2	Demonstrate the school children to opt for self-employment as a viable option for earning dignified means of living.
CO3	Demonstrate the students to appreciate the dynamic changes happening in the economy.
CO4	Demonstrate the students about the role of Entrepreneurship in the growth and economic development of the nation.
CO5	Demonstrate the Entrepreneurship as life-skills to improve quality of life, skills of creation and management of entrepreneurial pursuits.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO4	2	-	-	-	2	-	-	-	-	-	2	-	-	-
CO5	3	-	-	2	2	-	-	-	-	-	2	-	-	-
CO*	**2.8**	**-**	-	**2**	**2**	-	-	-	-	-	**2**	-	-	-

RENEWABLE ENERGY SOURCES (OPEN ELECTIVE)

B. Tech III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA02608	Elective	3	-	-	3	30	70	100
Contact Classes: 51	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 51		

Course Objectives:

The course should enable the students to:

It introduces solar energy its radiation, collection, storage and application. It also introduces the Wind energy, Biomass energy, Geothermal energy and ocean energy as alternative energy sources.

UNIT-I **PRINCIPLES OF SOLAR RADIATION** **Classes: 10**

PRINCIPLES OF SOLAR RADIATION: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors

UNIT-II **SOLAR ENERGY STORAGE AND APPLICATIONS& WIND ENERGY** **Classes: 10**

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

UNIT-III **BIO-MASS** **Classes: 10**

Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation

And economic aspects.

UNIT-IV **GEOTHERMAL ENERGY & OCEAN ENERGY** **Classes: 12**

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT-V **DIRECT ENERGY CONVERSION** **Classes: 09**

Need for DEC, Carnot cycle, limitations, principles of DEC.

Text Books:

1. Non-Conventional Energy Sources by G.D. Rai, Khanna Publishers
2. Renewable Energy Resources – Twidell & Wier, CRC Press(Taylor & Francis)

Reference Books:

1. Renewable energy resources by Tiwari and Ghosal, Narosa.
2. Renewable Energy Technologies by Ramesh & Kumar, Narosa.
3. Non-Conventional Energy Systems by K Mittal, Wheeler
4. Renewable energy sources and emerging technologies byD.P.Kothari,K.C.Singhal, PHI

COURSE OUTCOMES	
CO1	Understand the Electric power generation from renewable energy sources as sun, wind and ocean.
CO2	Analyze the generation principles and operation of variety of sources of energy
CO3	Understand energy storage and economy
CO4	Understand the necessity and principles of Geo thermal energy conversions.
CO5	Understand the necessity and principles of direct energy conversions.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-	-

ARTIFICIAL NEURAL NETWORKS AND FUZZY LOGIC
(OPEN ELECTIVE)

B. Tech III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04506	Elective	L	T	P	C	CIA	SEE	Total
		3	0	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Course Objectives:

The course should enable the students to:

V. Meliorate the knowledge of fundamentals and types of neural networks.
VI. Develop the different Algorithms for neural networks.
VII. Meliorate the knowledge in Fuzzy logic principles.
VIII. Correlate the principles with applications of neural networks and fuzzy logic.

UNIT-I	INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS AND LEARNING LAWS	Classes: 11

Artificial neural networks and their biological motivation, terminology, models of neuron, topology, characteristics of artificial neural networks, types of activation functions,
Learning methods: Error correction learning, Hebbian learning, perception, XOR problem, perceptron learning rule convergence theorem, adaline.

UNIT-II	FEEDFORWARD AND RECURRENT NEURAL NETWORKS	Classes: 08

Multilayer perception, back propagation learning algorithm, universal function approximation, associative memory, auto association, hetero association, recall and cross talk, linear auto associator, bi-directional associative memory, Hopfield neural network.

UNIT-III	UNSUPERVISED LEARNING AND SELF ORGANISING NETWORKS	Classes: 09

Competitive learning neural networks, max net, mexican hat, hamming net.
Kohonen self-organizing feature map, counter propagation, learning vector quantization, applications of neural networks in image processing, signal processing, modeling and control.

UNIT-IV	FUZZY SETS AND FUZZY RELATIONS	Classes: 08

Introduction, classical sets and fuzzy sets, classical relations and fuzzy relations, Fuzzy set theory and operations, Properties of fuzzy sets, membership functions, fuzzy to crisp conversion, fuzzy arithmetic

UNIT-V	FUZZY SYSTEMS	Classes: 09

Fuzzy Logic - Fuzzy Membership, Rules: Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications.

Text Books:

4. LaureneFausett, “Fundamentals of Neural Networks-Architectures, algorithms and applications, Pearson Education Inc., 2004.
5. Timothy J. Ross, Fuzzy Logic with Engineering Applications, John Wiley and sons, 2004
6. S.Haykin,"Neural Networks,A Comprehensive Foundation", Pearson Education Inc., 2004.

Reference Books:
4. Jacek.M.Zuruda,"Introduction to Artificial Neural Systems ",Jaico Publishing House ,2001. 5. J.S.R. Jang, C.T. Sun, E. Mizutani,, “Neuro Fuzzy and Soft Computing - A computational Approach to Learning and Machine Intelligence”, Pearson Education Inc., 2002. 6. Freeman J.A. and Skapura B.M., “Neural Networks, Algorithms Applications and Programming Techniques”, Addison-Wesely, 1991.
Web References:
4. http://www.willamette.edu/~gorr/classes/cs449/intro.html 5. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine -learning 6. http://ocw.mit.edu/courses/sloan-school-of-management/15-062-datamining-spring-2003/lecture-notes/NeuralNet2002.pdf
E-Text Books: 5. http://www.e-booksdirectory.com 6. http://www.ebooks.com/subjects/computer-science-neural-networks-ebooks/ 7. http://en.wikibooks.org/wiki/Artificial_Neural_Networks 8. http://jntu-ebooks.blogspot.in

COURSE OUTCOMES	
CO1	Apply the Fundamental knowledge and analyze types of neural networks.
CO2	Exhibit the concepts of feed forward neural networks and Recurrent Neural Networks and analyze its characteristics.
CO3	Demonstrate different generative models through unsupervised learning and analyze the application of fuzzy logic control to real time systems.
CO4	Exhibit the knowledge of fuzziness involved in various systems and analyze fuzzy set theory.
CO5	Demonstrate the knowledge on Fuzzy Membership, fuzzy Rules and analyze fuzzy algorithms and its applications.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	2	-	-	-	-	-	-	3	2
CO4	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO5	3	3	3	-	-	2	-	-	-	-	-	-	3	2
CO*	**3**	**2.8**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2.8**	**2**

JAVA PROGRAMMING (OPEN ELECTIVE)

B.Tech III Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA05405	Core	L	T	P	C	CIA	SEE	Total
		2	2	-	3	30	70	100
Contact Classes: 34	Tutorial Classes: 34	Practical Classes: Nil				Total Classes: 68		

Course Objectives:
The course should enable the students to :

- Study the syntax, semantics and features of Java Programming Language
- Learn Java features to create GUI applications & perform event handling

Unit-I	Overview Of Java, Data Types, Arrays and Variables	Classes: 13

Introduction: The Creation of java, how java changed the internet, Java's magic: The byte code, Servlets: java on the server side, java Buzzwords.**An Overview of Java:** Two control statements, Using blocks of codes, Lexical issues, The java class Libraries. **Data Types, Arrays and Variables:** Primitive Types, Integers, Floating-point Types, Characters, Booleans, literals, variables, Type conversion and casting, Automatic Type Promotion in Expressions, Arrays.

Unit-II	Operators, Control Statements, Classes	Classes: 14

Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logic operators, The assignment operator, The ?: Operator, Operator Precedence, Using Parentheses.
Control Statements: Java's selection Statements, Iteration statements, Jump Statements.
Introducing Classes: Class Fundamentals, Declaring Objects, Assuming Object reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The Finalize() method, A Stack class. Overloading Methods, Using Object as Parameter, Argument Passing, Returning Objects, Recursion, Introducing Access control, Understanding static, Introducing Nested and Inner classes, Exploring the String class, Using Command line Arguments, Varargs: variable-Length Arguments.

Unit-III	Inheritance, Packages and Interfaces, Exception Handling	Classes: 14

Inheritance: Basics, Using super, creating a multi level hierarchy, when constructors are executed, method overriding, dynamic method dispatch, using abstract class, using final with inheritance, the object class. **Packages and Interfaces:** Packages, Access protection, Importing Packages, Interfaces, Default Interfaces, Default interface methods, Use static methods in an Interface, Final thoughts on Packages and interface**s. Exception Handling:** Exception handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch clauses, Nested try statements, throw, throws, finally, Java Built-in Exceptions, Creating your own exception subclasses, Chained Exceptions, Three Recently added Exceptions features, Using Exceptions.

Unit-IV	I/O, Applets, and Generics	Classes: 13

I/O, Applets, and Other Topics: I/O basics, Reading Console input, Writing console Output, The PrintWriter class, Reading and writing files, Automatically closing a file, Applet fundamentals, enumerations type wrappers auto boxing annotations. **Generics**: What Are Generics? The general form of a generic class, Bounded Types,Using Wildcard Arguments, creating a generic method, generics interfaces.

Unit-V	Introduction to Awt, Using Awt Controls, Layout Managers, and Menus	Classes: 14

Introduction to AWT: Working with windows, graphics and Text:
AWT classes, window fundamentals, working with frame windows, creating a frame window in an AWT Based applet, creating a window program, displaying information within a window, Graphics, working with color, setting the paint mode, working with fonts, managing text output using font metrics.
Using AWT controls, Layout Mangers, and Menus:
AWT control fundamentals, Labels,using buttons, applying check boxes, check box group, choice controls, using lists, Managing scroll bars, using a Text field, Using a Text area, understanding layout managers, Menu bars and Menus, dialog boxes, file dialog, Overriding paint().

Text Books:

1. "Java, The Complete Reference", HerbertSchildt, MC GRAW HILL Education, 9th Edition,2016.
2. "Programming with Java" T.V.Suresh Kumar, B.Eswara Reddy, P.Raghavan Pearson Edition.

Reference Books:

1. "Java Fundamentals - A Comprehensive Introduction", Herbert Schildt and Dale Skrien, Special Indian Edition, McGrawHill, 2013.
2. "Java – How to Program", Paul Deitel, Harvey Deitel, PHI.

3. "Core Java", NageswarRao, Wiley Publishers.
4. "Thinking in Java", Bruce Eckel, Pearson Education.
5. "A Programmers Guide to Java SCJP", Third Edition, Mughal, Rasmussen, Pearson.
6. "Head First Java", Kathy Sierra, Bert Bates, O'Reilly "SCJP – Sun Certified Programmer for Java Study guide" – Kathy Sierra, Bert Bates, McGrawHill.

Web References:

1. http://www.javatpoint.com/java-tutorial
2. http://www.javatutorialpoint.com/introduction-to-java/

E-Text Books:

1. http://bookboon.com/en/java-programming-language-ebooks
2. https://en.wikibooks.org/wiki/Java_Programming

COURSE OUTCOMES	
CO1	Ability to solve problems using object oriented approach and implement them using java.
CO2	Ability to develop applications with control statements and String concepts.
CO3	Ability to write programs with interface concept and handle exceptions.
CO4	Ability to develop efficient programs with multithreading ability and develop Applets for web applications.
CO5	Ability to design GUI based applications with windows and graphics

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	2	-	-	-	-	-	2	-	-	-
CO5	3	3	2	-	2	-	-	-	-	-	2	-	-	-
CO*	**3**	**2.8**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**

EMBEDDED SYSTEMS (OPEN ELECTIVE)

B. Tech III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04701	Core	L	T	P	C	CIA	SEE	Total
		3	1	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

Course Objectives:

The course should enable the students to:

5. To understand the fundamental concepts of embedded systems.
6. To learn the kernel of RTOS, architecture of ARM processor.
7. To understand the addressing and interfacing of ARM processor
8. To understand the concepts of Internet of Things

UNIT-I	INTRODUCTION TO EMBEDDED SYSTEMS	Classes: 12

Embedded system introduction, host and target concept, embedded applications, features and architecture considerations for embedded systems- ROM, RAM, timers; data and address bus concept, Embedded Processor and their types, Memory types, overview of design process of embedded systems, programming languages and tools for embedded design.

UNIT-II	EMBEDDED PROCESSOR ARCHITECTURE	Classes: 11

Introduction to processor architecture, CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture. Introduction to ARM architecture and Cortex – M series, Introduction to the TM4C family viz. TM4C123x & TM4C129x and its targeted applications. TM4C block diagram, address space, on-chip peripherals (analog and digital) Register sets, Addressing modes and instruction set basics.

UNIT-III	OVERVIEW OF MICROCONTROLLER AND EMBEDDED SYSTEMS	Classes: 13

Embedded hardware and various building blocks, Processor Selection for an Embedded System , Interfacing Processor, Memories and I/O Devices, I/O interfacing concepts, Timer and Counting Devices, Serial Communication and Advanced I/O, Buses between the Networked Multiple Devices. Embedded System Design and Co-design Issues in System Development Process, Design Cycle in the Development Phase for an Embedded System, Uses of Target System or its Emulator and In-Circuit Emulator (ICE), Use of Software Tools for Development of an Embedded System, Design metrics of embedded systems.

UNIT-IV	MICROCONTROLLER FUNDAMENTALS FOR BASIC PROGRAMMING	Classes: 11

I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on TM4C, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. Basic Timer, Real Time Clock (RTC), Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).

UNIT-V	EMBEDDED COMMUNICATIONS PROTOCOLS AND INTERNET OF THINGS	Classes: 13

Embedded Networking fundamentals, Synchronous/Asynchronous interfaces (like UART, SPI, I2C, USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, Implementing and programming UART, SPI and I2C, SPI interface using TM4C.

Internet of Things: IoT overview and architecture, Overview of wireless sensor networks and design examples. Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications Building IoT applications using CC3100 user API.

Case Study: Tiva based embedded system application using the interface protocols with “Sensor Hub Booster Pack” for communication with external devices.

TEXT BOOKS:
1. Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, Create space publications.2014. 2. Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition , Jonathan W Valvano, Createspace publications, 2012. 3. Embedded Systems 2E Raj Kamal, Tata McGraw-Hill Education, 2011.
REFERENCE BOOKS:
1. CC3100/CC3200 Simple Link™ Wi-Fi® Internet-on-a-Chip User Guide Texas Instruments Literature Number: SWRU368A April 2014–Revised August 2015. 2. Embedded Systems architecture, Tammy Noergaard, Newnes publications,2005. 3. Embedded Systems handbook, Richard Zurawski, 4. The Art of Designing Embedded Systems by Jack Ganssle, 2nd edition, Newnes publications,2008.
WEBREFERENCES:
1. http://processors.wiki.ti.com/index.php/HandsOn_Training_for_TI_Embedded_Processors 2. http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_ Workshop 3. http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html

COURSE OUTCOMES	
CO1	Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.
CO2	Analyze various examples of embedded systems based on TM4C123x & TM4C129x processor
CO3	Apply the knowledge of software development for the embedded hardware and bus protocols.
CO4	Apply the knowledge of programming to writing the program to configure and interface the various peripherals with the TM4C processor.
CO5	Identify IoT technologies, analyze and evaluate the data received through sensors in IoT.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	2	-	-	-	-	2	3	2
CO2	2	-	-	-	-	-	-	-	-	-	-	2	2	2
CO3	2	2	-	-	2	-	-	-	-	-	-	-	2	2
CO4	3	-	-	-	3	-	-	-	-	-	-	-	3	3
CO5	2	2	2	-	-	-	2	-	-	-	-	-	2	-
CO*	**2.4**	**2**	**2**	**-**	**2.5**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**2.4**	**2.25**

MECHATRONICS (OPEN ELECTIVE)

<table>
<tr><td colspan="11">B. Tech III Year II Semester</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">17CA03802</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>2</td><td>2</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 34</td><td>Tutorial Classes: 34</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 68</td></tr>
</table>

Course Objectives:

The course should enable the students to:

1. Understand various general design rules for manufacture ability and criteria for material selection.
2. Apply various machining process and tolerance aspects in machining.
3. Analyze the design considerations for casting and welding process.
4. Apply the conceptual design factors to be considered in forging, extrusion and sheet metal work, design guidelines for manual assembly and development of DFA methodology.

UNIT-I	**INTRODUCTION**	**Classes: 14**

INTRODUCTION: Definition – Trends - Control Methods: Stand alone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

UNIT-II	**SIGNAL CONDITIONING**	**Classes: 14**

SIGNAL CONDITIONING: Introduction – Hardware - Digital I/O , Analog input – ADC , resolution , speed channels Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering.

UNIT-III	**PRECISION MECHANICAL SYSTEMS AND THEIR MODELING**	**Classes: 14**

Pneumatic Actuation Systems - Electropneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Bearings- Motor / Drive Selection.

UNIT-IV	**ELECTRONIC INTERFACE SUBSYSTEMS& ELECTROMECHANICAL DRIVES**	**Classes: 12**

ELECTRONIC INTERFACE SUBSYSTEMS: Motors Isolation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers, over current sensing, resettable fuses, Power Supply - Bipolar transistors/ mosfets.

ELECTROMECHANICAL DRIVES: Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - PWM‟s - Pulse Width Modulation – Variable Frequency Drives.

UNIT-V	**MICROCONTROLLERS OVERVIEW & PROGRAMMABLE LOGIC CONTROLLERS**	**Classes: 14**

MICROCONTROLLERS OVERVIEW: 8051 Microcontroller , micro processor structure - Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors – Applications, Programming –Assembly.

PROGRAMMABLE LOGIC CONTROLLERS: Basic Structure - Programming: Ladder diagram -Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling -Analog input / output - PLC Selection, interface – R232 etc.,
Applications.

Text Books:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, W Bolton, Pearson Education Press, 3rd edition, 2005.
2. Mechatronics, M.D.Singh, J.G.Joshi, PHI.

Reference Books:

COURSE OUTCOMES	
CO1	Explain mechatronics systems in industry
CO2	Identify mechatronic systems encountered in practice
CO3	Examine the components of a typical mechatronic system.
CO4	Develop programs using PLC.
CO5	Demonstrate an overview of microcontrollers.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO*	**2.6**	**2**	**2**	-	-	-	-	-	-	-	-	-	-	-

INFORMATION SECURITY (OPEN ELECTIVE)

B. Tech III Year II Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
17CA05612	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes:51	**Tutorial Classes:Nil**	**Practical Classes: Nil**				**Total Classes: 51**		

OBJECTIVES:

The course should enable the students to:

I. Learn the basic categories of threats to computers and networks.

II. Understand various cryptographic algorithms and be familiar with public-key cryptography.

III. Apply authentication functions for providing effective security.

IV. Analyze the application protocols to provide web security.

V. Discuss the place of ethics in the Information Security Area.

UNIT-I	ATTACKS ON COMPUTERS AND COMPUTER SECURITY	Classes: 12

Attacks on computers and computer security: Introduction, the need for security, security approaches, principles of security, types of security attacks, security services, security mechanism, a model for network security.

Cryptography concepts and techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

UNIT-II	SYMMETRIC KEY CIPHERS	Classes:10

Symmetric key ciphers: Block cipher principles and algorithms (DES,AES,Blowfish), differential and linear cryptanalysis, block cipher modes of operation, stream ciphers,RC4 location, and placement of encryption function, key distribution;

Asymmetric key ciphers: Principles of public key cryptosystems, algorithms (RSA Diffie- Helman, ECC) key distribution.

UNIT-III	MESSAGE AUTHENTICATION ALGORITHM AND HASH FUNCTIONS	Classes: 10

Message authentication algorithm and hash functions: Authentication requirements, functions, message, authentication codes, hash functions, secure hash algorithm, whirlpool, HMAC, CMAC, digital signatures, knapsack algorithm.

Authentication application: Kerberos, X.509 authentication service, public – key infrastructure, biometric authentication.

UNIT-IV	E-MAIL SECURITY	Classes: 10

E-mail security: Pretty good privacy; S/MIMI IP Security: IP security overview, IP security architecture, authentication header, encapsulating security payload, combining security associations, key management.

UNIT-V	WEB SECURITY	Classes: 09

Web security: Web security considerations, secure socket layer and transport layer security, secure electronic transaction intruders; Virus and firewalls: Intruders, intrusion detection password management, virus and related threats, countermeasures, firewall design principles; Types of firewalls case studies on cryptography and security: Secure inter-branch payment transactions, cross site scripting vulnerability, virtual electronics.

Text Books:

1. William Stallings, “Cryptography and Network Security”, Pearson Education, 4th Edition, 2005.
2. AtulKahate, “Cryptography and Network Security”, McGraw Hill, 2nd Edition, 2009.

Reference Books:

1. C K Shymala, N Harini, Dr. T R Padmanabhan, “Cryptography and Network Security”, Wiley India, 1st Edition, 2016.
2. Behrouz A. Forouzan, Debdeep Mukhopadhyay , “Cryptography and Network Security”, McGraw Hill, 2nd Edition, 2010.

Web References:

1. http://bookboon.com/en/search?q=INFORMATION+SECURITY
2. https://books.google.co.in/books/about/Cryptography_Network_Security_Sie_2E.html?id=Kokjwdf0E7QC
3. https://books.google.co.in/books/about/Information_Security.html?id=Bh45pU0_E_4C

E-Text Books:

1. https://books.google.co.in/books/about/Information_Security.html
2. http://www.amazon.in/Cryptography-Network-Security-Behrouz-Forouzan/dp/007070208X

COURSE OUTCOMES	
CO1	Gain Knowledge on Intrusion detection systems, security monitoring, Network Forensics principles and Intrusion Prevention system (IPS).
CO2	Analyze the threats and vulnerabilities in the network traffic for designing the solutions.
CO3	Detect, identify and mitigate the security attacks from the network traffic to provide the solutions to the real word problems.
CO4	Design novel solutions for detecting and mitigation of Intrusions in public and private networks.
CO5	Gain exposure on IDS and IPs tools of Intrusion and Extrusion detection for NSM data collections.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	1	1	-	-	1	1	-	-	1	-	-
CO2	-	3	2	2	2	-	-	-	-	-	-	1	-	-
CO3	2	2	3	1	1	-	-	-	-	-	-	1	-	-
CO4	2	2	3	3	2	-	-	-	-	-	-	1	-	-
CO5	-	2	2	3	2	2	-	2	-	-	-	1	-	-
CO*	**2.3**	**2.0**	**2.0**	**2.0**	**1.6**	**2**	**-**	**1.5**	**1**	**-**	**-**	**1.0**	**-**	**-**

OPERATIONS RESEARCH (OPEN ELECTIVE)

<table>
<tr><td colspan="10">B. Tech III Year II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">17CA53609</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>-</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 51</td><td colspan="2">Tutorial Classes: Nil</td><td colspan="3">Practical Classes: Nil</td><td colspan="3">Total Classes: 51</td></tr>
</table>

Course Objectives:

The course should enable the students to:

To introduce the use of linear programming for decision making. To introduce transportation algorithm for making allocation related decisions. To explain methods for solving sequencing and making decision under uncertainty. To explain various types of simulation methods for business decisions. To explain project management methods for managing projects.

UNIT - I	**INTRODUCTION TO OPERATIONS RESEARCH**	**Classes: 10**

Meaning,Nature, and Scope - Typical applications of Operations Researchin managerial decision-making. Decision-making environments:- Decision-making under certainty, uncertainty and risk situations; Decision tree approach and its applications.The Linear Programming Problem – Introduction, Formulation of Linear Programming problem, Limitations of Linear Programming problem, Graphical solution to Linear Programming problem, Simplex Method, Big M Method

UNIT-II	**TRANSPORTATION AND ASSIGNMENT PROBLEMS**	**Classes: 10**

Transportation problem-Various methods of finding Initial basic feasible solution and optimal solution - mathematical model, IBFS by north-west corner rule, least cost entry method and Vogel‘s Approximation method, Unbalanced Transportation Problem, Transportation problem with maximization, Optimal solution by MODI‘s method, Assignment problem, mathematical model, Hungarian‘s algorithm for solving Assignment problem, Travelling salesmen Assignment

UNIT - III	**JOB SEQUENCING**	**Classes: 12**

Introduction to Job Sequencing problems, processing *n* jobs through two machines, processing *n* jobs through three machines, processing *n* jobs through *m* machines processing two jobs through *m* machines problem. Queuing Theory: Characteristics of M/M/I Queue model; Application of Poisson and Exponential distribution in estimating arrival rate and service rate; Applications of Queue model for better service to the customers.

UNIT - IV	**GAME THEORY**	**Classes: 10**

Introduction to theory of games, Two-person zero-sum games, pure strategies-games with saddle point, mixed strategies- games without saddle point rules of dominance, solution method games without saddle point by algebraic method, arithmetic method and matrix method, Odds Method; Dominance Method and Graphical Method for solving Mixed Strategy Game. Significance of Game theory in Managerial Application.

UNIT - V	**PROJECT MANAGEMENT& DECISION ANALYSIS**	**Classes: 09**

Network analysis- Rules for drawing the Net work diagram, Applications of CPM and PERT techniques in Project Planning and Control, - Float – project crashing – Maximin and Minimax in Decision making under uncertainty

Text Books:

1. Kanti Swaroop,GuptaP.K. Man Mohan, ―Operations Research‖, Sultan Chand and Sons.
2. S.D. Sharma – Kedarnath / OperationsResearch.
3. J K Sharma, Operations Research: Theory and Practice, Macmillan Publishers India Ltd, 5th Edition, 2013

4. FS Hillier and GJ Lieberman, Introduction to Operations Research, TMH, 8/E, 2006.
5. JC Pant, Introduction to Optimization: Operations Research, Jain Brothers, New, 6/E, 2004.
6. A Ravindran, DT Philips and JJ Solberg, Operations Research: Principles and Practice, John Wiley & Sons, Singapore, Second Edition.

Reference Books:

7. Vijay Sathe, "Corporate Entrepreneurship", Cambridge, 1st Edition, 2009.
8. Vasanth Desai, "Dynamics of Entrepreneurial Development and Management", HPH,Millenium Edition, 2007.
9. P Narayana Reddy, "Entrepreneurship – Text and Cases", Cengage Lerning", 1st Edition, 2010.
10. David H. Hott, "Entrepreneurship New Venture Creation", PHI, 1st Edition,2004.

Web References:

https//www.tutorialspoint.com/entrepreneurship_development/entrepreneurship_development_tutorial.pdf
1. https://www.advalue-project.eu/content_files/EN/33/AdValue_Personal_Effectiveness_EN.pdf

E-Text Books:

1. https://www.freebookcentre.net/Business/Entrepreneurship-Books.html
1. https://www.e-booksdirectory.com/listing.php?category=390
2. https://www.bookboon.com/en/entrepreneurship-ebooks

COURSE OUTCOMES	
CO1	To introduce the use of linear programming for decision making.
CO2	To introduce transportation algorithm for making allocation related decisions
CO3	To explain methods for solving sequencing, making decision under uncertainty and depending on other person strategy
CO4	To explain various types of queue theory applications in business decisions.
CO5	To explain project management methods in managing projects.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	-	-	2	-	-	-	-	-	-	2	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO5	2	-	-	-	-	-	-	-	-	-	2	2	-	-
CO*	**2.4**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**

ENERGY FROM WASTE (OPEN ELECTIVE)

B. Tech III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA02609	Elective	L	T	P	C	CIA	SEE	Total
		3	-	-	3	30	70	100
Contact Classes: 51	Tutorial Classes: Nil		Practical Classes: Nil			Total Classes: 51		

Course Objectives:

The course should enable the students to:

I. Understand the principles associated with effective energy management and to apply these principles in the day to day life.

II. Develop insight into the collection, transfer and transport of municipal solid waste.

III. Explain the design and operation of a municipal solid waste landfill.

IV. Device key processes involved in recovering energy from wastes, systematically evaluate the main operational challenges in operating thermal and biochemical energy from waste facilities.

UNIT - I	INTRODUCTION TO WASTE AND WASTE PROCESSING	Classes: 11

Solid waste sources solid waste sources, types, composition, properties, global warming; Municipal solid waste: Physical, chemical and biological properties, waste collection and, transfer stations, waste minimization and recycling of municipal waste, segregation of waste, size reduction, managing waste, status of technologies for generation of energy from waste treatment and disposal aerobic composting, incineration, furnace type and design, medical waste / pharmaceutical waste treatment technologies, incineration, environmental impacts, measures to mitigate environmental effects due to incineration .

UNIT - II	WASTE TREATMENT AND DISPOSAL	Classes: 11

Land fill method of solid waste disposal land fill classification, types, methods and sitting consideration; Layout and preliminary design of landfills: Composition, characteristics, generation, movement and control of landfill leach ate and gases, environmental monitoring system for land fill gases.

UNIT - III	BIO-CHEMICAL CONVERSION	Classes: 09

Energy generation from waste bio-chemical conversion: Sources of energy generation, anaerobic digestion of sewage and municipal waste, direct combustion of MSW-refuse derived solid fuel.
Industrial waste, agro residues and anaerobic digestion.

UNIT - IV	THERMO-CHEMICAL CONVERSION	Classes: 10

Biogas production, land fill gas generation and utilization, thermo-chemical conversion: Sources of energy generation, gasification of waste using gasifies briquetting, utilization and advantages of briquetting, environmental benefits of bio-chemical and thermo- chemical conversion.

UNIT - V	E-WASTE MANAGEMENT	Classes: 10

E-waste: E-waste in the global context: Growth of electrical and electronics industry in India, environmental concerns and health hazards; Recycling e-waste: A thriving economy of the unorganized sector, global trade in hazardous waste, impact of hazardous e-waste in India; **Management of e-waste:** E-waste legislation, government regulations on e-waste management, international experience, need for stringent health safeguards and environmental protection laws of India.

Text Books:

1. Nicholas P Cheremisinoff, “Handbook of Solid Waste Management and Waste Minimization Technologies”, An Imprint of Elsevier, New Delhi, 2003.
2. P Aarne Vesilind, William A Worrell and Debra R Reinhart, “Solid Waste Engineering”, 2nd edition 2002.
3. M Dutta , B P Parida, B K Guha and T R Surkrishnan, “Industrial Solid Waste Management and Landfilling practice”, Reprint Edition New Delhi, 1999.
4. Rajya Sabha Secretariat, “E-waste in India: Research unit”, Reprint Edition, June, 2011.
5. Amalendu Bagchi Design, “Construction and Monitoring of Landfills”, John Wiley and Sons, New York, 1994.
6. M. L. Davis and D. A. Cornwell, “Introduction to environmental engineering”, International Edition, 2008.
7. C. S. Rao, “Environmental Pollution Control Engineering”, Wiley Eastern Ltd. New Delhi, 1995.
8. S. K. Agarwal, “Industrial Environment Assessment and Strategy”, APH Publishing Corporation, New Delhi, 1996.
9. Sofer, Samir S. (ed.), Zaborsky, R. (ed.), “Biomass Conversion Processes for Energy and Fuels”, New York, Plenum Press, 1981.
10. Hagerty, D.Joseph; Pavoni, Joseph L; Heer, John E., “Solid Waste Management”, New York, Van Nostrand, 1973.
11. George Tchobanoglous, Hilary Theisen and Samuel Vigil Prsl: Tchobanoglous, George Theisen, Hillary Vigil, Samuel, “Integrated Solid Waste management: Engineering Principles and Management issues”, New York, McGraw Hill, 1993.

Reference Books:

1. C Parker and T Roberts (Ed), “Energy from Waste”, An Evaluation of Conversion Technologies, Elsevier Applied Science, London, 1985.
2. KL Shah, “Basics of Solid and Hazardous Waste Management Technology”, Prentice Hall, Reprint Edition, 2000.
3. M Datta, “Waste Disposal in Engineered Landfills”, Narosa Publishing House, 1997.
4. G Rich et.al, Hazardous, “Waste Management Technology”, Podvan Publishers, 1987.

Web References:

1. https://www.e-waste Management: From waste to Resource Klaus Hieronymi, Ramzy Kahnat, Eric williams Tech. & Engg.-2013(Publisher: Earthscan 2013
2. https://www.What is the impact of E-waste: Tamara Thompson
3. https://www. E-waste poses a Health Hazard: Sairudeen Pattazhy

E-Text Books:

1. https://www.unep.org
2. https://www.outledge.com

COURSE OUTCOMES	
CO1	Acquires knowledge about bio-chemical conversion and thermo-chemical conversion.
CO2	Different Methods to the collection, transfer and transport of municipal solid waste
CO3	Design and operation of a municipal solid waste landfill.
CO4	Device key processes involved in recovering energy from wastes, systematically evaluate the main operational challenges in operating thermal and biochemical energy from waste facilities
CO5	Apply the knowledge in planning and operations of Waste to Energy plants.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	-	-	-	-	-	-	-	-	-	-	-

RESEARCH METHODOLOGIES (OPEN ELECTIVE)

<table>
<tr><td colspan="10">B. Tech III Year II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">17CA53602</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:51</td><td>Tutorial Classes:Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 51</td></tr>
<tr><td colspan="9">Course Objectives:
The course should enable the students to:
I. Orient the student to make an informed choice from the large number of alternative methods and experimental designs available.
II. Empower the student with the knowledge and skills they need to undertake a research project, to present a conference paper and to write a scientific article.
III. Develop a thorough understanding of the fundamental theoretical ideas and logic of research.
IV. Identify various sources of information for literature review and data collection.</td></tr>
<tr><td>UNIT-I</td><td colspan="6">INTRODUCION TO RESEARCH AND PHILOSOPHIES</td><td colspan="2">Classes: 10</td></tr>
<tr><td colspan="9">Introduction to research: The role of research, research process overview; Philosophies and the language of research theory building: Science and its functions, what is theory, the meaning of methodology.</td></tr>
<tr><td>UNIT-II</td><td colspan="6">A RESEARCHER PROBLEMS AND HYPOTHESES</td><td colspan="2">Classes: 10</td></tr>
<tr><td colspan="9">Thinking like a researcher: Understanding concepts, constructs, variables, and definitions; Problems and hypotheses: Defining the research problem, formulation of the research hypotheses, the importance of problems and hypotheses.</td></tr>
<tr><td>UNIT-III</td><td colspan="6">RESEARCH DESIGN AND DATA COLLECTION</td><td colspan="2">Classes: 10</td></tr>
<tr><td colspan="9">Research design: Experimental and no experimental research design, field research, and survey research.
Methods of data collection: Secondary data collection methods, qualitative methods of data collection, and survey methods of data collection.</td></tr>
<tr><td>UNIT-IV</td><td colspan="6">ATTITUDE MEASUREMENT , SCALING AND SAMPLING TECHNIQUES</td><td colspan="2">Classes: 12</td></tr>
<tr><td colspan="9">Attitude measurement and scaling: Types of measurement scales; Questionnaire designing, reliability and validity.
Sampling techniques: The nature of sampling, probability sampling design, non probability sampling design, and determination of sample size.</td></tr>
<tr><td>UNIT-V</td><td colspan="6">PROCESSING AND ANALYSIS OF DATA,ETHICAL ISSUES</td><td colspan="2">Classes: 09</td></tr>
<tr><td colspan="9">Processing and analysis of data ; Ethical issues in conducting research; Report generation, report writing, and APA format; Title page, abstract, introduction, methodology, results, discussion, references, and appendices.</td></tr>
<tr><td colspan="9">Text Books:</td></tr>
<tr><td colspan="9">1. Bryman, Alan, Bell, Emma, “Business Research Methods”, Oxford University Press, 3rd Edition, 2011.
2. Kerlinger, F.N., Lee, H.B.,“Foundations of Behavioral Research”, Harcourt Inc., 4thEdition, 2000.
3. Rubin, Allen, Babbie, Earl, “Essential Research Methods for Social Work”, Cengage Learning Inc., USA, 2009.</td></tr>
<tr><td colspan="9">Reference Books:</td></tr>
</table>

1. Anantasi A., UrbinaS., “Psychological Testing”, Pearson Education, 2004.
2. Chawla, Deepak, Sondhi, Neena, “Research Methodology: Concepts and Cases”,Vikas Publishing House Pvt. Ltd. Delhi, 2011.
3. Pawar B. S., “Theory Building For Hypothesis Specification In Organizational Studies”, Response Books, New Delhi, 2009.
4. NeumanW.L., “Social Research Methods: Qualitative and Quantitative Approaches”, Pearson Education, 2008

Web References:

1. https://en.wikipedia.org/wiki/Online_research_methods
2. https://www.prescott.edu/library/resources/research-bibliography.php

E-Text Books:

1. https://www.hcmuaf.edu.vn/.../Research%20Methodology%20-%20Methods%20and%20T...
2. https://www.federaljack.com/ebooks/My%20collection%20of%20medical%20books,%2020...

COURSE OUTCOMES	
CO1	Understand basic concepts and its methodologies.
CO2	Demonstrate the knowledge of research processes.
CO3	Demonstrate and explain research articles in their academic discipline.
CO4	Analyze various types of testing tools used in research.
CO5	Design a research paper without any ethical issues.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO*	**2.6**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

DIGITAL IMAGE PROCESSING (OPEN ELECTIVE)

B. Tech III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
17CA04801	Core	L	T	P	C	CIA	SEE	Total
		3	1	0	3	30	70	100
Contact Classes: 45	Tutorial Classes:15	Practical Classes: Nil				Total Classes: 60		

Course Objectives:

The course should enable the students:

5. To know the fundamentals of Image Processing.
6. To know the transformation on images.
7. To know about various techniques of image enhancement and reconstruction.
8. To understand different redundancies related to images.

UNIT-I	INTRODUCTION TO DIGITAL IMAGE PROCESSING	Classes: 12

Introduction, Image sensing and Acquisition, Image Modeling, Sampling, Quantization and Digital Image representation, Basic relationships between pixels, Mathematical tools/ operations applied on images, Imaging geometry.

UNIT-II	IMAGE TRANSFORMATIONS	Classes: 12

Fast Algorithms, Discrete Fourier Transform, Discrete Cosine Transforms, Walsh Transforms, Hadamard Transforms- Hoteling Transforms, Comparison of properties of the above transforms.

UNIT-III	IMAGE ENHANCEMENT	Classes: 12

Background enhancement by point processing, Histogram processing, Spatial filtering, Enhancement in frequency Domain, Image smoothing, Image sharpening, Color image Enhancement.

UNIT-IV	DEGRADATION MODEL AND IMAGE SEGMENTATION	Classes: 12

Degradation model, Algebraic approach to restoration, Inverse filtering, Least Mean Square filters, Constrained Least square restoration, Blind Deconvolution.

Image Segmentation: Edge detection, Edge linking, Threshold based segmentation methods, Region based Approaches, Template matching Use of motion in segmentation.

UNIT-V	REDUNDANCIES	Classes: 12

Redundancies in Images, Compression models, Information theoretic perspective, Fundamental coding theorem, Huffman Coding, Arithmetic coding, Bit plane coding, Run length coding, Transform coding, Image Formats and Compression Standards.

TEXT BOOKS:

1. R.C .Gonzalez & R.E. Woods, “Digital Image Processing”, Addison Wesley/Pearson education, 3rd Edition, 2010.
2. A .K. Jain, “Fundamentals of Digital Image processing”, PHI, 2010.

REFERENCE BOOKS:

1. Rafael C. Gonzalez, Richard E woods and Steven L.Eddins, “Digital Image processing using MATLAB”, Tata McGraw Hill, 2010.
2. S Jayaraman, S Esakkirajan, T Veerakumar, “Digital Image processing”, Tata McGraw Hill
3. William K. Pratt, “Digital Image Processing”, John Wilely, 3rd Edition, 2004, Instruments Literature Number: SWRU368A April 2014–Revised August 2015.

COURSE OUTCOMES	
CO1	Demonstrate knowledge on Identification, formulate & solve problems involving images.
CO2	Analyze and Apply various transformation techniques to process images of any context.
CO3	Analyze image enhancement and Develop algorithm.
CO4	Analyze image segmentation and Develop restoration algorithm applied for images.
CO5	Demonstrate knowledge on compression technique and skills to use modern engineering tools, software & equipment to analyze problems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2.8**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

DATABASE MANAGEMENT SYSTEMS (OPEN ELECTIVE)

B. Tech III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
17CA05404	Core	2	2	-	3	30	70	100
Contact Classes: 34	Tutorial Classes: 34	Practical Classes: Nil				Total Classes: 68		

Course Objectives:

The course should enable the students to:

- To understand the basic concepts and the applications of database systems.
- To master the basics of SQL and construct queries using SQL.
- To understand the relational database design principles.
- To become familiar with the basic issues of transaction processing and concurrency control.
- To become familiar with database storage structures and access techniques.

UNIT-I Introduction to Database systems — **Classes: 13**

Introduction-Database System Applications, Purpose of Database Systems, View of Data - Data Abstraction, Instances and Schemas, Data Models, Database Languages - DDL, DML, Database Architecture, Database Users and Administrators, History of Data base Systems.

Introduction to Data base design , ER diagrams, Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises. Relational Model: Introduction to the Relational Model - Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design, Introduction to Views Destroying/ altering Tables and Views.

Unit-II Relational Algebra and Calculus — **Classes: 13**

Relational Algebra and Calculus: Relational Algebra - Selection and Projection, Set operations, Renaming, Joins, Division, Examples of Algebra Queries, Relational calculus - Tuple relational Calculus - Domain relational calculus - Expressive Power of Algebra and calculus.

Form of Basic SQL Query - Examples of Basic SQL Queries, Introduction to Nested Queries, Correlated Nested Queries, Set - Comparison Operators, Aggregate Operators, NULL values - Comparison using Null values - Logical connectives - AND, OR and NOT - Impact on SQL Constructs, Outer Joins, Disallowing NULL values, Complex Integrity Constraints in SQL Triggers and Active Data bases.

Unit-III Normal Forms — **Classes: 14**

Introduction to Schema Refinement - Problems Caused by redundancy, Decompositions - Problem related to decomposition, Functional Dependencies - Reasoning about FDS, Normal Forms - FIRST, SECOND, THIRD Normal forms - BCNF - Properties of Decompositions - Loss less join Decomposition, Dependency preserving Decomposition, Schema Refinement in Data base Design - Multi valued Dependencies - FOURTH Normal Form, Join Dependencies, FIFTH Normal form, Inclusion Dependencies.

Unit-IV Transaction Management — **Classes: 14**

Transaction Management - Transaction Concept - Transaction State - Implementation of Atomicity and Durability - Concurrent - Executions - Serializability - Recoverability - Implementation of Isolation - Testing for Serializability. **Concurrency Control** - Lock - Based Protocols - Timestamp Based Protocols - Validation - Based Protocols - Multiple Granularity. **Recovery System**-Failure Classification-Storage Structure-Recovery and Atomicity - Log - Based Recovery - Recovery with Concurrent Transactions - Buffer Management - Failure with loss of nonvolatile storage - Advance Recovery systems - Remote Backup systems

UNIT-V Storage and Indexing Trees — **Classes: 14**

Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing - Clustered Indexes, Primary and Secondary Indexes, Index data Structures - Hash Based Indexing, Tree based Indexing, Comparison of File Organizations.

Tree Structured Indexing: Intuitions for tree indexes, Indexed Sequential Access Methods(ISAM) B+ Trees: A Dynamic Index Structure, Search, Insert, Delete.

Hash Based Indexing: Static Hashing, Extendable hashing, Linear Hashing, Extendible vs. Linear Hashing.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill, 4th Edition, 2002.

Reference Books:

1. RamezElmasri, ShamkantB.Navathe,"FundamentalDatabaseSystems",PearsonEducation, 3rdEdition, 2003.

2. Raghu Ramakrishnan, "Database Management System", Tata McGraw-Hill Publishing Company, 3rd Edition, 2003.
3. Hector Garcia Molina, Jeffrey D. Ullman, Jennifer Widom, "Database System Implementation", PearsonEducation, United States, 1st Edition, 2000.
4. PeterRob, CorlosCoronel,"DatabaseSystem,Design,ImplementationandManagement", ThompsonLearningCourseTechnology, 5th Edition,2003.

Web References:

1. https://www.youtube.com/results?search_query=DBMS+onluine+classes
2. http://www.w3schools.in/dbms/
3. http://beginnersbook.com/2015/04/dbms-tutorial/

E-Text Books:

1. http://www.e-booksdirectory.com/details.php?ebook=10166
2. http://www.e-booksdirectory.com/details.php?ebook=7400re

COURSE OUTCOMES	
CO1	Use SQL For Database Management.
CO2	Understand ER concepts and ER mapping to relational model.
CO3	Apply the concepts of relational algebra and calculus.
CO4	Apply normalization process to construct the database.
CO5	Understand concurrency and recovery strategies of data base.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO3	1	2	3	-	-	-	-	-	-	-	-	-	-	-
CO4	2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	2	-	-	-	-	-	-	-	-	-	-
CO*	**2.2**	**2**	**2.8**	**2**	-	-	-	-	-	-	-	-	-	-

R19

CHADALAWADA RAMANAMMA ENGINEERING COLLEGE

(AUTONOMOUS)

(Approved by AICTE | NAAC Accreditation with 'A' Grade | Permanently Affiliated to JNTUA)

Chadalawada Nagar, Tirupati - 517506, Andhra Pradesh.

OUTCOME BASED EDUCATION WITH CHOICE BASED CREDIT SYSTEM

BACHELOR OF TECHNOLOGY

ACADEMIC REGULATIONS-R19 UNDER AUTONOMOUS STATUS

B.Tech Regular Four Year Degree Programme

(for the batches admitted from the academic year 2019- 2020)

&

B.Tech (Lateral Entry Scheme)

(for the batches admitted from the academic year 2020 - 2021)

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

CONTENTS

"Take up one idea.
Make that one idea your life-think of it, dream of it, live on that idea. Let the brain muscles, nerves, every part of your body be full of that idea and just leave every other idea alone.
This is the way to success"

Swami Vivekananda

VISION AND MISSION OF THE INSTITUTE

VISION

To be a top notch institution, imparting quality education in technology and management to produce globally competent professionals and address socio-economic issues through research and innovation.

MISSION

- Continuously update curricula and teaching learning process to meet the needs of industry and promote entrepreneurship.
- Inculcate research, development and innovation culture among students and faculty.
- Capacity to work in diverse fields and cultures with ethical practices to address socio-economic issues.

PRELIMINARY DEFINITIONS AND NOMENCLATURES

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two main semesters i.e., (one odd + one even) and one supplementary semester.

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Anantapuramu) and State Government.

Backlog Course: A course is considered to be a backlog course if the student has obtained a failure grade (F) in that course.

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry, Biology etc., are considered to be foundational in nature.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

Branch: Means specialization in a program like B.Tech degree program in Mechanical Engineering, B.Tech degree program in Computer Science and Engineering etc.

Certificate Course: It is a course that makes a student gain hands-on expertise and skills required for holistic development in a specific area/field.

Choice Based Credit System: The credit based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Commission: Means University Grants Commission (UGC), New Delhi.

Continuous Internal Examination: It is an examination conducted towards sessional assessment.

Course: A course is a subject offered by a department for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture/tutorial hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources, and processes for evaluating the attainment of Program Educational Objectives.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff and other resources in the process of study for a degree.

Dropping from the Semester: A student who doesn’t want to register for any semester can apply in writing in prescribed format before commencement of that semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and/or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 - point scale.

Institute: Means CHADALAWADA RAMANAMMA ENGINEERING COLLEGE, Tirupati unless indicated otherwise by the context.

Massive Open Online Course (MOOC): MOOC courses inculcate the habit of self learning. MOOC courses would be additional choices in all the elective group courses.

Pre-requisite: A course, the knowledge of which is required for registration into higher level course.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Professional Elective: It indicates a course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Means, Bachelor of Technology (B.Tech) degree program / PG degree program: M.Tech/ MBA.

Program Educational Objectives: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project work: It is a design or research based work to be taken up by a student during his/her final year to achieve a particular aim. It is a credit based course and is to be planned carefully by the student.

Re-Appearing: A student can reappear only in the semester end examination for the theory component of a course, subject to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester of a Program.

Regulations: The regulations, common to all B.Tech programs offered by Institute are designated as "CREC Regulations R-19" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. The odd Semester starts usually in July and even semester in December.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

S/he: Means "she" and "he" both.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means the Jawaharlal Nehru Technological University Anantapur, Anantapuramu.

FOREWORD

The autonomy is conferred to CHADALAWADA RAMANAMMA ENGINEERING COLLEGE (CREC), Tirupati by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like J N T University Anantapuramu (JNTUA), Anantapuramu and AICTE. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own curriculum, examination system and monitoring mechanism, independent of the affiliating University but under its observance.

CREC is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUA to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute to order to produce a quality engineering graduate to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

ACADEMIC REGULATIONS

B.Tech. Regular Four Year Degree Programme
(For the batches admitted from the academic year 2019-20)
&
B.Tech. (Lateral Entry Scheme)
(For the batches admitted from the academic year 2020 - 21)

For pursuing four year undergraduate Bachelor Degree programme of study in Engineering (B.Tech) offered by CHADALAWADA RAMANAMMA ENGINEERING COLLEGE under Autonomous status and herein after referred to as CREC.

1.0. CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions (HEI's) are changing from the conventional course structure to Choice Based Credit System (CBCS) along with introduction to semester system at first year itself. The semester system helps in accelerating the teaching-learning process and enables vertical and horizontal mobility in learning.

The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

Choice Based Credit System (CBCS) is a flexible system of learning and provides choice for students to select from the prescribed elective courses. A course defines learning objectives and learning outcomes and comprises of lectures / tutorials / laboratory work / field work / project work / / seminars / assignments / alternative assessment tools / presentations / self-study etc. or a combination of some of these.

Under the CBCS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.

The CBCS permits students to:

- Choose electives from a wide range of elective courses offered by the departments.
- Undergo additional courses of interest.
- Adopt an interdisciplinary approach in learning.
- Make the best use of expertise of the available faculty.

2.0 MEDIUM OF INSTRUCTION

The medium of instruction shall be English for all courses, examinations, seminar presentations and project work. The curriculum will comprise courses of study as given in course structure, in accordance with the prescribed syllabi.

3.0 TYPES OF COURSES

Courses in a programme may be of three kinds: **Foundation / Skill, Core and Elective.**

3.1 Foundation / Skill Course:

Foundation courses are the courses based upon the content leads to enhancement of skill and knowledge as well as value based and are aimed at man making education. Skill subjects are those areas in which one needs to develop a set of skills to learn anything at all. They are fundamental to learning any subject.

3.2 Core Course:

There may be a core course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

3.3 Elective Course:

Electives provide breadth of experience in respective branch and applications areas. Elective course is a course which can be chosen from a pool of courses. It may be:

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student's proficiency/skill.

An elective may be discipline centric (Professional Elective) focusing on those courses which add generic proficiency to the students or may be chosen from an inter discipline called as "Open Elective".

There are FIVE professional elective groups, students can choose not more than two courses from each group. Overall, students can opt for FIVE professional elective courses which enhances their professional knowledge in line with latest industrial needs.
There are FOUR open elective groups, students can choose not more than two courses from each group consisting of four different subjects.
There are TWO humanities elective groups, students can choose not more than two courses from each group consisting of three different subjects.

4.0 SEMESTER STRUCTURE

Each academic year is divided into two semesters, odd and even.

4.1 Each main semester shall be of 21 weeks (Table 1) duration and this period includes time for registration of courses, course work, examination preparation and conduct of examinations.

4.2 Students admitted on transfer from JNTU affiliated institutes, Universities and other institutes in the subjects in which they are required to earn credits so as to be on par with regular students as prescribed by concerned "Board of Studies".

4.3 Each main semester shall have a minimum of 90 working days; out of which number of contact days for teaching / practical are 75 and 15 days for conduct of exams and preparation.

4.4 The academic calendar shown in Table 1 is declared at the beginning of the academic year.

Table 1: Academic Calendar

ZERO SEMESTER (3 weeks)	Induction Programm Physical Activities, Career Counseling, orientating of respective branch, Proficiency Modules and Productivity Tools and Communicating Skills	3 weeks	3 weeks
FIRST SEMESTER (21 weeks)	I Spell Instruction Period	8 weeks	19 weeks
	I Continuous Internal Examination (CIE-I)	1 week	
	II Spell Instruction Period	8 weeks	
	II Continuous Internal Examination (CIE-II)	1 week	
	Preparation	1 week	
	Semester End Examinations		2 weeks
Semester Break and Supplementary Exams			2 weeks
SECOND SEMESTER (21 weeks)	I Spell Instruction Period	8 weeks	19 weeks
	I Continuous Internal Examination (CIE-I)	1 week	
	II Spell Instruction Period	8 weeks	
	II Continuous Internal Examination (CIE-II)	1 week	
	Preparation	1 week	
	Semester End Examinations		2 weeks

5.0 REGISTRATION

5.1. Each student has to compulsorily register for course work at the beginning of each semester as per the schedule mentioned in the Academic Calendar. It is absolutely compulsory for the student to register for courses in time. The registration will be organized departmentally under the supervision of the Head of the Department.

5.2. IN ABSENTIA registration will not be permitted under any circumstance.

5.3. At the time of registration, students should have cleared all the dues of Institute and Hostel of the previous semesters, paid the prescribed fees for the current semester and not been debarred from institute for a specified period on disciplinary or any other ground.

6.0 UNIQUE COURSE IDENTIFICATION CODE

Every course of the B.Tech program will be placed in one of the four groups of courses as listed in the Table 2. The various courses and their two-letter codes are given below;

Table 2: Group of Courses

S. No	Branch	Code
1	Electrical and Electronics Engineering	02
2	Mechanical Engineering	03
3	Electronics and Communication Engineering	04
4	Computer Science and Engineering	05

7.0 CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Foundation / Skill Courses, Core Courses, Elective Courses, Laboratory Courses, Mandatory Courses, Social Relevant Project, Internship and Project work. The list of elective courses may include subjects from allied disciplines also.

Contact Periods: Depending on the complexity and volume of the course, the number of contact periods per week will be assigned. Each Theory and Laboratory course carries credits, based on the number of hours/weeks as follows:

- Contact classes (Theory): 1credit per lecture hour per week.
- Tutorial Classes (Theory): 1credit per lecture hours per week.
- Laboratory Hours (Practical): 1 credit for 2 Practical hours.

7.1 Credit distribution for courses offered is shown in Table 3.

Table 3: Credit distribution

S. No	Course	Hours	Credits
1	Theory Course (Core/Foundation/Elective)	2/3/4	2/3/4
2	Laboratory Course	2	1
3	MOOC Courses	-	3
4	Audit Course	3	0
5	Social Relevant Project	15/ Sem	0.5
6	Industrial Training/Internship	-	2
7	Project – I	-	2
8	Project – II	-	7

7.2 Course Structure

Every program of study shall be designed to have 41 theory courses and 17-20 laboratory courses. Every course of the B.Tech program will be placed in one of the eight categories with minimum credits as listed in the Table 4.In addition, a student has to carry out four socially Relevant Project, project work.

Table 4: Category Wise Distribution of Credits

S. No	Category	AICTE CREDITS	Average No. of Credits
1	Humanities and Social Sciences (HS), including Management.	12	**13**
2	Basic Sciences (BS) including Mathematics, Physics and Chemistry.	25	**24**
3	Engineering Sciences (ES), including Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Computer Engineering.	24	**21**
4	Professional Subjects - Core (PC), relevant to the chosen specialization/branch.	48	**62**
5	Professional Subjects - Electives (PE), relevant to the chosen specialization/branch.	18	**15**
6	Open Subjects - Electives (OE), from other technical and/or emerging subject areas.	18	**12**
7	Project Work, Social Relevant Project and Internship	15	**13**
TOTAL		**160**	**160**

7.3 Semester-wise course break-up

For Four year Regular program:

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
I Year I Semester	4 + Audit Course	3/4	18
I Year II Semester	5 + Audit Course	5/4	21.5
II Year I Semester	6 (3 Core + 3 Foundation) + Audit Course	2	21.5
II Year II Semester	6 (3 Core + 3 Foundation) +SRP	3/4	21.5
III Year I Semester	6(4 Core + 1 Professional Elective + 1 Open Elective) + SRP	2/3	21.5
III Year II Semester	6 (3 Core + 1 Professional Elective + 1 Open Elective + 1 Humanities Elective) + SRP	2/3	21.5
IV Year I Semester	6 (2 Core + 2 Professional Elective + 1 Open Elective + 1 Humanities Elective) + SRP + Project – I + Internship	0	21.5
IV Year II Semester	2 (1 Professional Elective + 1 Open Elective) + Project – II	0	13
Total	**41 (15 Foundation + 15 Core + 5 Professional Electives + 4 Open Electives+ 2 Humanities Elective) + 4 SRP + Project I & II + 1 Internship**	**17-20**	**160**

7.4 For Three year lateral entry program:

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
II Year I Semester	6 (3 Core + 3 Foundation) + Audit Course	2	21.5
II Year II Semester	6 (3 Core + 3 Foundation) +SRP	3/4	21.5
III Year I Semester	6(4 Core + 1 Professional Elective + 1 Open Elective) + SRP	2/3	21.5
III Year II Semester	6 (3 Core + 1 Professional Elective + 1 Open Elective + 1 Humanities Elective) + SRP	2/3	21.5
IV Year I Semester	6 (2 Core + 2 Professional Elective + 1 Open Elective + 1 Humanities Elective) + SRP + Project – I + Internship	0	21.5
IV Year II Semester	2 (1 Professional Elective + 1 Open Elective) + Project – II	0	13
Total	**32 (6 Foundation + 15 Core + 5 Professional Electives + 4 Open Electives+ 2 Humanities Elective) + 4 SRP + Project I & II + 1 Internship**	**9-12**	**120.5**

8.0 EVALUATION METHODOLOGY

8.1 Theory Course:

Each theory course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, final marks for 25 shall be arrived by considering 80% weightage to the better internal exam and 20% to the other. The remaining 5 Marks will be considered through Alternative Assessment Tool (AAT).The AAT may include

1. Seminar – 1 Mark
2. Assignment – 2 Marks
3. Slip Test – 2 Marks

AAT helps the student for the improvement of self learning and presentation skills.

8.1.1 Semester End Examination (SEE):

The syllabus for each theory course consists of FIVE units and each unit carries equal weightage in terms of marks distribution. The semester end examination is conducted for 70 marks of 3 hours duration.

The Semester End Examination (SEE) consists of two parts i.e Part A and Part B. Part A consists of 12 short questions, student has to answer any ten questions, each question carries two marks. Part B consists of five questions with 'either' 'or' choice will be drawn from each unit. Each question carries 10 marks. There could be a maximum of two sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept
30 %	To test the analytical skill of the concept
20 %	To test the application skill of the concept

8.1.2 Continuous Internal Assessment (CIA):

For each theory course the CIA shall be conducted by the faculty/teacher handling the course as given in Table-5. CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Alternative Assessment Tool (AAT).

Table-5: Assessment pattern for Theory Courses

COMPONENT	THEORY		TOTAL MARKS
Type of Assessment	CIE	AAT	
Max. CIA Marks	25	05	30

8.1.2.1 Continuous Internal Examination (CIE):

Two Continuous Internal Examinations (CIE) shall be conducted at the end of the 9th and 17th week of the semester respectively. The CIE is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. The calculation of CIE marks is carried out by considering 80% weightage of the better marks scored in both tests and 20% for the other test. The valuation and verification of answer scripts of CIE shall be completed within a week after the conduct of the Internal Examination.

8.1.2.2 Alternative Assessment Tool (AAT)

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). This AAT enables faculty to design own assessment patterns during the CIA. The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. If properly applied, the AAT converts the classroom into an effective learning center. The AAT may include seminars, assignments, micro- projects, five minutes video, flip class, etc.

However, it is mandatory for a faculty to obtain prior permission from the concerned HOD and spell out the teaching/assessment pattern of the AAT prior to commencement of the classes.

8.2 Laboratory Course:

8.2.2.1 Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment. The semester end lab examination for 70 marks shall be conducted by two examiners. Internal Examiner nominated by the HOD and the External Examiner nominated by the Controller of Examinations from the panel of experts recommended by HOD. For supplementary lab examinations both the examiners will be nominated by HOD.

8.2.2.2 All the drawing related courses are evaluated in line with theory courses. The distribution shall be 30 marks for internal evaluation (20 marks for day–to–day work, and 10 marks for internal tests) and 70 marks for semester end lab examination.

8.3 MOOC Courses:

Meeting with the global requirements, to inculcate the habit of self learning and incompliance with UGC guidelines, MOOC (Massive Open Online Course) courses have been introduced as electives.

8.3.1 The proposed MOOC courses would be additional choices in all the elective groups subject to the availability during the respective semesters and respective departments will declare the list of the courses at the beginning of the semester. Course content for the selected MOOC courses shall be drawn from respective MOOCs links or shall be supplied by the department. Course will be mentored by faculty members .

8.3.2 Three credits will be awarded upon successful completion of each MOOC courses having minimum of 8 weeks duration.

8.3.3 Students interested in doing MOOC courses shall register the course title at their department office at the start of the semester against the courses that are announced by various agencies and academic institutions.

8.3.4 In the event of non-availability, a suitable /relevant course in a given semester is not available through any service provider, the departments would offer an appropriate taught course in lieu of the MOOCs course, the assessment in such a case would be similar to that of any other regular theory courses.

8.4 Mandatory Courses (MC):

These courses are among the compulsory courses.

a) Environmental Science, Constitution of India and Essence of Indian Traditional Knowledge are audit courses offered in B.Tech I Year I Sem, B.Tech I Year II & B.Tech II Year I semesters respectively.

b) By the end of B.Tech III Year II semester, all the students should complete the audit courses.

c) Mandatory/Value added courses will carry no credit and a pass in each such course after completing SEE requirements during the programme to qualify for the award of Degree. The student is required to obtain 40 % of the marks to qualify out of the maximum 100 marks for “Satisfactory”, Other wise it is “Non-Satisfactory” performance.

8.5 Socially Relevant Projects :

The Social Relevant Project (SRP) shall be carried out in B.Tech II Year II Sem, B.Tech III Year I Sem, B.Tech III Year II & B.Tech IV Year I semesters. In a bid to support socially relevant projects, the college has approved the Scheme for Trans-Disciplinary Research for India`s Developing Economy (STRIDE). The scheme will provide support to research projects that are socially relevant, locally need-based, nationally important and globally significant. This will strengthen research culture and innovation in the college, help the students and the faculty to contribute towards India`s developing economy. Focus on humanities and human sciences will boost quality research on Indian languages and knowledge systems. It creates unity of intellectual frameworks beyond the disciplinary perspectives and solves problems by going beyond the boundaries of disciplines to involve various stakeholders.

The Social Relevant Project will be evaluated for 50 marks in total. Assessment will be done by the supervisor/guide based on the work and presentation/execution of the Project. Evaluation shall be done by a committee comprising the supervisor and Head of the department.

8.6 Project work

The project work will be divided into two parts as Project- I and Project- II in B.Tech IV Year I Sem and B.Tech IV Year II semesters respectively. Project- I shall be evaluated for 100 marks out of which 30 marks for internal evaluation and 70 marks for semester end evaluation. Project-II shall be evaluated for 200 marks out of which 60 marks for internal evaluation and 140 marks for semester end evaluation. The project work shall be innovative in nature, exploring the research bent of the mind of the student. A project batch shall comprise not more than four students.

In B.Tech IV Year II semester, the students have to identify the problem and have to collect the material relevant to the project by undergoing literature. By the end of semester, he has to submit the report and has to give brief presentation to project review committee comprising the Head of the department, project supervisor and senior faculty member of the department. In B.Tech IV Year II semester, the students have to analysis and design the prototype of the project. By the end of semester, he has to submit the project report and has to give the final presentation to project review committee comprising the Head of the department, project supervisor and an external examiner nominated by the Controller of Examinations. A minimum of 50% of maximum marks shall be obtained to earn the corresponding credits.

9.0 ATTENDANCE REQUIREMENTS AND DETENTION POLICY

9.1 It is desirable for a candidate to put on 100% attendance in each course. In every course (theory/laboratory), student has to maintain a minimum of 75% attendance including the days of attendance in sports, games, NCC and NSS activities to be eligible for appearing in Semester End Examination of the course.

9.2 A candidate shall put in a minimum required attendance of 75 % in that semester. Otherwise, s/he shall be declared detained and has to repeat semester.

9.3 For cases of medical issues, deficiency of attendance in each course to the extent of 10% may be condoned by the College Academic Committee (CAC) on the recommendation of Head of the department if their attendance is between 75% and 65% in a semester, subjected to submission of medical certificates, medical case file and other needful documents to the concerned departments. The condonation is permitted maximum of two times during the entire course of study.

9.4 A prescribed fee shall be payable towards condonation of shortage of attendance.

9.5 A student shall not be promoted to the next semester unless he/she satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he/she shall not be eligible for readmission into the same class.

9.6 Any student against whom any disciplinary action by the institute is pending shall not be permitted to attend any SEE in that semester.

10.0 CONDUCT OF SEMESTER END EXAMINATIONS AND EVALUATION

10.1 Semester end examination shall be conducted by the Controller of Examinations (COE) by inviting Question Papers from the External Examiners.

10.2 Question papers may be moderated for the coverage of syllabus, pattern of questions by a Examination Committee chaired by COE and senior subject expert before the commencement of semester end examinations. Internal Examiner shall prepare a detailed scheme of valuation.

10.3 The answer papers of semester end examination should be evaluated by the first examiner immediately after the completion of exam and the award sheet should be submitted to COE in a sealed cover before the same papers are kept for second evaluation by external examiner.

10.4 In case of difference is more than 15% of marks, the answer paper shall be re-evaluated by a third examiner appointed by the Examination Committee and the marks awarded by third examiner is compared with first and second evaluation marks and higher marks of minimum difference pair will be considered as final marks.

10.5 The CoE processes the evolution of all the end-semester answer scripts on a prescribed date(s).

10.6 Examinations Committee shall consolidate the marks awarded by both the examiners.

11.0 SCHEME FOR THE AWARD OF GRADE

11.1 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each theory course, if s/he secures

i. Not less than 35% marks for each theory course in the semester end examination, and

ii. A minimum of 40% marks for each theory course considering both internal and semester end examination.

11.2 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each Lab / Socially Relevant Project / Project, if s/he secures

i. Not less than 40% marks for each Lab / Project course in the semester end examination,

ii. A minimum of 40% marks for each Lab / Project course considering both internal and semester end examination.

11.3 If a candidate fails to secure a pass in a particular course, it is mandatory that s/he shall register and reappear for the examination in that course , when examination is conducted in that course. It is mandatory that s/he should continue to register and reappear for the examination till s/he secures a pass.

12.0 LETTER GRADES AND GRADE POINTS

12.1 Performances of students in each course are expressed in terms of marks as well as in Letter Grades based on absolute grading system. The UGC recommends a 10-point grading system with the following letter grades as given in the Table-6.

Table-6: Grade Points Scale (Absolute Grading)

Range of Marks	Grade Point	Letter Grade
90 – 100	10	S (Superior)
80 – 89	9	A+ (Excellent)
70 – 79	8	A (Very Good)
60 – 69	7	B+ (Good)
50 – 59	6	B (Average)
40 – 49	5	C (Pass)
Below 40	0	F (Fail)
Absent	0	AB (Absent)

12.2 A student is deemed to have passed and acquired to correspondent credits in particular course if s/he obtains any one of the following grades: “S”, “A+”, “A”, “B+”, “B”, “C”.

12.3 A student obtaining Grade F shall be considered Failed and will be required to reappear in the examination.

13.4 For noncredit courses, ‘Satisfactory’ or “Not Satisfactory” is indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

12.5 “SA” denotes shortage of attendance (as per item 10) and hence prevention from writing Semester End Examination.

12.6 At the end of each semester, the institute issues grade sheet indicating the SGPA and CGPA of the student. However, grade sheet will not be issued to the student if s/he has any outstanding dues.

13.0 COMPUTATION OF SGPA AND CGPA

The UGC recommends to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA). The credit points earned by a student are used for calculating the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA), both of which are important performance indices of the student. SGPA is equal to the sum of all the total points earned by the student in a given semester divided by the number of credits registered by the student in that semester. CGPA gives the sum of all the total points earned in all the previous semesters and the current semester divided by the number of credits registered in all these semesters. Thus,

$$SGPA = \sum_{i=1}^{n} (C_i G_i) / \sum_{i=1}^{n} C_i$$

where, C_i is the number of credits of the i^{th} course and $G_i$is the grade point scored by the student in the i^{th} course and n represent the number of courses in which a student is registered in the concerned semester.

$$CGPA = \sum_{j=1}^{m} (C_j S_j) / \sum_{j=1}^{m} C_j$$

where, S_j is the SGPA of the j^{th} semester and $C_j$is the total number of credits upto the semester and m represent the number of semesters completed in which a student registered upto the semester. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

14.0 ILLUSTRATION OF COMPUTATION OF SGPA AND CGPA

14.1 Illustration for SGPA

Course Name	Course Credits	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	3	A	8	3 x 8 = 24
Course 2	4	B+	7	4 x 7 = 28
Course 3	3	B	6	3 x 6 = 18
Course 4	3	S	10	3 x 10 = 30
Course 5	3	C	5	3 x 5 = 15
Course 6	4	B	6	4 x 6 = 24
	20			**139**

$$Thus, SGPA = 139 / 20 = 6.95$$

14.2 Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit: 20 SGPA: 6.9	Credit: 22 SGPA: 7.8	Credit: 25 SGPA: 5.6	Credit: 26 SGPA: 6.0
Semester 5	**Semester 6**		
Credit: 26 SGPA: 6.3	Credit: 25 SGPA: 8.0		

$$Thus,\ CGPA = \frac{20x6.9\ +\ 22x7.8\ +\ 25x5.6\ +\ 26x6.0\ +\ 26x6.3\ +\ 25x8.0}{144} = 6.73$$

15.0 REVALUATION

A student, who seeks the re-evaluation of the answer script, is directed to apply within 5 working days from the declaration of results in the prescribed format with prescribed fee to the Controller of Examinations through the Head of the department. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses.

16.0 PROMOTION POLICIES

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no. 10.

16.1 For students admitted into B.Tech (Regular) program

16.1.1 A student will not be promoted from B.Tech I Year II semester to B.Tech II Year I semester unless s/he fulfills the academic requirement of securing 40% of credits (16) from B.Tech I Year I Sem and B.Tech I Year II Sem semesters examinations, whether or not the candidate takes the examinations.

16.1.2 A student will not be promoted from B.Tech II Year II semester to B.Tech III Year I semester unless s/he fulfills the academic requirement of securing 40% of credits (33) upto B.Tech II Year II semester from all the examinations, whether or not the candidate takes the examinations.

16.1.3 A student will not be promoted from B.Tech III Year II semester to B.Tech IV Year I semester unless s/he fulfills the academic requirement of securing 40% of credits (51) upto B.Tech III Year II semester from all the examinations, whether or not the candidate takes the examinations.

16.1.4 A student shall register for all the 160 credits and earn all the 160 credits. Marks obtained in all the 160 credits shall be considered for the award of the Grade.

16.2 For students admitted into B.Tech (lateral entry students)

16.2.1 A student will not be promoted from B.Tech II Year II semester to B.Tech III Year I semester unless s/he fulfills the academic requirement of securing 40% of credits (18) upto IV semester from all the examinations, whether or not the candidate takes the examinations.

16.2.2 A student will not be promoted from B.Tech III Year II semester to B.Tech IV Year I semester unless s/he fulfills the academic requirement of securing 40% of credits (35) upto B.Tech III Year II semester from all the examinations, whether or not the candidate takes the examinations.

16.2.3 A student shall register for all the 120.5 credits and earn all the 120.5 credits. Marks obtained in all the 120.5 credits shall be considered for the award of the Grade.

17.0 GRADUATION REQUIREMENTS

The following academic requirements shall be met for the award of the B.Tech degree.

17.1 Student shall register and acquire minimum attendance in all courses and secure 160 credits for regular program and 120.5 credits for lateral entry program.

17.2 A student of a regular program, who fails to earn 160 credits within eight consecutive academic years from the year of his/her admission with less than or equal to 4.0 CGPA, shall forfeit his/her degree and his/her admission stands cancelled.

17.3 A student of a lateral entry program who fails to earn 120.5 credits within six consecutive academic years from the year of his/her admission with less than or equal to 4.0 CGPA, shall forfeit his/her degree and his/her admission stands cancelled.

18.0 AWARD OF DEGREE

18.1 Classification of degree will be as follows:

CGPA ≥ 7.5	CGPA ≥ 6.5 and < 7.5	CGPA ≥ 5.0 and < 6.5	CGPA ≥ 4.0 and < 5.0	CGPA < 4.0
First Class with Distinction	**First Class**	**Second Class**	**Pass Class**	**Fail**

18.2 In order to extend the benefit to the students with one/two backlogs after either B.Tech III Year II semester or B.Tech IV Year II semester, GRAFTING option is provided to the students enabling their

placements and fulfilling graduation requirements. Following are the guidelines for the Grafting:

a. Grafting will be done among the courses within the semester shall draw a maximum of 6 marks from the any one of the cleared courses in the semester and will be grafted to the failed course in the same semester.

b. Students shall be given a choice of grafting only once in the 4 years program, either after B.Tech III Year II semester (Option #1) or after B.Tech IV Year II semester (Option #2).

c. Option#1: Applicable to students who have maximum of TWO theory courses in B.Tech III Year I Sem and / or B.Tech III Year II semesters.

Option#2:Applicable to students who have maximum of TWO theory courses in B.Tech IV Year I and / or B.Tech IV Year II semesters.

d. Eligibility for grafting:

i. Prior to the conduct of the supplementary examination after the declaration of B.Tech III Year II or B.Tech IV Year II semester results.

ii. S/he must appear in all regular or supplementary examinations as per the provisions laid down in regulations for the courses s/he appeals for grafting.

iii. The marks obtained by her/him in latest attempt shall be taken into account for grafting of marks in the failed course(s).

18.3 By the end of B.Tech III Year II semester, all the students shall complete the audit courses offered to them with acceptable performance.

All the candidates who register for the semester end examination will be issued grade sheet by the institute. Apart from the semester wise grade sheet, the institute will issue the provisional certificate and consolidated grade sheet subject to the fulfillment of all the academic requirements.

19.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

19.1 A candidate is normally not permitted to break the study. However, if a candidate intends to temporarily discontinue the program in the middle for valid reasons (such as accident or hospitalization due to prolonged ill health) and to rejoin the program after the break from the commencement of the respective semester as and when it is offered, s/he shall apply to the principal in advance. Such application shall be submitted before the commencement of the semester and forwarded through the Head of the department stating the reasons for such withdrawal together with supporting documents and endorsement of his / her parent / guardian.

19.2 The institute shall examine such an application and if it finds the case to be genuine, it may permit the student to rejoin. Such permission is accorded only to those who do not have any outstanding dues like tuition fee etc.

19.3 The total period for completion of the program reckoned from the commencement of the semester to which the candidate was first admitted shall not exceed the maximum period specified in section 17.0. The maximum period includes the break period.

20.0 TERMINATION FROM THE PROGRAM

The admission of a student to the program may be terminated and the student is asked to leave the institute in the following circumstances:

a. The student fails to satisfy the requirements of the program within the maximum period stipulated for that program.

b. A student shall not be permitted to study any semester more than three times during the entire Program of study.

c. The student fails to satisfy the norms of discipline specified by the institute from time to time.

21.0 WITH-HOLDING OF RESULTS

If the candidate has not paid any dues to the institute / if any case of indiscipline / malpractice is pending against him, the results of the candidate will be withheld. The issue of the degree is liable to be withheld in such cases.

22.0 GRADUATION DAY

The institute shall have its own annual Graduation Day for the award of Degrees to students completing the prescribed academic requirements in each case, in consultation with the University and by following the provisions in the Statute. The college shall institute prizes and medals to meritorious students and award them annually at the Graduation Day. This will greatly encourage the students to strive for excellence in their academic work.

23.0 DISCIPLINE

Every student is required to observe discipline and decorum both inside and outside the institute and not to indulge in any activity which will tend to bring down the honor of the institute. If a student indulges in malpractice in any of the theory / practical examination, continuous assessment examinations he/she shall be liable for punitive action as prescribed by the Institute from time to time.

24.0 GRIEVANCE REDRESSAL COMMITTEE

The institute shall form a Grievance Redressal Committee for each department with the two senior faculty and the HOD as the members. This Committee shall solve all grievances related to the courses under consideration.

25.0 TRANSITORY REGULATIONS

A candidate, who is detained or discontinued in a semester, on readmission shall be required to do all the courses in the curriculum prescribed for the batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed such courses in the earlier semester(s) s/he was originally admitted into and substitute subjects are offered in place of them as decided by the Board of Studies. However, the decision of the Board of Studies will be final.

a) Four Year B.Tech Regular course:

A student who is following Jawaharlal Nehru Technological University (JNTUA) curriculum and detained due to shortage of attendance at the end of the first semester shall join the autonomous batch of first semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUA curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses will be offered in place of them as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUA for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUA regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

b) Three Year B.Tech program under Lateral Entry Scheme:

A student who is following JNTUA curriculum and detained due to shortage of attendance at the end of the first semester of second year shall join the autonomous batch of third semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with Lateral Entry regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUA curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester of second year or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses are offered in place of them as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUA for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUA regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

c) Transfer candidates (from non-autonomous college affiliated to JNTUA):

A student who is following JNTUA curriculum, transferred from other college to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses are offered in their place as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUA for the award of degree. The total number of credits to be secured for the award of the degree will be the sum of the credits upto previous semester under JNTUA regulations and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

d) Transfer candidates (from an autonomous college affiliated to JNTUA):

A student who has secured the required credits upto previous semesters as per the regulations of other autonomous institutions shall also be permitted to be transferred to this institute. A student who is transferred from the other autonomous colleges to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The total number of credits to be secured for the award of the degree will be the sum of the credits upto previous semester as per the regulations of the college from which he is transferred and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

26.0 REVISION OF REGULATIONS AND CURRICULUM

The Institute from time to time may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary and on approval by the Academic Council and the Governing Body shall come into force and shall be binding on the students, faculty, staff, all authorities of the Institute and others concerned.

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

B.TECH - PROGRAM OUTCOMES (POS)

PO-1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems (**Engineering Knowledge**).

PO-2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences **(Problem Analysis).**

PO-3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations **(Design/Development of Solutions).**

PO-4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions **(Conduct Investigations of Complex Problems).**

PO-5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations **(Modern Tool Usage).**

PO-6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice **(The Engineer and Society).**

PO-7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development **(Environment and Sustainability).**

PO-8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **(Ethics).**

PO-9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **(Individual and Team Work).**

PO-10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions **(Communication).**

PO-11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO-12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change **(Life-long learning).**

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

1. Who grants Autonomy? UGC, Govt., AICTE or University

In case of Colleges affiliated to a university and where statutes for grant of autonomy are ready, it is the respective University that finally grants autonomy but only after concurrence from the respective state Government as well as UGC. The State Government has its own powers to grant autonomy directly to Govt. and Govt. aided Colleges.

2 Shall CREC award its own Degree?

No. Degree will be awarded by Jawaharlal Nehru Technological University, Anantapuramu with a mention of the name CREC on the Degree Certificate.

3 What is the difference between a Deemed University and an Autonomy College?

A Deemed University is fully autonomous to the extent of awarding its own Degree. A Deemed University is usually a Non-Affiliating version of a University and has similar responsibilities like any

University. An Autonomous College enjoys Academic Autonomy alone. The University to which an autonomous college is affiliated will have checks on the performance of the autonomous college.

4 How will the Foreign Universities or other stake – holders know that we are an Autonomous College?

Autonomous status, once declared, shall be accepted by all the stake holders. The Govt. of Andhra Pradesh mentions autonomous status during the First Year admission procedure. Foreign Universities and Indian Industries will know our status through our website.

5 What is the change of Status for Students and Teachers if we become Autonomous?

An autonomous college carries a prestigious image. Autonomy is actually earned out of our continued past efforts on academic performances, our capability of self- governance and the kind of quality education we offer.

6 Who will check whether the academic standard is maintained / improved after Autonomy? How will it be checked?

There is a built in mechanism in the autonomous working for this purpose. An Internal Committee called Academic Programme Evaluation Committee, which will keep a watch on the academics and keep its reports and recommendations every year. In addition the highest academic council also supervises the academic matters. The standards of our question papers, the regularity of academic calendar, attendance of students, speed and transparency of result declaration and such other parameters are involved in this process.

7 Will the students of CREC as an Autonomous College qualify for University Medals and Prizes for academic excellence?

No. CREC has instituted its own awards, medals, etc. for the academic performance of the students. However for all other events like sports, cultural on co-curricular organized by the University the students shall qualify.

8 Can CREC have its own Convocation?

No. Since the University awards the Degree the Convocation will be that of the University, but there will be Graduation Day at CREC.

9 Can CREC give a provisional degree certificate?

Since the examinations are conducted by CREC and the results are also declared by CREC, the college sends a list of successful candidates with their final Grades and Grade Point Averages including CGPA to the University. Therefore with the prior permission of the University the college will be entitled to give the provisional certificate.

10 Will Academic Autonomy make a positive impact on the Placements or Employability?

Certainly. The number of students qualifying for placement interviews is expected to improve, due to rigorous and repetitive classroom teaching and continuous assessment. Also the autonomous status is more responsive to the needs of the industry. As a result therefore, there will be a lot of scope for industry oriented skill development built-in into the system. The graduates from an autonomous college will therefore represent better employability.

11 What is the proportion of Internal and External Assessment as an Autonomous College?

Presently, it is 70 % external and 30% internal. As the autonomy matures the internal assessment component shall be increased at the cost of external assessment.

12 Is it possible to have complete Internal Assessment for Theory or Practicals?

Yes indeed. We define our own system. We have the freedom to keep the proportion of external and internal assessment component to choose.

13 **Why Credit based Grade System?**
The credit based grade system is an accepted standard of academic performance the world over in all Universities. The acceptability of our graduates in the world market shall improve.

14 **What exactly is a Credit based Grade System?**
The credit based grade system defines a much better statistical way of judging the academic performance. One Lecture Hour per week of Teaching Learning process is assigned One Credit. One hour of laboratory work is assigned half credit. Letter Grades like S,A+,A, B+,B,C,F etc. are assigned for a Range of Marks. (e.g. 90% and above is S, 80 to 89 % could be A+ etc.) in Absolute Grading System while grades are awarded by statistical analysis in relative grading system. We thus dispense with sharp numerical boundaries. Secondly, the grades are associated with defined Grade Points in the scale of 1 to 10. Weighted Average of Grade Points is also defined Grade Points are weighted by Credits and averaged over total credits in a Semester. This process is repeated for all Semesters and a CGPA defines the Final Academic Performance

15 **What are the norms for the number of Credits per Semester and total number of Credits for UG/PG programme?**
These norms are usually defined by UGC or AICTE. Usually around 25 Credits per semester is the accepted norm.

16 **What is a Semester Grade Point Average (SGPA)?**
The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the semester.

$$SGPA = \sum_{i=1}^{n} \left(C_i\, G_i \right) / \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the i^{th} course and $G_i$is the grade point scored by the student in the i^{th} course and i represent the number of courses in which a student registered in the concerned semester. SGPA is rounded to two decimal places.

17 **What is a Cumulative Grade Point Average (CGPA)?**
An up-to-date assessment of overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is weighted average of the grade points obtained in all the courses registered by the students since he entered the Institute.

$$CGPA = \sum_{j=1}^{m} \left(C_j\, S_j \right) / \sum_{j=1}^{m} C_j$$

Where, S_j is the SGPA of the j^{th} semester and $C_j$is the total number of credits upto the semester and *m*represent the number of semesters completed in which a student registered upto the semester. CGPA is rounded to two decimal places.

18 **Is there any Software available for calculating Grade point averages and converting the same into Grades?**
Yes, the institute has its own MIS software for calculation of SGPA, CGPA, etc.

19 **Will the teacher be required to do the job of calculating SGPAs etc. and convert the same into Grades?**
No. The teacher has to give marks obtained out of whatever maximum marks as it is. Rest is all done by the computer.

20 **Will there be any Revaluation or Re-Examination System?**
No. There will double valuation of answer scripts. There will be a makeup Examination after a

reasonable preparation time after the End Semester Examination for specific cases mentioned in the Rules and Regulations. In addition to this, there shall be a 'summer term' (compressed term) followed by the End Semester Exam, to save the precious time of students.

21 How fast Syllabi can be and should be changed?
Autonomy allows us the freedom to change the syllabi as often as we need.

22 Will the Degree be awarded on the basis of only final year performance?
No. The CGPA will reflect the average performance of all the semester taken together.

23 What are Statutory Academic Bodies?
Governing Body, Academic Council, Examination Committee and Board of Studies are the different statutory bodies. The participation of external members in every body is compulsory. The institute has nominated professors from IIT, NIT, University (the officers of the rank of Pro-vice Chancellor, Deans and Controller of Examinations) and also the reputed industrialist and industry experts on these bodies.

24 Who takes Decisions on Academic matters?
The Governing Body of institute is the top academic body and is responsible for all the academic decisions. Many decisions are also taken at the lower level like Boards of Studies. Decisions taken at the Board of Studies level are to be ratified at the Academic Council and Governing Body.

25 What is the role of Examination committee?
The Examinations Committee is responsible for the smooth conduct of internal, End Semester and makeup Examinations. All matters involving the conduct of examinations spot valuations, tabulations preparation of Grade Cards etc, fall within the duties of the Examination Committee.

26 Is there any mechanism for Grievance Redressal?
The institute has grievance redressal committee, headed by Dean - Student affairs and Dean - IQAC.

27 How many attempts are permitted for obtaining a Degree?
All such matters are defined in Rules & Regulation

28 Who declares the result?
The result declaration process is also defined. After tabulation work wherein the SGPA, CGPA and final Grades are ready, the entire result is reviewed by the Moderation Committee. Any unusual deviations or gross level discrepancies are deliberated and removed. The entire result is discussed in the Examinations and Result Committee for its approval. The result is then declared on the institute notice boards as well put on the web site and Students Corner. It is eventually sent to the University.

29 Who will keep the Student Academic Records, University or CREC?
It is the responsibility of the Dean, Academics of the Autonomous College to keep and preserve all the records.

30 What is our relationship with the JNT University?
We remain an affiliated college of the JNT University. The University has the right to nominate its members on the academic bodies of the college.

31 Shall we require University approval if we want to start any New Courses?
Yes, It is expected that approvals or such other matters from an autonomous college will receive priority.

32 Shall we get autonomy for PG and Doctoral Programmes also?
Yes, presently our PG programmes also enjoying autonomous status.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Controller of Examinations.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and

	the examination.	project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Controller of Examinations /Additional Controller of Examinations/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the COE or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the COE or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the Institute premises or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.

9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

R19 - COURSE STRUCTURE

B.Tech I Year 0Semester

S.No	Course Code	Course Name	Subject Aera	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
					L	T	P		CIA	SEE	Total
THEORY &PRACTICALS											
1	19CA56001	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	Foundation	0	0	6	0	-	-	-
2	19CA56002	Career Counseling	MC	Foundation	2	0	2	0	-	-	-
3	19CA56003	Orientation to all branches -- career options, tools, etc.	MC	Foundation	3	0	0	0	-	-	-
4	19CA04001	Orientation on admitted Branch - corresponding labs, tools and platforms	EC	Foundation	1	0	4	0	-	-	-
5	19CA05001	Proficiency Modules & Productivity Tools	ES	Foundation	2	1	2	0	-	-	-
6	19CA56004	Assessment on basic aptitude and mathematical skills	MC	Foundation	1	0	4	0	-	-	-
7	19CA56005	Remedial Training in Foundation Courses	MC	Foundation	2	1	2	0	-	-	-
8	19CA56006	Human Values & Professional Ethics	MC	Foundation	3	0	0	0	-	-	-
9	19CA52001	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	Foundation	2	1	2	0	-	-	-
	TOTAL				**16**	**3**	**22**	**0**	**-**	**-**	**-**

B.Tech I Year I Semester

S.No	Course Code	Course Name	Subject	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
					L	T	P		CIA	SEE	Total
THEORY											
1	19CA54101	Mathematics I	BS	Foundation	3	1	0	4	30	70	100
2	19CA55103	Applied Physics	BS	Foundation	3	0	0	3	30	70	100
3	19CA05101	Problem Solving and Programming	ES	Foundation	3	1	0	4	30	70	100
4	19CA52101	Communicative English I	HS	Foundation	2	0	0	2	30	70	100
5	19CA51103	Environmental Science	AC	Foundation	3	0	0	0	-	-	-
PRACTICAL											
6	19CA03102	Basic Engineering Workshop	LC	Foundation	0	0	2	1	30	70	100
7	19CA55104	Applied Physics Lab	BS	Foundation	0	0	3	1.5	30	70	100
8	19CA05102	Problem Solving and Programming Lab	ES	Foundation	0	0	3	1.5	30	70	100
9	19CA52102	Communicative English I Lab	HS	Foundation	0	0	2	1	30	70	100
	TOTAL				**14**	**2**	**10**	**18**	**240**	**560**	**800**

B.Tech I Year II Semester

S.No	Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max.Marks		
					L	T	P		CIA	SEE	Total
THEORY											
1	19CA54201	Mathematics II	BS	Foundation	3	1	0	4	30	70	100
2	19CA51101	Engineering Chemistry	BS	Foundation	3	0	0	3	30	70	100
3	19CA02203	Principles of Electrical Engineering	ES	Foundation	3	1	0	3	30	70	100
4	19CA03103	Basic Civil & Mechanical Engineering	ES	Foundation	2	1	0	3	30	70	100
5	19CA03101	Engineering Graphics & Design	ES	Foundation	1	0	4	3	30	70	100
6	19CA56201	Constitution of India	AC	Foundation	3	0	0	0	-	-	-
PRACTICAL											
7	19CA04201	Electronics & Communication Engineering Workshop	LC	Foundation	0	0	2	1	30	70	100
8	19CA51102	Engineering Chemistry lab	BS	Foundation	0	0	3	1.5	30	70	100
9	19CA02204	Principles of Electrical Engineering Lab	ES	Foundation	0	0	3	1.5	30	70	100
10	19CA03206	Basic Civil & Mechanical Engineering Lab	ES	Foundation	0	0	3	1.5	30	70	100
	TOTAL				**15**	**3**	**15**	**21.5**	**270**	**630**	**900**

B.Tech II Year I Semester

S.No	Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max.Marks		
					L	T	P		CIA	SEE	Total
THEORY											
1	19CA54301	Mathematics III	BS	Foundation	3	1	0	4	30	70	100
2	19CA58301	Life Sciences for Engineers	BS	Foundation	3	0	0	3	30	70	100
3	19CA04301	Electronic Devices & Circuits	PC	Core	3	0	0	3	30	70	100
4	19CA04302	Random Signals & Systems	PC	Core	3	0	0	3	30	70	100
5	19CA04303	Digital Electronics & Logic Design	PC	Core	3	0	0	3	30	70	100
6	19CA02305	Network Analysis and Transmission Lines	PC	Foundation	3	0	0	3	30	70	100
7	19CA56301	Essence of Indian Traditional Knowledge	AC	Foundation	3	0	0	0	-	-	-
PRACTICAL											
8	19CA04304	Electronic Devices & Circuits Lab	PC	Core	0	0	3	1.5	30	70	100
9	19CA04305	Basic Simulation Lab	PC	Core	0	0	2	1	30	70	100
	TOTAL				**21**	**1**	**5**	**21.5**	**240**	**560**	**800**

B.Tech II Year II Semester

S.No	Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max.Marks		
					L	T	P		CIA	SEE	Total
THEORY											
1	19CA54401	Mathematics-IV	BS	Foundation	3	0	0	3	30	70	100
2	19CA52401	Communicative English II	HS	Foundation	2	0	0	2	30	70	100
3	19CA04401	Electromagnetic Theory	PC	Core	2	1	0	3	30	70	100
4	19CA04402	Analog Electronic Circuits	PC	Core	3	0	0	3	30	70	100
5	19CA53301	Design Thinking & Product Innovation	ES	Foundation	2	1	0	3	30	70	100
6	19CA02401	Control Systems	PC	Core	3	0	0	3	30	70	100
PRACTICAL											
7	19CA04403	Digital Electronics & Logic Design Lab	PC	Core	0	0	2	1	30	70	100
8	19CA04404	Analog Electronic Circuits Lab	PC	Core	0	0	3	1.5	30	70	100
9	19CA52402	Communicative English II Lab	HS	Foundation	0	0	3	1.5	30	70	100
10	19CA04405	Socially Relevant Project-I	PR	Core	0	0	1	0.5	50	0	50

	TOTAL	15	2	9	21.5	320	630	950

B.Tech III Year I Semester

S.No	Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max.Marks		
					L	T	P		CIA	SEE	Total
		THEORY									
1	19CA04501	Antennas & Wave Propagation	PC	Core	3	0	0	3	30	70	100
2	19CA04502	Analog & Digital Communications	PC	Core	3	0	0	3	30	70	100
3	19CA04503	Integrated Circuits & Applications	PC	Core	2	0	0	2	30	70	100
4	19CA04504	Microprocessors & Microcontrollers	PC	Core	3	0	0	3	30	70	100
5		Professional Elective I	PE	Core Elective	3	0	0	3	30	70	100
6		Open Elective I	OE	Open Elective	3	0	0	3	30	70	100
		PRACTICAL									
7	19CA04509	Analog & Digital Communications Lab	PC	Core	0	0	3	1.5	30	70	100
8	19CA04510	Integrated Circuits & Applications Lab	PC	Core	0	0	2	1	30	70	100
9	19CA04511	Microprocessors & Microcontrollers Lab	PC	Core	0	0	3	1.5	30	70	100
10	19CA04512	Socially Relevant Project-II	PR	Project	-	-	-	0.5	50	-	50
	TOTAL				**16**	**1**	**8**	**21.5**	**290**	**560**	**850**

B.Tech III Year II Semester

S.No	Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max.Marks		
					L	T	P		CIA	SEE	Total
		THEORY									
1	19CA04601	Microwave & Optical Communication	PC	Core	2	1	0	3	30	70	100
2	19CA05604	Internet of Things (IoT)	ES	Core	3	0	0	3	30	70	100
3	19CA05505	AI Tools, Techniques and Applications	ES	Core	2	1	0	3	30	70	100
4		Professional Elective II	PE	Core Elective	3	0	0	3	30	70	100
5		Open Elective II	OE	Open Elective	3	0	0	3	30	70	100
6		Humanities Elective I	HS	HS Elective	3	0	0	3	30	70	100
		PRACTICAL									
7	19CA05511	AI Tools, Techniques and Applications Lab	ES	Core	0	0	3	1.5	30	70	100
8	19CA04606	Microwave & Optical Communication Lab	PC	Core	0	0	3	1.5	30	70	100
9	19CA04607	Socially Relevant Project-III	PR	Project	-	-	-	0.5	50	0	50
	TOTAL				**17**	**1**	**6**	**21.5**	**290**	**560**	**850**

B.Tech IV Year I Semester

S.No	Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
					L	T	P		CIA	SEE	Total
THEORY											
1	19CA04701	Digital Signal Processing	PC	Core	2	0	0	2	30	70	100
2	19CA04702	Electronic Measurements & Instrumentation	PC	Core	2	0	0	2	30	70	100
3		Professional Elective III	PE	Core Elective	3	0	0	3	30	70	100
4		Professional Elective IV	PE	Core Elective	3	0	0	3	30	70	100
5		Open Elective III (Inter Disciplinary Elective III)	OE	Open Elective	3	0	0	3	30	70	100
6		Humanities Elective II	HS	HS Elective	3	0	0	3	30	70	100
PRACTICAL											
7	19CA04712	Digital Signal Processing Lab	PC	Core	0	0	2	1	30	70	100
8	19CA04713	Industrial Training /Internship/ Research	PR	Project	-	-	-	2	30	70	100
9	19CA04714	Project Part-I	PR	Project	-	-	-	2	30	70	100
10	19CA04715	Socially Relevant Project-IV	PR	Project	-	-	-	0.5	50	0	50
	TOTAL				**16**	**0**	**2**	**21.5**	**320**	**630**	**950**

B.Tech IV Year II Semester

S.No	Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
					L	T	P		CIA	SEE	Total
THEORY											
1		Professional Elective V (MOOC)	PE	Core Elective	-	-	-	3	30	70	100
2		Open Elective IV (MOOC)	OE	Open Elective	-	-	-	3	30	70	100
3	19CA04805	Project Part II	PR	Project	-	-	-	7	60	140	200
	TOTAL				-	-	-	**13**	**120**	**280**	**400**

PROFESSIONAL ELECTIVE - I

Course Code	Course Title
19CA05301	Data Structures
19CA04505	Electromagnetic Interference & Compatibility
19CA05201	Python Programming
19CA04506	Digital System Design

PROFESSIONAL ELECTIVE -II

Course Code	Course Title
19CA04602	VLSI Design
19CA05401	Computer Organization
19CA04603	Information Theory & Coding
19CA04604	Data Communications & Networking

PROFESSIONAL ELECTIVE -III

Course Code	Course Title
19CA04703	Digital Image Processing
19CA04704	Analog IC Design
19CA04705	Digital Signal Processors & Architectures
19CA04706	Wireless Communications

PROFESSIONAL ELECTIVE -IV

Course Code	Course Title
19CA04707	Speech processing
19CA04708	Embedded System Design
19CA04709	Cellular & Mobile Communications
19CA04710	Digital IC Design

PROFESSIONAL ELECTIVE – V (MOOC)

Course Code	Course Title
19CA04801	Low Power VLSI Design
19CA04802	RF System Design
19CA04803	Radar & Satellite Systems
19CA04804	Cognitive Radio

OPEN ELECTIVE - I

Course Code	Course Title
19CA05403	Java Programming
19CA04513	Embedded Systems
19CA04508	Introduction to MEMS
19CA03202	Material Science and Engineering

OPEN ELECTIVE - II

Course Code	Course Title
19CA03611	Mechatronics
19CA05201	Python Programming
19CA52601	Soft skills
19CA04605	Industrial Automation & Control Systems

OPEN ELECTIVE - III

Course Code	Course Title
19CA05804	Real Time Systems
19CA04706	Wireless Communication
19CA02713	SCADA
19CA03701	Operations Research

OPEN ELECTIVE – IV (MOOC)

Course Code	Course Title
19CA02802	Renewable Energy Sources
19CA04803	Radar & Satellite Systems
19CA03801	Nondestructive Testing
19CA05711	Soft Computing

HS ELECTIVE-I

Course Code	Course Title
19CA53601	Managerial Economics and Financial Analysis
19CA53602	Industrial Engineering and Management
19CA53603	Entrepreneurship and Incubation

HS ELECTIVE-II

Course Code	Course Title
19CA53701	Management Science
19CA53702	Research Methodology
19CA53703	Human Resource Management

MATHEMATICS-I

B.Tech I Year I Semester								
Course code	category	Hours/week			Credits	Maximum Marks		
19CA54101	Foundation	L	T	P	C	CIA	SEE	TOTAL
		3	1	0	4	30	70	100
Contact Classes:48	Tutorial Classes:16		Practical Classes: NIL			Total Classes: 64		

Course Objectives:

The course should enable the students to:

1. This course will illuminate the students in the concepts of calculus and linear algebra.
2. To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

UNIT-I	MATRIX OPERATIONS AND SOLVING SYSTEMS OF LINEAR EQUATIONS	Classes:12

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix.

UNIT-II	QUADRATIC FORMS ANDMEAN VALUE THEOREMS	Classes:13

Quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

Rolle’s Theorem, Lagrange’s mean value theorem, Cauchy’s mean value theorem, Taylor’s and Maclaurin theorems with remainders (without proof).

UNIT-III	MULTIVARIABLE CALCULUS	Classes:13

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers

UNIT-IV	DOUBLE INTEGRALS	Classes:13

Double integrals, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves

UNIT-V	MULTIPLE INTEGRALS AND SPECIAL FUNCTIONS	Classes:13

Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, Beta and Gamma functions and their properties, relation between beta and gamma functions.

Text Books:

1.E.Kreyszig,” Advanced engineering mathematics”,John wiley & Son’s publishers ,New edition.

2.B.S.Grewal,”Higher engineering mathematics”,Khanna publishers, New edition.

Reference Books:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.

Web References:

1.https://www.efunda.com/math/math_home/math.cfm.

2.https://www.ocw.mit.edu/resources/#mathematics.

E-Text Books:

1.https://www.e-booksdirectory.com/detais.php?ebook=10166.

2.https://www.e-booksdirectory.com/details.php?ebook=7400re

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the basic knowledge on the system of equations and evaluate Eigen values & Eigen vectors of a matrix.

CO2: Analyze the nature of the Quadratic forms and solve Mean value theorems

CO3: Evaluate Partial derivatives, Jacobin and demonstrate maxima & minima for functions of single and two variables.

CO4: Evaluate Double integrals and change of order of integration.

CO5: Demonstrate basic knowledge on Beta and Gamma functions and Evaluate of triple integrals.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**2.4**	-	-	-	-	-	-	-	-	-	-	**3**	-

APPLIED PHYSICS

<table>
<tr><td colspan="9">B.Tech I Year I Semester</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">19CA55103</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:48</td><td colspan="3">Tutorial Classes: Nil</td><td colspan="2">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

Course Objectives:
The course should enable the students:

1. To develop students with sufficient knowledge in interference and diffraction and also to know the importance of the optical phenomenon in real time applications.
2. To develop basic concepts of electromagnetic waves and its propagation through optical fibers along with its engineering applications.
3. To know the importance of dielectric and magnetic materials by learning the concepts which lead to design and develop novel materials.
4. To develop students with sufficient knowledge in semiconductors in the functioning of electronic devices.
5. To know the importance of superconductors and nano materials by learning the basic concepts this could be useful to design novel materials in relevant engineering branches

UNIT – I	**WAVE OPTICS**	**Classes: 10**

Interference: Principle of superposition – Interference of light – Conditions for sustained interference – Interference in thin films (in reflected light) – Newton's Rings – Determination of wavelength – Engineering applications of interference.
Diffraction: Principle – Types of diffraction – Difference between interference and diffraction – Fraunhofer diffraction - Single slit and double slit diffraction – Diffraction grating – Grating spectrum – Engineering applications of diffraction.

UNIT – II	**ELECTROMAGNETIC WAVES AND FIBER OPTICS**	**Classes:10**

Electromagnetic waves: Divergence and curl of electric and magnetic fields – Gauss theorem for divergence and Stoke's theorem for curl – Maxwell's equations (quantitative) – Electromagnetic wave propagation (non conducting medium) – Poynting theorem.
Fiber optics: Optical fibers – Total internal reflection – Acceptance angle and numerical aperture –Classification of fibers based on refractive index and material – Modes of propagation of through optical fiber – attenuation and losses of fibers – Block diagram of fiber optic communication system – Optical fibers as sensors – Applications of optical fibers.

UNIT – III	**DIELECTRIC AND MAGNETIC MATERIALS**	**Classes:10**

Dielectrics: Dielectric polarization – Dielectric polarizability – Susceptibility and Dielectric constant – Types of polarizations: Electronic and Ionic (quantitative), Orientation polarizations (qualitative) – Frequency dependence of polarization – Lorentz (internal) field – Claussius - Mosotti equation – Applications of Dielectrics.
Magnetic materials: Magnetic dipole moment – Magnetization – Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Classification of magnetic materials – Hysteresis – soft and hard magnetic materials – Magnetic materials and their applications.

UNIT – IV	**SEMICONDUCTOR PHYSICS**	**Classes:09**

Classification of solids based on energy bands – Intrinsic semiconductors – density of charge carriers – Fermi energy – Electrical conductivity – extrinsic semiconductors – P - type & N - type – Density of charge carriers – Dependence of Fermi energy on carrier concentration and temperature – Drift and diffusion currents – Einstein's relation – Hall effect – Direct and Indirect band gap semiconductors – Formation of PN junction – Forward bias and reverse bias –Applications of Semiconductors.

UNIT – V	SUPERCONDUCTORS AND NANOMATERIALS	Classes:09
Superconductors: Introduction – Properties – Meissner effect – Types of superconductors – BCS Theory – Josephson effect (AC & DC) – Applications of superconductors. Nanomaterials: Significance of nanoscale – Physical, mechanical, magnetic and optical properties of nanomaterials – Synthesis of nanomaterials: top down – ball milling – Bottom up –Chemical vapor deposition – Tools for characterization of nanomaterials : X-ray diffraction (XRD) – Scanning Electron Microscope (SEM) – Applications of nano materials.		
Text books		
1. "A Text book of Engineering Physics" – M. N. Avadhanulu, P. G. Kshirsagar, TVS Arun Murthy, S. Chand Publications, 11th Edition, 2019. 2. Engineering Physics – B. K. Pandy and S.Chaturvedi, Cengage Learning, 2012.		
References		
1. Engineering Physics – K. Thyagarajan, McGraw Hill Publishing Company Ltd, 2016. 2. Engineering Physics – Shatendram Sharma, Jyotsna Sharma, Pearson Education, 2018. 3. Introduction to Electrodynamics – David J. Griffiths, 4th edition, Pearson Education, 2014. 4. "A Text book of Nano Science and Nano Technology" – T Pradeep,Tata Mc GrawHill, 2013.		
COURSE OUTCOMES: **Upon the successful completion of the course, the student will be able to** CO1: **Demonstrate** knowledge and analyze the basic concepts of wave optics & diffractions. CO2: **Apply** the knowledge and analyze the concepts of lasers and fiber optics. CO3: Exhibit the **knowledge** and analyze the dielectrics, magnetic materials. CO4: Apply and **analyze** the basic principles of semiconductors and their applications. CO5:**Analyze** the basic concepts of superconducting materials and applications of nonmaterial's.		

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	2	-	-	-	-	-	-	3	2
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	2	-	-	-	-	-	-	3	2
CO5	3	2	-	-	-	2	-	-	-	-	-	1	3	2
CO	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**2**

PROBLEM SOLVING AND PROGRAMMING

<table>
<tr><td colspan="11">B.Tech I Year I Semester</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">19CA05101</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:48</td><td>Tutorial Classes:16</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes:64</td></tr>
</table>

Course Objectives:
The course should enable the students to:

1. Understand problem solving techniques
2. Understand representation of a solution to a problem
3. Understand the syntax and semantics of C programming language
4. Understand the significance of Control structures
5. Learn the features of C language

UNIT - I	**INTRODUCTION TO COMPUTERS AND C LANGUAGE**	**Classes:13**

Introduction to Computers, Introduction to Programming, Algorithms, Flowcharts, Flow chart symbols, Input/Output, Assignment, operators, conditional if, repetition, function and sub charts. Example problems–Finding maximum of 3 numbers, Unit converters, Interest calculators, multiplication tables, GCD of 2 numbers. Example problems-Fibonacci generation, prime number generation. Minimum, Maximum and average of n numbers, Linear search, Binary Search.
Introduction to C Language, C Language Elements, Variables, Data Types, Operators and Expressions, Constants, Declarations, Operators, Type Conversions, Precedence and Order of Evaluation.

UNIT - II	**CONTROL STATEMENTS, LOOPS AND ARRAYS**	**Classes:12**

Statements: Selection Statements, Iteration Statements, Jump statements: Break, Continue, goto, Arrays: Accessing Array Elements, Single & Multi Dimensional Arrays.

UNIT - III	**STRINGS AND FUNCTIONS**	**Classes:13**

Strings: Declaring, Initialization of a String, Reading and Writing Strings, String manipulation functions from the standard Library, String I/O Functions: gets(), puts().
Functions: Definition, Function Call- Call by Value, Storage Class Specifiers, Understanding the scope of Functions with its Types, the Return Statement, Recursion, Command Line Arguments.

UNIT - IV	**POINTERS, STRUCTURES AND UNIONS**	**Classes:13**

Pointers: Pointer Variables, Pointer Expressions, Pointers And Arrays, Pointers to Strings, Call by Reference, C's Dynamic Allocation Functions, Problems with Pointers.
Structures and Unions: Accessing structure members, Array of structures, Passing Structures to Functions, Structure Pointers, Structures within Structures, Bit Fields, Enumerations, Typedef.

UNIT –V	**FILE I/O**	**Classes:13**

Streams and File, File System Basics: File pointer, opening a file using fopen(), closing a file, getc(), putc(), fclose(), feof(), fputs, fgets(), ferror(), fread(), fwrite(), fseek(), Formatted Console I/O: fprintf, fscanf, the Preprocessor Directives: #define and #include.

Text Books:

1. The Complete Reference C, Fourth Edition, Herbert Schildt, McGraw-Hill Education.
2. The C Programming Language" Second Edition, Brain W. Kernighan, Dennis M. Ritchie, Prentice Hall, India.

References:

1. Programming with C Second Edition, Byron Gottfried, Schaum's outline, McGraw-Hill Education.
2. Computer Fundamentals and C programming, B. L Juneja, A Seth, Cengage Learning India.
3. Programming in C and Data Structures", Hanly, Koffman, Kamthane, Ananda Rao, Pearson.
4. A BOOK ON C, Kelly pohl, Pearson Education.
5. Computer Fundamentals and C Programming, By Dr. P. Chenna Reddy, Pothi.com (Self Publishing).

Web References

1. https://www.tutorialspoint.com/cprogramming/
2. www.studytonight.com/c/
3. fresh2refresh.com/c-programming/
4. www.cprogramming.com/tutorial/c/

E-Text Books:

1. bookboon.com/en/c-cpp-csharp-ebooks
2. electronicsforu.com › Resources › Cool Stuff
3. https://en.wikibooks.org/wiki/C_Programming
4. www.e-booksdirectory.com › Computers & Internet

Outcomes:

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Exhibit the knowledge about the problem solving skills.

CO2: Develop programs using the basic elements like iteration statements, Arrays.

CO3: Apply the code reusability with the help of user defined functions.

CO4: Solve the memory access problems by using pointers and design the programs on structures and unions.

CO5: Apply the basics of file handling mechanism that is essential for understanding the concepts of management systems.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO	**2.4**	**2.8**	**-**	**-**	-	-	-	-	-	-	-	-	-	-

COMMUNICATIVE ENGLISH I

<table>
<tr><td colspan="10">B.Tech I Year I Semester</td></tr>
<tr><td>Course code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA52101</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:32</td><td colspan="2">Tutorial Classes: Nil</td><td colspan="3">Practical Classes: Nil</td><td colspan="3">Total Classes:32</td></tr>
</table>

Course Objectives:
The course should enable the students to:

1. Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers.
2. Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials.
3. Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations.
4. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information.
5. Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing.

UNIT-I **Classes:07**

Listening: Identifyingthe topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Reading for Writing: Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.

Grammar and Vocabulary: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.

Learning Outcomes
At the end of the module, the learners will be able to

- Understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- Ask and answer general questions on familiar topics and introduce oneself/others
- Employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- Recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- Form sentences using proper grammatical structures and correct word forms

UNIT-II **Classes:07**

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts.

Speaking: Discussion in pairs/ small groups on specific topics followed by short structured talks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters.

Grammar and Vocabulary: Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

Learning Outcomes
At the end of the module, the learners will be able to

- comprehend short talks on general topics
- participate in informal discussions and speak clearly on a specific topic using suitable discourse

markers
- understand the use of cohesive devices for better reading comprehension
- write well structured paragraphs on specific topics
- identify basic errors of grammar/ usage and make necessary corrections in short texts

UNIT-III		**Classes:06**

Listening: Listening for global comprehension and summarizing what is listened to.
Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed **Reading:** Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.
Grammar and Vocabulary: Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.
Learning Outcomes
At the end of the module, the learners will be able to
- comprehend short talks and summarize the content with clarity and precision
- participate in informal discussions and report what is discussed
- infer meanings of unfamiliar words using contextual clues
- write summaries based on global comprehension of reading/listening texts
- use correct tense forms, appropriate structures and a range of reporting verbs in speech and writing.

UNIT-IV		**Classes:06**

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
Reading: Studying the use of graphic elements in texts to convey information, reveal 46 trends/patterns/relationships, communicate processes or display complicated data.
Writing: Information transfer; describe, compare, contrast, identify significance/trendsbased on information provided in figures/charts/graphs/tables.
Grammar and Vocabulary:Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms
Learning Outcomes
At the end of the module, the learners will be able to
- infer and predict about content of spoken discourse
- understand verbal and non-verbal features of communication and hold formal/informal conversations
- interpret graphic elements used in academic texts
- produce a coherent paragraph interpreting a figure/graph/chart/table
- use language appropriate for description and interpretation of graphical elements

UNIT-V		**Classes:06**

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides.
Reading: Reading for comprehension.
Writing: Writing structured essays on specific topics using suitable claims and evidences
Grammar and Vocabulary: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)
Learning Outcomes
At the end of the module, the learners will be able to
- take notes while listening to a talk/lecture and make use of them to answer questions
- make formal oral presentations using effective strategies
- comprehend, discuss and respond to academic texts orally and in writing

- produce a well-organized essay with adequate support and detail
- edit short texts by correcting common errors.

Text Books:

Reference Books:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.

Web References:

1 Grammar/Listening/Writing 1-language.com
http://www.5minuteenglish.com/
https://www.englishpractice.com/

Grammar/Vocabulary

English Language Learning Online
http://www.bbc.co.uk/learningenglish/
http://www.better-english.com/
http://www.nonstopenglish.com/
https://www.vocabulary.com/
BBC Vocabulary Games
Free Rice Vocabulary Game

Reading

https://www.usingenglish.com/comprehension/
https://www.englishclub.com/reading/short-stories.htm
https://www.english-online.at/

Listening

https://learningenglish.voanews.com/z/3613
http://www.englishmedialab.com/listening.html

Speaking

https://www.talkenglish.com/
BBC Learning English – Pronunciation tips
Merriam-Webster – Perfect pronunciation Exercises

All Skills

https://www.englishclub.com/
http://www.world-english.org/
http://learnenglish.britishcouncil.org/

Online Dictionaries

Cambridge dictionary online
MacMillan dictionary
Oxford learner’s dictionaries

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate to overcome the barriers in communication process using non-verbal language suitable to different situations in professional life to become effective technical communicator.

CO2: Apply the knowledge on social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information.

CO3: Exhibit the knowledge on cohesive devices for better conversation in informal discussions and speak clearly on a specific topic using suitable discourse markers.

CO4: Apply the concepts of Entrepreneurship Skills and Analyze discourse markers to speak clearly on a specific topic in informal discussions and create a coherent paragraph writing.

CO5: Apply the Knowledge to recognize the need of ability to engage in independent and life-long learning communication effectively in English over speech.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	2	3	-	-	3	3
CO2	3	2	-	-	-	-	-	-	3	3	-	-	3	3
CO3	3	-	-	-	-	-	-	-	2	3	-	-	3	3
CO4	3	2	-	-	-	-	-	-	3	3	-	-	3	3
CO5	3	-	-	-	-	-	-	-	-	3	-	2	3	3
CO	**3**	**2**	-	-	-	-	-	-	**2.5**	**3**	-	**2**	**3**	**3**

ENVIRONMENTAL SCIENCE

<table>
<tr><td colspan="11">B.Tech I Year I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA51103</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Contact Classes:48</td><td>Tutorial Classes:-Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes:48</td></tr>
</table>

Course Objectives:
The course should enable the students:

1. To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.
2. To understand the impacts of developmental activities and mitigation measures along with the environmental policies and regulations.

UNIT-I	**NATURAL RESOURCES**	**Classes:10**

INTRODUCTION: – Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people –Water resources –Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams –benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources.

UNIT-II	**ECOSYSTEMS**	**Classes:10**

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems.

UNIT-III	**BIODIVERSITY AND ITS CONSERVATION**	**Classes:10**

Introduction, Definition, genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity, consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity, habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India –Conservation of biodiversity In-situ and Ex-situ conservation of biodiversity.

UNIT-IV	**ENVIRONMENTAL POLLUTION AND GLOBAL ISSUES**	**Classes:09**

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of: a. Air Pollution, b. Water pollution, c. Soil pollution, d. Marine pollution, e. Noise pollution, f. Thermal pollution, d. Nuclear hazards.

SOLID WASTE MANAGEMENT: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT-V	**HUMAN POPULATION AND THE ENVIRONMENT**	**Classes:09**

Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

FIELD WORK: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site- Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Text Books:

1. Text Book of Environmental Studies for Undergraduate Cources, Erach Bharucha, Universities Press Pvt Ltd, Hyderabad. 2nd Edition 2013.
2. Environmental Studies by Kaushik, New Age Pubilishers.

Reference Books:

1. Environmental Studies by Rajagopalan, Oxford Pubilishers.
2. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: **Demonstrate knowledge** on fundamentals of Environment and Analyze the availability of non-conventional energy resources.

CO2: **Identify appropriate** types of habitats in the surrounding.

CO3: **Analyze** the influence of habitats on survival.

CO4: **Identify** appropriate method of controlling of pollution and design the ecofriendly Techniques.

CO5: **Identify and analyze** environmental problems as well as the risks associated with these problems and efforts to be taken to protect the environment from getting polluted.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	2	-	-	-	2	2	2	-	2	-	-
CO	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**2**	**-**	**2**	**-**	**-**

BASIC ENGINEERING WORKSHOP

B.Tech I Year I Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
19CA03102	**Foundation**	**0**	**0**	**2**	**1**	**30**	**70**	**100**
Contact Classes: Nil	**Tutorial Classes: Nil**		**Practical Classes: 32**			**Total Classes: 32**		

Course Objectives:

The course should enable the students to:

1. Identify and use of tools, types of joints in carpentry, fitting, forming and welding operations.
2. Understand electrical wiring and components.

Any 10 of the following experiments.

CARPENTRY	
Expt. 1	Preparation of dove tail joint as per given taper angle.
Expt. 2	Preparation of lap joint as per given dimensions.
Expt. 3	Preparation of Cross Lap joint as per given taper angle.
FITTING	
Expt. 4	Make a square fit for given sizes.
Expt. 5	Make a V Joint for given dimensions.
Expt. 6	Make a half round fit for given dimensions.
FORMING	
Expt. 7	Prepare the development of a surface and make a rectangular tray.
Expt. 8	Prepare the development of a surface and make a round tin.
WELDING	
Expt. 9	Preparation of V butt joint using Arc welding
Expt. 10	Preparation of Lap joint using Arc welding
Expt. 11	Preparation of T fillet joint using Arc welding
ELECTRICAL WIRING	
Expt. 12	Two bulbs controlled by one switch in series
Expt. 13	Two bulbs controlled by one switch in parallel
Expt. 14	One bulb controlled by 2 Two way switches

References:

1. K. C. John, “Mechanical Workshop Practice”, PHI, 2nd Edition, 2010.
2. H.S. Bawa, “Workshop Practice”, Tata McGraw Hill Publishing Company Limited, 2nd Edition 2009.
3. S. K. Hajra Choudhury, A. K. Hajra Choudhury, “Elements of Workshop Technology”, Media Promoters, 1st Edition, 2009.
4. Engineering Work shop practice for JNTU, V. Ramesh Babu, VRB Publishers Pvt. Ltd., 2009
5. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on differ tools used in carpentry, fitting, forming, welding and electrical wiring.

CO2: Analyze the basic the knowledge on differ tools used in carpentry, fitting, forming, welding and electrical wiring.

CO3: Apply the knowledge on differ tools used in carpentry, fitting, forming, welding and electrical wiring.

CO4: Follow ethical values during conducting of Experiments.

CO5: Work individually or in a team effectively.

CO6: Communicate verbally and in written form pertaining to results of the Experiments.

CO7: Perform experiments involving physical Phenomena in future years.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO7	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**-**	**-**

APPLIED PHYSICS LAB

<table>
<tr><td colspan="9">B.Tech I Year I Semester</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">19CA55104</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td colspan="3">Tutorial Classes: Nil</td><td colspan="2">Practical Classes: 32</td><td colspan="3">Total Classes: 32</td></tr>
</table>

Course Objectives:
The course should enable the students to:

1. To understand the basic principles of interference, diffraction.
2. To understand the role of optical fiber parameters in communication.
3. To recognize the importance of energy gap in the study of conductivity and Hall effect in a semiconductor.
4. To illustrate the magnetic and dielectric materials applications.
5. To apply the principles of semiconductors in various electronic devices.

Any 10 of the following experiments.

Expt. 1	Determination of thin object using wedge method
Expt. 2	Determination of radius of curvature of plano-convex lens - Newton's rings
Expt. 3	Determination of wavelength of different colors using grating
Expt. 4	Determination of dispersive power a diffraction grating.
Expt. 5	Determination of resolving power of a grating.
Expt. 6	Determination of dielectric constant by charging and discharging method
Expt. 7	Determination of magnetic field along the axis of a circular coil carrying current.
Expt. 8	Determination of self inductance of the coil (L) using Anderson's bridge.
Expt. 9	Study the variation of B versus H by magnetizing the magnetic material using B-H curve method.
Expt. 10	Determination of numerical aperture and acceptance angle of given optical fiber.
Expt. 11	Measurement of magnetic susceptibility by Gouy's method.
Expt. 12	Determination of Charge density and Hall coefficient or magnetic flux density – Hall effect.
Expt. 13	Determination of resistivity of semiconductor by four probe method
Expt. 14	Determination of Band gap of semiconductor
Expt. 15	Measurement of resistance with varying temperature

References:

1. A Text book of practical physics – S. Balasubramanian, M. N. Srinivasan, S. Chand Publishers, 2017
2. http://vlab.amrita.edu/index/php - virtual labs, Amrita University.

COURSE OUTCOMES:
Upon the successful completion of the course, the student will be able to

CO1: **Demonstrate** on various optical instruments, material properties and magnetic properties.
CO2: **Analyze** the various magnetic properties, material properties.
CO3: **Formulate** the properties of dielectric materials and optical fiber materials.
CO4: **Follow ethical** values during conducting of Experiments.
CO5: **Work individually** or in a team effectively.
CO6: **Communicate** verbally and in written form pertaining to results of the Experiments.
CO7: **Perform** experiments involving physical Phenomena in future years.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	-	3	-	-	-		-	-	-	-	3	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

PROBLEM SOLVING AND PROGRAMMING LAB

B.Tech I Year I Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
19CA05102	Foundation	L	T	P	C	CIA	SEE	Total
		0	0	3	1.5	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil			Practical Classes: 48		Total Classes: 48		

Course Objectives:
The course should enable the students to:

1. To learn C Programming language.
2. To make the student solve problems, implement algorithms using C language.
3. To write diversified solutions using C language.

Design an algorithm and construct a flow chart using Raptor tool and then write programs for the following problems.

LIST OF PROGRAMS

Week -l BASIC C PROGRAMS

Write C program to
1. Find the Sum of three numbers.
2. Exchange (swap) of two numbers by using third variable.
3. Exchange (swap) of two numbers without using third variable.
4. Print the size of all data types.

Week - 2 BASIC C PROGRAMS

a). Develop a calculator to convert time, distance, area, volume and temperature from one unit to another.

b). Write a C program to find the Priority and associativity of operators using expressions. Take the expressions with different operators.

c). Write a C program to swap two numbers using bitwise operators.

Week - 3 CONTROL STATEMENTS

a) Write a C program to find whether the given number is odd or even.
b) Write a C program to find the Maximum and minimum of N numbers.
c) Write a C program to find the Maximum of three numbers.
d) Write a C program to print 'hello world' without using semicolon.
e) Write a C program to find whether the given number is odd or even using bitwise operator.
f) Write a C program to find the maximum of two numbers using Conditional operator.
g) Write a program which takes two integers and one arithmetic operator from the user, and performs the operation and then prints the result by using **switch-case**.(Operators : +, -, *, /, %)

Week -4 ITERATION STATEMENTS

a) Write a C program to generate the required multiplication table.
b) Write a C program to find the Factorial of a given number.
c) Write a C program to check whether the given number is prime or not.
d) Write a C program to find GCD

Week - 5 ITERATION STATEMENTS

a) Write a C program to find the sum of the digits of a number.
b) Write a C program to find whether the given integer is a Palindrome or not.
c) Write a C program to generate Fibonacci numbers in the given range.

Week - 6 NESTED LOOPS

a) Write a C program to print the following pattern.

```
1
2 2
```

3 3 3 b) Print multiplication tables upto the given table. c) Write a C program to print Series of prime numbers in the given range.	
Week - 7	**NESTED LOOPS**
a) Write a C program to check given number is strong number or not. b) Write a C program to evaluate the sum of the following series up to 'n' terms $e^x = 1 + x + x^2/2! + x^3 /3! + x^4 /4! +$ --------	
Week - 8	**ARRAYS**
a).calculate the maximum, minimum and average of N numbers. b).Write a C program to find the sum of positive and negative numbers in a given set(Array) of numbers. c).Design a flowchart to perform Linear search on list of N unsorted numbers(Iterative and recursive) d)Write a C program to read two matrices and find i) Sum. ii) Product and display the result in the matrix form.	
Week -9	**ARRAYS**
a) Write a C program to read matrix and perform the following operations i) Find the sum of Diagonal Elements of a matrix. ii) Print Transpose of a matrix. iii) Print sum of even and odd numbers in a given matrix.	
Week - 10	**STRINGS**
a) Write a C program to read two strings and perform the following operations without using built-in string Library functions. i) String length determination. ii) Compare Two Strings. iii) Concatenate Two Strings. iv) String reversing b) Write a C program to accept a line of characters and print the number of Vowels, Consonants, blank spaces, digits and special characters. c) Write a C program to read a set of strings and sort them in alphabetical order.	
Week -11	**FUNCTIONS**
a) Write a C program to illustrate the following types of functions i) Function with no arguments and no return values ii) Function with arguments and no return value iii) Function without arguments and with return value iv) Function with arguments and with return value	
Week - 12	**POINTERS**
a) Write a C program to exchange two numbers using pointers. b) Write a program to print the elements of an array in reverse order using pointers.	
Week - 13	**FUNCTIONS**
a) Write a C program to express a four digit number in words. For example 1546 should be written as one thousand five hundred and forty six b) Write a C program using recursion for finding Factorial of a number c). calculate the greatest common divisor using iteration and recursion for two numbers as specified by the user d).Write a C program to illustrate the Dynamic Memory allocation function malloc( )	

Week -14 **STRUCTURES**

a) Declare a structure time that has three fields hr, min, secs. Create two structure variables start_time and end_time. Input there values from the user. Then if start_time is not equal to end_time then display HELLO CREC on the screen.
b) Write a C program to read student roll no, name and marks in six subjects for n number of students and give class of each student by following the required conditions.
c) Write a C program to demonstrate self referential structures.

Week -15 **FILES**

a) Write a program to create a file and write some text data on the file. Then display the contents of the file and also print number of characters, number of words, number of lines in the file.
b) Write a C program to merge two files.

Week -16 **FILES**

a) Write a C program to create a text file and write data on it, then display every 5th character in that file.
b) Write a program to read student records into a file. Record consists of rollno, name and marks of a student in six subjects and class. Class field is empty initially. Compute the class of a student. The calculation of the class is as per CREC rules. Write the first class, second class, third class and failed students lists separately to another file.

References:

1. How to Solve it by Computer, R.G. Dromey, Pearson.
2. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, Pearson.
3. Let us C, Yeswant Kanetkar, BPB publications
4. Pointers in C, Yeswant Kanetkar, BPB publications.
5. Programming in C and Data Structures, J.R.Hanly, Ashok N.Kamthane and A.Ananda Rao,Pearson Education.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Apply the Knowledge to design the algorithm and flowchart for the given problem
CO2: Analyze the concepts of control statements and arrays
CO3: Design the programs for functions and strings
CO4: Solve the memory access problems by using pointers and design the programs on structures and unions
CO5: Select appropriate procedure to solve given problem
CO6: Follow the ethical principles in implementing the programs
CO7: Do experiments effectively as an individual and as a team member in a group.
CO8: Communicate verbally and in written form, the understandings about the experiments.
CO9: Continue updating their skill related to loops, pointers and files Implementing programs in future.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-		-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO7	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**-**	**-**

COMMUNICATIVE ENGLISH - I LAB

B.Tech I Year I Semester

Course Code	Category	Hours/week			Credits	Maximum Marks		
19CA52102	Foundation	L	T	P	C	CIA	SEE	TOTAL
		0	0	2	1	30	70	100

Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes:32	Total Classes:32

OBJECTIVES:

The course should enable the :

1. students will be exposed to a variety of self instructional, learner friendly modes of language learning.
2. students will cultivate the habit of reading passages from the computer monitor. Thus providing them with the required facility to face computer based competitive exams like GRE, TOEFL, and GMAT etc.
3. students will learn better pronunciation through stress, intonation and rhythm.
4. students will be trained to use language effectively to face interviews, group discussions, public speaking.
5. students will be initiated into greater use of the computer in resume preparation, report writing, format making etc.

UNIT-I | **Classes:07**

1. Phonetics for listening comprehension of various accents
2. Reading comprehension
3. Describing objects/places/persons

Learning Outcomes

At the end of the module, the learners will be able to

- understand different accents spoken by native speakers of English
- employ suitable strategies for skimming and scanning on monitor to get the general idea of a text and locate specific information
- learn different professional registers and specific vocabulary to describe different persons, places and objects.

UNIT-II | **Classes:07**

1. JAM
2. Small talks on general topics
3. Debates

Learning Outcomes

At the end of the module, the learners will be able to

- produce a structured talk extemporarily
- comprehend and produce short talks on general topics
- participate in debates and speak clearly on a specific topic using suitable discourse markers.

UNIT-III | **Classes:07**

1. Situational dialogues – Greeting and Introduction
2. Summarizing and Note making
3. Vocabulary Building

Learning Outcomes

At the end of the module, the learners will be able to

- Learn different ways of greeting and introducing oneself/others
- summarize the content with clarity and precision and take notes while listening to a talk/lecture and make use of them to answer questions
- replenish vocabulary with one word substitutes, homonyms, homophones, homographs to reduce errors in speech and writing.

UNIT-IV | **Classes:07**

1. Asking for Information and Giving Directions

2. Information Transfer
3. Non-verbal Communication – Dumb Charade

Learning Outcomes

At the end of the module, the learners will be able to

- Learn different ways of asking information and giving directions
- Able to transfer information effectively
- understand non-verbal features of communication.

UNIT-V		**Classes:06**

1. Oral Presentations
2. Précis Writing and Paraphrasing
3. Reading Comprehension and spotting errors

Learning Outcomes

At the end of the module, the learners will be able to

- make formal oral presentations using effective strategies
- learn different techniques of précis writing and paraphrasing strategies
- comprehend while reading different texts and edit short texts by correcting common errors

Minimum Requirements for ELCS Lab:

The English Language Lab shall have two parts:

1. Computer Assisted Language Learning (CALL) Lab: The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self study by learners.
2. The Communication Skills Lab with movable chairs and audio-visual aids with a P.A. system, Projector, a digital stereo-audio & video system and camcorder etc.

System Requirement (Hardware component):
Computer network with LAN with minimum 60 multimedia systems with the following specifications:

i) P – IV Processor
 a) Speed – 2.8 GHZ
 b) RAM – 512 MB Minimum
 c) Hard Disk – 80 GB
ii) Headphones of High quality

Suggested Software:

1. Clarity Pronunciation Power – Part I (Sky Pronunciation)
2. Clarity Pronunciation Power – part II
3. K-Van Advanced Communication Skills
4. Walden InfoTech Software.

References:

1. A Textbook of English Phonetics for Indian Students 2nd Ed T. Balasubramanian. (Macmillian),2012.
2. A Course in Phonetics and Spoken English, Dhamija Sethi, Prentice-Hall of India Pvt .Ltd
3. Speaking English Effectively, 2nd Edition Krishna Mohan & NP Singh, 2011. (Mc Millan).
4. A Hand book for English Laboratories, E. Suresh Kumar, P. Sreehari, Foundation Books, 2011
5. Spring Board Succes, Sharada Kouhik, Bindu Bajwa, Orient Blackswan, Hyderabad, 2010.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Exhibit the skills on the different aspects of the English Language proficiency with emphasis on LSRW skills.

CO2: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking by group discussion.

CO3: Conduct investigation and Analyze communication ability

CO4: Use of modern computing facilities and suitable software tools to improve communication skills and elocution.

CO5: Follow ethical principles in listening, writing, presenting and communicative ability towards jobs.

CO6: Do experiments effectively as an individual and as a member in a group.

CO7: Communicate verbally and in written form, the understandings about the experiments.

CO8: Continue updating their written communication skills among learners for both academic and professional purposes during their life time.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	3		-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO	**3**	**3**	**-**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

MATHEMATICS II

B.Tech I Year II Semester								
Course Code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
19CA54201	**Foundation**	**3**	**1**	**0**	**4**	**30**	**70**	**100**
Contact Classes:48	**Tutorial Classes:16**	**Practical Classes: NIL**				**Total Classes:64**		

Course Objectives:

The course should enable the students:

1. To enlighten the learners in the concept of differential equations and multivariable calculus.
2. To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

UNIT-I	**LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER**	**Classes:13**

Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.

UNIT-II	**EQUATIONS REDUCIBLE TO LINEAR DIFFERENTIAL EQUATIONS AND APPLICATIONS**	**Classes:13**

Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients, Applications: Mass spring system and L-C-R Circuit problems.

UNIT-III	**PARTIAL DIFFERENTIAL EQUATIONS – FIRST ORDER**	**Classes:13**

First order partial differential equations, solutions of first order linear and non-linear PDEs. Solutions to homogenous and non-homogenous higher order linear partial differential equations

UNIT-IV	**MULTIVARIABLE CALCULUS (VECTOR DIFFERENTIATION)**	**Classes:13**

Scalar and vector point functions, vector operator del, del applies to scalar point functions- Gradient, del applied to vector point functions- Divergence and Curl, vector identities.

UNIT-V	**MULTIVARIABLE CALCULUS (VECTOR INTEGRATION)**	**Classes:12**

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and its applications.

Text Books:

1. E.Kreyszig," Advanced engineering mathematics", John wiley & Son's publishers ,New edition.
2. B.S.Grewal,"Higher engineering mathematics", Khanna publishers, New edition.

Reference Books:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
5. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.

Web References:

1.https://www.efunda.com/math/math_home/math.cfm.
2.https://www.ocw.mit.edu/resources/#mathematics.

E-Text Books:

1.https://www.e-booksdirectory.com/detais.php?ebook=10166.
2.https://www.e-booksdirectory.com/details.php?ebook=7400re

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Solve Linear Differential Equations of Higher Order in the field of engineering course.
CO2: Analyze first and second order ODE in the field of engineering course (spring system and L-C-R Circuit problems).
CO3: Evaluate partial differential equations.

CO4: Analyze of Vector calculus: vector operator’s del - Gradient, Divergence and Curl, vector identities.
CO5: Solve Vector integrals and it’s Applications.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	1	-	-	-	-	-	-	3	1
CO2	3	3	-	-	-	1	-	-	-	-	-	-	3	1
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	-	2	-	-	-	-	-	-	3	2
CO	**3**	**2.4**	**-**	**-**	**-**	**1.3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1.3**

ENGINEERING CHEMISTRY

<table>
<tr><td colspan="11">B.Tech I Year II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA51101</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 48</td><td colspan="2">Tutorial Classes: NIL</td><td colspan="3">Practical Classes: NIL</td><td colspan="3">Total Classes: 48</td></tr>
</table>

Course Objectives:

The course should enable the students:

1. To familiarize engineering chemistry and its applications
2. To train the students on the principles and applications of electrochemistry and polymers
3. To identify the constituents of Portland cement
4. To Calculate the hardness of water

UNIT-I WATER TECHNOLOGY — Classes:08

Introduction –Soft Water and hardness of water, Estimation of hardness of water by EDTA Method - Boiler troubles - scale and sludge, Industrial water treatment – specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, zeolite and ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

UNIT-II ELECTROCHEMISTRY AND APPLICATIONS: — Classes:10

Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations.

Primary cells –Leclanche cell, Li Battery.

Secondary cells – lead acid, and lithium ion batteries- working of the batteries including cell reactions.

Fuel cells- Basic Principles and Working Principles of hydrogen-oxygen, methanol fuel cells

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion,_cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

UNIT-III POLYMERS AND FUEL CHEMISTRY — Classes:12

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth and coordination polymerization.

Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of PVC and Bakelite.

Elastomers – Preparation, properties and applications of Buna S, Buna N, Thiokol.

Fuels – Types of fuels, calorific value, numerical problems based on calorific value; Analysis of coal, Liquid Fuels refining of petroleum, fuels for IC engines, knocking and anti-knock agents, Octane and Cetane values, cracking of oils; alternative fuels- propane, methanol and ethanol, bio fuels.

UNIT-IV ADVANCED ENGINEERING MATERIALS — Classes:10

Composites- Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications.

Refractories- Classification, Properties, Factors affecting the refractory materials and Applications.

Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils and Applications.

Building materials- Portland Cement, constituents, phases and reactivity of clinker, Setting and Hardening of cement.

UNIT-V SURFACE CHEMISTRY AND APPLICATIONS — Classes:08

Introduction to surface chemistry, colloids, micelle formation, synthesis of colloids (any two methods with examples), chemical and electrochemical methods (not more than two methods) of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, solid-gas interface, solid-liquid interface, adsorption isotherm, applications of colloids and nanomaterials –

catalysis, medicine, sensors.

Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.
2. K N Jayaveera, G V Subba Reddy and C Rama Chandraiah, Engineering Chemistry 1/e Mc Graw Hill Education (India) Pvt Ltd, New Delhi 2016.

Reference Books:

1. J. D. Lee, Concise Inorganic Chemistry, 5/e, Oxford University Press, 2008.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.
3. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
4. Ben L. Feringa and Wesley R. Browne, Molecular Switches, 2/e, Wiley-VCH, 2011.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: **Differentiate** hard and soft water. Analyze the disadvantages using hard water and apply suitable treatments domestically and industrially.

CO2: **Apply the knowledge** of the various materials to construction of batteries, and electrochemical sensors as well as prevention methods of corrosion.

CO3: **Display the knowledge on the preparation**, of thermoplastic and thermo setting elastomers and conducting polymers.

CO4: **Exhibits the knowledge** on setting and Harding of cement and concrete phase.

CO5: **Summarize** the concept of colloids and nanomaterials in various applications (sensors and catalysis).

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO3	2	2	-	-	-	2	2	-	-	-	-	-	-	-
CO4	3	3	-	-	-	2	2	-	-	-	-	-	-	-
CO5	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO	**2.6**	**2.2**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

PRINCIPLES OF ELECTRICAL ENGINEERING

B.Tech I Year II Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
19CA02203	Foundation	L	T	P	C	CIA	SEE	TOTAL
		3	1	0	3	30	70	100
Contact Classes:48	Tutorial Classes: 16		Practical Classes: Nil			Total Classes: 64		

Course Objectives:

The course should enable the students:

1. To introduce basics of electric & magnetic circuits.
2. To teach DC and AC electrical circuit analysis.
3. To explain working principles of transformers and electrical machines.
4. To impart knowledge on low voltage electrical installations

UNIT – I	DC CIRCUITS	Classes: 12

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems, Maximum power transfer theorem & Reciprocity theorem - Time-domain analysis of first-order RL and RC circuits.

UNIT – II	AC CIRCUITS	Classes: 12

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), Concept of Resonance in series & parallel circuits, bandwidth and quality factor, Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT – III	TRANSFORMERS	Classes: 15

Magnetic materials, BH characteristics, Mutual coupled circuits, Dot Convention in coupled circuits, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency, Auto-transformer and three –phase transformers connections.

UNIT – IV	ELECTRICAL MACHINES	Classes: 15

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor, Single-phase induction motor, construction, working, torque- speed characteristic and speed control of separately excited dc motor, construction and working of synchronous generators.

UNIT – V	ELECTRICAL INSTALLATIONS	Classes: 14

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing, Types of Batteries, Important Characteristics for Batteries, Elementary calculations for energy consumption, power factor improvement and battery backup.

Text Books:

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.

References

1. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
2. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
3. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Web References:

1. Youtube: http-sewor,Carleton.cag,kardos/88403/drawings.html conic sections-online, red woods.edu

E-Text Books:

1. https://www.wiziq.com/tutorial/219645-ENGINEERING-DRAWING-BOOK

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate knowledge on basic circuit components and basic concepts of electrical engineering, Analyze Circuits by different network reduction techniques

CO2: determine and analyze different parameters of periodic waveforms and Analyze the steady state analysis of R, L,C circuits.

CO3: Exhibit the knowledge on various transformers

CO4: Demonstrate knowledge on Construction and performance of machines and analyze losses methods

CO5: Analyze the principles of electrical installations

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**3**	-	-	-	-	-	-	-	-	-	-	-	-

ENGINEERING GRAPHICS AND DESIGN LAB

B.Tech I Year II Semester									
Course Code	Category	Hours/Week			Credits	Maximum Marks		
19CA03101	Foundation	L	T	P	C	CIA	SEE	TOTAL
		1	0	4	3	30	70	100
Contact Classes:16	Tutorial Classes: Nil			Practical Classes: 64		Total Classes: 80		

Course Objectives:
The course should enable the students to:

1. Bring awareness that Engineering Drawing is the Language of Engineers.
2. Trained in Engineering Graphics concepts using Auto CAD.
3. Teach the practices for accuracy and clarity in presenting the technical information.
4. Develop the engineering imagination essential for successful design.
5. Instruct the utility of drafting & modeling packages in orthographic and isometric drawings.
6. Train the usage of 2D and 3D modeling.

UNIT – I	INTRODUCTION TO AUTO CAD AND ENGINEERING GRAPHICS	Classes: 16

Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions. Dimensioning principles and conventional representations.

Orthographic Projections: Systems of projections, conventions and application to orthographic projections. Principles of Engineering Graphics and their significance-Conventions in drawing-lettering - BIS conventions.

a) Conic sections including the rectangular hyperbola- general method only.
b) Cycloid, epicycloid and hypocycloid.

UNIT – II	PROJECTION OF POINTS & LINES	Classes: 16

Projection of points: Positions, notation system and projections in any quadrant.
Projection of Lines: Projection of lines parallel to one plane and perpendicular to the other, parallel to both planes, inclined to one plane or both planes.

UNIT – III	PROJECTIONS OF PLANES AND SOLIDS	Classes: 16

Projection of planes: Parallel to on plane and perpendicular to the other, perpendicular to both planes, inclined to one or both planes.

Projection of solids: Projections of regular solids inclined to one or both planes by rotational or auxiliary views method.

UNIT – IV	SECTIONS AND DEVELOPMENTS OF SOLIDS	Classes: 16

Sections of solids: Sectional planes and sectional view of regular solids-Prism, cylinder, cone and pyramids.
Development of Solids: Development of surfaces of regular solids-Prism, cylinder, cone andf pyramids.

UNIT – V	ISOMETRIC PROJECTIONS	Classes: 16

Principles of isometric projection- Isometric scale; Isometric views: planes, simple solids. Conversion of orthographic to isometric view.

Text Books:

1. D.M Kulkarni, A.P. Rastogi and A.M. Sarkar, Engineering Graphics with Auto CAD, PHI learning Private Limited, New Delhi 2009.
2. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
3. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

References

1. Dhanajay A Jolhe, Engineering Drawing: with an introduction to Auto CAD, Tata McGraw-Hill, 2008
2. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009
3. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

Web References:

1. Youtube: http-sewor,Carleton.cag,kardos/88403/drawings.html conic sections-online, red woods.edu

E-Text Books:

1. https://www.wiziq.com/tutorial/219645-ENGINEERING-DRAWING-BOOK

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Understand the concepts of Conic Sections, cycloidal curves and the application of industry standards.

CO2: Understand the Orthographic Projections of Points and Lines and are able to improve their visualization skills so that they can apply these skills in developing the new products.

CO3: Understand and apply Orthographic Projections of Planes wherever necessary.

CO4: Understand and analyze the Orthographic Projections of Solids.

CO5: Employ freehand 3D pictorial sketching to aid in the visualization process and efficiently communicate ideas graphically.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	2	-	-	1	-	-	-	-	-
CO2	2	-	-	-	-	2	-	-	1	-	-	-	-	-
CO3	2	-	3	2	1	-	-	-	3	-	-	-	-	-
CO4	-	2	3	-	-	2	-	-	3	-	-	-	-	-
CO5	2	-	2	-	-	2	-	-	2	-	-	-	-	-
CO	**2**	**2**	**2.6**	**2**	**1**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**

CONSTITUTION OF INDIA

B.Tech I Year II Semester									
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
19CA56201	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		3	**0**	**0**	**0**	**-**	**-**	**-**
Contact Classes:48	**Tutorial Classes:Nil**	**Practical Classes: Nil**				**Total Classes:48**		

Course Objectives:
The course should enable the students:

1. To realize the significance of constitution of India to students from all walks of life and help them to understand the basic concepts of Indian constitution.
2. To identify the importance of fundamental rights as well as fundamental duties.
3. To understandthefunctioningofUnion,StateandLocalGovernmentsinIndianfederalsystem.
4. To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure.

UNIT I	**INTRODUCTION TO CONSTITUTION**	**Classes:10**

Meaning and importance of the Constitution, salient features of Indian Constitution. Preamble of the Constitution. Fundamental rights- meaning and limitations. Directive principles of state policy and Fundamental duties-their enforcement and their relevance.

UNIT II	**UNION GOVERNMENT**	**Classes:10**

Union Executive- President, Vice-president, Prime Minister, Council of Ministers. Union Legislature-Parliament and Parliamentary proceedings. Union Judiciary-Supreme Court of India–composition and powers and functions.

UNIT III	**STATE GOVERNMENT**	**Classes:10**

State Executive-Governor, Chief Minister, Council of Ministers. State Legislature-State Legislative Assembly and State Legislative Council. State Judiciary-High court.

UNIT IV	**LOCAL GOVERNMENT**	**Classes:09**

Local Government-Panchayat raj system with special reference to 73rd and Urban Local Self Govt. withspecialreferenceto74thAmendment.

UNIT V	**ELECTION PROVISIONS, EMERGENCY PROVISIONS, AMENDMENT OF THE CONSTITUTION**	**Classes:09**

Election Commission of India-composition, powers and functions and electoral process. Types of emergency-grounds, procedure, duration and effects. Amendment of the constitution- meaning, procedure and limitations.

Text Books:

1. M.V.Pylee,"IntroductiontotheConstitutionofIndia",4thEdition,Vikaspublication,2005.
2. Durga Das Basu (DD Basu),"Introduction to the constitution of India",(Student Edition),19th edition,Prentice-Hall EEE,2008.

References:

1. Merunandan,"MultipleChoiceQuestionsonConstitutionofIndia",2ndEdition,Meagapublication,2007.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Understand and explain the significance of Indian Constitution as the fundamental law of the land.

CO2: Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building.

CO3: Analyze the Indian political system, the powers and functions of the Union and State Governments in detail

CO4: Analyze the Indian political system, the powers and functions of the Local Governments in detail.

CO5: Understand Electoral Process, Emergency provisions and Amendment procedure.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**2.4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

ELECTRONICS & COMMUNICATION ENGINEERING WORKSHOP

B.Tech I Year II Semester								
Course Code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
19CA04201	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		0	**0**	**2**	**1**	**30**	**70**	**100**
Contact Classes:-	**Tutorial Classes :NIL**		**Practical Classes: 32**			**Total Classes:32**		

Course Objectives:

The course should enable the students:

1. To know about different tools, abbreviations and symbols in Electrical Engineering
2. To learn about types of measuring instruments to measure electrical quantities
3. To gain knowledge on different types of earthing and earth resistance
4. To study different types of wiring

EXP.1	Study of Introduction to Electrical tools, symbols and abbreviations
EXP.2	Study of types of sizes of wires and making "T" joint and straight joint for wires
EXP.3	Measurements of Electrical quantities (like Voltage, Current, Power, Power factor in RLC circuits)
EXP.4	Study of measurements of Energy (using Single phase and Three phase Energy meter) by connecting different loads
EXP.5	Study of earthing and measurement of earth resistance
EXP.6	Study and performance of residential wiring (using Energy meter, Fuses, Switches, Indicator, Lamps, etc.)
EXP.7	Study of Fluorescent lamp wiring
EXP.8	Study of various electrical gadgets (CFL and LED)
EXP.9	Study of PV Cell
EXP.10	Study of Induction motor and Transformer
EXP.11	Assembly of choke or small transformer
EXP.12	Study of trouble shooting of electrical equipments (fan, iron box, mixer-grinder, etc.)
EXP.13	Measurement of wire guages using guage meter

References:

1. Lab manual of Electrical Engineering by TTTI, Chennai

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on the basics of various electrical and electronic experiments

CO2: Analyze the concepts of the basics of various electrical and electronic experiments

CO3: Conduct investigation and test the functionality of various electrical and electronic experiments

CO4: Follow ethical principles in doing experiments.

CO5: Do experiments effectively as an individual and as a member in a group.

CO6: Communicate verbally and in written form, the understandings about the experiments.

CO7: Continue updating their skill related to electronics for various applications during their life time.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3		-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO5	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-		3	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

ENGINEERING CHEMISTRY LAB

B.Tech I Year II Semester								
Course Code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
19CA51102	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		0	**0**	**3**	**1.5**	**30**	**70**	**100**
Contact Classes: Nil	**Tutorial Classes: NIL**	**Practical Classes: 48**				**Total Classes:48**		

Course Objectives:
The course should enable the students to:

1. Verify the fundamental concepts with experiments

EXP.1	Determination of Hardness of a groundwater sample
EXP.2	PH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base
EXP.3	Estimation of dissolved oxygen in water by Winkler's method.
EXP.4	Determination of Alkalinity of water sample
EXP.5	Estimation of Ferrous ion by dichrometry.
EXP.6	Estimation of copper by EDTA method
EXP.7	Preparation of Polymer
EXP.8	Determination of cell constant and conductance of solutions
EXP.9	Potentiometry - determination of redox potentials and emfs
EXP.10	Determination of Strength of an acid in Pb-Acid battery

References:

1. Laboratory Manual on Engineering Chemistry ,by Dr.Sudha Rani , Dhanpat Rai publishing house 2009.
2. A Text book on experiments and calculations in engineering chemistry ,by SS Dara , S .Chand publications 2015.

COURSE OUTCOMES:
Upon the successful completion of the course, the student will be able to

CO1: Demonstrate knowledge on analytical chemistry techniques to address the water related problems technically.
CO2: Analyze and acquire practical skills to handle the chemistry experiments.
CO3: Investigate and analyze different chemistry experiments.
CO4: Analyze the impact of contamination of various chemicals for various experiments in environmental contexts, and need for sustainable development.
CO5: Follow ethical principles in preparation of various chemicals compositions related to the every experiment in the lab.
CO6: Do experiments effectively as an individual and as a member in a group
CO7: Communicate verbally and in written form, of the every experiment in the laboratory.
CO8: Continue updating their skill related to Various titrations for industrial application during their life time

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO	**3**	**3**	**-**	**3**	**-**	**-**	**3**	**3**	**3**	**3**	**-**	**3**	**-**	**-**

PRINCIPLES OF ELECTRICAL ENGINEERING LAB

<table>
<tr><td colspan="10">B.Tech I Year II Semester</td></tr>
<tr><td rowspan="1">Course Code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA02204</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td colspan="2">Tutorial Classes :NIL</td><td colspan="3">Practical Classes: 48</td><td colspan="3">Total Classes:48</td></tr>
</table>

Course Objectives:

The course should enable the students to:

1. Verify the fundamental concepts with experiments

EXP.1	Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
EXP.2	Verification of Thevenin's and Norton Theorems.
EXP.3	Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
EXP.4	Transformers: Observation of the no-load current waveform on an oscilloscope (non- sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
EXP.5	Verification of Superposition theorem for DC and AC Networks.
EXP.6	Verification of Maximum power transfer theorem for DC and AC Networks.
EXP.7	Verification of Reciprocity theorem.
EXP.8	To determine the performance characteristics of a Shunt Motor.
EXP.9	To determine the performance characteristics of a Compound Motor.
EXP.10	To determine speed control of DC Shunt Motor.
EXP.11	To determine the load characteristics of a Shunt Generator.
EXP.12	Demonstration of components of LT switchgear.
EXP.13	3 – Phase Power Measurements for balanced loads

References

1. Laboratory Manual on Principles of Electrical Engineering ,by Dr.Sudha Rani , Dhanpat Rai publishing house 2009

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on different network theorems and electrical machines

CO2: Analyze the basic the principles of different network theorems and electrical machines

CO3: Apply the basic knowledge on different network theorems and calculate characteristics of electrical machines

CO4: Follow ethical values during conducting of Experiments.

CO5: Work individually or in a team effectively.

CO6: Communicate verbally and in written form pertaining to results of the Experiments.

CO7: Perform experiments involving electrical circuits in future years.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3		-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO7	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**-**	**-**

BASIC CIVIL AND MECHANICAL ENGINEERING LAB

<table>
<tr><td colspan="8">B.Tech I Year II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA03206</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:- Nil</td><td colspan="2">Tutorial Classes: Nil</td><td colspan="3">Practical Classes: 48</td><td colspan="3">Total Classes:48</td></tr>
</table>

Course Objectives:
The course should enable the students to:

1. Study different materials in engineering practices with respect to their workability, formability & machinability with hand tools & power tools
2. Develop skills through hands on experience.

	I. Mechanical Engineering Lab
EXP.1	Welding - Metal arc welding tools and equipment, exercises.
EXP.2	Fitting - Tools, operations, exercises, types of joints. (Term work to include one job involving fitting to size, male-female fitting with drilling and tapping
EXP.3	Foundry- Tools, preparation of moulding sand, patterns, cores, foundry exercises.
EXP.4	Carpentry- Tools, carpentry process, carpentry exercises, types of joints.
EXP.5	Assembly and Inspection.(Assembly and Disassembly of some products, tools used. Videos of advancement in manufacturing technology. Inspection of various components using different measuring instruments.)
EXP.6	Machine Tools I - Demonstration of drilling machine.
EXP.7	Machine Tools II - Demonstration of Lathe.
EXP.8	Study of Automobile and Power Transmission.
EXP.9	Wood working - Demonstration of wood working machinery and furniture manufacturing.(Term work includes one job involving joint and woodturning)
	II. Civil Engineering Lab
EXP.1	**Buildings:** Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.
EXP.2	**Plumbing Works**: (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings. (b) Study of pipe connections requirements for pumps and turbines. (c) Preparation of plumbing line sketches for water supply and sewage works. (d) Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components. (e) Demonstration of plumbing requirements of high-rise buildings.
EXP.3	**Carpentry using Power Tools only:** (a) Study of the joints in roofs, doors, windows and furniture. (b) Hands-on-exercise: Wood work, joints by sawing, planing and cutting. (c) Demonstration of elementary surveying techniques

COURSE OUTCOMES:
Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on different tools used in civil and mechanical engineering
CO2: Analyze the basic the principles of civil and mechanical engineering mechanisms
CO3: Apply the knowledge on the principles of civil and mechanical engineering mechanisms
CO4: Follow ethical values during conducting of Experiments.
CO5: Work individually or in a team effectively.
CO6: Communicate verbally and in written form pertaining to results of the Experiments.
CO7: Perform experiments involving physical Phenomena in future years.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO7	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO	**3**	**3**	-	**3**	-	-	-	**3**	**3**	**3**	-	**3**	-	-

List of equipment and components (For a Batch of 30 Students)

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	**15 Sets**
2. Carpentry vice (fitted to work bench)	**15 No.'s**
3. Standard woodworking tools	**15 Sets**
4. Models of industrial trusses, door joints, furniture joints	**5 each**
5. Power Tools: (a) Rotary Hammer: 2 Nos (b) Demolition Hammer: 2 Nos (c) Circular Saw: 2 Nos (d) Planer: 2 Nos (e) Hand Drilling Machine: 2 Nos (f) Jigsaw: 2 Nos	
6. Surveying equipment for Demonstration	

MATHEMATICS III

<table>
<tr><td colspan="10">B.Tech II Year I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA54301</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:48</td><td colspan="2">Tutorial Classes:16</td><td colspan="3">Practical Classes: NIL</td><td colspan="3">Total Classes:64</td></tr>
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COURSE OBJECTIVES:

The course should enable the students to :

1. Understand the analyticity of complex functions and conformal mappings.
2. Apply Cauchy's integral formula and Cauchy's integral theorem to evaluate improper integrals along contours.

UNIT-I	COMPLEX VARIABLE – DIFFERENTIATION	Classes:13

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method-Conformal mappings-standard and special transformations (sin z, e^z, cos z, z^2) Mobius transformations (bilinear) and their properties.

UNIT-II	COMPLEX VARIABLE - INTEGRATION	Classes:12

Line integral-Contour integration, Cauchy's integral theorem, Cauchy Integral formula, power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof).

UNIT-III	LAPLACE TRANSFORMS	Classes:13

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function– Second shifting theorem – Dirac's delta function –Laplace transform of Periodic function.

UNIT-IV	INVERSE LAPLACE TRANSFORMS	Classes:13

Inverse Laplace transform by different methods; inverse Laplace transforms by convolution theorem(Without proof); Applications of Laplace transforms to ordinary differential equations of first and higher order with constant coefficients.

UNIT-V	FOURIER SERIES	Classes:13

Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions- Parseval's formula- Complex form of Fourier series.

Text Books:

1. B.S.Grewal, "Higher Engineering Mathematics", Khanna publishers.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India

Reference Books:

1. B.V.Ramana,Higher, "Engineering Mathematics", Mc Graw Hill publishers.
2. Alan Jeffrey, "Advanced Engineering Mathematics", Elsevier.

E-Text Books:

1. https://www.e-booksdirectory.com/detais.php?ebook=10166.
2. https://www.e-booksdirectory.com/details.php?ebook=7400re

Web References:

1. https://www.efunda.com/math/math_home/math.cfm
2. https://www.ocw.mit.edu/resources/#mathematics.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Analyze of complex variables and conformal mappings.

CO2: Apply Cauchy's integral formula and Cauchy's theorem to evaluate improper integrals along contours.

CO3: Demonstrate the basic knowledge and apply the principle of Laplace Transforms in the field of engineering course.

CO4: Evaluate Inverse Laplace Transforms and it's applications in the field of engineering course.

CO5: Demonstrate and solve Fourier series, even and odd functions and half range sine, cosine series.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	2	-	-	-	-	-	-	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**

LIFE SCIENCES FOR ENGINEERS

<table>
<tr><td colspan="10">B.Tech II Year I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA58301</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:48</td><td colspan="2">Tutorial Classes: Nil</td><td colspan="3">Practical Classes:NIL</td><td colspan="3">Total Classes:48</td></tr>
</table>

COURSE OBJECTIVES:

The course should enable the students:

1. To provide basic understanding about life and life Process. Animal an plant systems.
2. To understand what biomolecules, are, their structures are functions. Application of certain biomolecules in Industry.
3. To brief about human physiology and bioengineering.
4. To understand hereditary units, i.e. DNA (genes) and RNA and their synthesis in living organism.
5. To explain biology Principles can be applied in our daily life using different technologies.
6. To brief the production of transgenic microbes, Plants and animals.

UNIT-I	**INTRODUCTION TO BASIC BIOLOGY**	**Classes:10**

Evolution : Different patterns of evolution, Darwin’s theory of evolution, Cell as Basic unit of life, Cell structure, cell theory, Cell shapes, Cell cycle, Chromosomes.

Prokaryotic and eukaryotic Cell. Plant Cell, Animal Cell, Plant tissues and Animal tissues, Brief introduction to five kingdoms of classification.

Unit Outcomes:

After completing this unit, the student will be able to

1. Summarize the basis of life. (L1)
2. Understand the difference between lower organisms (prokaryotes) from higher organisms (eukaryotes). (L2)
3. Understand how organisms are classified. (L3)

UNIT-II	**INTRODUCTION TO BIOMOLECULES**	**Classes:10**

Carbohydrates, lipids, proteins, Vitamins and minerals, Nucleic acids (DNA and RNA) and their types. Enzymes, Large scale production of enzymes by Fermentation. Enzyme application in Industry.

Unit Outcomes:

After completing this unit, the student will be able to

1. Understand what are biomolecules? their role in living cells, their structure, function and
2. how they are produced. (L1)
3. Interpret the relationship between the structure and function of nucleic acids. (L2)
4. Summarize the applications of enzymes in industry. (L3)
5. Understand what is fermentation and its applications of fermentation in industry. (L4)

UNIT-III	**HUMAN PHYSIOLOGY**	**Classes:09**

Nutrition: Nutrients or food substances. Digestive system, Respiratory system, (aerobic and anaerobic Respiration). Respiratory organs, Respiratory cycle. Excretory system.

Unit Outcomes:

After completing this unit, the student will be able to

1. Understand what nutrients are (L1)
2. Understand the mechanism and process of important human functions (L2 & L3

UNIT-IV	**INTRODUCTION TO MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY**	**Classes:09**

Prokaryotic gene and Eukaryotic gene structure. DNA replication, Transcription and Translation, DNA technology, Introduction to gene cloning.

Unit Outcomes:

After completing this unit, the student will be able to

1. Understand and explain about gene structure and replication in prokaryotes and Eukaryotes(L1)

2. How genetic material is replicated and also understands how RNA and proteins are synthesized. (L2)
3. Understand about recombinant DNA technology and its application in different fields.(L3)
4. Explain what is cloning. (L4)

UNIT-V	APPLICATION OF BIOLOGY	Classes:10

Brief introduction to industrial Production of Enzymes, Pharmaceutical and therapeutic Proteins, Vaccines and antibodies. Basics of biochips, bio fuels, biosensors, and bio engineering. Basics of Production of Transgenic plants and animals.

Unit Outcomes:

After completing this unit, the student will be able to Understand.

1. How biology is applied for production of useful products for mankind.(L1)
2. What are biosensors, biochips etc. (L2)
3. Understand transgenic plants and animals and their production (L3)

Text Books:

Reference Books:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, “Biology: A Global Approach”, Pearson Education Ltd, 2018.
2. T Johnson, Biology for Engineers, CRC press, 2011
3. J.M. Walker and E.B. Gingold, Molecular Biology and Biotechnology 2ed..Panima Publications. PP 434.
4. David Hames, Instant Notes in Biochemistry –2016
5. Phil Tunner, A. Mctennan, A. Bates & M. White, Instant Notes – Molecular Biology –- 2014

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Summarize the basics of life and differentiate between lower organisms (prokaryotes) from higher organisms (eukaryotes).

CO2: Demonstrate the knowledge on biomolecules.

CO3: Apply the knowledge on the nutrients and process of digestive system in human body functions

CO4: Exhibit the knowledge on gene structure and replication in prokaryotes and Eukaryotes, as well as recombinant DNA, cloning technology and its application in different fields.

CO5: Display the knowledge how biology is applied for production of useful products for mankind and on biosensors, biochips etc.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	2	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	2	-	-	-	-	-	-	-
CO	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

ELECTRONIC DEVICES & CIRCUITS

B.Tech II Year I Semester								
Course Code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
19CA04301	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes:48	**Tutorial Classes:Nil**	**Practical Classes:NIL**				**Total Classes:48**		

COURSE OBJECTIVES:

The course should enable the students:

1. To familiarize with the characteristics of ideal and practical diodes, analyze and design diode application circuits such as rectifiers, filters, clippers and clampers.
2. To provide students a base for a further study of analog and digital electronics and to develop the ability to analyze and design electronic circuits.
3. To familiarize with the biasing of FET and BJT.
4. To perform analysis of BJT and FET amplifiers at low frequencies.

UNIT-I	**PN JUNCTIONDIODE AND ITS APPLICATIONS**	**Classes:10**

Theory of PN Diode, Derivation of Electrostatic Potential Difference at Thermal Equilibrium, Depletion Width and Depletion Capacitance, Derivation of current equation and V-I characteristics.
Rectifiers and filter circuits: Half wave rectifier, Full wave rectifier, Bridge rectifier and their analysis, L,C and Pi filters, Series and shunt diode clippers, Clipping at two independent levels, Clamping circuits and its operation.

UNIT-II	**SPECIAL PURPOSE ELECTRONIC DEVICES**	**Classes:09**

Zener diode construction, working and characteristics, Zener and Avalanche break down mechanism,Tunnel Diode, Varactor diode, DIAC, TRAIC, SCR, UJT, LED, LCD, Photo diode, Photovoltaic cell.

UNIT-III	**TRANSISTORS**	**Classes:09**

Bipolar Junction Transistors (BJT): PNP and NPN Transistors, Basic Transistor Action, Minority Carrier Distribution and Terminal Currents, Modes of operation, Input and Output Characteristics of CB, CE and CC Configurations.
Field Effect Transistors (FET): JFET Construction, Idea of Channel Formation, Current-Voltage Output Characteristics, JFET parameters. MOSFET types, Working and Characteristic curves of Depletion type MOSFET and Enhancement type MOSFET, Comparison of BJT and FET.

UNIT-IV	**TRANSISTOR BIASING**	**Classes:10**

Need for Biasing, BJT Operating point, DC and AC load lines, Biasing - Fixed Bias, Emitter Feedback Bias, Collector to Emitter feedback bias, Voltage divider bias, Bias stability, Stabilization factors, stabilization against variations in V_{BE} and β; Bias Compensation Techniques, Thermal runaway, Thermal stability, FET Biasing methods.

UNIT-V	**BJT AND FET AMPLIFIERS**	**Classes:10**

BJT Amplifiers: Transistor hybrid model, Determination of h-parameters, Conversion of h-parameters, Generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis.
FET Amplifiers: Generalized analysis of Small signal model, Analysis of CG, CS and CDamplifiers.

Text Books:

1. Millman and Halkias: Integrated Electronics, Tata Mc.Graw Hill, 2004.
2. R E Boylstead and L Nashelsky: Electronic Devices and Circuit Theory, 9/e, Pearson Education
3. Electronic Devices and Circuits, David A. Bell – 5th Edition, Oxford.
4. S. Salivahanan, N. Suresh Kumar,A. Vallavaraj, “Electronic Devices and Circuits”, Tata McGraw Hill, 2nd edition,2011.

Reference Books:

1. Sedra and Smith: Microelectronic Circuits, 4/e, Oxford University Press 1998.

2. Donald A Neamen. : Electronic Circuit Analysis and Design, 3/e, Tata Mc.Graw Hill.
3. B. Razavi , "Fundamentals of Microelectronics", Wiley

Web References:

1. http://www-mdp.eng.cam.ac.uk/web/library/enginfo/electrical/hong1.pdf
2. https://archive.org/details/ElectronicDevicesCircuits
3. http://www.vidyarthiplus.in/2011/11/electronic-device-and-circuits-edc.html
4. http://www.satishkashyap.com/2013/03/video-lectures-on-electron-devices-by.html

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on PN junction operation and analyze the PN junction Diode circuits

CO2: Analyze various special purpose devices and their applications.

CO3: Apply the basic concepts of BJT, FET & UJT operations and analyze basic circuits with these transistors

CO4: Exhibit the knowledge on basic concepts of biasing and analyze the biasing circuits using BJT & FET

CO5: Exhibit the knowledge on basic concepts of biasing and analyze the biasing circuits using BJT & FET

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	2	-	-	-	-	-	-	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**2.6**	**2**	-	-	**2**	-	-	-	-	-	-	**3**	**2**

RANDOM SIGNALS AND SYSTEMS

B.Tech II Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
19CA04302	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

COURSE OBJECTIVES:

The course should enable the students:

1. To study about signals and systems.
2. To do analysis of signals & systems (continuous and discrete) using time domain & frequency domain methods.
3. To understand the stability of systems through the concept of ROC.
4. To know various transform techniques in the analysis of signals and systems.

UNIT - I	**INTRODUCTION TO SIGNALS & SYSTEMS**	**Classes: 10**

Definition and classification of Signal and Systems (Continuous time and Discrete time), Elementary signals such as Dirac delta, unit step, ramp, sinusoidal and exponential and operations on signals. Analogy between vectors and signals – Orthogonality - Mean SquareError - Fourier series: Trigonometric & Exponential, concept of discrete spectrum.

UNIT - II	**FOURIER TRANSFORM**	**Classes: 10**

CONTINUOUS TIME FOURIER TRANSFORM: Definition, Computation and properties of Fourier Transform for different types of signals. Statement and proof of sampling theorem of low pass signals and systems.

DISCRETE TIME FOURIER TRANSFORM: Definition, Computation and properties of Fourier Transform for different types of signals and systems.

UNIT - III	**SIGNAL PROCESSING THROUGH LINEAR SYSTEMS**	**Classes: 10**

Linear system, impulse response, Response of a linear system, linear time-invariant (LTI) system, linear time variant (LTV) system, Transfer functions of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-
Wiener criterion for physical realization, Relationship between bandwidth and rise time. Energy and Power Spectral Densities.

UNIT - IV	**LAPLACE TRANSFORM**	**Classes: 09**

Definition, ROC, ROC-Properties, Inverse Laplace transforms: S-plane, BIBO stability, Transfer functions, System Response to standard signals, Solution of differential equations with initial conditions.

UNIT - V	**Z–TRANSFORM**	**Classes: 09**

Derivation and definition, ROC, ROC-Properties.

Z-TRANSFORM PROPERTIES: Linearity, time shifting, change of scale, Z-domain differentiation, differencing, accumulation, convolution in discrete time, initial and final value theorems. Poles and Zeros in Z –plane, The inverse Z-Transform.

System analysis: Transfer function, BIBO stability, System Response to standard signals, Solution of difference equations with initial conditions.

Text Books:

1. Signals, Systems & Communications - B.P. Lathi, 2009, BS Publications.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2ndEdn.
3. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2nd Edition

Reference Books:

1. Signals and Systems – A. Ramakrishna Rao - 2008, TMH.
2. Linear Systems and Signals – B. P. Lathi, Second Edition, Oxford University press, 2008.
3. Fundamentals of Signals and Systems Michel J. Robert, MGH International Edition, 2008.
4. Signals, Systems and Transforms - C. L. Philips, J. M. Parr and Eve A. Riskin, Pearson education 3rd Edition.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on the basic concepts of signals and sytems and analyze various types of signals and systems.

CO2: Investigate and analyze the Continuous-time & discrete –time FT of various signals

CO3: Exhibit the knowledge on LTI systems and analyze various filters, Causality and Poly-Wiener criterion

CO4: Demonstrate the knowledge on the basic concepts of Laplace Transforms. Analyze Laplace Transforms and inverse laplace Transforms of different functions.

CO5: Apply the knowledge on the basic concepts of Z Transforms. Analyze Z Transforms and inverse Z Transforms of different functions.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

DIGITAL ELECTRONICS & LOGIC DESIGN

B.Tech II Year I Semester								
Course Code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
19CA04303	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand basic number systems, codes and logical gates.
2. Acquire the skills to manipulate on different simplification methods for minimizing Boolean functions.
3. Outline procedures for the analysis and design of combinational and sequential logic circuits.
4. Obtain the knowledge about various types of memories.

UNIT-I	**FUNDAMENTALS OF DIGITAL SYSTEMS**	**Classes: 10**

Review of Number systems: Binary, Octal, Decimal, and Hexa decimal, Number Base Conversions methods, Complements of Numbers, Signed Binary Numbers binary codes: Binary coded decimal, excess-3, gray codes, error detecting and error correcting codes.

UNIT-II	**BOOLEAN ALGEBRA AND MINIMIZATION**	**Classes: 09**

Boolean algebra: Postulates and theorems, Logic gates and truth tables, Representation of switching functions, sum of products and product of sums forms, NAND & NOR Implementation, karnaugh map representation, simplification of logic functions using Karnaugh maps, Don't Care Conditions, Quine - McClusky method.

UNIT-III	**COMBINATIONAL CIRCUITS**	**Classes: 10**

Introduction and Design of Combinational Circuits using conventional logic gates, Half adder, full adder, Subtractor, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers and DeMultiplexers.

UNIT-IV	**SEQUENTIAL CIRCUITS**	**Classes: 10**

Synchronous Sequential Circuits: Latches, Flip-flops, analysis of clocked sequential circuits,
Register and Counters: Registers, Shift registers, Ripple counters, Synchronous counters and other counters.

UNIT-V	**PROGRAMMABLE LOGIC DEVICES**	**Classes: 09**

Memory and Programmable Logic: Introduction to Random Access Memory, Memory Decoding, Read Only Memory, Programmable Logic Array, Programmable Array Logic and Sequential Programmable Devices.
Digital Integrated Circuits: RTL and DTL Circuits, Transistor-Transistor Logic (TTL), Emitter-Coupled Logic (ECL), MOS, CMOS Logic, Comparisons of Logic Families.

Text Books:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 4^{th} Edition, Pearson Education, 2013.
2. Z. Kohavi and N. K. Jha, "Switching and Finite Automata Theory", 3^{rd} Edition, Tata McGraw Hill, 2010.
3. A. Anand Kumar, "Switching Theory and Logic Design", Prentice Hall of India, 1^{st} Edition, 2014.

Reference Books:

1. Roth, "Fundamentals of Logic Design", Cengage learning, 5^{th} edition, 2004.
2. John M. Yarbrough, "Digital logic applications and design", Thomson publications, 2^{nd} Edition, 2006.

E-Text Books:

1. https://books.google.co.in/books/about/Switching_Theory_and_Logic_Design

2. https://www.smartzworld.com/notes/switching-theory-and-logic-design-stld
3. https://www.researchgate.net/.../295616521_Switching_Theory_and_Logic_Design
4. https://books.askvenkat.com/switching-theory-and-logic-design-textbook-by-anand-kumar/
5. http://www.springer.com/in/book/9780387285931

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Exhibit the knowledge on number systems and analyze different coding techniques

CO2: Demonstrate the basic knowledge on the fundamental postulates and theorems and analyze various minimization techniques. Design the minimized circuits with gates.

CO3:Analyze various combinational logic circuits and design different circuits with combinational logic principles.

CO4: Analyze SR, JK, D and T flip-flops and design synchronous sequential circuits with flipflops.

CO5: Investigate and analyze various Programmable Logic Devices and digital integrated circuits and design combinational circuits with the Programmable Logic Devices.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	2	-
CO	**3**	**2.6**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.8**	**-**

NETWORK ANALYSIS AND TRANSMISSION LINES

B.Tech II Year I Semester								
Course Code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
19CA02305	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes:48	**Tutorial Classes: Nil**		**Practical Classes: NIL**			**Total Classes:48**		

COURSE OBJECTIVES:

The course should enable the students:

1. To know the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits and study of series and parallel resonance
2. To understand the transients response of RL, RC and RLC circuits for DC and AC excitations
3. To discuss the concept of network parameters.
4. To know the applications of Fourier transforms to electrical circuits excited by non- sinusoidal sources.
5. To Study different types of filters, equalizers. And transmission lines.

UNIT-I	**THREE PHASE CIRCUITS AND RESONANCE**	**Classes:10**

Three phase circuits: Star and delta connections, phase sequence,relation between line and phase voltages and currents in balanced star and delta circuits, three phase three wire and three phase four wire systems, shifting of neutral point, analysis of balanced and unbalanced three phase circuits, measurement of active and reactive power

Series, parallel resonance circuits, concept of band width and Q factor

UNIT-II	**TWO PORT NETWORK PARAMETERS**	**Classes:10**

Two port network parameters: Z, Y, ABCD, hybrid and inverse hybrid parameters, conditions for symmetry and reciprocity, inter relationships of different parameters. Series and parallel connection of two port networks

UNIT-III	**DC AND AC TRANSIENT ANALYSIS**	**Classes:10**

D.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for D.C Excitation-Initial Conditions-Solution Method Using Differential Equations and Laplace Transforms, Response of R-L & R-C Networks to Pulse Excitation.

A.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for Sinusoidal Excitations-Initial Conditions-Solution Method Using Differential Equations and Laplace Transform.

UNIT-IV	**FILTERS**	**Classes:09**

Filters –Low Pass –High Pass and Band Pass –RC, RL filters–derived filters and composite filters design –Attenuators –Principle of Equalizers –Series and Shunt Equalizers –L Type -T type and Bridged –T and Lattice Equalizers.band pass, band elimination filters, introduction to active filter.

UNIT-V	**TRANSMISSION LINES**	**Classes:09**

Types, Transmission line parameters (Primary and Secondary), Transmission line equations,
Input impedance, Standing wave ratio & power, Smith chart & its applications, Applications of transmission lines of various lengths, Micro-strip transmission lines – input impedance,
Illustrative Problems.

Text Books:

1. A Chakrabarthy, “Electric Circuits”, Dhanipat Rai & Sons, 6th Edition, 2010.
2. A Sudhakar, Shyammohan S Palli, “Circuits and Networks”, Tata McGraw Hill, 4th Edition, 2010.
3. M E Van Valkenberg, “Network Analysis”, PHI, 3 rd Edition, 2014.

Reference Books:

1. John Bird, “Electrical Circuit Theory and Technology”, Newnes, 2nd Edition, 2003.
2. C L Wadhwa, “Electrical Circuit Analysis Including Passive Network Synthesis”, New Age

International, 2nd Edition, 2009.

3. David A Bell, “Electric circuits”, Oxford University Press, 7th Edition, 2009.
4. G. S. N. Raju, “Electromagnetic Field Theory and Transmission Lines,” Pearson Education, 2013

Web References:

1. https://www.igniteengineers.com
2. https://www.ocw.nthu.edu.tw
3. https://www.uotechnology.edu.iq
4. https://www.crectirupati.com

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate knowledge on three phase balanced and unbalanced circuits and analyze active and reactive powers in three phase circuits and various resonance circuits

CO2: Investigate and analyze of two port network parameters

CO3: Investigate and analyze the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations

CO4: Analyze and design the passive and active filters

CO5: Investigate and analyze of transmission lines

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	2	-	-	-	-	-	-	-	-	2	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	2	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**2**	**2**	**2**	-	-	-	-	-	-	-	-	**2.6**	-

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

<table>
<tr><td colspan="10">B.Tech II Year I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA56301</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>0</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Contact Classes:48</td><td colspan="2">Tutorial Classes:-Nil</td><td colspan="3">Practical Classes: NIL</td><td colspan="3">Total Classes:48</td></tr>
</table>

COURSE OBJECTIVES:

The course should enable the students:

1. Understand the concept of Traditional knowledge and its importance
2. Know the need and importance of protecting traditional knowledge.
3. Know the various enactments related to the protection of traditional knowledge.
4. Understand the concepts of Intellectual property to protect the traditional knowledge.

UNIT-I	INTRODUCTION TO TRADITIONAL KNOWLEDGE	Classes:10

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge.

UNIT-II	PROTECTION OF TRADITIONAL KNOWLEDGE	Classes:10

Protection of traditional knowledge: The need for protecting traditional knowledge Significance of TKProtection, value of TK in global economy, Role of Government to harness TK.

UNIT-III	LEGAL FRAMEWORK AND TK	Classes:10

A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006,Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act);
B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.Geographical indicators act 2003.

UNIT-IV	TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY	Classes:09

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

UNIT-V	TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS	Classes:09

Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK. 139.

Text Books:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin KumaSingh, Pratibha Prakashan 2012.

Reference Books:

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Understand and elucidate the basic knowledge of traditional knowledge to develop the physical and social changes on traditional knowledge system.

CO2: Describe the significance of traditional knowledge protection to communicate traditional knowledge system.

CO3: Explain the acts related to schedule tribes, traditional forest dwellers, plants

protection and farmers to inculcate the legal protection information.
CO4: Evaluate the legal mechanism of traditional knowledge protection to show the difference between IPR and non-IPR system.
CO5: Demonstrate the engineering, biotechnology, agricultural and medicine system to understand find the healthcare soundness of the traditional societies.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-	-

ELECTRONIC DEVICES & CIRCUITS LABORATORY

<table>
<tr><td colspan="10">B.Tech II Year I Semester</td></tr>
<tr><td rowspan="3">Course Code

19CA04304</td><td rowspan="3">Category

Core</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 48</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

The course should enable the students:

1. To provide exposure to the students with hands on experience on basic engineering practices in electronics engineering.
2. To Understand the nature and scope of modern electronics.
3. To study basic electronic components.
4. To observe the characteristics of electronic devices.

LIST OF EXPERIMENTS

PART-A (ELECTRONIC WORKSHOP PRACTICE)

1. Identification, specifications, testing of R, L, C components (Color Codes), Potentiometers, Gang condensers, Relays, Bread boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, SCR, UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function Generator, Regulated Power Supply and CRO.

PART-B (ANY TEN EXPERIMENTS)

EXP. 1	PN Junction Diode Characteristics.
EXP. 2	Zener Diode Characteristics.
EXP. 3	Half and Full Wave Rectifiers (with and without filters).
EXP. 4	Clipper and Clamper Circuits using Diodes.
EXP. 5	Common Base Input and Output Characteristics.
EXP. 6	Common Emitter Input and Output Characteristics.
EXP. 7	Common Collector Input and Output Characteristics.
EXP. 8	FET Input and Output Characteristics.
EXP. 9	UJT Characteristics.
EXP. 10	SCR Characteristics.
EXP. 11	Emitter follower
EXP. 12	JFET amplifier.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on identification & testing of passive components along with active devices.
CO2: Analyze the practical characteristics of diodes and transistors with different configurations
CO3: Design various amplifier circuits and verify the results.
CO4: Investigate and Analyze the amplifiers for future applications
CO5: Follow ethical principles in designing circuits and mea suring
CO6: Do experiments effectively as an individual and as a member in a group.
CO7: Communicate verbally and in written form, the understandings about the experiments.
CO8: Continue updating their skill related to electronic devices and their applications during their life time

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3		-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-		3	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

LIST OF EQUIPMENT REQUIRED FOR A BATCH

S. No	Name of the Equipment	Range
1	Cathode Ray Oscilloscope	0-25 MHz
2	Function generator	0-1MHz
3	Function generator	0-2MHz
4	Regulated Power supplies	---
5	Digital Multimeters	---
6	Decade Résistance Boxes/Rheostats	---
7	Decade Capacitance Boxes	---
8	Digital Multimeters	0-20V/ 0-200mA/10 Ω -10k Ω
9	Active & Passive Electronic Components	---

BASIC SIMULATION LABORATORY

B.Tech II Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
19CA04305	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	**0**	**2**	**1**	**30**	**70**	**100**
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 32**				**Total Classes: 32**		

COURSE OBJECTIVES:

The course should enable the students to:

1. Apply knowledge of mathematics, science, and engineering for the analysis and processing of signals and to generate various continuous and discrete time signals using MATLAB tool.
2. Apply the convolution theorem and correlation for continuous time signals.
3. Analyze a continuous time LTI/LTV systems using convolution.
4. Design and conduct experiments on modulation techniques to analyze and interpret results.

ANY TEN EXPERIMENTS

EXP. 1	Basic operations on Matrices.
EXP. 2	Generation of various signals and sequences such as unit impulse, unit step, triangular, sawtooth, sinusoidal, sinc.
EXP. 3	Operations on signals and sequences such as addition, multiplication, scaling, shifting, folding.
EXP. 4	Finding the even and odd parts of signal or sequence and real and imaginary parts of signal.
EXP. 5	Convolution between signals and sequences.
EXP. 6	Autocorrelation and cross correlation between signals and sequences.
EXP. 7	Finding the Fourier Transforms of given signal and plotting its magnitude and phase spectrum.
EXP. 8	Verification of linearity and time invariance property of a given continuous/discrete system.
EXP. 9	Verification of Sampling Theorem.
EXP. 10	Removal of noise by Autocorrelation/Cross correlation in a given signal corrupted by noise.
EXP. 11	Waveform synthesis using Laplace Transform.
EXP. 12	Locating Zero's and Pole's, and plotting the pole-zero maps in S-Plane and Z-Plane for given transfer functions.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on the basic concepts of matrices, signals and systems.
CO2: Analyze different signal generations and operations.
CO3: Develop a MATLAB program to analyze various systems with different signals.
CO4: Investigate and analyze different MATLAB programs on signal analysis.
CO5: Follow the ethical values in developing the programs with MATLAB.
CO6: Do experiments effectively as an individual and as a member in a group.
CO7: Communicate verbally and in written form, the understandings about the MATLAB Programs.
CO8: Continue updating their analysis and design skills related to various programs based on application during their life time.

LIST OF EQUIPMENT REQUIRED FOR A BATCH

HARDWARE	Desktop Computer Systems 36 Nos
SOFTWARE	MATLAB

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3		-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

MATHEMATICS – IV

<table>
<tr><td colspan="9">B.Tech II Year II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA54401</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:48</td><td colspan="2">Tutorial Classes: Nil</td><td colspan="3">Practical Classes: Nil</td><td colspan="3">Total Classes:48</td></tr>
</table>

COURSE OBJECTIVES:

The course should enable the students to :

1. Use various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.
2. Know the theory of Probability and random variables.

UNIT-I	**SOLUTION OF ALGEBRAIC & TRANSCENDENTAL EQUATIONS**	**Classes:10**

Introduction-Bisection method-Iterative method- Regular falsi method-Newton Raphson method-System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.

UNIT-II	**INTERPOLATION**	**Classes:10**

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

UNIT-III	**NUMERICAL INTEGRATION & SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**	**Classes:10**

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.

UNIT-IV	**FOURIER TRANSFORMS**	**Classes:09**

Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem

UNIT-V	**Z –TRANSFORMS**	**Classes:09**

Z – transforms, inverse Z– transforms, damping rule, shifting rule, initial and final value theorems. Convolution theorem (without proof), solution of difference equations by Z– transforms.

Text Books:

1. B.S.Grewal, "Higher Engineering Mathematics", Khanna publishers.
2. Ronald E. Walpole, "Probability and Statistics for Engineers and Scientists", PNIE.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India

Reference Books:

1. B.V.Ramana, "Higher Engineering Mathematics", Mc Graw Hill publishers.
2. Alan Jeffrey, "Advanced Engineering Mathematics", Elsevier Publishers

Web References:

1. https://www.efunda.com/math/math_home/math.cfm.
2. https://www.ocw.mit.edu/resources/#mathematics.

E-Text Books:

1. https://www.e-booksdirectory.com/detais.php?ebook=10166.
2. https://www.e-booksdirectory.com/details.php?ebook=7400re

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate numerical methods to solve algebraic and transcendental equations by various mathematical methods.

CO2: Demonstrate and analyze interpolating polynomials using interpolation formulae.

CO3: Exhibit the knowledge in higher order linear differential equations and develop analytical skills in solving problems involving higher order non-homogeneous linear differential equations.

CO4: Exhibit the Knowledge on Fourier Transforms and analyze for different types of signals with their properties, which can be used in communications and signal and image processing and data processing.

CO5: Apply the knowledge on Z-transforms and analyze with their properties and develop analytical skills in solving problems involving initial value problems for differential equations using z-transform.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**2**	**2**	-	-	-	-	-	-	-	**-**	**3**	**-**

COMMUNICATIVE ENGLISH II

B.Tech II Year II Semester								
Course Code	Category	Hours/week			Credits	Maximum Marks		
19CA52401	Foundation	L	T	P	C	CIA	SEE	TOTAL
		2	0	0	2	30	70	100
Contact Classes:32	Tutorial Classes: NIL	Practical Classes: NIL				Total Classes:32		

COURSE OBJECTIVES:

The course should enable the students to:

1. Help improve speaking skills through participation in activities.
2. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well useful information.
3. Provide knowledge of presentations structures and vocabulary and encourage their appropriate use in speech and writing.

UNIT-I		**Classes:06**

1. Features of Communication and Forms of Communication.
2. Non-Verbal Communication and Types of Non-verbal Communication.
3. Barriers to Communication and Remedies.

Learning Outcomes

At the end of the module, the learners will be able to

- Become effective technical communicators.
- Sensitive use of non-verbal language suitable to different situations in professional life.
- Understand how to overcome the barriers in Communication process.

UNIT-II		**Classes:06**

1. Self Introduction-about you
2. English for Etiquette- Greetings-Introducing a person-Congratulating-Complimenting-
3. English for Etiquette - Requesting-Accepting/Declining an invitation-Expressing Gratitude.

Learning Outcomes

At the end of the module, the learners will be able to

- Understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- Ask and answer general questions on familiar topics and introduce oneself/others

Form sentences using proper grammatical structures and correct word forms

UNIT-III		**Classes:06**

1. Effective usage of Modal Auxiliaries in framing Coversations.
2. Dialogue building-Formal conversation-Semi formal-Informal Conversation.
3. Asking/Giving directions-Asking some for directions-Giving directions

Learning Outcomes

At the end of the module, the learners will be able to

- comprehend short talks on general topics
- participate in informal discussions and speak clearly on a specific topic using suitable discourse markers
- understand the use of cohesive devices for better conversation

UNIT-IV		**Classes:07**

1. Writing Stories from outline-Developing the hints-How to write stories from the outline given.
2. Letter writing-Informal letter-Formal letter (Business and order)-Official letter.
3. Abstract Writing-Book Review-Film Review

Learning Outcomes

At the end of the module, the learners will be able to

- infer meanings of unfamiliar words using contextual clues
- write summaries based on global comprehension of reading/listening texts
- Use appropriate format for writing memos and produce a coherent paragraph for notice
- use language appropriate for description elements

UNIT-V		**Classes:07**

1. Designing a Resume-Guidelines for a better presentations-Purpose of the Resume-Designing and formatting your Resume with covering letter- Difference between CV & Resume
2. Welcome Speech and Vote of Thanks-Charesteristics of Welcome Speech-Some common welcome quotes-How to write Vote of thanks-The order of speech for vote of thanks.
3. Report Writing- Types of Reports-Project Report

Learning Outcomes

At the end of the module, the learners will be able to

- make formal oral presentations using effective strategies
- write his/her winning Resume
- produce a well-organized speech

Text Books:

1. **Advanced Skills for Communication in English: Book I** by V.JEYA SANTHI Dr.R.SELVAM M.A., M.Phil., Ph.D. - December 2015 *with*200 Reads, Publisher: 978-81-2343-101-7, Publisher: New Century Book House
2. Effective Technical Communication, M Ashraf Rizvi, Tata Mc.Graw-Hill Pub,company Ltd

Reference Books:

1. Business Etiquette : A Guide For The Indian Professional (English, Paperback, Shital Kakkar Mehra) Publisher: HarperCollins Publishers India Genre: Business & Economics ISBN: 9789350291085, 9350291088
2. Resume: The Secrets to Writing a Resume that is guaranteed to Get You the Job (Resume Writing, CV, Interview, Career Planning, Cover Letter, Negotiating Book 1) Kindle Edition Publisher**:** Lifestyle Initiative, Inc. (23 June 2016)

How to Write and Give a Speech: A Practical Guide for Anyone Who Has to Make Every Word Count 3rd Edition, Kindle Edition Publisher: St. Martin's Griffin; 3 edition (4 March 2014)

Web References:

Speaking
https://www.talkenglish.com/
BBC Learning English – Pronunciation tips
Merriam-Webster – Perfect pronunciation Exercises

All Skills
https://www.englishclub.com/
http://www.world-english.org/
http://learnenglish.britishcouncil.org/

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate to overcome the barriers in communication process using non-verbal language suitable to different situations in professional life to become effective technical communicator.

CO2: Apply the knowledge on social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information.

CO3: Exhibit the knowledge on cohesive devices for better conversation in informal discussions and speak clearly on a specific topic using suitable discourse markers.

CO4: Apply the concepts of Entrepreneurship Skills and Analyze discourse markers to speak clearly on a specific topic in informal discussions and create a coherent paragraph writing.

CO5: Apply the Knowledge to recognize the need of ability to engage in independent and life-long learning communication effectively in English over speech.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	2	3	-	-	3	3
CO2	3	2	-	-	-	-	-	-	3	3	-	-	3	3
CO3	3	-	-	-	-	-	-	-	2	3	-	-	3	3
CO4	3	2	-	-	-	-	-	-	3	3	-	-	3	3
CO5	3	-	-	-	-	-	-	-	-	3	-	2	3	3
CO	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2.5**	**3**	**-**	**2**	**3**	**3**

ELECTROMAGNETIC THEORY

B.Tech II Year II Semester									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
19CA04401	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		2	**1**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 32	**Tutorial Classes: 16**	**Practical Classes: Nil**				**Total Classes: 48**		

COURSE OBJECTIVES:

The course should enable the students to:

1. Provide the foundational education in static electromagnetic fields, and time varying electromagnetic waves.
2. Introduce the concepts of Electrostatics and Magneto statics.
3. Develop an understanding of Electromagnetic Waves and their Propagation.

UNIT-I	**ELECTROSTATICS-I**	**Classes: 10**

Review of Vector algebra, Co-ordinate systems & transformation, Vector calculus, Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Illustrative Problems.

UNIT-II	**ELECTROSTATICS-II**	**Classes: 10**

Maxwell's Two Equations for Electrostatic Fields, Electric dipole, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.

UNIT-III	**MAGNETOSTATICS**	**Classes: 10**

Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Magnetic torque and moment, Magnetic dipole, Inductances and Magnetic Energy, Illustrative Problems.

UNIT-IV	**MAXWELL'S EQUATIONS (FOR TIME VARYING FIELDS)**	**Classes: 09**

Faraday's Law and Transformer e.m.f, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. Boundary ConditionsofElectromagneticfields:Dielectric-DielectricandDielectric-ConductorInterfaces, Illustrative Problems.

UNIT-V	**EM WAVE CHARACTERISTICS**	**Classes: 09**

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization, Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector, and Poynting Theorem – Applications, Power Loss in a Plane Conductor, Illustrative Problems.

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetic", Oxford University Press, 4th edition,2009.
2. E.C. Jordan, K.G. Balmain, "Electromagnetic waves and Radiating Systems", PHI learning, 2nd Edition,2000.
3. Umesh Sinha, Satya Prakashan, "Transmission lines and Networks", Tech India Publications, 1st edition, 2010.

Reference Books:

1. Nathan Ida, "Engineering Electromagnetic", Springer (India) Pvt. Ltd, 2nd Edition, 2005
2. William H. Hayt Jr., John A. Buck, "Engineering electromagnetic", Tata McGraw Hill, 7th Edition, 2006.

3. G. Sashibushana Rao, “Electromagnetic Field theory and Transmission Lines, Wiley India, 2013.
4. John D. Ryder, “Networks, Lines and Fields”, PHI learning, 2nd Edition, 1999.

Web References:

1. http:// web.stanford.edu/class
2. http://www.electronicagroup.com
3. http://www.cpri.in/about-us/departmentsunits/library-and-information-centre/digital-library-links.html
4. http://nptel.ac.in/courses/antennas
5. http://www.tutorialspoint.com/discrete_mathematics

E-Text Books:

1. http://www.bookboon.com/en/concepts-in-electrostatics-ebook
2. http://www.www.jntubook.com
3. http://www.allaboutcircuits.com
4. http://www.archive.org

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate spatial coordinate system and Analyze the fundamental laws of electrostatic fields to Solve the Field intensity and Flux density of various charge distributions.

CO2: Analyze the convection, conventional currents, Poisson and Laplace equations, Design various capacitor models.

CO3: Demonstrate Biot-Savart’s law and Ampere’s Circuit law to determine forces due to magnetic fields and Formulate the energy relations for magnetic fields.

CO4: Demonstrate the Maxwell’s equations and their application to time varying fields and boundary conditions.

CO5: Demonstrate and analyze the propagation of electromagnetic waves in different media and its interfaces, analyze them under power loss by using Smith chart.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**2**	**2**	-	-	-	-	-	-	-	-	**3**	-

ANALOG ELECTRONIC CIRCUITS

B.Tech II Year II Semester									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**			
19CA04402	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**	
		3	**0**	**0**	**3**	**30**	**70**	**100**	
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**			

COURSE OBJECTIVES:

The course should enable the students:

1. To perform analysis of FET and BJT amplifiers at low & high frequencies, cascade and Darlington amplifiers.
2. To familiarize with the feedback concept in amplifiers and stability issues.
3. To perform analysis of Oscillators, Power and Tuned amplifiers.
4. To familiarize with the operation and characteristics of multivibrators, time base generators and sweep circuits.

UNIT-I	**SINGLE STAGE AND MULTISTAGE AMPLIFIERS**	**Classes: 10**

Classification of amplifiers, Various types of distortions in amplifiers, Analysis of CB, CE and CC transistor amplifiers circuit using simplified h-parameter model, Millers theorem and its dual, Design of Single stage RC coupled amplifier using BJT, Low frequency response of BJT amplifier, Effect of coupling and bypass capacitor.

Multistage amplifiers: Different coupling schemes used in amplifiers, RC coupled amplifiers, Transformer coupled amplifiers and Direct coupled amplifiers, Cascode amplifier, Analysis of Cascaded RC coupled amplifiers, Darlington pair amplifier, Analysis of Multi-stage CS and CD amplifiers using FET.

UNIT-II	**HIGH FREQUENCY RESPONSE OF TRANSISTOR**	**Classes: 10**

The hybrid-π Common Emitter transistor model, Hybrid-π conductance and Hybrid-π capacitances, Common Emitter short circuit current gain, Current gain with resistive load, α and β cut-off frequencies, Gain Bandwidth product, Emitter follower at high frequencies, Analysis of CS and CD amplifiers at high frequencies.

UNIT-III	**FEEDBACK AMPLIFIERS AND OSCILLATORS**	**Classes: 10**

Feedback amplifiers: Concept of feedback, Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Analysis of voltage series, voltage shunt, current series and current shunt feedback configurations.

Oscillators: Classification of Oscillators, Conditions for oscillations, Generalized analysis of LC oscillators, Hartley and Colpitt's oscillators, RC phase shift oscillator, Wien bridge and Crystal oscillators, Frequency and Amplitude stability of oscillators.

UNIT-IV	**LARGE SIGNAL AND TUNED AMPLIFIERS**	**Classes: 09**

LARGE SIGNAL AMPLIFIERS: Class A large signal amplifier, Transformer coupled Class A audio power amplifiers, Efficiency of Class A amplifier, Class B amplifier, Class B push-pull amplifier, Complementary symmetry Class B push-pull amplifier, Efficiency of Class B amplifier, Phase inverters, Thermal stability and Heat sinks.

TUNED AMPLIFIERS: Series and Parallel resonant circuits, Q - factor, Small Signal Tuned amplifiers, Effect of cascading Single and Double Tuned amplifiers on bandwidth, Staggered Tuned amplifiers, Stability of Tuned amplifiers.

UNIT-V	**MULTIVIBRATORS AND TIME BASE GENERATORS**	**Classes: 09**

MULTIVIBRATORS: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors.

TIME BASE GENERATORS: General features of a Time base Signal, Methods of Generating Time Base Waveform, Transistor Miller Time Base generator, Transistor Bootstrap Time Base Generator, UJT Sawtooth generator.

Text Books:

1. Jacob Millman, Christor C Halkias, “Integrated Electronics”, Tata McGraw Hill, 1st Edition, 2008.
2. Sedra A.S., K.C. Smith, “Micro Electronic Circuits”, Oxford University Press, 6th Edition, 2013.
3. Donald A Neamen, “ Electronic Circuits Analysis and Design” , Tata McGraw Hill , 3rd Edition, 2007.

Reference Books:

1. David A. Bell “Electronic Devices & Circuits” 5th Edition,. Oxford university press, 7th Edition, 2009.
2. Robert L. Boylestad, Louis Nashelsky, “Electronic Devices and Circuits Theory”, Pearson education, 9th Edition, 2008.
3. S.Salivahana, N. Suresh kumar, “Electronic circuit analysis”, McGraw Hill education, 1st Edition, 2011.
4. B.Razavi, “Fundamentals of Micro electronics” , Wiley.

Web References:

1. http://www.igniteengineers.com
2. http://www.ocw.nthu.edu.tw
3. http://www.uotechnology.edu.iq

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the concept of single stage and multistage amplifiers and analyze various parameters using frequency response of transistor in CE configuration.

CO2: Demonstrate the hybrid-Π model on CE configuration of a transistor to formulate the gain, bandwidth and gain bandwidth product and Analyze its frequency response at higher frequencies.

CO3: Analyze the concept of feedback in amplifiers using negative feedback and frequency of oscillators for audio and radio frequency ranges.

CO4: Demonstrate and Analyze various power and tuned amplifiers to measure the efficiency and formulate the Q-factor, Bandwidth.

CO5: Able to Identify appropriate Multivibrator and Time base circuit based on the application in display devices.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**2**	**2**	-	-	-	-	-	-	-	-	**3**	-

DESIGN THINKING & PRODUCT INNOVATION

<table>
<tr><td colspan="10">B.Tech II Year II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA53301</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>2</td><td>1</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:32</td><td colspan="2">Tutorial Classes: 16</td><td colspan="3">Practical Classes: Nil</td><td colspan="3">Total Classes:48</td></tr>
</table>

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand the concepts of design thinking approaches.
2. Create design thinking teams and conduct design thinking sessions.
3. Apply both critical thinking and design thinking in parallel to solve problems.
4. Apply some design thinking concepts to their daily work.

UNIT-I	INTRODUCTION TO DESIGN THINKING	Classes:09

Introduction to Design thinking: Concept and its role within new product development and Innovation, Frame work of design thinking, Non linear process, principles and mindset.
Inspirational Design Briefing: Nine Criteria, Writing, Research findings, pitfalls to avoid, Keys to success.

UNIT-II	CUSTOMER EXPERIENCE MAPPING	Classes:10

Customer Experience Mapping: Inputs to experience mapping, Experience mapping process, Experience map as spring board to innovative solutions.

UNIT-III	BRIDGE RESEARCH AND CONCEPT DESIGN	Classes:10

Bridge research and concept design: Challenges in idea generation, Need for systematic method to connect to the user, The Visualize, Empathize and Ideate method, applying the method.

UNIT-IV	CREATIVITY IN IDEA GENERATION	Classes:10

Boosting creativity in idea generation using Design heuristics: Design Heuristics, The evidence base, Design heuristics for idea generation, Using Design heuristics to generate design concepts, Evidence of the value of design heuristics tools.
The role of design in early stage ventures: An emerging start up culture, Basics, Process, and Troubleshooting common mistakes.

UNIT-V	CORPORATE CULTURE OF DESIGN THINKING	Classes:09

Leading for Corporate culture of design thinking: What is corporate culture, Impact of corporate culture, Corporate forces that undermine the design thinking, Four pillars of innovation for enabling design thinking, Four stages of transforming to a culture of design thinking.

Text Books:

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, "Exploring Engineering: An Introduction to Engineering and Design", 4th edition, Elsevier, 2016.
2. David Ralzman, "History of Modern Design", 2nd edition, Laurence King Publishing Ltd., 2010
3. An AVA Book, "Design Thinking", AVA Publishing, 2010.

Reference Books:

1. G. Pahl, W.Beitz, J. Feldhusen, KH Grote, "Engineering Design: A Systematic Approach", 3rd edition, Springer, 2007.
2. Tom Kelley, Jonathan Littman, "Ten Faces in Innovation", Currency Books, 2006.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate and analyze the concepts and principles of Design Thinking.
CO2: Formulate the methods, processes, and tools of Design Thinking.
CO3: Apply the basic knowledge on Design Thinking approach and model to real world situations
CO4: Analyze and Design the Design heuristics to generate the design concepts.
CO5: Analyze and Design the role of primary and secondary research in the discovery stage of Design Thinking.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	-	2	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	3	-	-	2	-	-	-	-	-	-	3	2
CO	**3**	**3**	**3**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**

CONTROL SYSTEMS

<table>
<tr><td colspan="10">B.Tech II Year II Semester</td></tr>
<tr><td rowspan="1">Course code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA02401</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:48</td><td colspan="2">Tutorial Classes:Nil</td><td colspan="3">Practical Classes: NIL</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

The course should enable the students to:

1. Organize modeling and analysis of electrical and mechanical systems.
2. Analyze control systems by block diagrams and signal flow graph technique.
3. Demonstrate the analytical and graphical techniques to study the stability.
4. Illustrate the frequency domain and state space analysis.

UNIT-I	**INTRODUCTION AND MODELING OF PHYSICAL SYSTEMS**	**Classes: 10**

Control systems: Introduction, open loop and closed loop systems, examples, mathematical models concept of transfer function, translational and rotational mechanical systems, electrical systems, force voltage and force current analogy.

UNIT-II	**REDUCTION TECHNIQUES AND TIME RESPONSE ANALYSIS**	**Classes: 10**

Block Diagrams: Block diagram representation of various systems, block diagram algebra, signal flow graph, Mason's gain formula

Time response analysis: Standard test signals, shifted unit step, ramp and impulse signals, shifting theorem, convolution integral, impulse response, unit step response of first and second order systems, time domain specifications, steady state errors and error constants.

UNIT-III	**CONCEPT OF STABILITY AND ROOT LOCUS TECHNIQUE**	**Classes: 10**

Concept of stability: Necessary and sufficient conditions for stability, Routh's and Routh Hurwitz stability criterions and limitations. Root locus technique: Introduction, root locus concept, construction of root loci, graphical determination of 'k' for specified damping ratio, relative stability, effect of adding zeros and poles on stability.

UNIT-IV	**FREQUENCY DOMAIN ANALYSIS**	**Classes: 09**

Frequency domain analysis: Introduction, frequency domain specifications, stability analysis from Bode plot, Polar plot, Nyquist plot, calculation of gain margin and phase margin, determination of transfer function from Bode plot.

Compensators: Lag, lead, lag lead networks

UNIT-V	**STATE SPACE ANALYSIS AND COMPENSATORS**	**Classes: 09**

State Space Analysis: Concept of state, state variables and state model, derivation of state models from block diagrams, Diagonalization, solving the time invariant state equations, state transition matrix and properties, concept of controllability and Observability.

Text Books:

1. I J Nagrath, M Gopal, "Control Systems Engineering", New Age International Publications, 3rd Edition, 2007.
2. K Ogata, "Modern Control Engineering", Prentice Hall, 4th Edition, 2009.
3. N C Jagan, "Control Systems", B S Publications, 1st Edition, 2007.

Reference Books:

1. AAnand Kumar, "Control Systems", PHI Learning, 1st Edition, 2007.
2. S Palani, "Control Systems Engineering", Tata McGraw Hill Publications, 1st Edition, 2001.
3. N K Sinha, "Control Systems", New Age International Publishers, 1st Edition, 2002.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the basic concepts of Control Systems and Analyze block diagram reduction technique and Mason's gain formula to find the transfer function of a system.

CO2: Demonstrate the different standard test input signals for the performance analysis of second order systems and steady state errors and Analyze the time domain analysis to predict transient response specifications of the system for system stability.

CO3: Analyze and Design the time response of the system for system stability using R-H criterion and root locus techniques.

CO4: Analyze and Design the stability of second order systems using frequency domain concept to increase the steady state of the system.

CO5: Analyze and Design the stability of second order systems using frequency domain concept to increase the steady state of the system.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**3**	**2.5**	**2.66**	-	-	-	-	-	-	-	-	-	-

DIGITAL ELECTRONICS & LOGIC DESIGN LABORATORY

B.Tech II Year II Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
19CA04403	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	**0**	**2**	**1**	**30**	**70**	**100**
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 32**				**Total Classes: 32**		

COURSE OBJECTIVES:

The course should enable the students to:

1. Design of combinational circuits using Verilog Hardware Description Language.
2. Implementation of Sequential circuits using Verilog Hardware Description Language.
3. Demonstration of different case studies for Verilog HDL implementation.

LIST OF EXPERIMENTS (ANY TEN EXPERIMENTS)

EXP. 1	Realization of a Boolean function
EXP. 2	Design of Logic gates
EXP. 3	Design of decoder and encoder
EXP. 4	Design of multiplexer and de multiplexer
EXP. 5	Design of code converters
EXP. 6	Half adder and half subtractor design modeling
EXP. 7	Full adder and full subtractor design modeling
EXP. 8	Design of SR & T flip flops
EXP. 9	Design of JK & D flip flops
EXP. 10	Design of Binary Counters
EXP. 11	Design of Universal shift Registers

Equipment required for Laboratory (Software):

i. PC installed with Xilinx tool
ii. Computer Systems with required specifications.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate basic postulates of Boolean algebra and the methods for simplifying Boolean expressions.
CO2: Analyze the concepts of combinational and sequential circuits for simplifying the algebraic expressions.
CO3: Design the combinational and sequential circuits through simulation.
CO4: Conduct investigation and test the functionality on implementation of adders, subtractor and flip flops.
CO5: Select appropriate kit to analyze and implement various digital logical circuits.
CO6: Follow ethical principles in designing, simulating and implementing circuits.
CO7: Do experiments effectively as an individual and as a member in a group.
CO8: Communicate verbally and in written form, the understandings about the experiments.
CO9: Continue updating their skill related to implementation for various application during their life time.

ANALOG ELECTRONIC CIRCUITS LABORATORY

<table>
<tr><td colspan="10">B.Tech II Year II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA04404</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 48</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

The course should enable the students to:

1. Operate electronic test equipment and hardware/software tools to characterize the behavior of devices and circuits.
2. Design and construct amplifier circuits.
3. Design and Implement Multivibrators using Transistors.
4. Design negative feedback amplifier circuits and oscillators.

Note: The students are required to design the electronic circuit and they have to perform the analysis through simulator using Multisim/ Pspice/Equivalent Licensed simulation software tool. Further they are required to verify the result using necessary hardware in the hardware laboratory**.**

LIST OF EXPERIMENTS (ANY TEN EXPERIMENTS)

EXP. 1	Cascade Amplifier.
EXP. 2	Darlington Amplifier.
EXP. 3	Voltage Series and Voltage Shunt negative feedback Amplifier.
EXP. 4	RC phase shift Oscillators.
EXP. 5	Colpitts and Hartley Oscillators.
EXP. 6	Class A Power amplifier.
EXP. 7	Class B Complementary symmetry Power amplifier.
EXP. 8	Single Tuned Amplifier.
EXP. 9	Astable Multivibrator.
EXP. 10	Schmitt Trigger.
EXP. 11	Bootstrap sweep generator.
EXP. 12	UJT saw tooth generator.

Equipment required for Laboratory:

Software:

i. Multisim/ Pspice/Equivalent Licensed simulation software tool.
ii. Computer Systems with required specifications.

Hardware:

1. Regulated Power supplies.
2. Analog/Digital Storage Oscilloscopes.
3. Analog/Digital Function Generators.
4. Digital Multimeters.
5. Decade Résistance Boxes/Rheostats.
6. Decade Capacitance Boxes.
7. Ammeters (Analog or Digital).
8. Voltmeters (Analog or Digital).
9. Active & Passive Electronic Components.
10. Bread Boards.
11. Connecting Wires.
12. CRO Probes etc.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the concepts of Small, large signal amplifiers and oscillators.
CO2: Analyze various amplifiers and oscillators in hardware and verify the results through simulation.
CO3: Design and test various amplifiers and oscillators results through simulation.
CO4: Conduct investigation and test the functionality on implementation of amplifiers and oscillators
CO5: Select appropriate tools as Multisim PSPICE simulation package tool and procedure to simulate and implement amplifiers and oscillators.

CO6: Follow ethical principles in designing, simulating and implementing circuits.
CO7: Do experiments effectively as an individual and as a member in a group.
CO8: Communicate verbally and in written form, the understandings about the experiments.
CO9: Continue updating their skill related to implementation for various application during their life time.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-		3	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

COMMUNICATIVE ENGLISH II LABORATORY

<table>
<tr><td colspan="10">B.Tech II Year II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA52402</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td colspan="2">Tutorial Classes: Nil</td><td colspan="3">Practical Classes:48</td><td colspan="3">Total Classes:48</td></tr>
</table>

COURSE OBJECTIVES:

The course should enable the students to :

1. Use multi-media instruction for language development
2. Improve the students' fluency in English, through a well-developed vocabulary and enable them to listen the English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and Professional contexts.
3. Communicate their ideas relevantly and coherently in writing and placing MNCs.

UNIT-I	**COMMUNICATIVE COMPETENCE**	**Classes:10**

1. Syllables
2. Stress & Intonations
3. Listening Comprehension, Listening to the News and Understand

UNIT-II	**WRITING SKILLS**	**Classes:09**

1. Precise Writing
2. Resume Preparation
3. E-mail Writing

UNIT-III	**PRESENTATION SKILLS**	**Classes:09**

1. Oral presentation
2. Power point presentation
3. Poster presentation

UNIT-IV	**GETTING READY FOR JOB**	**Classes:10**

1. SWOT Analysis
2. Group Discussions
3. Interview skills

UNIT-V	**INTERPERSONAL SKILLS**	**Classes:10**

1. Time Management
2. Problem Solving & Decision Making
3. Etiquettes-Telephonic Etiquettes

Minimum Requirements for SOFT SKILLS Lab:

Soft Skills Laboratory shall have the following infra-structural facilities to accommodate at least 60 students in the lab:

1. Spacious room with appropriate acoustics.
2. Round Tables with movable chairs
3. Audio-visual aids
4. LCD Projector
5. Public Address system
6. P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
7. T. V, a digital stereo & Camcorder
8. Headphones of High quality

Suggested Software:

1. Walden Info tech: Advanced English Communication Skills Lab
2. K-VAN SOLUTIONS-Advanced English Language Communication Skills lab
3. DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.
4. TOEFL & GRE(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
5. Train2success.com

Reference:

1. Objective English for Competitive Exams, Hari Mohana Prasad, 4th edition, Tata Mc Graw Hill.
2. Technical Communication by Meenakshi Raman & Sangeeta Sharma, O U Press 3rdEdn. 2015.
3. Essay Writing for Exams, Audrone Raskauskiene, Irena Ragaisience & Ramute Zemaitience, OUP, 2016
4. Soft Skills for Everyone, Butterfield Jeff, Cengage Publications, 2011.
5. Management Shapers Series by Universities Press (India) Pvt. Ltd., Himayatnagar, Hyderabad 2008.
6. Campus to Corporate, Gangadhar Joshi, Sage Publications, 2015
7. Communicative English, E Suresh Kumar & P. Sreehari, Orient Black swan, 2009.
8. English for Success in Competitive Exams, Philip Sunil Solomon OUP, 2015

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Exhibit the skills on the different aspects of the English Language proficiency with emphasis on LSRW skills.

CO2: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking by group discussion.

CO3: Conduct investigation and Analyze communication ability

CO4: Use of modern computing facilities and suitable software tools to improve the communication skills and elocution.

CO5: Follow ethical principles in communication skills and elocution.

CO6: Do experiments effectively as an individual and as a member in a group.

CO7: Communicate verbally and in written form, the understandings about the experiments.

CO8: Continue updating their written communication skills among learners for both academic and professional purposes during their life time.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	3		-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO	**3**	**3**	**-**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

ANTENNAS & WAVE PROPAGATION

<table>
<tr><td colspan="10">B.Tech III Year I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA04501</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 48</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

1. Be proficient in the radiation phenomena associated with various types of antennas and understand basic terminology and concepts of antennas along with emphasis on their applications.
2. Analyze the electric and magnetic field emission from various basic antennas with mathematical formulation of the analysis.
3. Explain radiation mechanism of different types of antennas and their usage in real time field.
4. Justify the propagation of the waves at different frequencies through different layers in the existing layered free space environment structure.

UNIT-I	ANTENNA BASICS & THIN WIRE ANTENNAS	Classes: 10

Antenna Basics: Introduction, Basic antenna parameters- patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective height, Polarization– Linear, Elliptical, & Circular polarizations, Antenna temperature, Antenna impedance, Front–to-back ratio, Reciprocity theorem.

Thin Wire Antennas: Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipoles, Field Components, Radiated power, Radiation Resistance.

UNIT-II	LOOP ANTENNAS AND ANTENNA ARRAYS	Classes: 10

Loop Antennas: Introduction, small loop, Comparison of Far fields of small loop and short dipole, Radiation resistances of small loop antenna.

Antenna Arrays: Point sources, definition, patterns; Arrays of 2 isotropic sources, different cases, Principle of pattern multiplication, Uniform linear arrays - Broadside arrays; End-fire arrays; Binomial arrays, Yagi-Uda array, Helical antennas-Helical geometry, Helix modes, Practical design considerations for Helical antenna in axial and normal modes.

UNIT-III	VHF, UHF AND MICRO WAVE ANTENNAS	Classes:10

Horn antennas: Types, Fermat's principle, optimum horns, design considerations of pyramidal horns, Illustrative problems.

Lens antennas: Introduction, types of lens antennas, geometry of metallic and Non-metallic dielectric lenses, zoning, tolerances, applications.

Slot & Microstrip antennas: Introduction, features, advantages and limitations, its pattern, Babinet's principle, impedance of slot antennas, Rectangular patch antennas- geometry and parameters, characteristics of microstrip antennas.

UNIT-IV	REFLECTOR ANTENNAS AND ANTENNA MEASUREMENTS	Classes: 09

Reflector Antennas: Introduction, flat sheet and corner reflectors, Paraboloidal reflectors-Geometry, pattern characteristics, feed methods.

Antenna Measurements: Introduction, concepts, sources of errors patterns to be measured, Pattern measurement arrangement, directivity measurement, Gain measurements-Comparison method, absolute and 3-antenna methods.

UNIT-V	RADIO WAVE PROPAGATION	Classes: 09

Introduction, definitions, general classifications, different Modes of Wave Propagation, Ground wave propagation- Introduction, plane earth reflections, space and surface waves, Space wave propagation- Introduction, effect of earth's curvature, super refraction, duct propagation, scattering phenomena, tropospheric propagation, Sky wave propagation- Introduction, structure of ionosphere, critical frequency, MUF, virtual height and skip distance, Relation between MUF and skip distance.

Text Books:

1. John D. Kraus, Ronald J. Marhefka, Ahmad S. Khan, “Antennas and Wave Propagation”, TMH, 4th Edition, 2010.
2. C.A.Balanis, “Antenna Theory”, John Wiley and Sons, 2nd Edition, 2001.

Reference Books:

1. E.C. Jordan, K.G. Balmain, “Electromagnetic Waves and Radiating Systems”, PHI, 2nd Edition, 2000.
2. E.V.D. Glazier, H.R.L. Lamont, “Transmission and Propagation”, Her Majesty's Stationery Office, 1958.
3. F.E. Terman, “Electronic and Radio Engineering”, McGraw-Hill, 4th Edition, 1955.
4. K.D. Prasad, Satya Prakashan, “Antennas and Wave Propagation”, Tech India Publications, 1st Edition, 2001.

Web References:

1. http://web.stanford.edu/class
2. http://www.electronicagroup.com
3. http://www.cpri.in/about-us/departmentsunits/library-and-information-centre/digital-library-links.html
4. http://nptel.ac.in/courses/antennas

E-Text Books:

1. http://www.ebookgalaxy.in/2016/01/antennas-and-wave-propagation-by-g-s-n.html#.WBGI7NJ97IU
2. https://www.jntubook.com/antennas-wave-propagation-textbook
3. http://117.55.241.6/library/E-Books/Antennas_mcgraw-hill_2nd_ed_1988-john_d_kraus.pdf

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Apply the concept of mechanism of radiation, analyze various types of antennas with field components and configure their current distributions.

CO2: Demonstrate the loop antennas and antenna arrays, analyze their characteristic parameters and design yagiuda and helical antenna for real time applications.

CO3: Exhibit the knowledge on High frequency Antennas, Analyze their characteristics and design with relevant parameters.

CO4: Demonstrate reflector antennas, identify the requirements and carry out the design with suitable precautions and familiarize with the procedure to enable antenna measurements.

CO5: Apply the concept of wave propagation theory and Analyze crictical frequency, MUF, Skip distance in various applications.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	2		-	-	-	-	-	3	2
CO3	3	2	2	-	-	-	-	-	-	-	-	-	2	-
CO4	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO5	2	1	2	-	-	2	2	-	-	-	-	-	2	2
CO	**2.8**	**2.4**	**1.8**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2.4**	**2**

ANALOG AND DIGITAL COMMUNICATIONS

B.Tech III Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
19CA04502	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

COURSE OBJECTIVES:

1. To develop ability to analyze system requirements of analog and digital communication systems.
2. To understand the generation, detection of various analog and digital modulation techniques.
3. To acquire theoretical knowledge of each block in AM, FM transmitters and receivers.
4. To understand the concepts of pulse shaping in baseband transmissions.

UNIT-I	**AMPLITUDE MODULATION**	**Classes: 10**

Need for modulation, Amplitude Modulation - Time and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves - Switching modulator, Detection of AM Waves - Envelope detector, DSBSC modulation - time and frequency domain description, Generation of DSBSC Waves - Balanced Modulators, Coherent detection of DSB-SC Modulated waves, SSB modulation - time and frequency domain description, Demodulation of SSB Waves, principle of Vestigial side band modulation.

UNIT-II	**ANGLE MODULATION**	**Classes: 10**

Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave using Bessel functions, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Signal- Armstrong Method, Detection of FM Signal: Balanced slope detector, Phase locked loop, Comparison of FM and AM, Concept of Pre-emphasis and de-emphasis.

UNIT-III	**TRANSMITTERS AND RECEIVERS**	**Classes: 10**

Transmitters: Classification of Transmitters AM Transmitters, FM Transmitters.
Receivers: Radio Receiver - Receiver Types - Tuned radio frequency receiver, Super hetrodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, Image frequency, Automatic Gain Control, Amplitude limiting, FM Receiver.

UNIT-IV	**PULSE MODULATION & PULSE CODE MODULATION**	**Classes: 09**

Pulse Modulation: Types of Pulse modulation- PAM, PWM and PPM.
Pulse Code Modulation: PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, DPCM, Adaptive DPCM, DM and Adaptive DM, Noise in PCM and DM.

UNIT-V	**PULSE SHAPING AND DIGITAL MODULATION TECHNIQUES**	**Classes: 09**

Pulse Shaping: Base-band Transmission, Inter-symbol Interference (ISI), Nyquist’s criterion for distortion less baseband binary transmission, Ideal Nyquist channel, Raised cosine filter & its spectrum, Eye diagrams.
Digital Modulation Techniques: ASK- Modulator, Coherent ASK Detector, FSK- Modulator, Non-Coherent FSK Detector, BPSK- Modulator, Coherent BPSK Detection. Principles of QPSK and Differential PSK.

Text Books:

1. S. S. Haykin, “Communication Systems”, Wiley Eastern, 2nd Edition, 2006.
2. Taub, Schilling, “Principles of Communication Systems”, Tata McGraw-Hill, 4th Edition, 2013.
3. B.P. Lathi, “Signals, Systems and Communications”, BS Publications, 5th Edition, 2009.
4. Analog and Digital Communications – Simon Haykin, John Wiley, 2005.

5. Electronics Communication Systems-Fundamentals through Advanced-Wayne Tomasi, 5th Edition, 2009, PHI.

Reference Books:

1. Principles of Communication Systems - Herbert Taub, Donald L Schilling, GoutamSaha, 3rd Edition, McGraw-Hill, 2008.
2. Electronic Communications – Dennis Roddy and John Coolean , 4 th Edition , PEA, 2004
3. John G. Proakis, Masond, Salehi, “Fundamentals of Communication Systems”, PEA, 1st Edition,2006.
4. George Kennedy,Bernard Davis, “Electronics and Communication System”, Tata McGraw Hill , 5th Edition, 2011.
5. B.P. Lathi, Zhi Ding, “Modern analog and digital Communication Systems”, Oxford Publication, 4th Edition, 2011.

Web References:

1. http://www.web.eecs.utk.edu
2. https://everythingvtu.wordpress.com
3. http://nptel.ac.in/
4. http://www.iare.ac.in

E-Text Books:

1. http://www.bookboon.com/
2. http://www.jntubook.com
3. http://www.smartzworld.com
4. http://www.archive.org

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the basic concepts, need of modulation and Analyze the generation and detection techniques and Formulate the power relations of AM used in broadcasting systems.

CO2: Analyze the generation and detection techniques of PM, FM and formulate the bandwidth, modulation index and power requirements.

CO3: Analyze the different characteristics of transmitter and receivers.

CO4: Apply the fundamental knowledge on various Pulse Modulation techniques like PAM, PWM, PPM and different Pulse Code Modulation system, analyze its quantization and coding.

CO5: Apply the knowledge of ISI to reduce its impact in transmission of digital data through a baseband channel with different pulse shaping techniques and also Analyze and design the pass band transmission techniques like ASK,BPSK, DPSK,BFSK, QPSK etc.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

INTEGRATED CIRCUITS & APPLICATIONS

<table>
<tr><td colspan="11">B.Tech III Year I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA04503</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>2</td><td>1</td><td>0</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 32</td><td>Tutorial Classes:16</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

1. Be acquainted to principles and characteristics of op-amp and apply the techniques for the design of comparators, instrumentation amplifier, integrator, differentiator, multivibrators, waveform generators, log and anti-log amplifiers.
2. Analyze and design filters, timer, analog to digital and digital to analog Converters.
3. Understand the functionality and characteristics of commercially available digital integrated circuits.

UNIT-I	**INTEGRATED CIRCUITS**	**Classes: 10**

Integrated Circuits: Classification of integrated circuits, Package types and temperature ranges. **Differential Amplifier**: Types of differential amplifiers, DC and AC analysis of Dual input Balanced/Unbalanced output Configuration, Single input Balanced/Unbalanced output Configuration, DC Coupling and Cascade Differential Amplifier Stages.
Characteristics of OP-Amps: Op-amp Block Diagram, Ideal and practical Op-amp, DC and AC characteristics, 741 op-amp & its features; Op-Amp parameters & Measurement: Input & Out put Off set voltages & currents, slew rate, CMRR and PSRR.

UNIT-II	**APPLICATIONS OF OP-AMPS**	**Classes: 10**

Inverting and non-inverting amplifier, integrator, differentiator, instrumentation amplifier, V to I converter, I to V converter, Adders, Subtractors, AC amplifiers, Comparators, multivibrators, triangular and square wave generators, function generators, log and antilog amplifiers, Analog multiplier and divider.

UNIT-III	**PASSIVE AND ACTIVE FILTERS**	**Classes: 10**

Passive Filter: RC Response of Low pass and High pass circuits.
Active Filters: Classification of filters, 1st order Low pass and High pass filters, 2nd order Low pass, High pass, Band pass, Band reject and All pass filters.

UNIT-IV	**TIMERS & PLL**	**Classes: 09**

Timers: Introduction to 555 timer, functional diagram and operation of Mono-stable, Astable multivibrators using 555and their applications, Schmitt Trigger.
PLL: Introduction, Block schematic, Principles and description of individual blocks, 565 PLL. Applications of PLL.

UNIT-V	**DATA CONVERTERS**	**Classes: 09**

Data converters: Introduction, classification, Need of data converters.
DAC techniques: Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, DAC characteristics.
ADC techniques: Integrating, successive approximation, flash converters and A/D characteristics.

Text Books:

1. D. Roy Chowdhury, “Linear Integrated Circuits”, New age international (p) Ltd, 2nd Edition, 2003.
2. Ramakanth A. Gayakwad, “Op-Amps & linear ICs”, PHI, 3rd Edition, 2003.

Reference Books:

1. Salivahanan, “Linear Integrated Circuits and Applications”, TMH, 1st Edition, 2008.

COURSE OUTCOMES:
Upon the successful completion of the course, the student will be able to

CO1: Apply the concept of operational amplifiers and formulate its DC and AC characteristics.
CO2: Apply the principle to construct an op-amp as for the design of comparators, instrumentation amplifier, integrator, differentiator, multivibrators, waveform generators, log, anti-log amplifiers, etc.
CO3: Analyze and Design various types of active filters and Passive filters using op-amp and formulate its characteristics.
CO4: Apply the knowledge on Timers, analyze the PLLs and Design the multivibrators using IC555 timer.
CO5: Analyze and design analog and digital data converters for data processing applications.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	2	-	-	-	-	-	-	-	3	-
CO	**3**	**2.8**	**2.25**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

MICROPROCESSORS & MICROCONTOLLERS

<table>
<tr><td colspan="10">B.Tech III Year I Semester</td></tr>
<tr><td rowspan="1">Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA04504</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:48</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes:48</td></tr>
</table>

COURSE OBJECTIVES:

1. To introduce students with the architecture and operation of typical microprocessors and microcontrollers.
2. To familiarize the students with the programming and interfacing of microprocessors and microcontrollers.
3. To provide strong foundation for designing real world applications using microprocessors and microcontrollers.

UNIT-I	**INTRODUCTION**	**Classes: 10**

8086 Architecture-Block Diagram, Pin Diagram, Register Organization, Flag Register, Timing Diagrams, Memory Segmentation, Interrupt structure of 8086.

UNIT-II	**INSTRUCTION SET & PROGRAMMING**	**Classes: 10**

Addressing Modes-Instruction Set of 8086, Assembler Directives- Macros and Procedures-Simple ALPs.

UNIT-III	**LOW POWER RISC MSP430**	**Classes: 10**

Block diagram, features and architecture, Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, Register sets Addressing modes, Instruction set, on-chip peripherals (analog and digital), Sample Embedded system on MSP430 microcontroller

UNIT-IV	**I/O PORTS**	**Classes: 09**

Pull up/down resistors concepts, Interrupts, Watchdog Timer, System clocks, Low Power aspects of MSP430: Low power modes, Active Vs Standby current consumption, FRAM Vs Flash, Basic Timers, Real Time Clock (RTC), PWM control, Data transfer using DMA

UNIT-V	**SERIAL COMMUNICATION**	**Classes: 09**

Serial communication basics, Synchronous/Asynchronous interfaces - UART, USB, SPI, and I2C. Implementing and programming UART, I2C, SPI interfaces using MSP430, Implementing Embedded Wi-Fi using CC3100

Text Books:

1. A.K.Ray & K.M.Bhurchandi "Advanced Microprocessors and Peripherals", 2nd Edition TMH 2012.
2. MSP430 microcontroller basics, John H. Davies, Newnes Publication, 1st Edition, 2008.

Reference Books:

1. The X86 Microprocessors, Architecture, Programming and Interfacing, Lyla B. Das, Pearson Publications,2010
2. http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode
3. http://processors.wiki.ti.com/index.php/MSP430_16-Bit_Ultra-Low_Power_MCU_Training

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the architecture and different modes of operations of 8086 microprocessor and analyze their timing diagram.

CO2: Analyze different addressing modes and instructions of 8086, design and develop assembly language programs using software interrupts, subroutines and macros .

CO3: Exhibit the concepts of MSP430 family and their register set, addressing modes.

CO4: Analyze the concepts of I/O ports, Low power aspects of MSP430.

CO5: Design and Programming of serial communication Interface like UART, USB, SPI, and I2C using MSP430.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CO5	2	3	3	-	-	1	-	-	-	-	-	-	3	1
CO	**2.6**	**2.4**	**1.75**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2.6**	**1**

PROFESSIONAL ELECTIVE-I
DATA STRUCTURES

B.Tech III Year I Semester								
Course Code	Category	Hours/ Week			Credits	Maximum Marks		
19CA05301	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

COURSE OBJECTIVES:

1. Understand the Principles of Data Structures
2. Analyze how data structures are identified for solving Computational Problems.
3. Learn to provide design solutions for complex engineering problems using linear and non-linear data structures.
4. Acquire contextual knowledge of data structures to design applications for societal applications.

UNIT-I	INTRODUCTION TO DATA STRUCTURES, SEARCHING AND SORTING	Classes: 10

Introduction and Overview: Definitions, concept of data structures, classification of data structures, searching techniques: linear search, binary search; sorting techniques: insertion sort, selection sort, bubble sort, quick sort, Merge sort.

UNIT-II	LINKED LISTS	Classes: 10

Linked lists: Definition- Single linked list- Circular linked list- Double linked list- Circular Double linked list- Application of linked lists.

UNIT-III	STACKS AND QUEUES	Classes:10

STACKS: Basic Stack Operations Stack Linked List, Implementation, and Stack Applications
QUEUES: Queue Operations, Queue Linked List Design and Queue Applications.

UNIT-IV	TREES, SEARCH TREES, AND HEAPS	Classes: 09

Trees: Basic Tree Concepts, Binary Trees.
Binary Search Trees (BST): Basic Concepts, BST Operations, BST Applications.
AVL Search Trees: Basic Concepts, AVL Tree Implementations.
Heaps: Basic Concepts, Heap Implementation, Heap Application.

UNIT-V	MULTI-WAY TREES, GRAPHS AND HASHING	Classes: 09

Multi-way Trees: B-Trees, Simplified B-Trees, B-Tree Variations.
Graphs: Introduction- graph terminologies- representation of graphs- operations on graphs- application of graph structures: shortest path problem- topological sorting.
Hashing: Hashing Techniques, Collision Resolution Techniques, Closed Hashing, Open Hashing

Text Books:

1. Debasis Samanta, “Classic Data Structures”, PHI Learning, Second Edition, 2009.
2. Richard Gileberg, Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C”, Second Edition, 2007.

Reference Books:

1. G.A.V. Pai, “Data Structures and Algorithms”, Tata McGraw Hill, Second Edition, 2009
2. Fundamentals of Data Structures in C – Horowitz, Sahni, Anderson-Freed, Universities Press, Second Edition.
3. Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J.Augenstein, “Data Structures Using C”, Pearson Education, 2005.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Understand the concept of searching and sorting techniques.

CO2: About implementation of Linked Lists and its implementation.

CO3: About implementation of Stacks and Queues and its implementation.

CO4: Understand the conceptof Trees and Graphs and its implementation.

CO5: About implementation of Multiway Trees, Graphs and Hashing and its implementation.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	2	-	1	-	-	2	-	2	3	-	-
CO2	3	3	3	3	-	1	-	-	2	-	2	3	-	-
CO3	3	3	3	3	-	1	-	-	2	-	2	3	-	-
CO4	3	3	3	3	-	1	-	-	2	-	2	3	-	-
CO5	3	3	3	3	-	1	-	-	2	-	2	3	-	-
CO	**3**	**3**	**3**	**2.8**	**-**	**1**	**-**	**-**	**2**	**-**	**2**	**3**	**-**	**-**

ELECTROMAGNETIC INTERFERENCE & COMPATABILITY

B.Tech III Year I Semester

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
19CA04505	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

COURSE OBJECTIVES:

1. To study the basics of EMI, EMC.
2. To instill knowledge on the EMI coupling mechanism and its mitigation techniques.
3. To impart comprehensive insight about the current EMC standards and about various measurement techniques.

UNIT-I	BASIC THEORY	Classes: 10

Introduction to EMI and EMC, Intra and inter system EMI, Elements of Interference, Sources and Victims of EMI, Conducted and Radiated EMI emission and susceptibility, Case Histories, Radiation hazards to humans, Various issues of EMC, EMC Testing categories, EMC Engineering Application.

UNIT-II	COUPLING MECHANISM	Classes: 10

Electromagnetic field sources and Coupling paths, Coupling via the supply network, Common mode coupling, Differential mode coupling, Impedance coupling, Inductive and Capacitive coupling, Radiative coupling, Ground loop coupling, Cable related emissions and coupling, Transient sources, Automotive transients.

UNIT-III	EMI MITIGATION TECHNIQUES	Classes:09

Working principle of Shielding and Murphy's Law, LF Magnetic shielding, Apertures and shielding effectiveness, Choice of Materials for H, E, and free space fields, Gasketting and sealing, PCB Level shielding, Principle of Grounding, Isolated grounds, Grounding strategies for Large systems, Grounding for mixed signal systems, Filter types and operation, Surge protection devices, Transient protection.

UNIT-IV	STANDARDS AND REGULATIONS	Classes: 10

Need for Standards, Generic/General Standards for Residential and Industrial environment, Basic Standards, Product Standards, National and International EMI Standardizing Organizations; IEC, ANSI, FCC, AS/NZS, CISPR, BSI, CENELEC, ACEC. Electro Magnetic Emission and susceptibility standards and specifications, MIL461E Standards.

UNIT-V	TEST METHODS AND INSTRUMENTATION	Classes: 09

Fundamental considerations, EMI Shielding effectiveness tests, Open field test, TEM cell for immunity test, Shielded chamber , Shielded anechoic chamber, EMI test receivers, Spectrum analyzer, EMI test wave simulators, EMI coupling networks, Line impedance stabilization networks, Feed through capacitors, Antennas, Current probes, MIL -STD test methods, Civilian STD test methods.

Text Books:

1. Clayton Paul, "Introduction to Electromagnetic Compatibility", Wiley Interscience, 2006.
2. H.S.Kalsi, "Electronic Instrumentation", TMH, 2nd Edition, 2004.

Reference Books:

1. V Prasad Kodali, "Engineering Electromagnetic Compatibility", IEEE Press, Newyork, 2001.
2. Henry W. Ott, "Electromagnetic Compatibility Engineering", John Wiley & Sons Inc, Newyork, 2009.
3. Daryl Gerke and William Kimmel, "EDN"s Designers "Guide to Electromagnetic

Compatibility", Elsevier Science & Technology Books, 2002.
4. W Scott Bennett, "Control and Measurement of Unintentional Electromagnetic Radiation", John Wiley & Sons Inc., (Wiley Interscience Series) 1997.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Exhibit the knowledge on basics of EMI and EMC.
CO2: Apply the knowledge on the EMI coupling mechanism.
CO3: Analyze and design for the solution to EMI Sources, EMI problems in PCB level/ Subsystem and system level design.
CO4: Analyze the emission immunity level from different systems to couple with the prescribed EMC standards.
CO5: Demonstrate the knowledge on Measurement methods for field strength-EMI and various measurement techniques.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**2**	**1.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.4**	**-**

PYTHON PROGRAMMING

B.Tech III Year I Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
19CA05201	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes:48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

COURSE OBJECTIVES:

1. To elucidate problem solving through python programming language
2. To train in development of solutions using modular concepts
3. To teach practical Pythonic solution pattern.
4. To introduce function-oriented programming paradigm through python

UNIT-I	**INTRODUCTION TO PYTHON**	**Classes:10**

Introduction to Python: Python– Numbers, Strings, Variables, operators, expressions, statements, String operations, Math function calls, Input/Output statements

UNIT-II	**CONTROL STATEMENTS**	**Classes:09**

Conditional If, while and for loops, User defined Functions, parameters to functions, recursive functions, Turtle Graphics.

UNIT-III	**DATA STRUCTURES AND IDIOMATIC PROGRAMMING IN PYTHON**	**Classes: 09**

Lists, Tuples, Dictionaries, Strings, Files and their libraries. Beautiful Idiomatic approach to solve programming problems.

UNIT-IV	**PYTHON OBJECT ORIENTED PROGRAMMING**	**Classes: 10**

Introduction to oops: Concept of class, object and instances, Method. Inheritance. Polymorphism. Data Abstraction. Encapsulation. **Oops through Python:** Data hiding, Polymorphism, Inheritance, Class and static variables, Class methods and Static methods, Constructors and Destructors.

UNIT-V	**EVENT DRIVEN PROGRAMMING**	**Classes: 10**

Turtle Bar Chart, Event Driven programming. Key press events, Mouse events, timer events.

Text Books:

1. http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
2. https://zhanxw.com/blog/wp-content/uploads/2013/03/BeautifulCode_2.pdf
3. Allen B.Downey," Think Python: How to like a computer scientist " , 2nd edition. Green Tea Press
4. Mark Lutz, "Programming Python," O'Reilly Publications, Fourth Edition, 2011.

Reference Books:

1. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python:
2. An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
3. Timothy A. Budd, ―Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd., 2015.
4. Kenneth A. Lambert, ―Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.
5. Kenneth Lambert and B.L. Juneja, Fundamentals of Python, Cengage Learning, Third Edition, 2012.
6. John V Guttag, ―Introduction to Computation and Programming Using Python'', Revised

and expanded Edition, MIT Press , 2013
COURSE OUTCOMES: **Upon the successful completion of the course, the student will be able to** CO1: Demonstrate the knowledge on python programming language CO2: Analyze the concept of module for providing the solutions CO3: Implement python solution patterns CO4: Analyze programming paradigms CO5: Investigate and analyze function oriented python paradigms

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**2.6**	**1.75**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

DIGITAL SYSTEM DESIGN

B.Tech III Year I Semester									
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
19CA04506	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes:48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

COURSE OBJECTIVES:

1. To be able to use computer-aided design tools for development of complex digital logic circuits.
2. To be able to model, simulate, verify, analyze, and synthesize with hardware description languages.
3. To be able to design and prototype with standard cell technology and programmable logic.
4. To be able to design tests for digital logic circuits, and design for testability.

UNIT-I | CMOSLOGIC | Classes:10

Introduction to logic families, CMOS logic, CMOS steady state electrical behavior, CMOS dynamic electrical behavior, CMOS logic families.
Bipolar Logic and Interfacing; Bipolar logic, Transistor logic, TTL families, CMOS/TTL interfacing, low voltage CMOS logic and interfacing, emitter coupled logic, comparison of logic families, Familiarity with standard 74-series and CMOS40-series-ICs-specifications.

UNIT-II | HARDWARE DESCRIPTION LANGUAGE | Classes:09

Hardware Description Language: Design flow, Program Structure, Types and constants, functions and procedures, Libraries and Packages.
The VHDL design elements: Structural design elements, data flow design elements, behavioral design elements, time dimension and simulation synthesis.

UNIT-III | COMBINATIONAL LOGIC DESIGN | Classes: 10

Decoders, Encoders, Multiplexers and demultiplexers, Code Converters, EX-OR gates and parity circuits, comparators, adders and subtractors, ALUs, combinational multipliers. VHDL modes for the above ICs. Design examples-Barrel shifter, comparators, floating-point encoder, dual parity encoder.

UNIT-IV | SEQUENTIAL LOGIC DESIGN | Classes: 10

Latches and Flip-flops, PLDs, Counters, Shift registers and their VHDL models, Synchronous Design methodology.

UNIT-V | MEMORY DEVICES | Classes: 09

ROMs: Internal Structure, 2D– decoding commercial types, timing and applications.
Static RAMs: Internal Structure, timing and standard SRAMs, Synchronous SRAMs.
Dynamic RAMs: Internal Structure, timing and standard DRAMs, Synchronous DRAMs.

Text Books:

1. John F.Wakerly, "Digital Design Principles and Practices", 4th edition, Pearson Education., 2009.
2. Charles H.Roth, Jr., "Fundamentals of Logic Design" 5th edition, CENGAGE Learning 2012.

Reference Books:

1. M.Morris Manoand Michael D.Cilleti., "Digital Logic Design", 4th edition Pearson

Education., 2013.
2. Stephen Brown and Zvonko Vranesic, “Fundamentals of digital logic with VHDL design”, 2nd edition McGraw Hill Higher Education.
3. J. Bhasker, “AVHDL PRIMER”, 3rd edition Eastern Economy Edition, PHI Learning, 2010.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Apply the knowledge on Various digital logic families and Analyze the structural description and electrical characteristics.

CO2: Demonstrate the fundamental concepts of HDL and Programming models of VHDL.

CO3: Analyze the Combinational logic circuits and design using IC’s. Develop the programs for Combinational logic circuits using VHDL code.

CO4: Analyze the the Sequential circuits and design by using VHDL code.

CO5: Analyze and Design different types of memory elements.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO5	2	3	2	-	-	-	-	-	-	-	-	-	2	-
CO	**2.8**	**3**	**2.75**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.8**	**-**

OPEN ELECTIVE-I
JAVA PROGRAMMING

<table>
<tr><td colspan="10">B.Tech III Year I Semester</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>19CA05403</td><td>Elective</td><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:48</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

1. Study the syntax, semantics and features of Java Programming Language.
2. Learn the method of creating Multi-threaded programs and handle exceptions.
3. Learn Java features to create GUI applications & perform event handling.

UNIT-I	**OOP CONCEPTS, OVERVIEW OF JAVA, DATA TYPES, ARRAYS AND VARIABLES**	**Classes: 10**

Introduction: Basic concepts of Object Oriented Programming: Object, Class, Encapsulation, Data abstraction, Inheritance, Polymorphism, The Creation of java, Java's magic: The byte ode, java Buzz words. An Overview of Java: Lexical issues. Data Types, Arrays and Variables: Primitive Types, Integers, Floating-point Types, Characters, Booleans, literals, variables, Arrays.

UNIT-II	**OPERATORS, CONTROL STATEMENTS AND CLASSES**	**Classes: 09**

Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logic operators, The assignment operator, The ?: Operator Control Statements: Java's selection Statements, Iteration statements, Jump Statements. Introducing Classes: Class Fundamentals, Declaring Objects, Introducing Methods, Constructors, The this Keyword, Overloading Methods, Introducing Access control, Exploring the String class.

UNIT-III	**INHERITANCE, PACKAGES AND INTERFACES, EXCEPTION HANDLING**	**Classes: 10**

Inheritance: Basics, Using super, method overriding, dynamic method dispatch, using abstract class, using final with inheritance, the object class. Packages and Interfaces: Packages, Importing Packages, Defining an Interface, Implementing an interfaces, Interfaces can be extended. Exception Handling: Exception handling Fundamentals, Exception Types, Using try and catch, Multiple catch clauses, throw, throws, finally, Java Built-in Exceptions.

UNIT-IV	**MULTITHREADING, I/O, AND APPLETS**	**Classes: 09**

Multithreading, I/O, and Applets: The Java Thread Model, The main thread, creating a thread, I/O basics, Reading Console input, Writing console Output, Reading and writing files, Applet fundamentals, An applet skeleton, Simple Applet displaying methods, passing parameters to Applets.

UNIT-V	**INTRODUCTION TO AWT, USING AWT CONTROLS, LAYOUT MANAGERS, AND MENUS**	**Classes: 10**

Introduction to AWT: Working with windows, and graphics :
AWT classes, window fundamentals, creating a frame window in an AWT Based applet, creating a window program, Graphics.
Using AWT controls, and Layout Managers :
Control fundamentals: Labels, using buttons, applying check boxes, choice controls, Managing scroll bars, using a Text field, Understanding layout managers.

Text Books:

1. "Java, The Complete Reference", Herbert Schildt, MC GRAW HILL Education, 9th Edition,2016.
2. "Programming with Java" T.V.Suresh Kumar, B.Eswara Reddy, P.Raghavan Pearson Edition.

Reference Books:

1. "Java Fundamentals - A Comprehensive Introduction", Herbert Schildt and Dale Skrien, Special Indian Edition, McGrawHill, 2013.
2. "Java – How to Program", Paul Deitel, Harvey Deitel, PHI.
3. "Core Java", NageswarRao, Wiley Publishers.
4. "Thinking in Java", Bruce Eckel, Pearson Education.
5. "A Programmers Guide to Java SCJP", Third Edition, Mughal, Rasmussen, Pearson.
6. "Head First Java", Kathy Sierra, Bert Bates, O'Reilly "SCJP – Sun Certified Programmer for Java Study guide" – Kathy Sierra, Bert Bates, McGrawHill

Web References:

1. http://www.javatpoint.com/java-tutoria
2. http://www.javatutorialpoint.com/introduction-to-java/

E-Text Books:

1. http://bookboon.com/en/java-programming-language-ebooks
2. https://en.wikibooks.org/wiki/Java_Programming

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Ability to use an IDE to develop, run and test Java programs

CO2: Ability to solve the problems using object oriented approach and design solutions which are robust

CO3: Build Java applications by handling exceptions

CO4: Construct concurrent applications by applying Multithreading and Applets concepts in java

CO5: Design applications using AWT concepts in java

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	-	2	-	-	2	2	2	-	2	-	-
CO2	3	3	2	-	2	-	-	2	2	2	-	1	-	-
CO3	3	3	2	-	2	-	-	2	2	2	-	2	-	-
CO4	3	3	2	-	2	-	-	2	2	2	-	2	-	-
CO5	3	3	2	-	2	-	-	2	2	2	-	2	-	-
CO	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**2**	**2**	**2**	**-**	**1.8**	**-**	**-**

EMBEDDED SYSTEMS

B.Tech III Year I Semester									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
19CA04513	Core	3	1	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

1. To understand the fundamental concepts of Embedded systems.
2. To learn the kernel of RTOS, architecture of ARM processor.
3. To understand the addressing and interfacing of ARM processor
4. to understand the concepts of Internet of Things

UNIT-I	INTRODUCTION TO EMBEDDED SYSTEMS	Classes: 12

Introduction, host and target concept, embedded applications, features and architecture considerations for embedded systems- ROM, RAM, timers; data and address bus concept, Embedded Processor and their types, Memory types, overview of design process of embedded systems, programming languages and tools for embedded design.

UNIT-II	EMBEDDED PROCESSOR ARCHITECTURE	Classes: 11

Introduction to processor architecture, CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture. Introduction to ARM architecture and Cortex – M series, Introduction to the TM4C family viz. TM4C block diagram, address space, on-chip peripherals,Addressing modes and instruction set basics.

UNIT-III	OVERVIEW OF MICROCONTROLLER AND EMBEDDED SYSTEMS	Classes: 13

Embedded hardware and various building blocks, Processor Selection for an Embedded System, Interfacing Processor, Memories and I/O Devices, I/O interfacing concepts, Timers, Serial Communication and Advanced I/O, Buses between the Networked Multiple Devices. Embedded System Design and Co-design Issues in System Development Process, Design Cycle in the Development Phase for an Embedded System.

UNIT-IV	MICROCONTROLLER FUNDAMENTALS FOR BASIC PROGRAMMING	Classes: 11

I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, System Clocks and control, Hibernation Module on TM4C, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. Basic Timer, Real Time Clock (RTC).

UNIT-V	EMBEDDED COMMUNICATIONS PROTOCOLS AND INTERNET OF THINGS	Classes: 13

Embedded Networking fundamentals,Synchronous/Asynchronous interfaces (like UART, SPI, I2C), serial communication basics, baud rate concepts, Interfacing digital and analog external device, Internet of Things: IoT overview and architecture, Overview of wireless sensor networks. Embedded Wi-Fi, User APIs for Wireless and Networking applications.

TEXT BOOKS:

1. Embedded Systems: Real-Time Interfacing to ARMCortex-M Microcontrollers, Create space publications.2014.
2. Embedded Systems: Introduction to ARM Cortex - M Microcontrollers, 5th edition, Jonathan W Valvano, Createspace publications, 2012.
3. Embedded Systems 2E Raj Kamal, Tata McGraw-Hill Education, 2011.

REFERENCE BOOKS:

1. CC3100/CC3200 Simple Link™ Wi-Fi® Internet-on-a-Chip User Guide Texas Instruments Literature Number: SWRU368A April 2014–Revised August 2015.
2. Embedded Systems architecture, Tammy Noergaard, Newnes publications,2005.
3. Embedded Systems handbook, Richard Zurawski,
4. The Art of Designing Embedded Systems by Jack Ganssle, 2nd edition, Newnes publications,2008.

WEBREFERENCES:

1. http://processors.wiki.ti.com/index.php/HandsOn_Training_for_TI_Embedded_Processors
2. http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_Workshop
3. http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html

COURSE OUTCOMES:

After completion the students will be able to

1. Design of embedded systems leading to 32-bit application development.
2. Understand hardware-interfacing concepts to connect digital as well as analog sensors while ensuring low power considerations.
3. Review and implement the protocols used by microcontroller to communicate with external sensors and actuators in realworld.
4. Understand Embedded Networking and IoT concepts based upon connected MCUs.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	1	-	-	-	-	-	-	3	1
CO3	2	3	1	-	-	1	-	-	-	-	-	-	2	1
CO4	3	1	-	-	-	2	-	-	-	-	-	-	2	2
CO5	3	1	-	-	-	-	-	-	-	-	-	-	2	-
CO	**2.8**	**2.2**	**1.67**	**-**	**-**	**1.33**	**-**	**-**	**-**	**-**	**-**	**-**	**2.4**	**1.33**

INTRODUCTION TO MEMS

B.Tech III Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
19CA04508	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

COURSE OBJECTIVES:
The course should enable the students to:

1. To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
2. To educate on the rudiments of Micro fabrication techniques.
3. To introduce various sensors and actuators
4. To introduce different materials used for MEMS
5. To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

UNIT-I	**INTRODUCTION TO MEMS & MICRO SYSTEMS**	**Classes: 10**

Introduction to MEMS & Microsystems, Introduction to Micro sensors, Evaluation of MEMS, Market Survey, Application of MEMS, MEMS Materials, MEMS Materials Properties, MEMS Materials Properties

UNIT-II	**MICROELECTRONIC TECHNOLOGY FOR MEMS**	**Classes: 10**

Microelectronic Technology for MEMS, Micromachining Technology for MEMS, Micromachining Process, Etch Stop Techniques and Microstructure, Surface and Quartz Micromachining, Fabrication of Micro machined Microstructure, Micro stereo lithography.

UNIT-III	**MICRO SENSORS**	**Classes: 10**

MEMS Micro sensors, Thermal Micro sensors, Mechanical Micro machined Micro sensors, MEMS Pressure Sensor, MEMS Flow Sensor, Micro machined Flow Sensors, MEMS Inertial Sensors, MEMS Gyro Sensor

UNIT-IV	**MEMS ACCELEROMETERS**	**Classes: 08**

Micro machined Micro accelerometers for MEMS, MEMS Accelerometers for Avionics, Temperature Drift and Damping Analysis, Piezo resistive Accelerometer Technology, MEMS Capacitive Accelerometer, MEMS Capacitive Accelerometer Process, MEMS for Space Application

UNIT-V	**MEMS APPLICATIONS**	**Classes: 10**

Polymer MEMS & Carbon Nano Tubes CNT, Wafer Bonding & Packaging of MEMS, Interface Electronics for MEMS, Introduction to Bio MEMS and Micro Fluidics, Introduction to Bio Nano Technology, Bio Sensors, Fluidics, MEMS for Biomedical Applications (Bio-MEMS)

TEXT BOOKS:

1. Chang Liu, ‘Foundations of MEMS’, Pearson Education Inc., 2012.
2. Stephen D Senturia, ‘Microsystem Design’, Springer Publication, 2000.
3. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2002.

REFERENCE BOOKS:

1. Nadim Maluf, “An Introduction to Micro Electro Mechanical System Design”, Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, “The MEMS Handbook”, CRC press Baco Raton, 2001
3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, JohnWiley & Son LTD, 2002.
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, “Introduction MEMS, Fabrication and Application,” Springer, 2010.

6. Varadan, V KandVaradan “Microsensors, actuators, MEMS, and electronics for smart structures” Rai-Choudhury P (ed.) Handbook of Microlithography, Micromachining, and Micro fabrication, SPIE Optical Engineering Press.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Apply the knowledge on MEMS & Microsystems; identify different materials used for MEMS.

CO2: Exhibit the knowledge on the Microelectronic Technology and analyze the rudiments of Micro fabrication techniques.

CO3: Apply the fundamental knowledge on various sensors and actuators

CO4: Exhibit the concept of MEMS Accelerometers.

CO5: Exhibit the knowledge on the applications of MEMS to discipline of Bio-Medical Engineering.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	-	3	-	-	-	-	-	-	3	3
CO	**3**	**2**	**1**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2.8**	**3**

MATERIAL SCIENCE AND ENGINEERING

<table>
<tr><td colspan="10">B.Tech III Year I Semester</td></tr>
<tr><td>Course code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA03202</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:48</td><td colspan="2">Tutorial Classes: Nil</td><td colspan="3">Practical Classes: Nil</td><td colspan="3">Total Classes:48</td></tr>
</table>

COURSE OBJECTIVES:

1. To understand the basic structure, properties of metals, mechanism of crystallization and imperfections in crystals.
2. To study the importance of binary phase diagrams.
3. To acquire knowledge on properties and structure of ferrous and nonferrous alloys and to select suitable materials for various engineering applications.
4. To learn various methods of heat treatment.
5. To demonstrate the properties of ceramics, composites and their applications.

UNIT-I	**STRUCTURE OF METALS AND CONSTITUTION OF ALLOYS**	**Classes:10**

Bonds in Solids – Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size. Necessity of alloying, types of solid solutions, Hume Rotherys rules and intermediate alloy phases.

UNIT-II	**EQUILIBRIUM DIAGRAMS**	**Classes:10**

Construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni- , Al-Cu, and Fe-Fe_3C.

UNIT-III	**CAST IRONS AND STEELS**	**Classes:10**

Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

Non-Ferrous Metals And Alloys: Structure and properties of copper and its alloys, Aluminum and its alloys, Titanium and its alloys.

UNIT-IV	**HEAT TREATMENT OF ALLOYS**	**Classes:08**

Heat Treatment Of Alloys: Effect of alloying elements on Iron – Iron carbon system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability, surface - hardening methods, Age hardening treatment. Heat treatment of plastics

UNIT-V	**CERAMIC MATERIALS AND COMPOSITE MATERIALS**	**Classes:10**

Ceramic Materials: Crystalline ceramics, glasses, cermets.

Composite Materials: Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, polymer composites, metal ceramic mixtures, metal – matrix composites and Carbon – Carbon composites.

Text Books:

1. Kodgire, Material Science and Metallurgy, 42nd edition Everest Publishing House 2017.
2. Donald R. Askeland, Essential of Materials Science and Engineering. Thomson Publications 2014

Reference Books:

1. Sidney H. Avener, Introduction to Physical Metallurgy, TMH
2. William and collister, Materials Science and Engineering, wiley pub. 2014
3. V. Raghavan, Material science and engineering, PH Pub. 2015
4. R.K.Rajput, Engineering materials and metallurgy. S.Chand & Co. 2006
5. O.P. Khanna, Material Science and Metallurgy. Dhanpatrai Pub. 2014
6. L.H. Van Vlack, Elements of Material Science and Engineering, 6/e, Pearson Education, 2008

COURSE OUTCOMES:

At the end of the course, the student will be able to

1. Understand the mechanism of crystallization, methods of determining grain size and factors affecting the solid solubility.
2. Interpret the phase diagrams of materials
3. Understand the structure and properties of various cast irons, steels and non ferrous alloys.
4. Describe the concept of heat treatment of steels and surface hardening methods depending on material requirements.
5. Understand the importance of ceramics, composites and their use.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO2	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO3	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO4	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO5	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO	**3**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

ANALOG & DIGITAL COMMUNICATIONS LABORATORY

B.Tech III Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
19CA04509	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	**0**	**3**	**1.5**	**30**	**70**	**100**
Contact Classes: Nil	**Tutorial Classes:Nil**	**Practical Classes: 48**				**Total Classes:48**		

Course OBJECTIVES:

1. Implement various Modulation techniques in Analog communication.
2. Understand the importance of Automatic Gain Control.
3. Understand the importance of Time Division of Multiplexing.
4. Experience real time behavior of different Digital Modulation schemes.

LIST OF EXPERIMENTS

Experiments on Analog Communication (ANY FIVE EXPERIMENTS)

1	**AMPLITUDE MODULATION AND DEMODULATION**
Generation of amplitude modulation and demodulation using hardware.	
2	**BALANCED MODULATOR AND SYNCHRONOUS DETECTOR**
Generation of Double side band suppressed carrier modulation and demodulation using hardware.	
3	**SINGLE SIDE BAND MODULATION AND DEMODULATION**
Generation of Single Side Band suppressed carrier modulation and demodulation using hardware.	
4	**FREQUENCY MODULATION AND DEMODULATION**
Generation of frequency modulation and demodulation using hardware.	
5	**PRE-EMPHASIS AND DE-EMPHASIS**
Verification of pre-emphasis and de-emphasis to boost high frequency modulating signal using hardware.	
6	**CHARACTERISTICS OF AUTOMATIC GAIN CONTROL**
Verification of automatic gain control characteristics using hardware.	

Experiments on Digital Communication (ANY FIVE EXPERIMENTS)

7	**TIME DIVISION MULTIPLEXING.**
To design Time Division Multiplexing using hard ware.	
8	**PULSE CODE MODULATION.**
To design Pulse Code Modulation using hard ware.	
9	**DIFFERENTIAL PULSE CODE MODULATION.**
To design Differential Pulse Code Modulation using hard ware.	
10	**DELTA MODULATION.**
To design Delta Modulation using hard ware.	
11	**FREQUENCY SHIFT KEYING.**
To design Frequency Shift Keying using hard ware.	
12	**DIFFERENTIAL PHASE SHIFT KEYING.**
To design Differential Phase Shift keying using hard ware.	

Reference Books:

1. John Proakis, “Digital Communications”, TMH, 2nd Edition 1983.
2. B.P.Lathi, “Modern Analog and Digital Communication”, Oxford reprint, 3rd Edition, 2004.
3. Singh, Sapre, “Communication Systems Analog and Digital”, TMH, 2ndEdition
4. S.S.Haykin, “Communication Systems”, Wiley Eastern, 2nd Edition, 2006.
5. Taub, Schilling, “Principles of Communication Systems”, Tata McGraw-Hill, 4th edition, 2013.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate knowledge on analog and Digital Communication systems.

CO2: Analyze the functionality of modulation and demodulation of various analog and digital communication systems.
CO3: Design the Time division multiplexing and demultiplexing circuit for various signals, analog and digital communication systems.
CO4: Conduct investigation and test the functionality on implementation of modulation and demodulation circuits.
CO5: Follow ethical principles in designing implementing circuits.
CO6: Do experiments effectively as an individual and as a member in a group.
CO7: Communicate verbally and in written form, the understandings about the experiments.
CO8: Continue updating their skill related to implementation for various applications during their life time.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-		3	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

LIST OF EQUIPMENT REQUIRED

S. No	Name of the Equipment	Range
1	CRO	0-20 MHz
2	Arbitrary Wave Form Generators/ Pns Generators	2 Nos
3	Amplitude modulation and demodulation kit	---
4	Frequency modulation and demodulation kit	---
5	Single side band & suppressed carrier kit	---
6	Double side band and suppressed carrier kit	---
7	Pre-emphasis and de-emphasis kit	---
8	Automatic gain control kit	---
9	Time division multiplexing and demultiplexing kit	---
10	PCM, DPCM trainer kits	---
11	DELTA Modulation trainer kits	---
12	FSK, DPSK trainer kits	---

INTEGRATED CIRCUITS & APPLICATIONS LABORATORY

B.Tech III Year I Semester									
Course Code	Category	Hours / Week			Credits	Maximum Marks		
19CA04510	Core	L	T	P	C	CIA	SEE	Total
		0	0	2	1	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 32				Total Classes:32		

COURSE OBJECTIVES:

1. To implement different circuits and verify circuit concepts.
2. To Study the concepts of multivibrators and filters.
3. To verify the operations of the timers and PLLs and their applications.
4. To design and verify combinational and sequential circuits.

LIST OF EXPERIMENTS

MINIMUM OF TEN EXPERIMENTS TO BE CONDUCTED (FIVE FROM EACH PART)

1	**INVERTING, NON-INVERTING AND DIFFERENTIAL AMPLIFIERS**
To construct and test the performance of an Inverting, Non-inverting amplifier and Differential amplifier.	
2	**INTEGRATOR AND DIFFERENTIATOR**
To construct and test the performance of an Integrator and Differentiator.	
3	**FIRST ORDER ACTIVE BANDPASS FILTERS**
To design and verify the operation of the Active Band Pass filter.	
4	**ASTABLE MULTIVIBRATOR**
To design and construct an Astable multivibrator.	
5	**PHASE LOCKED LOOP (PLL)**
To verify characteristics of PLL.	
6	**INSTRUMENTATION AMPLIFIER**
To design and verify the operation of instrumentation amplifier	
EXPERIMENTS CAN BE PERFORMED USING HARDWARE OR SOFTWARE TOOLS	
7	**MULTIPLEXER AND DEMULTIPLEXER**
To verify functionality of Multiplexer (1:4) and Demultiplexer (4:1).	
8	**ENCODER AND DECODER**
To Verify Functionality of Encoder (4:2) and Decoder (2:4).	
9	**REALIZATION OF DIFFERENT FLIP-FLOPS USING LOGIC GATES**
To Verify functionality of Flip-flops using Universal Logic Gates.	
10	**4 BIT COUNTERS**
To verify functionality of counters using JK Flip Flops.	
11	**REALIZATION OF SHIFT REGISTERS**
To verify functionality of 4 bit Shift Registers in SISO, SIPO, PISO, PIPO modes using D Flip-Flop.	
12	**DECADE COUNTER**
To verify functionality of decade counter using J-K/T Flip-Flop.	

Reference Books:

1. D. Roy Chowdhury, “Linear Integrated Circuits”, New age international (p) Ltd, 2nd Edition, 2003.
2. Ramakanth A. Gayakwad, “Op-Amps & linear ICs”, PHI, 3rd Edition,2003.
3. John F. Wakerly, “Digital Design Principles and Practices”, Prentice Hall, 3rd Edition, 2005.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Apply the concepts of Operational Amplifiers in Linear and Non-linear applications, PLL, Combinational & Sequential Logic circuits.

CO2: Analyze the characteristics of Operational Amplifiers in Linear and Non-linear applications, PLL, Combinational & Sequential Logic circuits.

CO3: Design the Operational Amplifiers in Linear and Non-linear applications, PLL, Combinational & Sequential Logic circuits.

CO4: Conduct investigation and test the functionality on design of Various Operational Amplifiers in Linear and Non-linear applications, PLL, Combinational & Sequential Logic circuits.

CO5: Follow ethical principles in designing circuits.

CO6: Do experiments effectively as an **individual** and as a member in a group.

CO7: Communicate verbally and in written form, the understandings about the experiments.

CO8: Continue updating their skill related to implementation for various application during their life time**.**

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-		3	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

LIST OF EQUIPMENT REQUIRED		
S. No	**Name of the Equipment**	**Range**
1	REGULATED POWER SUPPLY	0-30V DC
2	CRO	0-20 MHz
3	FUNCTION GENERATOR	20 MHZ
4	DIGITAL IC TRAINER KIT	--
5	RESISTORS	47Ω, 82 Ω, 100 Ω, 150 Ω, 220 Ω, 470 Ω, 560 Ω, 1k Ω, 2.2k Ω, 3.3kΩ, 5k Ω,10k Ω
6	INDUCTORS	0.01mH, 0.1mH,10mH, 50mH
7	CAPACITORS	0.01µF, 0.1µF, 0.47µF, 470µF, 33µF
8	DECADE COUNTER	IC 7490
9	OP-AMP	741 IC
10	TIMER IC	555 IC
11	LED’S	Different Colors
12	7 SEGMENT DISPLAY UNIT	-----

MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

<table>
<tr><td colspan="11">B.Tech III Year I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA04511</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 48</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

The course should enable the students to:

1. Develop assembly language programs and provide the basics of the microprocessors.
2. Understanding the interfacing of external devices to the processor and controller for various applications.
3. Learn Embedded C programming using MSP430microcontroller.
4. Develop ability in programming using microprocessor and microcontroller.

LIST OF EXPERIMENTS

<table>
<tr><td>WEEK – l</td><td>DESIGN A PROGRAM USING WIN862</td></tr>
<tr><td colspan="2">Design and develop an Assembly language program using 8086 microprocessor and to show the following aspects.
a) Programming b)Execution c)Debugging
To Demonstrate the MASM/TASM software and Trainer kit for 8086 Microprocessor.</td></tr>
<tr><td>WEEK-2</td><td>16 –BIT ARITHMETIC AND LOGICAL OPERATIONS</td></tr>
<tr><td colspan="2">Write an ALP program to perform 16 Bit arithmetic and logical operations.</td></tr>
<tr><td>WEEK-3</td><td>MULTIBYTE ADDITION AND SUBRACTION</td></tr>
<tr><td colspan="2">Write an ALP program to perform multi byte addition and subtraction.</td></tr>
<tr><td>WEEK -4</td><td>PROGRAMS TO SORT NUMBERS</td></tr>
<tr><td colspan="2">a) Write an ALP program to perform ascending order using 8086.
b) Write an ALP program to perform descending order using 8086.</td></tr>
<tr><td>WEEK -5</td><td>PROGRAMS FOR STRING MANIPULATIONS OPERATIONS</td></tr>
<tr><td colspan="2">a) Write an ALP program to insert or delete a byte in the given string.
b) Write an ALP program to search a number/character in a given string.
c) Write an ALP program to move a block of data from one memory location to the other
d) Write an ALP program for reverse of a given string.</td></tr>
<tr><td>WEEK -6</td><td>CODE CONVERSIONS</td></tr>
<tr><td colspan="2">Write an ALP program to convert packed BCD to Unpacked BCD.</td></tr>
<tr><td>WEEK -7</td><td>INTERFACING AND PROGRAMMING GPIO PORTS IN Embedded C USING MSP430</td></tr>
<tr><td colspan="2">Interfacing and programming GPIO ports in Embedded C using MSP430 (blinking LEDs).</td></tr>
<tr><td>WEEK -8</td><td>INTERFACING AND PROGRAMMING GPIO PORTS IN Embedded C USING MSP430</td></tr>
<tr><td colspan="2">Interfacing and programming GPIO ports in Embedded C using MSP430 (LED blink using push button).</td></tr>
<tr><td>WEEK-9</td><td>USAGE OF LOW POWER MODES</td></tr>
<tr><td colspan="2">a) Measure the active mode current
b) Standby mode current using MSPEXP430FR5969 as hardware</td></tr>
<tr><td>WEEK-l0</td><td>USING ULP ADVISOR</td></tr>
<tr><td colspan="2">Using ULP advisor in Code Composer Studio on MSP430</td></tr>
<tr><td>WEEK-l1</td><td>LOW POWER MODES AND ENERGY TRACE++</td></tr>
<tr><td colspan="2">a) Enable Energy Trace and Energy Trace ++ modes in CC Studio
b) Compute Total Energy, and Estimated lifetime of an AAbattery.</td></tr>
<tr><td>WEEK-12</td><td>PWM GENERATION</td></tr>
</table>

PWM generation using Timer on MSP430 GPIO

Reference Books:

1. A.K.Ray & K.M. Bhurchandi "Advanced Microprocessor and Peripherals", 2nd Edition TMH, 2012.
2. MSP430 microcontroller basics. John H. Davies, Newnes Publication, 1st Edition, 2008.

Web References:

1. http://www.nptel.ac.in/downloads/106108100
2. http://www.the8051microcontroller.com/web-references

HARDWARE AND SOFTWARE REQUIRED

HADWARE: Desktop Computer Systems.
SOFTWARES: MASM/TASM and CC Studio.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate knowledge on Assembly Language Program using 8086 Microprocessor.
CO2: Analyze the Assembly Language Program to perform Arithmetic, Logical Operations, Sorting, String manipulation operations and Code conversion.
CO3: Design the GPIO Ports, PWM Generation in Embedded C programming using MSP430 microcontroller.
CO4: Conduct investigation and test the functionality of Low power modes and energy trace.
CO5: Select appropriate tools as MASM/TASM software and Trainer kit for 8086 Microprocessor and procedure to Interface external devices to the processor and controller.
CO6: Follow ethical principles in designing, simulating and implementing circuits.
CO7: Do experiments effectively as an individual and as a member in a group.
CO8: Communicate verbally and in written form, the understandings about the experiments.
CO9: Continue updating their skill related to implementation for various application during their life time.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-		3	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

LIST OF EQUIPMENT REQUIRED

S. No	Name of the Equipment	Range
1	MSP430 Trainer kits	12 MHz/5V
2	Serial Interface cable	--

MICROWAVE & OPTICAL COMMUNICATION

B.Tech III Year II Semester								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
19CA04601	**Core**	**2**	**1**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 32	**Tutorial Classes:16**	**Practical Classes: Nil**				**Total Classes:48**		

COURSE OBJECTIVES:

1. To develop the knowledge on transmission lines for microwaves, waveguide components and applications.
2. To understand the scattering matrix parameters and its use.
3. The course gives an account of optical Communication starting with the basic of fiber optics.
4. To give clear understanding of various components such as Optical fibers, Photo detectors, connectors, coupling devices and optical amplifiers Knowledge of various components used in optical networks.

UNIT-I	MICROWAVE TRANSMISSION LINES	Classes: 10

MICROWAVE TRANSMISSION LINES: Introduction, Microwave spectrum and bands, applications of Microwaves. Rectangular Waveguides-Solution of Wave Equation in Rectangular Coordinates, TE/TM mode analysis, Expressions for fields, Characteristic equation and cutoff frequencies, dominant and degenerate modes, sketches of TE and TM mode fields in the cross-section. Mode characteristics- Phase and Group velocities, wavelengths and impedance relations.

UNIT-II	WAVEGUIDE COMPONENTS AND APPLICATIONS	Classes: 10

Coupling mechanisms: Probe, loop, waveguide discontinuities, Waveguide attenuators; Waveguide phase shifters; waveguide multiport junctions: Properties and s-matrix calculations of E plane Tee, H plane Tee, Magic Tee, Directional Coupler.
Ferrites: Faraday rotation principle, gyrator, isolator, circulator.

UNIT-III	MICROWAVE TUBES & INTRODUCTION TO OPTICAL FIBERS	Classes: 09

Microwave linear beam tubes: Limitations of conventional tubes at microwave frequencies; Two Cavity klystron Amplifier, Single cavity Klystron Oscillator..
Introduction To Optical Fibers: Evolution of fiber optic system, Element of an Optical Fiber Transmission link, Ray Optics, OpticalFiber Modes and Configurations, Mode theory of Circular Wave guides, Key Modal concepts, Linearly Polarized Modes.

UNIT-IV	SIGNAL DEGRADATION OPTICAL FIBERS	Classes: 10

Attenuation, Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides, Information Capacity determination, Group Delay, Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers, Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers, Mode Coupling.

UNIT-V	FIBER OPTICAL SOURCES AND COUPLING	Classes: 09

Direct and indirect Band gap materials, LED structures, Light source materials, Quantum efficiency and LED power, Modulation of a LED, lasers Diodes, Modes and Threshold condition, Rate equations,
External Quantum efficiency, Resonant frequencies, Temperature effects, Introduction to Quantum laser, source-to-fiber Power Launching, Lensing schemes, Fiber–to- Fiber joints, Fiber splicing.

Text Books:

1. Samuel Y. Liao, "Microwave Devices and Circuits", Pearson, 3rd Edition, 2003.
2. Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, "Microwave Principles", CBSPublishers and Distributors, New Delhi, 1st Edition, 2004.
3. Gerd Keiser, "Optical Fiber Communication" McGraw –Hill International, Singapore, 3rd edition,2000.

4. J.Senior, “Optical Communication, Principles and Practice”, Prentice Hall of India, 1994.

Reference Books:

1. R.E.Collin,“FoundationsforMicrowaveEngineering”IEEEPress,JohnWiley,2nd Edition,2002.
2. Peter A.Rizzi,“Microwave Engineering Passive Circuits”, PHI,3rd Edition, 1999.
3. Max Ming-Kang Liu, “Principles and Applications of Optical Communications”, TMH, 2010.
4. S.C.Gupta, “Text book on optical fiber communication and its applications”, PHI, 2005.

Web References:

1. http://nptel.ac.in/courses/117101119/1
2. http://www-group.slac.stanford.edu/kly/Lecture_Series/slac_klystron_lecture_series.htm
3. https://books.google.co.in/books?id=ZU19Uemy83YC&printsec=frontcover&dq=microwave + engineering&hl=en&redir_esc=y#v=onepage&q&f= false

E-Text Books:

1. https://ecedmans.files.wordpress.com/2014/10/microwave-devices-and-circuits-samuel-liao.pdf
2. http://www.faadooengineers.com/threads/11621-Microwave-engineering-ebook-pdf-Free- Download
3. http://www2.electron.frba.utn.edu.ar/~jcecconi/Bibliografia/Ocultos/Libros/Microwave_Engineer in g_David_M_Pozar_4ed_Wiley_2012.pdf.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Exhibit the knowledge on transmission lines for microwave circuits, cavity resonators and wave guide components.

CO2: Analyze and design various microwave circuits and devices using S-matrix parameters.

CO3: Investigate and analyze different microwave tubes such as klystron, Reflex klystron, and M type tubes and introduction to optical fibers

CO4: Exhibit the knowledge on various types of losses in optical fibers.

CO5: Demonstrate the basic knowledge on Optical fibers, Photo detectors, connectors, coupling devices and optical amplifiers Knowledge of various components used in optical networks.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	2	-
CO3	3	1	3	-	-	-	-	-	-	-	-	-	2	-
CO4	2	1	1	-	-	-	-	-	-	-	-	-	1	-
CO5	2	1	1	-	-	-	-	-	-	-	-	-	1	-
CO	**3**	**1.4**	**1.6**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.6**	**-**

INTERNET OF THINGS (IOT)

<table>
<tr><td colspan="10">B.Tech III Year II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA05604</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 48</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

The course should enable the students to:

1. Introduce the fundamental concepts of IoT and physical computing.
2. Expose the student to a variety of embedded boards and IoT Platforms.
3. Create a basic understanding of the communication protocols in IoT communications.
4. Familiarize the student with application program interfaces for IoT.
5. Enable students to create simple IoT applications.

UNIT-I		**Classes: 09**

Overview of IoT: The Internet of Things: An Overview, The Flavour of the Internet of Things, The “Internet” of “Things”, The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things? Design Principles for Connected Devices: Calm and Ambient Technology, Privacy, Web Thinking for Connected Devices, Affordances. Prototyping: Sketching, Familiarity, Costs Vs Ease of Prototyping, Prototypes and Production, Open source Vs Close source, Tapping into the community.

UNIT-II		**Classes: 10**

Embedded Devices: Electronics, Embedded Computing Basics, Arduino, Raspberry Pi, Mobile phones and tablets, Plug Computing: Always-on Internet of Things.

UNIT-III		**Classes: 10**

Communication in the IoT: Internet Communications: An Overview, IP Addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols Prototyping Online Components: Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols Protocol.

UNIT-IV		**Classes: 10**

Business Models: A short history of business models, The business model canvas, Who is the business model for, Models, Funding an Internet of Things startup, Lean Startups. Manufacturing: What are you producing, Designing kits, Designing printed circuit boards.

UNIT- V		**Classes: 09**

Manufacturing continued: Manufacturing printed circuit boards, Mass-producing the case and other fixtures, Certification, Costs, Scaling up software. Ethics: Characterizing the Internet of Things, Privacy, Control, Environment, Solutions.

Text Books:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547 R16 B.TECH ECM.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.

Web References:

1. https://www.arduino.cc/
2. https://www.raspberrypi.org/

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Choose the sensors and actuators for an IoT application.
CO2: Select protocols for a specific IoT application.
CO3: Utilize the cloud platform and APIs for IoT applications.
CO4: Experiment with embedded boards for creating IoT prototypes.
CO5: Design a solution for a given IoT application.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO	**3**	**2.6**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.2**	**-**

AI TOOLS, TECHNIQUES AND APPLICATIONS

B.Tech III Year II Semester								
Course Code	Category	Hours / Week			Credit	Maximum Marks		
19CA05505	Core	L	T	P	C	CIA	SEE	Total
		2	1	0	3	30	70	100
Contact Classes: 32	Tutorial Classes: 16	Practical Classes: Nil				Total Classes: 48		

COURSE OBJECTIVES:

The course should enable the students to:

1. Study the concepts of artificial intelligence in problem solving.
2. Explore the methods of agents and reasoning patterns.
3. Introduce the concepts of knowledge representation and learning.
4. IV. Analyze and solve statistical learning methods using AI techniques.

UNIT-I | INTRODUCTION | Classes:10

The AI problems, what is an AI technique, the levels of the model, the underlying assumption, problems; Problem spaces and search: Defining the problem as a state space search, production systems, problem characteristics and production system characteristics; Problem-solving: Uninformed search strategies; Informed search strategies: Heuristic search strategies, local search algorithms and optimization problems, backtracking search for CSP.

UNIT-II | KNOWLEDGE AND REASONING | Classes: 10

Logical agents, knowledge-based agents, the wumpus world and propositional logic, reasoning patterns in propositional logic and agents based on propositional logic; First-order logic: Syntax and semantic of first-order logic, knowledge engineering in first-order logic; Inference in first-order logic: Propositional vs first-order inference, unification and lifting, forward chaining, backward chaining, resolution.

UNIT-III | KNOWLEDGE REPRESENTATION | Classes: 09

Categories and objects, actions, situations and events, mental events and mental objects: The internet shopping world, truth maintenance systems. Uncertain knowledge and reasoning: Uncertainty, acting under uncertainty, basic probability notation, the axioms of probability, inference using full joint distributions, independence, Baye's rule and its use.

UNIT-IV | LEARNING | Classes: 10

Learning from observations, forms of learning, Inductive learning: Learning decision trees, ensemble learning; Why learning works: Computational learning theory.

UNIT- V | STATISTICAL LEARNING METHODS | Classes: 09

Knowledge in learning: A logical formulation of learning, knowledge in learning; Neural networks; Fuzzy logic systems: Introduction, crisp sets, fuzzy sets, some fuzzy terminology, fuzzy logic control, sugeno style of fuzzy inference processing, fuzzy hedges, α cut threshold.

Text Books:

1. Stuart J. Russell, Peter Norving, "Artificial Intelligence A Modern Approach", Pearson Education, 3rd Edition, 2013.
2. Elaine Rich, Kevin Knight , Shiva Shankar B Nair, "Artificial Intelligence", Tata McGraw Hill, 3 rd Edition, 2008.

Reference Books:

1. George F. Luther, "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", Pearson Education, 5th Edition, 2005.
2. Eugene Charniak , Drew McDermott, "Introduction to Artificial Intelligence", Addison – Wesley Series in Computer Science, Revised Edition,1985.

Web References:

1. http://www.udacity.com/
2. http://www.library.thinkquest.org/2705/
3. http://www.ai.eecs.umich.edu
4. http://www.macs.hw.ac.uk/alison/ai3notes/chapter2_5.html

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Study the concepts of artificial intelligence in problem solving.
CO2: Apply the methods of agents and reasoning patterns.
CO3: Analyze the concepts of knowledge representation and learning
CO4: Implement the concepts of learning
CO5: Solve statistical learning methods using AI techniques.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**2.6**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.6**	**-**

PROFESSIONAL ELECIVE-II
VLSI DESIGN

B.Tech III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
19CA04602	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	3	70	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

OBJECTIVES:

1. To understand the concepts of MOS devices for the fabrication of integrated chips.
2. To understand VLSI circuit design processes.
3. To understand basic circuit concepts and designing Arithmetic Building Blocks.
4. To have an overview of Low power VLSI.

UNIT-I INTRODUCTION TO MOS CHARACTERISTICS — Classes: 10

Introduction: Basic steps of IC fabrication, PMOS, NMOS, CMOS & BiCMOS and SOI process technologies, MOS transistors - MOS transistor switches – Basic gate using switches.

Basic Electrical Properties of MOS and Bi-CMOS Circuits: Working of MOS transistors – threshold voltage; MOS design equations: I_{ds}–V_{ds} relationships, Threshold Voltage, Body effect, Channel length modulation , g_m, g_{ds}, figure of merit ω_0; Pass transistor, NMOS Inverter, CMOS Inverter analysis and design, Various pull ups loads, Bi-CMOS Inverters.

UNIT-II VLSI CIRCUIT DESIGN PROCESSES VLSI DESIGN STYLES — Classes: 10

Basic Circuit Concepts: Capacitance, resistance estimations- Sheet Resistance R_S, MOS Device Capacitances, routing Capacitance, Analytic Inverter Delays, Driving large Capacitive Loads, Fan-in and fan-out.

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2µm CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

UNIT-III DESIGN AND IMPLEMENTATION STRATEGIES — Classes: 10

Gate level Design: Logic gates and other complex gates, Switch logic, Alternate gate circuits.
Physical Design: Floor-Planning, Placement, routing, Clock and Power routing.

UNIT-IV SUB SYSTEM DESIGN & STYLES — Classes: 09

Subsystem Design: Shifters, Adders, ALUs, Multipliers, High Density Memory Elements.
VLSI Design styles: Full-custom, Standard Cells, FPGAs, CPLDs and Design Approach for Full-custom and Semi-custom devices.

UNIT- V VHDL SYNTHESIS AND TESTING — Classes: 09

VHDL Synthesis: VHDL Synthesis, Circuit Design Flow, Circuit Synthesis, Simulation, Layout, Design capture tools, Design Verification Tools.
Test and Testability: Fault-modeling and simulation, test generation, design for testability, Built-in-self-test.

Text Books:

1. Kamran Eshraghian, Eshraghian Douglas and A. Pucknell, “Essentials of VLSI circuits and systems”, PHI, 2013 Edition.
2. K.Lal Kishore and V.S.V. Prabhakar, “VLSI Design”, IK Publishers, 2009.

Reference Books:

1. Weste and Eshraghian, “Principles of CMOS VLSI Design”, Pearson Education, 1999.
2. Wayne Wolf, “Modern VLSI Design”, Pearson Education, 3rd Edition, 1997.
3. John P. Uyemura, “Introduction to VLSI Circuits and Systems”, John wiley, 2003.
4. John M. Rabaey, “Digital Integrated Circuits”, PHI, EEE, 1997.

Web References:

1. http://www.nptel.ac.in/downloads/117101058/

2. https://www.tutorialspoint.com/vlsi_design/vlsi_design_digital_system.htm

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on MOS devices for the fabrication of integrated chips.

CO2: Able to design VLSI circuits as per specifications given.

CO3: Implement Gate level design and physical design strategies

CO4: Analyze the various subsystem design and VLSI design styles

CO5: Investigate and analyze VHDL Synthesis and testing

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**2.6**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.8**	**-**

COMPUTER ORGANIZATION

B.Tech III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
19CA05401	Elective	3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

COURSE OBJECTIVES:

The course should enable the students to :

1. Learn the fundamentals of computer organization. It is relevant to classical & modern problems of computer design.
2. Identify where- when and how enhancements of computer Performance can be accomplished.
3. How to use concepts of computer in real life setting using various PC performance improvements.
4. Understand the mining of ALU- control unit- CPU and its function also in real life.

UNIT-I | **Basic Structures of Computers & Machine instructions and Programs** | **Classes: 10**

Basic Structures of Computers: Computer Types- Functional Units-Basic Operational Concepts- Bus Structures-Software- Performance- Multiprocessors and Multicomputer

Machine instructions and Programs: Numbers- Arithmetic Operations and Characters- Memory Locations and Addresses-Memory Operations- Instructions and Instruction Sequencing- Addressing Modes-Assembly Language.

UNIT-II | **Basic Input Output Operations** | **Classes: 10**

Basic Input Output Operations-Subroutines-Additional Instructions- Example Programs Input/output Organization: Accessing I/O Devices-Interrupts- Processor Examples- Direct Memory Access-Buses-Interface Circuits-Standard I/O Interfaces.

UNIT-III | **Memory System** | **Classes: 10**

The Memory System: Some Basic Concepts- Semiconductor RAM Memories-Read Only Memories-Speed Size and Cost- Cache Memories-Performance Considerations-Virtual Memories- Memory Management Requirements-Secondary Storage.

UNIT-IV | **Computer Arithmetic & Basic Processing Unit** | **Classes:09**

Computer Arithmetic: Introduction- Addition and subtraction- Multiplication algorithms- Division algorithms- Floating point Arithmetic operations-Decimal Arithmetic unit

Basic Processing Unit: Some Fundamental Concepts- Execution of a Complete Instruction-Multiple-Bus

UNIT- V | **Pipelining & Large Computer Systems** | **Classes: 09**

Pipelining: Basic concepts- Data hazards- Instruction hazards- Influence on instruction sets- Data path and control considerations- Performance considerations

Large Computer Systems: Forms of Parallel Processing-Array Processors-The Structure of General-Purpose Multiprocessors- Interconnection Networks.

Text Books:

1. Carl Hamacher- ZvonkoVranesic and SafwatZaky- “Computer Organization”- FifthEdition-Tata McGraw Hill- 2002.
2. Morris Mano- “Computer System Architecture”- Third Edition- Pearson Publication- 2008.

Reference Books:

1. Wiiliam Stallings- Computer Organization and Architecture Designing for Performance- 8th Edition- Pearson Education- 2010.
2. John P. Hayes- “Computer Architecture and Organization”- Third Edition- TataMcGraw Hill-1998.

Web References:

1. https://www.tutorialspoint.com/computer_logical_organization/
2. https://www.courseera.org/learn/comparch
3. https://www.cssimplified.com/.../computer-organization-and-assembly-language-programming

COURSE OUTCOMES:
Upon the successful completion of the course, the student will be able to

CO1: Understand the fundamentals of computer organization.
CO2: Analyze relevant classical & modern problems of computer design.
CO3: Investigate when and how the enhancements of computer Performance be accomplished
CO4: Analyze the concepts of computer in real life setting using various PC performance improvements
CO5: Understand the mining of ALU- control unit- CPU and its function also in real life

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1	-	-	-	-	-	-	-	-	-	2	3	2
CO2	3	2	1	-	-	-	-	-	-	-	-	2	3	2
CO3	3	2	1	-	-	-	-	-	-	-	-	2	3	2
CO4	3	2	1	-	-	-	-	-	-	-	-	2	3	2
CO5	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**1.6**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

INFORMATION THEORY & CODING

<table>
<tr><td colspan="9">B.Tech III Year II Semester</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>19CA04603</td><td>Elective</td><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 48</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

1. To define and apply the basic concepts of information theory (entropy, channel capacity, etc.)
2. To learn the principles and applications of information theory in communication systems.
3. To study various data compression methods and describe the most common such methods.
4. To understand the theoretical framework upon which error-control codes are built.

UNIT-I	CODING FOR RELIABLE DIGITAL TRANSMISSION AND STORAGE	Classes: 10

Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies.
Source Codes: Shannon-fano coding, Huffman coding.

UNIT-II	LINEAR BLOCK CODES	Classes:10

Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

UNIT-III	CYCLIC CODES	Classes: 10

Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.

UNIT-IV	CONVOLUTIONAL CODES	Classes: 09

Encoding of Convolutional Codes- Structural and Distance Properties, state, tree, trellis diagrams, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

UNIT-V	BCH CODES	Classes: 09

Minimum distance and BCH bounds, Decoding procedure for BCH codes, Syndrome computation and iterative algorithms, Error locations polynomials for single and double error correction.

Text Books:

1. Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc 2014.
2. Error Correcting Coding Theory-Man Young Rhee, McGraw – Hill Publishing 1989
3. Umesh Sinha, Satya Prakashan, “Transmission lines and Networks”, Tech India Publications, 1st edition, 2010.

Reference Books:

1. Digital Communications- John G. Proakis, 5th ed., , TMH 2008.
2. Introduction to Error Control Codes-Salvatore Gravano-oxford.
3. Error Correction Coding – Mathematical Methods and Algorithms – Todd K.Moon, 2006, Wiley India.
4. Information Theory, Coding and Cryptography – Ranjan Bose, 2nd Edition, 2009, TMH.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Study the concepts of artificial intelligence in problem solving.

CO2: Apply the methods of agents and reasoning patterns.

CO3: Analyze the concepts of knowledge representation and learning

CO4: Implement the concepts of learning

CO5: Solve statistical learning methods using AI techniques.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.6**	**-**

DATA COMMUNICATIONS AND NETWORKING

B.Tech III Year II Semester								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
19CA04604	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

COURSE OBJECTIVES:

1. Study the evolution of computer networks and future directions.
2. Study the concepts of computer networks from layered perspective.
3. Study the issues open for research in computer network protocols suite are addressed.

UNIT-I	DATA COMMUNICATIONS	Classes: 10

Components, Direction of Data flow, networks and categories, types of connections, topologies, Internet History, Standards and Administration. Network Models: Protocol Layering, The ISO reference model, TCP/IP Protocol Suite, The Physical layer: Data and Signals, Transmission impairment, Data rate limits, Performance, Transmission media: Introduction, Guided Media, Unguided Media, Switching: Introduction, Circuit Switched Networks, Packet switching.

UNIT-II	DATA LINK LAYER	Classes:10

Introduction, Link layer addressing, Error detection and Correction: Cyclic codes, Checksum, Forward error correction.

Data link control: DLC Services, Data link layer protocols, HDLC, Point to Point Protocol. **Media Access control:** Random Access, Controlled Access, channelization, Connecting devices and virtual LANs.

UNIT-III	MULTI PLE ACESS AND DATA NETWORKS	Classes: 09

Multiple access: CDMA, CSMA/CD, CSMA/CA, Wired LANs: IEEE standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LANs: IEEE 802.11, Bluetooth IEEE 802.16.

The Network Layer: Network layer design issues, Routing algorithms, Congestion control algorithms, Quality of service, Internetworking,

The network layer in the Internet: IPV4 Addresses, IPV6, Internet Control protocol, OSPF, BGP, IP.

UNIT-IV	TRANSPORT LAYER	Classes: 10

Transport Services, Elements of Transport Protocols, Congestion Control. **Internet transport protocols:** UDP, TCP, Performance problems in computer networks, Network performance measurement.

UNIT-V	APPLICATION LAYER	Classes: 09

Introduction, Client Server Programming, DNS in internet, WWW and HTTP, FTP, e-mail, TELNET, Secure Shell, Domain Name System, SMTP, SNMP.

Text Books:

1. “Data communications and networking”, Behrouz A. Forouzan, Mc Graw Hill Education, 5th edition, 2012.
2. “Computer Networks”, Andrew S. Tanenbaum, Wetherall, Pearson, 5th edition, 2010.

Reference Books:

1. Data Communication and Networks, Bhushan Trivedi, Oxford
2. Internetworking with TCP/IP – Principles, protocols, and architecture- Volume 1, Douglas E. Comer, 5th edition, PHI
3. Computer Networks‖, 5E, Peterson, Davie, Elsevier.
4. Introduction to Computer Networks and Cyber Security‖, Chawan- Hwa Wu, Irwin, CRC Publications.
5. Computer Networks and Internets with Internet Applications‖, Comer.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

- **CO1:** Demonstrate the concepts of the Network Protocols, Network Models. Physical Layer, Transmission media.
- **CO2:** Analyze the concepts of Data Link Layer for error detection and correction and also use their Media Access Control.
- **CO3:** Demonstrate the concepts of Multiple Access of Networks and Network Layers.
- **CO4:** Demonstrate Knowledge on Transport Protocols in computer networks
- **CO5:** Demonstrate the concepts of different protocols in application layers.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

OPEN ELECTIVE-II
MECHATRONICS

B.Tech III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
19CA03611	Elective	3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

COURSE OBJECTIVES:

1. know the principles of Real Time Operating Systems, Graphical User Interface , Simulation
2. Explain the concept of precision mechanical systems.
3. Familiarize the applications of microcontrollers.
4. Understand the fundamental properties of Programmable Logic Controllers.

UNIT-I — **Classes: 10**

INTRODUCTION:
Definition – Trends - Control Methods: Stand alone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

UNIT-II — **Classes: 10**

SIGNAL CONDITIONING:
Introduction – Hardware - Digital I/O , Analog input – ADC , resolution , speed channels Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering.

UNIT-III — **Classes: 10**

PRECISION MECHANICAL SYSTEMS:
Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Harmonic Transmission - Bearings- Motor / Drive Selection.

UNIT-IV — **Classes: 09**

ELECTRONIC INTERFACE SUBSYSTEMS: TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isoation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers , over current sensing , resetable fuses , thermal dissipation - Power Supply - Bipolar transistors/ MOSFETS.

MICROCONTROLLERS: 8051 Microcontroller, micro processor structure – Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications.

UNIT- V — **Classes: 09**

ELECTROMECHANICAL DRIVES : Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.

PROGRAMMABLE LOGIC CONTROLLERS: Basic Structure - Programming: Ladder diagram - Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling -Analog input / output - PLC Selection -Applications.

Text Books:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, W Bolton, Pearson Education Press, 3rd edition, 2005.
2. Mechatronics, M.D. Singh, J.G. Joshi, PHI.

Reference Books:

1. Mechatronics Source Book, Newton C Braga, Thomson Publications, Chennai.
2. Mechatronics, N. Shanmugam, Anuradha Agencies Publisers.
3. Mechatronics System Design, Devdasshetty, Richard, Thomson

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Explain the principles of CNC, FMS, CIM

CO2: Understand the concept of signal conditioning systems.

CO3: Apply Electromechanical Drives for different applications.

CO4: Utilize the microcontrollers in engineering.

CO5: Choose Electronic Interface Subsystems for various applications.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**1.4**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

PYTHON PROGRAMMING

B.Tech III Year II Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
19CA05201	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

COURSE OBJECTIVES:

The course should enable the students to:

1. To elucidate problem solving through python programming language
2. To train in development of solutions using modular concepts
3. To teach practical Python solution patterns
4. To introduce function-oriented programming paradigm through python.

UNIT-I	**INTRODUCTION TO PYTHON**	**Classes: 10**

Introduction to Python: Python– Numbers, Strings, Variables, operators, expressions, statements, String operations, Math function calls, Input/Output statements.

UNIT-II	**CONTROL STATEMENTS**	**Classes: 10**

Conditional If, while and for loops, User defined Functions, parameters to functions, recursive functions, Turtle Graphics.

UNIT-III	**DATA STRUCTURES AND IDIOMATIC PROGRAMMING IN**	**Classes: 10**

Lists, Tuples, Dictionaries, Strings, Files and their libraries. Beautiful Idiomatic approach to solve programming problems.

UNIT-IV	**PYTHON OBJECT ORIENTED PROGRAMMING**	**Classes: 09**

Introduction to OOPS: Concept of class, object and instances, Method. Inheritance. Polymorphism. Data Abstraction. Encapsulation. Oops through Python: Data hiding, Polymorphism, Inheritance, Class and static variables, Class methods and Static methods, Constructors and Destructors.

UNIT- V	**EVENT DRIVEN PROGRAMMING**	**Classes: 09**

Turtle Bar Chart, Event Driven programming. Key press events, Mouse events, timer events.

Text Books:

1. http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
2. https://zhanxw.com/blog/wp-content/uploads/2013/03/BeautifulCode_2.pdf
3. Allen B.Downey," Think Python : How to like a computer scientist " , 2nd edition. Green Tea Press
4. Mark Lutz, "Programming Python," O'Reilly Publications, Fourth Edition, 2011.

Reference Books:

1. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
2. Timothy A. Budd, ―Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd.,, 2015.
3. Kenneth A. Lambert, ―Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012
4. Kenneth Lambert and B.L. Juneja, Fundamentals of Python, Cengage Learning, Third Edition, 2012
5. John V Guttag, ―Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on python programming language
CO2: Analyze the concept of module for providing the solutions
CO3: Implement python solution patterns
CO4: Analyze programming paradigms
CO5: Investigate and analyze function oriented python paradigms

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**2.6**	**1.4**	-	-	-	-	-	-	-	-	-	-	-

SOFT SKILLS

B.Tech III Year II Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
19CA052601	**Elective**	**3**	**0**	**0**	**3**	**3**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

COURSE OBJECTIVES:

1. To enhance employability skills through Group discussions and Mock Interviews.
2. To enable the students collectively in organizational skills.
3. To train the students to meet communicative competence.

UNIT-I	**VERBAL ABILITY & COMMUNICATION SKILLS**	**Classes: 10**

Communication: Verbal and Non-Verbal Communication, Barriers to effective Communication, Types of Communication - Oral, Aural, Writing and Reading

Grammar:- usage of Articles, Preposition, Verb, Tenses, Adverbs, If-Conditionals, Adjectives, Degrees of Comparison, Conjunction, Simple, Compound & Complex, Active & Passive voice, Reported Speech and Common Errors in English.

Word Power: - Synonyms, Antonyms, Affixes, One word substitutions and Idioms & Phrases.

UNIT-II	**EMPLOYABILITY SKILLS**	**Classes: 10**

COMPREHENSIONS:-Listening Comprehension, Reading Comprehension, Technical Reports, Resume Writing, E-mail Writing and Essay Writing

SVAR (Accent): Phonetics, Inflections, Stress and Intonation.

GROUP ACTIVITIES: Just-A-Minute (JAM), Debate, Group Discussion and Interview Skills

UNIT-III	**Arithmetic III**	**Classes: 10**

Number System, Averages, Percentages, Simple Interest & Compound Interest, Problems on Ages, Profit & Loss, Probability, Permutation & Combinations, Logarithms

UNIT-IV	**Arithmetic IV**	**Classes: 09**

Time & work, Time and Distance, Allegation and Mixtures, Mesuration2D, Mensuration3D, Data Interpretation.

UNIT- V	**Reasoning II**	**Classes: 09**

Analogy, Classification, Number series, Coding Decoding, Direction & Distance, Blood Relation. Critical Reasoning – Syllogism, Statements & Assumptions, Statements & Arguments, Data sufficiency, Seating Arrangement, Puzzles.

Text Books:

1. Rizvi M. Ashraf Effective Technical Communication, Tata McGraw-Hill Publishing Company Limited, 2006.
2. R.S Aggarwal, Quantitative Aptitude for Competitive Examinations, S. Chand Publications
3. R.S.Aggarwal, Verbal and Non Verbal Reasoning, S.Chand Publications.

Reference Books:

1. Bovee Courtland and Throill John, Business Communication Essentials: A skills-Based Approach to Vital Business English. Pearson Education Inc., 2011. 106 CS-Engg&Tech-SRM-2013
2. Dhanavel, S.P., English & Communication Skills for Students of Science and Engineering. Orient Black Swan, 2009.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Apply grammatical structures to formulate correct sentences and communicate fluently

CO2: Analyze the correct production of sounds and LSRW skills to perform any situation in their career.

CO3: Exhibit the knowledge on Simple Arithmetic Calculations for real time Applications

CO4: Investigate the Complex Arithmetic Operations in real time Applications

CO5: Analyze on Reasoning, Analytical and Logical thinking methods.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-		2	3	-	3	3	3
CO2	3	2	-	-	-	-	-	2	3	3	-	3	3	3
CO3	3	3	-	2	-	2	-	-	-	-	-	2	3	2
CO4	3	3	-	3	-	2	-	-	-	-	-	2	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	1	3	1
CO	**3**	**2.6**	**-**	**2.5**	**-**	**2**	**-**	**2**	**2.5**	**3**	**-**	**2.2**	**3**	**2.2**

INDUSTRIAL AUTOMATION & CONTOL SYSTEMS

B.Tech III Year II Semester									
Course Code	Category	Hours/			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
19CA04605	Elective	3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

COURSE OBJECTIVES:

1. To study the basics of process control and automation.
2. To instill knowledge on the controllers and actuators.
3. To impart about PLC, SCADA standards and about control systems techniques.

UNIT-I PROCESS CONTROL & AUTOMATION — **Classes: 10**

Process control principles, Analog and Digital control, Types of Automation; Architecture of Industrial Automation Systems, Advantages and limitations of Automation, Industrial revolutions.

UNIT-II TRANSMITTERS AND SIGNAL CONDITIONING — **Classes: 10**

Need of transmitters, Standardization of signals, Current, Voltage and Pneumatic signal standards, 2-Wire & 3-Wire transmitters, Analog and Digital signal conditioning for sensors, Smart and Intelligent transmitters.

UNIT-III CONTROLLERS AND ACTUATORS — **Classes:09**

PID Controller, Mechanical switches, Solid-state switches, Electrical actuators: Solenoids, Relays and Contactors, AC Motor, energy conservation schemes through VFD, DC Motors, Servo Motor, Pneumatic and hydraulic actuators.

UNIT-IV PLC & SCADA — **Classes: 10**

Functions of PLC, Architecture, Selection of PLC, Networking of PLCs, Ladder Programming, Interfacing Input and Output devices with PLC, PLC based automated systems. High frequency inputs. PLC programming standard IEC61131

SCADA: Elements of SCADA, Features of SCADA, MTU, RTU Functions, Applications of SCADA, Communications in SCADA.

UNIT-V DISTRIBUTED CONTROL SYSTEM & HMI — **Classes: 09**

Introduction to DCS, Architecture, Input and output modules, Specifications of DCS.

Human Machine Interface (HMI): Device network: CAN, PROFIBUS-PA, Control network: Control Net, PROFIBUS-DP, Ethernet, Interfaces: RFID, Barcode, HMI: Block Diagram, Types, Advantages and industrial applications.

Text Book:

1. Programmable Logic controllers and Industrial Automation: Madhuchhanda Mitra, Samarjit Sen Gupta, Penram International Publishing India Pvt. Ltd 2001.

Reference Books:

1. Programmable Logic Controllers, Principles and Applications: John W.Webb, Ronold AReis, 5th Edition, Prentice Hall of India Pvt. Ltd.
2. Stuart A.Boyer, SCADA supervisory control and data acquisition, ISA Publication.
3. Process Control Instrumentation Technology: Curtis Johnson, 8th Edition, Pearson Education.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Understand process control, PLC architecture and interfacing.

CO2: Develop PLC ladder logic for industrial applications.

CO3: Design Automation systems for industrial applications.

CO4: Understand process control, PLC architecture and interfacing.
CO5: Develop PLC ladder logic for industrial applications.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO4	2	2	2	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO	**2.8**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

HUMANITIES ELECTIVE-I

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

B.Tech III Year II Semester

Course Code	Category	Hours/			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
19CA53601	Elective	3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

COURSE OBJECTIVES:

The course should enable the students to:

1. Describe the market dynamics namely demand, elasticity of demand and pricing in different market structures.
2. Discuss how the production function is carried out to achieve least cost combination of inputs and cost analysis.
3. Analyze how capital budgeting decisions are carried out.
4. Develop the frame work for both manual and computerized accounting process.
5. Analyze and interpret the financial statements through ratio analysis.

UNIT-I	INTRODUCTION AND DEMAND ANALYSIS	Classes: 10

Introduction to Managerial Economics – Definition, Nature and Scope of Managerial Economics. Demand Analysis: Concepts of Demand - Demand Function - Law of Demand - Elasticity of demand: Definition, types, Significance - Measurement of Elasticity – Methods of Demand Forecasting, Factors Governing Demand Forecasting.

UNIT-II	PRODUCTION AND COST ANALYSIS	Classes: 10

Production Function - Least Cost Combination –Short-run and Long-run Production Functions Cost Analysis: Cost concept and behavior - Break Even Analysis (BEA)- determination of Break-Even Point (simple problems) - Managerial Significance and Limitations of Break Even Point – Cost Sheet preparation

UNIT-III	MARKETS AND NEW ECONOMIC ENVIRONMENT	Classes:10

Market Structure - Types of Market - Perfect and Imperfect Competitions - Futures of Perfect Competition, Monopoly and Monopolistic Competition – Oligopoly - Price-output Determination - Pricing Methods - Joint Stock Company, Public Private Partnership (PPP) Enterprises and their Types.

UNIT-IV	FINANCIAL ACCOUNTING AND ANALYSIS	Classes: 09

Introduction to Financial accounting - Objectives, Functions; Single and Double Entry Book Keeping, Principles of Accounting - Journal, Ledger, Trial Balance. Financial Analysis: Ratio Analysis - Liquidity, Leverage, Profitability and Activity Ratio (Problems) – Use of e table.

UNIT-V	CAPITAL BUDGETING	Classes: 09

Concepts of Capital and its Significance, Types of Capital - Methods and Evaluation of Capital Budgeting Projects - Payback Methods - Accounting Rate of Return (ARR) - Net Present Value (NPV) Method and Internal Rate of Return Method (IRR) (Simple Problems).

Text Books:

1. S.A. Siddiqui, “Managerial Economics and Financial Analysis”, New Age International Publishers, Edition: 1, 2017.
2. Aryasri, “Managerial Economics and Financial Analysis”, TMH, 4th Edition, 2012.
3. M Kasi Reddy, Saraswathi, “Managerial Economics and Financial Analysis”, PHI, New Delhi, 2 nd Edition, 2012. 76.
4. Varshney, Maheswari, Sultan Chand, “Managerial Economics”, 11th Edition, 2009. International Publishers, 2013.
5. S N Maheswari, S K Maheswari, “Financial Accounting”, Vikas publications, 2012.
6. J V Prabhakar Rao and P V Rao, “Managerial Economics and Financial Analysis”, Maruthi Publishers, 2011.

7. Vijay Kumar, Appa Rao, "Managerial Economics and Financial Analysis", Cengage 2011.

Reference Books:

1. https://www.scribd.com/doc/37684926
2. https://www.slideshare.net/glory1988/managerial-economics-and- financial analysis
3. https://www.cs.utah.edu/~devnani/2-2.pdf
4. https://www.thenthata.web4kurd.net/mypdf/managerial-economics-and- financial analysis
5. https://www.bookshallcold.link/pdfread/managerial-economics-and-financial analysis
6. https://www.gvpce.ac.in/syllabi/Managerial Economics and financial analysis.

E-Text Book:

1. https://www.books.google.co.in/books/about/Managerial economics and financial analysis.
2. https://www.ebooktake.in/pdf/title/managerial-economics-and-financial analysis.
3. https://www.ll4ryou.blogspot.in/2012/06/mefa-managerial-economics & financial analysis.
4. https://www.books.google.com/books/about/Managerial economics and financial analysis.
5. https://www.scribd.com/doc/37684926.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: **Demonstrate** microeconomic factors in related to demand analysis and its forecasting.

CO2: **Apply the Knowledge** on the theory of production function and Cost concepts to determine the Break Even Analysis.

CO3: **Demonstrate** different market structures, pricing strategies and different forms business organization.

CO4: **Analyze** the investment, capital budgeting decisions and Strategies of organizations.

CO5: Analyze and interpret the financial statements through ratio analysis.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO4	3	3	-	-	2	-	-	-	-	-	2	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	2	-	-	-
CO	**3**	**2.5**	-	-	**2**	-	-	-	-	-	**2**	-	-	-

INDUSTRIAL ENGINEERING AND MANAGEMENT

B.Tech III Year II Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
19CA03602	Elective	3	0	0	3	30	70	100
Contact Classes:48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

COURSE OBJECTIVES:

1. To create awareness to learn principles, concepts, functions of management and also to design organizational structures.
2. To gain knowledge on plant location, layouts and analyze concepts of network techniques.
3. To familiarize the students regarding work study and work sampling
4. To train with materials and marketing management concepts in organizational context.
5. To get awareness on Human Resource Management and its functions.

UNIT-I	Management and Organization	Classes:10

Concepts of Management and Organization – Functions of Management – Evolution of Management Thought: Taylor's Scientific Management, Fayol's Principles of Management - Systems Approach to Management. Basic concepts related to Organization – Departmentation and Decentralization, Types of organization, Line organization, Line and staff organization, functional organization, Committee organization, matrix organization and their merits and demerits

UNIT-II	Plant Location & Project Management	Classes:10

Plant location, definition, factors affecting the plant location, comparison of rural and urban sites- methods for selection of plant. Plant Layout – definition, objectives, types of production, types of plant layout. PERT & CPM Project management, network modeling-probabilistic model, various types of activity-times estimation programme evaluation review techniques- Critical Path-probability of completing the project, deterministic model, critical path method -critical path calculation.

UNIT-III	Work Study	Classes:10

WORK STUDY: Definition, objectives, Method study - definition, objectives, steps involved- various types of associated charts-difference between micro-motion and memo-motion studies. Work measurement- definition, time study, steps involved-equipment, different methods of performance rating- allowances, standard time calculation. Work Sampling – definition, steps involved, standard time calculations, differences with time study- Applications. Predetermined motion time study – Method time measurement (MTM), introduction to ergonomics.

UNIT-IV	Materials Management	Classes:09

MATERIALS MANAGEMENT: Objectives, Inventory – functions, types, associated costs, inventory classification techniques. Stores Management and Stores Records. Purchase management, duties of purchase manager, associated forms. Marketing, selling, marketing mix, product life cycle.

UNIT-V	Human Resource Management	Classes:09

HUMAN RESOURCE MANAGEMENT: Functions of HRM, Job Evaluation, different types of evaluation methods. Job description, Merit Rating- difference with job evaluation, different methods of merit ratings, wage incentives, different types of wage incentive schemes.

Text Books:

1. O.P. Khanna, Industrial Engineering and Management.,DhanpatRai, 2018,17th ed.
2. Stoner, Freeman, Gilbert, Management, Pearson Edu., 2007, 6th Ed.
3. Pannerselvam, Production and Operations Management. PHI, 2010.
4. Armine, Manufacturing Organization and Management. Pearson, 2009.

ReferenceBooks:

1. Ralph M Barnes, Motion and Time Studies. John Wiley and Sons, 2007.
2. Chase, Jacobs, Aquilano, Operations Management. TMH, 2007, 10th Ed.

3. L.S. Srinath, PERT/CPM. East-West Press, 2005.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1. Discuss the principles and functions of management & decide the competitive strategy that works best for the organization.

CO2. Understand the importance of plant locations and develop effective project management techniques.

CO3. Understand the concept of work study, method study and types of associated charts, the work measurement, work sampling and their steps.

CO4. Learn the concepts of material management and apply the knowledge of inventory management and marketing strategies in work setting

CO5. Discuss the importance of various sub systems of HRM.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	3	3	-	3	-	-
CO2	3	3	-	3	-	-	-	-	-	-	3	-	-	-
CO3	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	-	-	1	-	-	3	3	3	3	-	-
CO5	3	3	-	-	-	-	-	1	3	3	-	-	-	-
CO	**3**	**3**	**-**	**3**	**-**	**1**	**-**	**1**	**3**	**3**	**3**	**3**	**-**	**-**

ENTREPRENEURSHIP AND INCUBATION

<table>
<tr><td colspan="10">B.Tech III Year II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA53603</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 48</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

The aim of this course is to have a comprehensive perspective of inclusive learning, ability to learn and implement the Fundamentals of Entrepreneurship and Incubation procedures.

UNIT-I	**ENTREPRENEURIAL PERSPECTIVES**	**Classes: 10**

Introduction to Entrepreneurship – Evolution - Concept of Entrepreneurship - Types of Entrepreneurs - Entrepreneurial Competencies, Capacity Building for Entrepreneurs. Entrepreneurial Training Methods - - Hand holding for Entrepreneurship - Models for Entrepreneurial Development - The process of Entrepreneurial Development.

UNIT-II	**NEW VENTURE CREATION**	**Classes: 10**

Introduction, Mobility of Entrepreneurs, Solar Oven case-study Paradigm shift from Design to Entrepreneurship; Business plans – Purpose, Contents, Presenting Business Plan, Procedure for setting up Enterprises, Central level - Startup and State level - T Hub, Other Institutions initiatives.

UNIT-III	**MANAGEMENT OF MSMES AND FUNDING AGENCIES**	**Classes:09**

Challenges of MSMEs, Preventing Sickness in Enterprises – Government loan schemes for small businesses – MUDRA – Standup India Scheme – CGFMSE Scheme – CLCSS – Udyogini – National Single window System

UNIT-IV	**MANAGING MARKETING AND GROWTH OF ENTERPRISES**	**Classes: 11**

Essential Marketing Mix of Services, Key Success Factors in Service Marketing, Cost and Pricing, Branding, New Techniques in Marketing, International Trade.

UNIT-V	**STRATEGIC PERSPECTIVES IN ENTREPRENEURSHIP AND INCUBATION AWARENESS**	**Classes: 10**

Strategic Growth in Entrepreneurship, The Valuation Challenge in Entrepreneurship, The Final Harvest of New Ventures, Technology, Business Incubation, India way – Entrepreneurship; Women Entrepreneurs – Learning from examples Start-up PITCHES - Using Lean Canvas Model Part 1 Learning from examples Start-up PITCHES - Using Lean Canvas Model Part 2

Text Book:

1. Entrepreneurship Development and Small Business Enterprises, Poornima M. Charantimath,2e, Pearson, 2014.
2. Entrepreneurship, a South – Asian Perspective, D.F. Kuratko and T. V. Rao, 3e, Cengage,2012.
3. Entrepreneurship, Arya Kumar, 4 e, Pearson 2015.
4. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, HimalayaPublishing House, 2015.
5. THE FORTUNE AT BOTTOM OF PYRAMID: Eradicating Poverty Through Profits by C.K.Prahalad Stay Hungry
6. Innovation By Design: Lessons from Post Box Design & Development by Chakravarthi.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

1. Identify a potential personal or entrepreneurial opportunity and evaluate it through a process of exploration, experimentation and feedback.
2. Determine a useful resource strategy for building a new venture.

3. Review and discuss contemporary entrepreneurial planning documents required by various stakeholders within an entrepreneurial ecosystem, describing critical elements for a new entrepreneurial venture.
4. Apply principles and practice of new entrepreneurial venture planning to assess and present viability of a business idea for feedback from entrepreneurs, industry experts, and/or investors.
5. Evaluate teams to establish criteria that underpin the different phases of a balanced and effective successful entrepreneurial team.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**2.6**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

AI TOOLS, TECHNIQUES AND APPLICATIONS LABORATORY

<table>
<tr><td colspan="10">B.Tech III Year II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/ Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA05511</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:Nil</td><td>Tutorial Classes:Nil</td><td colspan="4">Practical Classes: 48</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

The course should enable the students to:

1. Implement the basic knowledge of Study of Prolog.
2. Construct Problem solving Techniques.
3. Apply Different Search Techniques.
4. Practice various Traversal Problems.

LISTOF EXPERIMENTS

Exp. 1	Study of PROLOG. Write the following programs using PROLOG.
Exp. 2	Program to show how integer variable is used in prolog program.
Exp. 3	Write a program to solve 8 queens problem
Exp. 4	Program to add two numbers
Exp. 5	Program to delete an integer from the list .
Exp. 6	Solve any problem using depth first search.
Exp. 7	Program to categorize animal characteristics.
Exp. 8	Program to show concept of list.
Exp. 9	Solve any problem using best first search.
Exp. 10	Program to read address of a person using compound variable
Exp. 11	Program to demonstrate family relationship
Exp. 12	Solve 8-puzzle problem using best first search
Exp. 13	Program of fun to show concept of cut operator .
Exp. 14	Solve Robot (traversal) problem using means End Analysis.
Exp. 15	Program to count number of elements in a list .
Exp. 16	Solve traveling salesman problem.
Exp. 17	Program to reverse the list.
Exp. 18	Program to append an integer into the list.
Exp. 19	Program to replace an integer from the list.

Equipment/Software required for Laboratories: PROLOG

Reference Books:

1. Artificial Intelligence: A Modern Approach,. Russell & Norvig. 1995, Prentice Hall.
2. Artificial Intelligence, Elain Rich and Kevin Knight, 1991, TMH.
3. Artificial Intelligence-A modern approach, Staurt Russel and peter norvig, 1998, PHI.
4. Artificial intelligence, Patrick Henry Winston:, 1992, Addition Wesley 3 Ed.,

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on prolog Programming and Analyze the PROLOG programming through SWI

CO2: Analyze the various problem solving techniques

CO3: Design and develop prolog program to add variables

CO4:Conduct investigation and test the functionality on implementation of prolog programming

CO5: Select appropriate techniques or algorithm tool kit to analyze and implement DFS,BFS

CO6: Follow **ethical** principles in designing and programming AI problems.

CO7: Do experiments effectively as an **individual** and as a member in a **group**.

CO8:**Communicate** verbally and in written form, the understandings about the programming.

CO9: Continue updating their skill related to implementation for various applications during

their **life time.**

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3	-	-	-	-	-3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-	-	-	3	**-**	**3**
CO	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

MICROWAVE & OPTICAL COMMUNICATION LABORATORY

<table>
<tr><td colspan="9">B.Tech III Year II Semester</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3">Hours/ Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>19CA04606</td><td>Core</td><td>0</td><td>0</td><td>3</td><td>1.5</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:Nil</td><td>Tutorial Classes:Nil</td><td colspan="4">Practical Classes: 48</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

1. Understand the working principle of Optical sources, detectors, fibers and microwave components.
2. Understand the simple optical communication link.
3. To learn about the characteristics and measurements in optical fiber.
4. To Practice microwave measurement procedures.

<table>
<tr><td colspan="2">LISTOF EXPERIMENTS</td></tr>
<tr><td colspan="2">MINIMUMOFTENEXPERIMENTSTOBECONDUCTED</td></tr>
<tr><td colspan="2">Microwave Lab(PART–A)---Any Six(6) Experiments</td></tr>
<tr><td>Exp. 1</td><td>Reflex Klystron Characteristics.</td></tr>
<tr><td>Exp. 2</td><td>Gunn Diode Characteristics.</td></tr>
<tr><td>Exp. 3</td><td>Attenuation Measurement.</td></tr>
<tr><td>Exp. 4</td><td>Directional Coupler Characteristics.</td></tr>
<tr><td>Exp. 5</td><td>VSWR Measurement.</td></tr>
<tr><td>Exp. 6</td><td>Impedance Measurement.</td></tr>
<tr><td>Exp. 7</td><td>Frequency and Wavelength measurements using slotted section.</td></tr>
<tr><td>Exp. 8</td><td>Scattering parameters of Magic Tee.</td></tr>
<tr><td>Exp. 9</td><td>Radiation Pattern Measurement of horn Antennas (at least two antennas).</td></tr>
<tr><td colspan="2">Optical Fiber Lab (PART– B) ---Any Four (4) Experiments</td></tr>
<tr><td>Exp. 10</td><td>Characterization of LED.</td></tr>
<tr><td>Exp. 11</td><td>Characterization of Laser Diode.</td></tr>
<tr><td>Exp. 12</td><td>Transmission of analog signal through Optical fiber.</td></tr>
<tr><td>Exp. 13</td><td>Transmission of digital signal through Optical fiber.</td></tr>
<tr><td>Exp. 14</td><td>Measurement of Numerical Aperture of the given fiber.</td></tr>
<tr><td>Exp. 15</td><td>Measurement of Bending losses for Analog Optical link.</td></tr>
</table>

Equipment required for Laboratories:

S. No	Name of the Equipment	Quantity
1	Regulated Klystron Power Supply	6 Nos.
2	VSWR Meter	6 Nos.
3	Milli/Micro Ammeters	10 Nos.
4	Multi meters	10 Nos.
5	CROs	8 Nos.
6	GUNN Power Supply, Pin Moderator	4 Nos.
7	Relevant Microwave components	------
8	Fiber Optic Analog Trainer based LED	3 Nos.
9	Fiber Optic Analog Trainer based laser	2 Nos.
10	Fiber Optic Digital Trainer	1 Nos.
11	Fiber cables	(Plastic)

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on the basics of waveguides, waveguide components, microwave & optical sources, etc.

CO2: Apply a proper waveguide component and it's ports to get required output signal

CO3: Analyze different waveguide components and microwave sources

CO4: Demonstrate different sources on different components for measuring purpose

CO5: Follow ethical principles in designing and implementing various measuring circuits.

CO6: Do experiments effectively as an individual and as a member in a group.

CO7: Communicate verbally and in written form, the understandings about the experiments.

CO8: Continue updating their skill related to microwave sources Optical fiber for various applications during their life time.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

DIGITAL SIGNAL PROCESSING

<table>
<tr><td colspan="12">B. Tech IV Year I Semester</td></tr>
<tr><td rowspan="1">Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum</td></tr>
<tr><td rowspan="2">19CA04701</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 32</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 32</td></tr>
</table>

Course Objectives:
The course should enable the students to:

1. Develop skills for analyzing discrete signals and systems also apply discrete fourier transformfor frequency domain analysis along with the implementation of FFT.
2. Provide concepts and skills for the design and realization of IIR and FIR filters, with givenspecifications, using different techniques.
3. Investigate the effect of finite word length in the design of digital filters.
4. Tackle the design of multirate filters using DSP concepts and use for real time applications.

UNIT-I	**REVIEW OF DISCRETE TIME SIGNALS AND SYSTEMS**	**Classes: 07**

Discrete time signals: Definition, Classification, Elementary Signals and its operations.
Discrete time systems: Definition, Classification, Linear time invariant (LTI) System, Properties of LTI system, Time and Frequency domain analysis of discrete time signals and systems, Methods of evaluating the convolution sum, Filtering using overlap-save and overlap-add method.

UNIT-II	**COMPUTATIONS OF DFT & FFT**	**Classes: 07**

Discrete Fourier Transforms: Introduction to Discrete Fourier transform (DFT), Direct computation of DFT, Properties of DFT, Circular Convolution using DFT, Relationship of DFT with other transforms.
Fast Fourier Transforms: Efficient Computation of DFT algorithms, Radix-2 Decimation-in-Time and Decimation-in-Frequency algorithms, Inverse FFT, Illustrative problems.

UNIT-III	**IIR FILTERS**	**Classes: 06**

IIR Digital filters: Review of analog filter design, Frequency transformation in the analog and digital domains, Design of IIR filters from Analog filters – Approximation of derivatives, Impulse invariance, Bilinear transformation, Design of Butterworth, Chebyshev filters, Illustrative problems.
Realization of IIR Systems: Structures for IIR systems - Direct form-I, Direct form-II, Cascade and Parallel.

UNIT-IV	**FIR FILTERS**	**Classes: 06**

FIR Digital Filters: Linear phase FIR filter, Characteristic response, Design of FIR filters using Windows, Design of FIR filter by Frequency sampling technique, Illustrative problems.
Realization of FIR Systems: Structures for IIR systems - Direct form, Cascade form, Comparison of IIR and FIR filters.

UNIT-V	**MULTIRATE SIGNAL PROCESSING & APPLICATIONS**	**Classes: 06**

Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor, Implementation of sampling rate conversion, Multi stage Implementation of sampling rate conversion, Polyphase structures for decimation and interpolation filters, Applications of multirate signal processing.

Text Books:

1. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, Principles, Algorithms andApplications", Prentice Hall, 4th Edition, 2007.
2. Sanjit K Mitra, "Digital signal processing, A computer base approach", McGraw-Hill HigherEducation, 4th Edition, 2011.

Reference Books:

1. Li tan, "Digital signal processing: fundamentals and applications" Elsevier Science &. TechnologyBooks, 2nd Edition, 2008.
2. Robert J.schilling, Sandra. L.harris, "Fundamentals of Digital signal processing using Matlab",Thomson Engineering, 2nd Edition, 2005.
3. Salivahanan, Vallavaraj, Gnanapriya, "Digital signal processing", McGraw-Hill Higher Education,2nd Edition, 2009.

Web References:

1. https://www.coursetalk.com/providers/coursera/courses/digital-signal-processing
2. https://www.edx.org/course/discrete-time-signal-processing-mitx-6-341x-1

E-Text Books:

1. http://www.dspguide.com/pdfbook.htm
2. http://dspguru.com/dsp/books/favorites
3. http://onlinevideolecture.com/ebooks
4. http://www.freebookcentre.net/SpecialCat/Free-Signal-Processing-Books

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Analyze the various discrete time signals and systems.
CO2: Implement DFT, FFT using Radix-2 in frequency and time domains.
CO3: Analyze and Design IIR filters using realization structures.
CO4: Analyze and Design FIR filters using Window techniques.
CO5: Exhibit the knowledge on multirate signal processing to meet the real time applications.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	2	-	2	-	-	-	-	-	-	3	2
CO*	**3**	**3**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

<table>
<tr><td colspan="10">B.Tech IV Year I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/ Week</td><td>Credits</td><td colspan="3">Maximum</td></tr>
<tr><td rowspan="2">19CA04702</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 32</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 32</td></tr>
</table>

Course Objectives:
The course should enable the students to:

1. Acquire a sound understanding theory and performance characteristics of instruments and errors in measurement and apply to DC voltmeters, ammeters, ohmmeters.
2. Provide concepts and operation of different signal generators and waveform analyzers.
3. Compare and contrast different types of oscilloscopes.
4. Select different types of DC and AC bridges for measurement of passive components and physical parameters.

UNIT-I	**INTRODUCTION TO MEASURING INSTRUMENTS**	**Classes: 07**

Introduction, Performance characteristics of Instruments, Static characteristics, Accuracy, resolution, precision, Sensitivity, Dynamic characteristics: Repeatability, Reproducibility, fidelity, lag, Static and Dynamic Errors.
Analog measuring instruments: D'Arsonval movement, DC voltmeters and ammeter, AC voltmeters and current meters, ohmmeters, multimeters, meter protection, extension of range.
Basic Nuclear Instrumentation system -block diagram, Personal monitors- Thermo Luminescence Detectors.

UNIT-II	**OSCILLOSCOPES**	**Classes: 06**

Oscilloscopes: Block Diagram of CRO, CRT features, Time base circuits, Derivation of Deflection sensitivity, delay lines, high frequency CRO considerations, applications, specifications, CRO probes. Special purpose oscilloscopes: Dual trace, Dual beam CRO, Sampling oscilloscopes, Storage oscilloscopes, Digital storage CRO.
Applications of CROs: Lissajous figures, frequency measurement, phase measurement, Digital frequency counters, Time and Period measurements.

UNIT-III	**SIGNAL GENERATOR AND SIGNAL ANALYZERS**	**Classes: 06**

Signal generator-fixed and variable, AF oscillators, function generators, pulse, random noise, sweep and arbitrary waveform generators, their standards, specifications and principles of working (Block diagram approach).Wave analyzers, Harmonic distortion analyzers, Spectrum analyzers, and Logic analyzers

UNIT-IV	**ACAND DC BRIDGES**	**Classes: 07**

Review of DC Bridges: Wheatstone bridge, Wein Bridge, errors and precautions in using bridges, AC bridges: Measurement of inductance, Maxwell's bridge, Anderson Bridge, Measurement of capacitance- Schearing Bridge. Kelvin Bridge, Q-meter, EMI and EMC, Interference and noise reduction techniques.

UNIT-V	**SENSORS AND TRANSDUCERS**	**Classes: 06**

Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance, LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples, and thermistors), Velocity, Acceleration, Vibration, pH measurement Signal Conditioning Circuits.

Text Books:

1. H.S.Kalsi, “Electronic Instrumentation”,TMH,2nd Edition,2004.
2. A.D. Helfrick and W.D.Cooper, “Modern Electronic Instrumentation and Measurement Techniques”, PHI, 5th Edition, 2002.

Reference Books:

1. Ernest O Doebelin and Dhanesh N Manik, “Measurement Systems Application and Design”,TMH,5th Edition, 2009.
2. Oliver and Cage, “Electronic Measurement and Instrumentation”, TMH. Robert A.Witte,“Electronic Test Instruments, Analog and Digital Measurements”, Pearson Education, 2ndEd., 2004.
3. DavidA.Bell,“ElectronicInstrumentation&Measurements”, PHI,2ndEdition,2003

WebReferences:

1. https://www.scribd.com/
2. https://www.worldcat.org/
3. https://www.infibeam.com/

E-TextBooks:

1. https://www.vssut.ac.in/lecture_notes/lecture1423813026.pdf
2. fmcet.in/ECE/EC2351_uw.pdf
3. https://www.jntubook.com/electronics-measurements-instrumentation-textbook-free-d

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Apply the knowledge on Measuring instruments and analyze the performance characteristics of each instrument, Illustrate basic meters such as voltmeters and ammeters.

CO2: Demonstrate various types of oscilloscopes and its applications.

CO3: Demonstrate different types of signal generators and analyzers, analyze their performance.

CO4: Analyze and design suitable DC and AC bridges for the measurement of R,L and C.

CO5: Exhibit the knowledge on working principle; analyze the criteria and applications of various sensor and transducers used in measurement systems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		-	-	-	-	-	-	-	-	-	3	-
CO2	3	2		-	-	3	-	-	-	-	-	-	3	3
CO3	3	3		-	-	-	-	-	-	-	-	-	3	-
CO4	3	3		-	-	-	-	-	-	-	-	-	3	-
CO5	3	3		-	-	2	-	-	-	-	-	-	3	2
CO*	**3**	**2.8**		**-**	**-**	**2.5**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2.5**

PROFESSIONAL ELECTIVE - III

DIGITAL IMAGE PROCESSING

B. Tech IV Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
19CA04703	Elective	3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

Course Objectives:

The course should enable the students:

1. To know the fundamentals of Image Processing.
2. To know the transformation on images.
3. To know about various techniques of image enhancement and reconstruction.
4. To understand different redundancies related to images.

UNIT-I	INTRODUCTION TO DIGITAL IMAGE PROCESSING	Classes: 10

Introduction, Image sensing and Acquisition, Image Modeling, Sampling and Quantization, Digital Image representation, Basic relationships between pixels, Mathematical tools, operations applied on images andImaging geometry.

UNIT-II	IMAGE TRANSFORMATIONS	Classes: 10

Fast Algorithms, Discrete Fourier Transform, Discrete Cosine Transforms, Walsh Transforms, HadamardTransforms- Hotelling Transforms, Comparison of properties of the above transforms.

UNIT-III	IMAGE ENHANCEMENT	Classes: 09

Background enhancement by point processing, Histogram processing, Spatial filtering, Enhancement in frequency Domain, Image smoothing, Image sharpening, Color image Enhancement.

UNIT-IV	DEGRADATION MODEL AND IMAGE SEGMENTATION	Classes: 10

Degradation model, Algebraic approach to restoration, Inverse filtering, Least Mean Square filters,Constrained Least square restoration, Blind Deconvolution.

Image Segmentation: Edge detection, Edge linking, Threshold based segmentation methods, Region basedApproaches, Template matching Use of motion in segmentation.

UNIT-V	REDUNDANCIES	Classes: 09

Redundancies in Images, Compression models, Information theoretic perspective, Fundamental coding theorem, Huffman Coding, Arithmetic coding, Bit plane coding, Run length coding, Transform coding,Image Formats and Compression Standards.

TEXT BOOKS:

1. R.C .Gonzalez & R.E. Woods, “Digital Image Processing”, Addison Wesley/Pearsoneducation, 3rd Edition, 2010.
2. A .K. Jain, “Fundamentals of Digital Image processing”, PHI, 2010.

REFERENCE BOOKS:

1. Rafael C. Gonzalez, Richard E woods and Steven L.Eddins, “Digital Image processing using MATLAB”, Tata McGraw Hill, 2010.
2. S Jayaraman, S Esakkirajan, T Veerakumar, “Digital Image processing”, Tata McGraw Hill
3. William K. Pratt, “Digital Image Processing”, John Wilely, 3rd Edition, 2004, Instruments Literature Number: SWRU368A April 2014–Revised August 2015.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate knowledge on Identification, formulate & solve problems involving images.
CO2: Analyze and Apply various transformation techniques to process images of any context.
CO3: Analyze image enhancement and Develop algorithm.
CO4: Analyze image segmentation and Develop restoration algorithm applied for images.
CO5: Demonstrate knowledge on compression technique and skills to use modern engineering tools, software & equipment to analyze problems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2.8**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

ANALOG IC DESIGN

B. Tech IV Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
19CA04704	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

Course Objectives:

The course should enable the students to:

1. Understand significance of different biasing styles and apply them for designing analog ICs.
2. Analyze the functionality of Current Mirrors, Current Sinks, Differential amplifiers and Current amplifiers.
3. Design basic building blocks of analog ICs like, current mirrors, current sources, current sinks, two stage CMOS Power amplifiers and comparators.

UNIT - I	MOS DEVICES AND MODELING	Classes: 10

The MOS Transistor, Passive Components-Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Sub-threshold MOS Model.

UNIT-II	ANALOG CMOS SUB-CIRCUITS	Classes: 10

MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage.

UNIT - III	CMOS AMPLIFIERS	Classes: 10

Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures, Mismatch-offset cancellation techniques, Reduction of Noise by offset cancellation techniques, Alternative definition of CMRR.

UNIT - IV	CMOS OPERATIONAL AMPLIFIERS	Classes: 09

Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

UNIT-V	COMPARATORS	Classes: 09

Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators

Text Books:

1. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition.
2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.

Reference Books:

1 Analog Integrated Circuit Design- David A.Johns, Ken Martin, Wiley Student Edn, 2013.
2. CMOS: Circuit Design, Layout and Simulation- Baker, Li and Boyce,
3. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition, 2010.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Analyze the small and large signal models of MOS transistors.
CO2: Analyze and Design current mirror circuits.
CO3: Demonstrate the use of Analogue circuits analysis techniques to analyze the operation and behavior of various Analogue Integrated Circuits.
CO4: Analyze and Design Analogue operational Trans conductance Amplifiers.

CO5: Design a two stage open loop comparators.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2.8**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	-

DIGITAL SIGNAL PROCESSORS & ARCHITECTURES

B.Tech IV Year I Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
19CA04705	Elective	3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

Course Objectives:
The course should enable the students :

1. To introduce architectural features of programmable DSP Processors of TI and Analog Devices.
2. To recall digital transform techniques.
3. To give practical examples of DSP Processor architectures for better understanding.
4. To develop the programming knowledge using Instruction set of DSP Processors.
5. To understand interfacing techniques to memory and I/O devices for DSP applications.

UNIT-I	INTRODUCTION TO DIGITAL SIGNAL PROCESSING	Classes: 08

Introduction: Digital signal-processing system, discrete Fourier Transform (DFT) and fast Fourier transform (FFT), differences between DSP and other micro processor architectures; Number formats: Fixed point, floating point and block floating point formats, IEEE-754 floating point, dynamic range and precision, relation between data word size and instruction word size; Sources of error in DSP implementations: A/D conversion errors, DSP computational errors, D/A conversion errors, Q-notation.

UNIT-II	ARCHITECTURE OF PROGRAMMABLE DSPs	Classes: 10

Multiplier and multiplier accumulator, modified bus structures and memory access in PDSPs, multiple access memory, multiport memory, SIMD, VLIW architectures, pipelining, special addressing modes in PDSPs, on-chip peripherals.

UNIT-III	OVERVIEW OF TMS320C54XX PROCESSOR	Classes: 10

Architecture of TMS320C54XX DSPs, addressing modes, memory space of TMS320C54XX processors. Program control, instruction set and programming, on-chip peripherals, interrupts of TMS320C54XX processors, pipeline operation.

UNIT-IV	INTERFACING MEMORY AND I/O PERIPHERALS TO DSPs	Classes: 10

Memory space organization, external bus interfacing signals, memory interface, parallel I/O interface, programmed I/O, interrupts and I/O, direct memory access (DMA).

UNIT-V	APPLICATION PROGRAMS IN C54X:	Classes: 10

Pipeline operation, Code Composer Studio, an overview of the C5402-based DSK, Introduction to C54X Assembly Language Programming, application programs in C54X.

Text Books:

1. B. Ventakaramani, M. Bhaskar, Digital Signal Processors Architecture Programming and Applications‖, Tata McGraw-Hill, 2nd Edition
2. Avtar Singh and S. Srinivasan, Digital Signal Processing Thomson Publications, 1st Edition, 2004.
3. Lapsley et al., DSP Processor Fundamentals, Architectures & Features‖, S. Chand & Co, 1 st Edition, 2000.

References:

1. Jonatham Stein, Digital Signal Processing‖, John Wiley, 1st Edition, 2000.
2. Sen M. Kuo&WoonSergGan, Digital Signal Processors Architectures, Implementation and Application‖, Pearson Practice Hall, 1st Edition, 2013.
3. K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, A Practical Approach to Digital Signal

Processing‖, New Age International, 1st Edition, 2006.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Exhibit the knowledge on basics of Digital Signal Processing and transforms.

CO2: Analyze the architectural features of General purpose processors and DSP processors.

CO3: Demonstrate the knowledge on the architectures of TMS320C54xx devices and its addressing modes.

CO4: Analyze various memory and parallel I/O interfaces.

CO5: Design and implement interfacing techniques to memory and I/O devices for DSP applications.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	-

WIRELESS COMMUNICATIONS

<table>
<tr><td colspan="9">B.Tech IV Year I Semester</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">19CA04706</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 48</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

Course Objectives:

The course should enable the students :

1. To introduce architectural features of programmable DSP Processors of TI and Analog Devices.
2. To recall digital transform techniques.
3. To give practical examples of DSP Processor architectures for better understanding.
4. To develop the programming knowledge using Instruction set of DSP Processors.
5. To understand interfacing techniques to memory and I/O devices for DSP applications.

UNIT-I	WIRELESS COMMUNICATION SYSTEMS & STANDARDS	Classes: 08

Evolution of Mobile Radio Communications, Examples of Wireless Communication Systems, Comparison of Common Wireless Communication Systems, Different generations (1G to 5G) of Cellular Networks, Wireless Local Loop (WLL), Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANs).

UNIT-II	CELLULAR CONCEPT	Classes: 10

Frequency Reuse, Channel Assignment strategies, Handoff Strategies, Interference and System Capacity, Trunking and Grade of service, Improving coverage and capacity in Cellular systems.

UNIT-III	MOBILE RADIO PROPAGATION & FADING	Classes: 10

Introduction to Radio wave propagation, free space propagation model, the three basic propagation mechanisms, Reflection, Ground reflection (Two Ray) model, practical link budget design using path loss models, Outdoor propagation models: Longley Rice- Model, Durkin's Model- A Case Study, Okumura model, Hata Model. Indoor Propagation Models: Partition Losses, Long distance path loss model. Small scale fading and Multipath fading, impulse response model of a multipath channel. Types of small scale fading.

UNIT-IV	EQUALIZATION AND DIVERSITY	Classes: 10

Introduction and fundamental of equalization, Training a generic adaptive equalizer, equalizers in a communication receiver, survey of equalization techniques, Linear and Non equalizers. Adaptive equalization algorithms. Diversity Schemes (Space, frequency, field and polarization diversities) and combining techniques, Outage probability in MRC under imperfect ISI, Capacity of Wireless Channels, RAKE receiver.

UNIT-V	FUNDAMENTALS OF 5G ARCHITECTURE	Classes: 10

5G Architecture, Planning of 5G Network, Quality of Service, Radio Network, Requirements, Security, SIM in 5G Era, Specifications, Standardization, Terminal States, Difference between 4G and 5G.

Text Books:

1. T. S. Rappaport, Wireless Communication Principles (2/e), Pearson, 2002.

References:

1. W. C. Y. Lee, Mobile Communication Engineering. (2/e), McGraw- Hill, 1998.
2. A Goldsmith, Wireless Communications, Cambridge University Press, 2005.
3. https://www.qualcomm.com/5g/what-is-5g
4. https://www.gsma.com/futurenetworks/wp-content/uploads/2018/04/Road-to-5G-Introduction-and-Migration_FINAL.pdf

COURSE OUTCOMES:
Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the basic knowledge on the principles and applications of wireless systems and standards.
CO2: Analyze the cellular system design and technical challenges.
CO3: Analyze the Mobile radio propagation, fading, diversity concepts and the channel modeling.
CO4: Exhibit the basic knowledge on the equalization and Diversity techniques to enhance the quality of wireless link.
CO5: Analyze the technologies and interworking architecture of the 5G.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

PROFESSIONAL ELECTIVE - IV
SPEECH PROCESSING

B. Tech IV Year I Semester									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
19CA04707	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

Course Objectives:
The course should enable the students :

1. To understand the fundamentals of the speech processing
2. To Explore the various speech models
3. To Gather knowledge about the phonetics and pronunciation processing
4. To Perform wavelet analysis of speech
5. To understand the concepts of speech recognition

UNIT-I	**INTRODUCTION**	**Classes: 9**

Introduction - knowledge in speech and language processing - ambiguity - models and algorithms - language - thought - understanding - regular expression and automata - words & transducers – N programs.

UNIT-II	**SPEECH MODELLING**	**Classes: 10**

Word classes and part of speech tagging – hidden markov model – computing likelihood: the forward algorithm – training hidden markov model – maximum entropy model – transformation-based tagging – evaluation and error analysis – issues in part of speech tagging – noisy channel model for spelling.

UNIT-III	**SPEECH PRONUNCIATION AND SIGNAL PROCESSING**	**Classes: 9**

Phonetics - speech sounds and phonetic transcription - articulatory phonetics - phonological categories and pronunciation variation - acoustic phonetics and signals - phonetic resources - articulatory and gestural phonology.

UNIT-IV	**SPEECH IDENTIFICATION**	**Classes: 10**

Speech synthesis - text normalization - phonetic analysis - prosodic analysis – diphone waveform synthesis - unit selection waveform synthesis – evaluation.

UNIT-V	**SPEECH RECOGNITION**	**Classes: 10**

Automatic speech recognition - architecture - applying hidden markov model - feature extraction: mfcc vectors - computing acoustic likelihoods - search and decoding - embedded training - multipass decoding: n-best lists and lattices- a* (‗stack‘) decoding - context-dependent acoustic models: triphones - discriminative training - speech recognition by humans.

TEXT BOOKS:

1. Daniel Jurafsky and James H. Martin, ― Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition‖, Person education, 2013.

REFERENCE BOOKS:

1. Kai-Fu Lee, ―Automatic Speech Recognition‖, The Springer International Series in Engineering andComputerScience,1999.
2. Himanshu Chaurasiya, ―Soft Computing Implementation of Automatic Speech Recognition‖, LAP Lambert Academic Publishing, 2010.
3.Claudio Becchetti, Klucio Prina Ricotti, ―Speech Recognition: Theory and C++

implementation,Wileypublications2008.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate knowledge on the fundamentals of the speech processing.
CO2: Analyze and Apply various speech models of any text.
CO3: Analyze Speech phonetics and pronunciation processing techniques and algorithms.
CO4: Analyze different wavelet transforms of speech processing.
CO5: Demonstrate and analyze knowledge on concepts of speech recognition and tools.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

EMBEDDED SYSTEMS DESIGN

<table>
<tr><td colspan="9">B.Tech IV Year I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/ Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA04708</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 48</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes :Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

Course Objectives:

The course should enable the students :

1. To understand the fundamental concepts of embedded systems.
2. To understand the architecture of ARM and TM4C Family fundamentals.
3. To understand the addressing and interfacing of ARM processor
4. To understand the concepts of microcontroller interface.
5. To understand the concept of IOT devices.

UNIT-I	**INTRODUCTION TO EMBEDDED SYSTEMS**	**Classes: 8**

Introduction, Characteristics and Classification of Embedded Systems, Applications of an Embedded Systems, Memory Types, Interfacing: serial Communication, Parallel communication, Design Process.

UNIT-II	**EMBEDDED SYSTEMS ARCHITECTURE**	**Classes: 10**

Typical architecture of Embedded System: Hardware Architecture, Von-Neumann Architecture, Harvard Architecture. Introduction of ARM and ARM architecture and Cortex – M series, Introduction to the TM4C family viz. TM4C123x & TM4C129x and its targeted applications. TM4C129CNCZAD block diagram, address space, on-chip peripherals (analog and digital) Register sets, Addressing modes and instruction set basics.

UNIT-III	**DESIGN AND INTERFACING OF EMBEDDED SYSTEMS**	**Classes: 10**

Embedded hardware and various building blocks, Processor Selection for an Embedded System, Interfacing Processor, Memories and I/O Devices, I/O interfacing concepts, Timer and Counting Devices. Embedded System Design and Co-design Issues in System Development Process, Design Cycle in the Development Phase for an Embedded System, Uses of Target System or its Emulator and In-Circuit Emulator (ICE), Use of Software Tools for Development of an Embedded System, Design metrics of embedded systems.

UNIT-IV	**BASIC PROGRAMMING USING MICROCONTROLLER**	**Classes: 10**

I/O pin multiplexing, pull up/down registers, GPIO control, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Hibernation Module on TM4C, Activevs Stand by current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. Basic Timer, Real Time Clock (RTC), Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).

UNIT-V	**COMMUNICATION PROTOCOLS AND INTERNET OF THINGS**	**Classes: 10**

Embedded Networking fundamentals, Synchronous/Asynchronous interfaces (like UART, SPI, I2C,USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, Implementing and programming UART, SPI and I2C,

Internet of Things: IoT overview and architecture, Overview of wireless sensor networks and design examples.

Case study: Tiva based embedded system application using the interface protocols for communication with external devices “sensor hub booster pack”.

TEXT BOOKS:

1. Embedded Systems: Real-Time Interfacingto ARM Cortex-M Microcontrollers, Create space publications.2014.
2. Embedded Systems: Introduction to ARM Cortex-M Microcontrollers, 5thedition, Jonathan W.Valvano, Create space publications,2012.
3. Embedded Systems2E RajKamal,TataMcGraw-HillEducation,2011.

REFERENCEBOOKS:

1. CC3100/CC3200SimpleLink™Wi-Fi®Internet-on-a-ChipUserGuideTexasInstrumentsLiterature Number: SWRU368A April2014–RevisedAugust 2015.
2. Embedded Systems architecture, Tammy Noergaard, Newnes publications,2005.
3. Embedded Systems hand book, RichardZurawski,
   The Art of Designing Embedded Systems by JackGanssle, 2nd edition, Newnes publications,2008

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Exhibit the knowledge on the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.

CO2: Analyze various examples of embedded systems based on TM4C123x & TM4C129x processor.

CO3: Apply the knowledge of software development for the embedded hardware and bus protocols.

CO4: Apply the knowledge of programming to writing the program to configure and interface the various peripherals with the TM4C processor.

CO5: Exhibit the knowledge on IOT Technologies, analyze and evaluate the data received through sensors in IoT.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

CELLULAR & MOBILE COMMUNICATIONS

B. Tech IV Year I Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
19CA04709	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes:48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes:48**		

Course Objectives:

The course should enable the students:

1. To enable the student to synthesis and analyze wireless and mobile cellular communication systems over a stochastic fading channel.
2. To provide the student with an understanding of advanced multiple access techniques.
3. To provide the student with an understanding of diversity reception techniques.
4. To give the student an understanding of digital cellular systems (GSM, CDMA One, GPRS, CDMA 2000, and W-CDMA).

UNIT-I	INTRODUCTION TO CELLULAR MOBILE RADIO SYSTEMS	Classes: 10

CELLULAR MOBILE RADIO SYSTEMS: Introduction to Cellular Mobile system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, Hexagonal shaped cells, Analog and Digital Cellular systems.

ELEMENTS OF CELLULAR RADIO SYSTEM DESIGN: General description of the problem, concept of frequency channels, Co-channel Interference Reduction Factor, desired C/I from a normal case in a Omni directional Antenna system, Cell splitting, consideration of the components of cellular system.

UNIT-II	INTERFERENCE	Classes: 09

Introduction to Co-channel interference, real time co-channel interference, Co-channel measurement, Antenna parameters and their effects, diversity receiver, non-co-channel interference-different types.

UNIT-III	CELL COVERAGE FOR SIGNAL AND TRAFFIC	Classes: 09

Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long distance propagation antenna height gain, form of a point to point model.

UNIT-IV	CELL SITE AND MOBILE ANTENNAS & FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT	Classes: 10

CELL SITE AND MOBILE ANTENNAS: Sum and difference patterns and their synthesis, Omni directional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, minimum separation of cell site antennas, high gain antennas.

FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT: Numbering and grouping, setup access and paging channels, channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non-fixed channel assignment.

UNIT-V	HANDOFF & DIGITAL CELLULAR NETWORKS	Classes: 10

HANDOFF: Handoff, dropped calls and cell splitting, types of handoff, handoff invitation, delaying handoff, forced handoff, mobile assigned handoff. Intersystem handoff, cell splitting, micro cells, vehicle locating methods, dropped call rates and their evaluation.

DIGITAL CELLULAR NETWORKS: GSM architecture, GSM channels, multiple access schemes, FDMA, TDMA and CDMA.

TEXTBOOKS:

1. Mobile cellular telecommunications-W .C. Y. Lee, Tata Mc-Graw Hill, 2nd Edition, 2006.
2. Wireless communications-Theodore. S. Rapport,Pearson Education,2ndEdn.,2002.

REFERENCES:

1. Principles of Mobile communications-Gordon L. Stuber, Springer International 2nd Edition, 2007.
2. Wireless and Mobile Communications-Lee McGraw Hills, 3rd Edition, 2006.
3. Wireless communications and Networking-Jon W.Mark and WeihuaZhqung, PHI, 2005.
4. Wireless communication Technology-R.Blake, Thompson Asia Pvt.Ltd., 2004.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Analyze and Design wireless and mobile cellular systems.

CO2: Exhibit the knowledge on impairments due to multipath fading channel.

CO3: Demonstrate the knowledge on the fundamental techniques to overcome the different fading effects.

CO4: Analyze Co-channel and Non Co-channel interferences.

CO5: Exhibit the knowledge on cell coverage for signal and traffic, diversity techniques and mobile antennas, frequency management, channel assignments.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2.6**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

DIGITAL IC DESIGN

<table>
<tr><td colspan="10">B. Tech IV Year I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA04710</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 48</td><td colspan="2">Tutorial Classes: Nil</td><td colspan="3">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

Course Objectives:

The course should enable the students :

1. To study about different semiconductor devices and their design.
2. To realize and implement different logic design circuits using Digital ICs.
3. To provide an exposure to VHDL and different styles of modeling using VHDL

UNIT – I	**MOS DESIGN PSEUDO NMOS LOGIC**	**Classes: 10**

Inverter, Inverter threshold voltage, Output high voltage, Output Low voltage, Gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic.

UNIT – II	**COMBINATIONAL MOS LOGIC CIRCUITS**	**Classes: 10**

MOS logic circuits with NMOS loads, Primitive CMOS logic gates – NOR & NAND gate, Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates , AOI and OIA gates, CMOS full adder, CMOS transmission gates, Designing with Transmission gates

UNIT - III	**SEQUENTIAL MOS LOGIC CIRCUITS**	**Classes: 09**

Behaviour of bistable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latch and edge triggered flip-flop.

UNIT IV	**DYNAMIC LOGIC CIRCUITS**	**Classes: 10**

Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits

UNIT-V	**SEMICONDUCTOR MEMORIES**	**Classes: 09**

Types, RAM array organization, DRAM – Types, Operation, Leakage currents in DRAM cell and refresh operation, SRAM operation Leakage currents in SRAM cells, Flash Memory-NOR flash and NAND flash

Text Books:

1. Digital Integrated Circuit Design – Ken Martin, Oxford University Press, 2011.
2. CMOS Digital Integrated Circuits Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 3rd Ed., 2011

Reference Books:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011
2. Digital Integrated Circuits – A Design Perspective, Jan M. Rabaey, AnanthaChandrakasan, BorivojeNikolic, 2nd Ed., PHI.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on MOS devices for the fabrication of integrated chips.
CO2: Able to design VLSI circuits as per specifications given.
CO3: Implement Gate level design and physical design strategies
CO4: Analyze the various subsystem design and VLSI design styles
CO5: Investigate and analyze VHDL Synthesis and testing.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**2.6**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

OPEN ELECTIVE-III

REAL TIME SYSTEMS

<table>
<tr><td colspan="10">B.Tech IV Year I Semester</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">19CA05804</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 48</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

Course Objectives:

The course should enable the students :

1. To study the scalability and clustering issues and the technology necessary for them.
2. To understand the technologies enabling parallel computing.
3. To study the different types of interconnection networks.
4. To study the different parallel programming models.
5. To study the software support needed for shared memory programming.

UNIT-I	**INTRODUCTION**	**Classes: 08**

Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Dead-lines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

UNIT-II	**REAL TIME SCHEDULING**	**Classes: 10**

Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

UNIT-III	**RESOURCES SHARING**	**Classes: 10**

Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Pre-emption Ceiling Protocol, Access Control in Multiple-Module Resources, Controlling Concurrent Accesses to Data Objects.

UNIT-IV	**REAL TIME COMMUNICATION**	**Classes: 10**

Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols.

UNIT-V	**REAL TIME OPERATING SYSTEMS AND DATABASES**	**Classes: 10**

Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Con-currency Control, Overview of Commercial Real Time databases.

Text Books:

1. Real Time Systems – Jane W. S. Liu, Pearson Education Publication.

References:

1. Real Time Systems – Mall Rajib, Pearson Education
2. Real-Time Systems: Scheduling, Analysis, and Verification – Albert M. K. Cheng, Wiley.
3. https://www.gsma.com/futurenetworks/wp-content/uploads/2018/04/Road-to-5G-Introduction-and-Migration_FINAL.pdf

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Understand concepts of Real-Time systems and modeling

CO2: Recognize the characteristics of a real-time system

CO3: Understand and develop document on an architectural design of a real-time system

CO4: Develop and document Task scheduling, resource management, real-time operating systems

CO5: Fault tolerant applications of Real-Time Systems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	2	2	3	3
CO2	3	3	3	3	3	-	-	-	-	-	2	2	3	3
CO3	3	3	3	3	3	-	-	-	-	-	2	2	3	3
CO4	3	3	3	3	3	-	-	-	-	-	2	2	3	3
CO5	3	3	3	3	3	-	-	-	-	-	2	2	3	3
CO*	**3**	**3**	**3**	**3**	**3**	-	-	-	-	-	**2**	**2**	**3**	**3**

WIRELESS COMMUNICATIONS

B.Tech IV Year I Semester								
Course Code	Category	Hours/Week			Credits	Maximum Marks		
19CA04706	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

Course Objectives:

The course should enable the students :

1. To introduce architectural features of programmable DSP Processors of TI and Analog Devices.
2. To recall digital transform techniques.
3. To give practical examples of DSP Processor architectures for better understanding.
4. To develop the programming knowledge using Instruction set of DSP Processors.
5. To understand interfacing techniques to memory and I/O devices for DSP applications.

UNIT-I	WIRELESS COMMUNICATION SYSTEMS & STANDARDS	Classes: 08

Evolution of Mobile Radio Communications, Examples of Wireless Communication Systems, Comparison of Common Wireless Communication Systems, Different generations (1G to 5G) of Cellular Networks, Wireless Local Loop (WLL), Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANs).

UNIT-II	CELLULAR CONCEPT	Classes: 10

Frequency Reuse, Channel Assignment strategies, Handoff Strategies, Interference and System Capacity, Trunking and Grade of service, Improving coverage and capacity in Cellular systems.

UNIT-III	MOBILE RADIO PROPAGATION & FADING	Classes: 10

Introduction to Radio wave propagation, free space propagation model, the three basic propagation mechanisms, Reflection, Ground reflection (Two Ray) model, practical link budget design using path loss models, Outdoor propagation models: Longley Rice- Model, Durkin's Model- A Case Study, Okumura model, Hata Model. Indoor Propagation Models: Partition Losses, Long distance path loss model. Small scale fading and Multipath fading, impulse response model of a multipath channel. Types of small scale fading.

UNIT-IV	EQUALIZATION AND DIVERSITY	Classes: 10

Introduction and fundamental of equalization, Training a generic adaptive equalizer, equalizers in a communication receiver, survey of equalization techniques, Linear and Non equalizers. Adaptive equalization algorithms. Diversity Schemes (Space, frequency, field and polarization diversities) and combining techniques, Outage probability in MRC under imperfect ISI, Capacity of Wireless Channels, RAKE receiver.

UNIT-V	FUNDAMENTALS OF 5G ARCHITECTURE	Classes: 10

5G Architecture, Planning of 5G Network, Quality of Service, Radio Network, Requirements, Security, SIM in 5G Era, Specifications, Standardization, Terminal States, Difference between 4G and 5G.

Text Books:

1. T. S. Rappaport, Wireless Communication Principles (2/e), Pearson, 2002.

References:

1.W. C. Y. Lee, Mobile Communication Engineering. (2/e), McGraw- Hill, 1998.
2. A Goldsmith, Wireless Communications, Cambridge University Press, 2005.
3. https://www.qualcomm.com/5g/what-is-5g
4. https://www.gsma.com/futurenetworks/wp-content/uploads/2018/04/Road-to-5G-Introduction-and-Migration_FINAL.pdf

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the basic knowledge on the principles and applications of wireless systems and standards.
CO2: Analyze the cellular system design and technical challenges.
CO3: Analyze the Mobile radio propagation, fading, diversity concepts and the channel modeling.
CO4: Exhibit the basic knowledge on the equalization and Diversity techniques to enhance the quality of wireless link.
CO5: Analyze the technologies and interworking architecture of the 5G.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO*	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

SCADA

B.Tech IV Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
19CA02713	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 48			

OBJECTIVES:

The course should enable the students to

1. Analyze SCADA.
2. Assess communication methodologies through SCADA.
3. Examine remote and master terminal units.
4. Evaluate sensors and actuators along with their applications.
5. Appraise operator interface.

UNIT-I | **INTRODUCTION TO SCADA** | **Classes:10**

Introduction – definition of SCADA – applicable processes – elements of a SCADA system – limited two-way system – development of telemetry – dependence on communications and computers – real-time control –master-slave –scan interval – Murphy's law – safety instrumented system – regulatory requirements.

UNIT-II | **COMMUNICATINS THROUGH SCADA** | **Classes:10**

Communications – analog-to-digital conversion – long distance communications – communication system components – protocol – modems – synchronous and asynchronous – telephone cable and radio – simplex and duplex – turn-on time – frequencies – path studies and seasonal variations –solar variations – reliability and maintenance – satellite communications – cell phones.

UNIT-III | **REMOTE AND MASTER TERMINAL UNITS** | **Classes:10**

Remote terminal unit (RTU) – communications interface – protocol detailed – discrete control – analog control – pulse control – serial control – monitor discrete signals – monitor analog signals – monitor pulse count signals – monitor serial signals – non-RTU functions – Master terminal units (MTU) – communication interface – configuring a picture –simple applications – data storage.

UNIT-IV | **SENSORS, ACTUATORS, WIRING AND APPLICATIONS** | **Classes:09**

Sensors and actuators – special considerations – standardization – maintenance – real-time applications – accounting and grade of data – scanning and communications – automatic control – advisory applications.

UNIT-V | **OPERATOR INTERFACE AND SCADA ECONOMICS** | **Classes:09**

Local security considerations – system security considerations – alarming – control change screens – status screens – graphics and trending – reports – parallel operator interface – cost versus benefits – time value of money – capital costs – training and maintenance costs – SCADA operating costs – reduced capital costs – reduced process operating costs – improved facility effectiveness – tax implications -

Text Books:

1. Stuart A. Boyer, "SCADA: Supervisory Control and Data Acquisition", The Instrumentation, Systems, and Automation Society, 3rd Edition, 2004.
2. Francis G.L., "SCADA: Beginner's Guide", Kindle Edition, 2016.

Reference Books:

1. K.S. Manoj, "Industrial Automation with SCADA", Notion Press, 2019.
2. TanujKumarBisht, "SCADA and Energy Management System",S.K. Kataria& Sons, 2013.

Course Outcomes:

On successful completion of the course, student will be able to

CO1: Analyze the principles of SCADA.
CO2: Assess the parameters of communication methodologies.
CO3: Analyze the parameters of remote and master terminal units.

CO4: Assess the parameters of sensors and actuators.
CO5: Analyze the principles of operator interface.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**3**	-	-	-	-	-	-	-	-	-	-	-	-

OPERATIONS RESEARCH

B.Tech IV Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
19CA03701	Elective	L	T	P	C	CIE	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

OBJECTIVES:

The course should enable the students to:

1. Explain various methods of Linear Programming problems.
2. Apply relevant traveling sales and assignment problems in different applications.
3. Understand the basics concept of Game theory and Queuing theory.
4. To understand the concept of Sequencing and Inventory models.
5. To understand the concept of maintenance and dynamic programming.

UNIT-I | INTRODUCTION TO OR | Classes: 10

Introduction to OR and Linear Programming-OR definition– Classification of Models – Types of Operations Research models; Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Big-M Method, Duality, Dual Simplex Method – Degeneracy, Infeasible and multiple optimal solutions.

UNIT-II | TRANSPORTATION AND ASSIGNMENT PROBLEM | Classes: 10

Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution-North-West Corner Rule, Least Cost Method, Vogel's Approximation Method Modified Distribution (MODI) Method, Unbalanced Transportation Problem, Degenerate Problem.

Assignment Problem – Formulation, Optimal Solution -Traveling Salesman problem.

UNIT-III | GAME AND QUEUING THEORY | Classes: 10

Game Theory - Introduction – Minimax (Maximin) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy –Games with Mixed Strategies – 2 X 2 Games -Dominance Principle– Solution by Graphical Method of m X 2 & 2 X n games.

Queuing Theory- Introduction –Terminology, Service Channel, Arrival Pattern, Population, Departure Pattern(Service Pattern), Queue Discipline, Birth & Death Process, Balking, Reneging, Jockeying; Single Channel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non-finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with finite queue length and nonfinite queue length.

UNIT- IV | SEQUENCING AND INVENTORY MODELS | Classes: 09

Sequencing -Solution of Sequencing Problem – Processing n Jobs through 2 Machines – Processing n Jobs through 3 Machines – Processing 2 Jobs through m machines – Processing n Jobs through m Machines.

Inventory models. Inventory costs, Models with deterministic demand – model (a) demand rate uniform and production rate infinite, model (b) demand rate non-uniform and production rate infinite, model (c) demand rate uniform and production rate finite.

UNIT-V | INTRODUCTION TO MAINTENANCE AND DYNAMIC PROGRAMMING | Classes: 09

Introduction to maintenance– Types of Maintenance, Types of Replacement Problem, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely Fail-Individual Replacement Model, Group Replacement Model.

Dynamic Programming - Introduction – Bellman's Principle of Optimality – Applications of Dynamic Programming-Capital Budgeting Problem – Shortest Path Problem.

Text Books:

1. Operations Research by R Panneerselvam, PHI, 2nd edition, 2012.
2. Operations Research by S.D. Sharma, Kedarnath & Ramnath Publications, 2012.

Reference Books:

1. Operations Research by H. A. Taha, Pearson Education.
2. Operations Research by P. S. Gupta and D. S. Hira, S. Chand & co., 2007.

Course Outcomes:

On successful completion of the course, student will be able to

CO1: Create mathematical models of the real life situations and capable of obtaining best solution using Graphical Method and Simplex Method, Big M method and the student must be able to implement the theory of duality for simplifying the solution procedure for certain LPPs.

CO2: Solve the special cases of LPP such as Transportation, Assignment and Travelling Salesmen problems.

CO3: Understand and will apply the fundamentals of game theory and queuing theory in real life situations.

CO4: Have aware of applying sequencing technique to identify better job sequence and Simulate inventory models.

CO5: Find optimal replacement period of a machine or group of parts and Apply Dynamic Programming technique to solve the complex problems by breaking them into a series of sub-problems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**3**	-	-	-	-	-	-	-	-	-	-	-	-

HUMANITIES ELECTIVE-II
MANAGEMENT SCIENCE

B.Tech IV Year I Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
19CA53701	Elective	3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

Course Objectives:
The course should enable the students :

1. To introduce architectural features of programmable DSP Processors of TI and Analog Devices.
2. To recall digital transform techniques.
3. To give practical examples of DSP Processor architectures for better understanding.
4. To develop the programming knowledge using Instruction set of DSP Processors.
5. To understand interfacing techniques to memory and I/O devices for DSP applications.

UNIT-I	INTRODUCTION TO MANAGEMENT	Classes: 08

Concept –nature and importance of Management –Generic Functions of Management – Evaluation of Management thought- Theories of Motivation – Decision making process-Designing organization structure- Principles of organization – Organizational typology- International Management: Global Leadership and Organizational Behavior Effectiveness(GLOBE) structure

UNIT-II	FOUNDATIONS	Classes: 10

Foundations of Individual Behavior Attitudes and Job Satisfaction, Components of Attitude, Major Job Attitude, Job Satisfaction, Personality and Values, Personality Determinants, Group decision making, Understanding teams, creating effective teams, Conflict Process, Conflict management communication.

UNIT-III	PROJECT MANAGEMENT	Classes: 10

(PERT/CPM): Development of Network – Event – Node – Fulkerson’s rule - Difference between PERT and CPM Identifying Critical Path- Probability- Project Crashing (Simple Problems)

UNIT-IV	STRATEGIC MANAGEMENT	Classes: 10

Vision, Mission, Goals, Strategy – Elements of Corporate Planning Process – Environmental Scanning – SWOT analysis- Steps in Strategy Formulation and Implementation, Generic Strategy Alternatives. Global strategies, theories of Multinational Companies.

UNIT-V	CONTEMPORARY MANAGEMENT PRACTICES	Classes: 10

Basic concepts of MIS, MRP, Just in- Time(JIT) system, Total Quality Management(TQM), Six sigma and Capability Maturity Model(CMM) Levies, Supply Chain Management, Enterprise Resource Planning (ERP).

Text Books:

1. 1. Dr. P. Vijaya Kumar & Dr. N. Appa Rao, ‘Management Science’ Cengage, Delhi, 2012.
2. Dr. A. R. Aryasri, Management Science’ TMH 2011.

References:

1. Koontz &Weihrich: ‘Essentials of management’ TMH 2011
2. Seth &Rastogi: Global Management Systems, Cengage learning , Delhi, 2011
3. Robbins: Organizational Behaviour, Pearson publications, 2011
4. KanishkaBedi: Production & Operations Management, Oxford Publications, 2011
5. Philip Kotler & Armstrong: Principles of Marketing, Pearson publications
6. Biswajit Patnaik: Human Resource Management, PHI, 2011
7. Hitt and Vijaya Kumar: Starategic Management, Cengage learning

8. Prem Chadha: Performance Management, Trinity Press(An imprint of Laxmi Publications Pvt. Ltd.) Delhi 2015.
9. Anil Bhat& Arya Kumar : Principles of Management, Oxford University Press, New Delhi, 2015.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Able to acquire knowledge of management functions, global leadership, and organizational behavior.

CO2: Able to identify the concepts of functional management & apply them in corporate situations

CO3: Understand project management terminology and Apply project management tools and techniques.

CO4: Effectively develop and implement corporate strategies

CO5: Identity, analyze, and apply contemporary management theory and research to current organizational issues.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO4	3	3	-	-	2	-	-	-	-	-	2	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	2	-	-	-
CO*	**3**	**2.5**	-	-	**2**	-	-	-	-	-	**2**	-	-	-

RESEARCH METHODOLOGY

<table>
<tr><td colspan="9">B.Tech IV Year I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA53702</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>S</td><td>Tot</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 48</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

1. Orient the student to make an informed choice from a large number of alternative methods and experimental designs available.
2. Empower the student with the knowledge and skills they need to undertake a research project, present a conference paper and write a scientific article
3. Develop a thorough understanding of fundamental theoretical ideas and logic of research.
4. Identify various sources of information for literature review and data collection.

UNIT-I	INTRODUCTION TO RESEARCH METHODOLOGY	Classes: 10

Meaning of Research – Objectives of Research – Types of Research – Research Approaches- Research Process – Guidelines for Selecting and Defining a Research Problem

UNIT-II	RESEARCH DESIGN AND DATA COLLECTION	Classes: 10

Research Design – Concepts related to Research Design – Basic Principles of Experimental Design.
Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

UNIT-III	MEASUREMENT, SCALING, AND SAMPLING TECHNIQUES	Classes: 10

Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation. Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design.

UNIT-IV	STATISTICAL INFERENCE AND BASIC SPSS	Classes:09

Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multi-variate Analysis. Use of statistical software SPSS and data handling

UNIT-V	REPORT WRITING AND PROFESSIONAL ETHICS	Classes: 09

Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation-Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

Text Books:

1. C.R.Kothari, " Research Methodology", New Age International Publishers, 2nd Edition,2004
2. Bryman, Alan, Bell, Emma, "Business Research Methods", Oxford University Press, 3rd Edition, 2011.
3. Kerlinger, F.N., Lee, H.B.,"Foundations of Behavioral Research", Harcourt Inc., 4thEdition, 2000.

Reference Books:

1. Chawla, Deepak, Sondhi, Neena, "Research Methodology: Concepts and Cases",Vikas Publishing House Pvt. Ltd. Delhi, 2011.
2. Pawar B. S., "Theory Building For Hypothesis Specification In Organizational Studies", Response Books, New Delhi, 2009.
3. NeumanW.L., "Social Research Methods: Qualitative and Quantitative Approaches", Pearson Education, 2008.

Web References:

1. https://en.wikipedia.org/wiki/Online_research_methods
2. https://www.prescott.edu/library/resources/research-bibliography.php

E-Text Books:

1. https://www.hcmuaf.edu.vn/.../Research%20Methodology%20-%20Methods%20and%20T...
2. https://www.federaljack.com/ebooks/My%20collection%20of%20medical%20books,%2020...

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Adapt the fundamentals of the research methodology and Identify the research problem.
CO2: Apply measuring techniques and Design data collection techniques.
CO3: Ability to build Scaling Techniques & Apply sampling methods.
CO4: Develop data processing procedures and apply tools.
CO5: Draft thesis/report writing.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO4	3	3	-	-	2	-	-	-	-	-	2	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	2	-	-	-
CO*	**3**	**2.5**	-	-	**2**	-	-	-	-	-	**2**	-	-	-

HUMAN RESOURCE MANAGEMENT

<table>
<tr><td colspan="11">B.Tech IV Year I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">19CA53703</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 48</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

Course Objectives:

The main objectives of this are about

1. The functions, systems, policies and applications of Human Resource Management in organizations.
2. An overview of theoretical foundations of key areas associated with HR development in the organizations, HR skills and their ability to assess the constraints and opportunities associated with managing employees in different socio-economic and political context.

UNIT-I | INTRODUCTION TO HUMAN RESOURCE MANAGEMENT | Classes: 08

Introduction–Significance–Objectives and Functions, Responsibilities and Role of HR Department – Strategies of HRM - HRM in global context – Challenges of HRM - HR for Sustainable competitive advantage.

UNIT-II | DEVELOPING HR SYSTEMS | Classes: 10

Job Analysis, Job Evaluation, Job Design, Job Enlargement, Job Rotation, Job Enrichment
HR Planning – Recruitment & Selection Process – Sources of Recruitment – Recruitment of Diverse Work Force - Placement-Induction – Transfer – Promotion - Separation

UNIT-III | TRAINING AND DEVELOPING AND PERFORMANCE MANAGEMENT | Classes: 10

Training and Development – Training process - Analyzing Training needs & Designing the program – Implementationoftrainingprogrammes–NewLearningandtrainingmethods–AIBasedlearningand Training - Evaluating Training and Development Effectiveness. Performance Management and Career Planning

UNIT-IV | COMPENSATION AND EMPLOYEE WELFARE | Classes: 10

Introduction – Basic factors in determining Pay rates -Establishing pay rates-Job Evaluation methods-Pricing managerial and professional Jobs-Monetary and non monetary benefits-Salient features of Payment of wages Act, 1936and Minimum Wages Act, 1948.
Employee welfare facilities -Occupational safety Law-Workplace health Hazards -Problems and Remedies.

UNIT-V | INDUSTRIAL RELATIONS AND RECENT TRENDS IN HRM | Classes: 10

Industrial Relations: Collective bargaining -Grievances handling procedure- Salient features of Industrial Disputes Act, 1947.
Recent trends in HRM: Outsourcing, Work Life Balance-Quality circles -Total Quality Management-HR analytics – Machine Learning HR Apps.

Text Books:

1. Human Resource Management, Aswathappa, 4th Edition, TMH2006

References:

1. HumanResource Management, Noe A.Raymond, John Hollenbeck, Barry GerhartandPatrick Wright, Tata McGraw Hill.
2. HumanResource Management, Ian Beardwell& Len Holden-Macmillan IndiaLtd.
3. PersonnalandHuman Resource Management – Text and cases, Subbarao,Himalaya.
4. ManagingHuman Resources: Productivity, quality of work life, profits-WayneF.Cascio TMH.

5. Strategies HRM by Rajeev LochanDhar, ExcelBooks.
6. Fundamentals of HR Analytics: A Manual on Becoming HR Analytical, by Fermin Diez,MarkBussin,Venessa Lee,Kindle

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: To Examine basic concepts of HRM and HRM in global context.

CO2: To understand how to develop HR Systems.

CO3: To Analyze Training and Development Process, Performance management and Career planning methods.

CO4: To Examine methods of Employee compensation, Employee welfare facilities.

CO5: To Examine Industrial relations and to analyze Recent trends in HRM.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO4	3	3	-	-	2	-	-	-	-	-	2	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	2	-	-	-
CO*	**3**	**2.5**	-	-	**2**	-	-	-	-	-	**2**	-	-	-

DIGITAL SIGNAL PROCESSING LABORATORY

B. Tech IV Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
19CA04712	Core	0	0	2	1	30	70	100
Contact Classes Nil	Tutorial Classes: Nil	Practical Classes: 32				Total Classes: 32		

Course Objectives:

The course should enable the students :

1. To implement the convolution in MATLAB.
2. To implement the digital signal processing algorithms in MATLAB and C.
3. To understand the real-time operation of digital filters.
4. To analyze the Multirate signal processing algorithms.

Conduct any 7 experiments from PART-A and any 3 experiments from PART-B

PART –A (The following experiments shall be conducted using MATLAB / Equivalent software)

Exp.1	Finding Power and (or) Energy of a given signal
Exp.2	Linear and Circular Convolution of discrete sequences.
Exp.3	Find DFT / IDFT of given discrete time signal
Exp.4	Implementation of FFT of given Sequence.
Exp.5	Design and implementation of IIR Butterworth (LP/HP) filter.
Exp.6	Design and implementation of IIR Chebhshev (LP/HP) filter.
Exp.7	Design and implementation of FIR with low pass filter using any two windowing techniques. Plot its magnitude and phase responses.
Exp.8	Design and implementation of FIR with high pass filter using any two windowing techniques. Plot its magnitude and phase responses.
Exp.9	Implementation of Decimation and Interpolation process.

PART –B (The following experiments shall be conducted using CC Studio/ TI / Equivalent DSP Processors)

Exp.10	Find DFT / IDFT of given discrete time signal.
Exp.11	Implementation of FFT of given Sequence.
Exp.12	Linear and Circular Convolution of discrete sequences.
Exp.13	Design and implementation of IIR Butterworth / Chebyshev (LP/HP) filter.
Exp.14	Design and implementation of FIR with low pass / high pass filter using any two windowing techniques. Plot its magnitude and phase responses.

Reference Books:

1. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, Principles, Algorithms and Applications", Prentice Hall, 4th Edition, 2007.
2. B. Preetham Kumar, "Digital Signal Processing Laboratory", CRC Press, 2nd Edition, 2010
3. B.Venkata Ramani, M.Bhaskar, " Digital Signal Processors- Architecture, Programming and applications", TMH, 2nd Edition, 2002

Web References:

1. http://eceweb1.rutgers.edu/~orfanidi/ece348/
2. http://www.eecs.umich.edu/courses/eecs452/refs.html
3. http://www.dsp.sun.ac.za/lab-reference-guide/

SOFTWARE AND HARDWARE REQUIRED FOR A BATCH OF 30 STUDENTS

HARDWARE: 30 numbers of Desktop Computer Systems with 2 GB RAM

SOFTWARES: a) MATLAB b) C6713 DSK Code Composer Studio c) TI d) DSP Processor

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS

S.No	Name of the Equipment	Range
1	TMS320C6713 DSP Starter Kit (DSK)	225 MHz device delivering up to 1800 million instructions per second (MIPs)
2	USB Cable	--
3	Universal Power Supply	+5V
4	AC Power Cord(s)	--

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on CC Studio and Analyze the DSP Systems programming through CCS.

CO2: Analyze the various DSP processor kits for floating point operations.

CO3: Design and develop programming on DSP tool kits using CCS.

CO4: Conduct investigation and test the functionality on implementation of CCS through DSP programming.

CO5: Select appropriate tool kit to analyze and implement DSP Processor.

CO6: Follow ethical principles in designing and programming DSP processors

CO7: Do experiments effectively as an individual and as a member in a group.

CO8: Communicate verbally and in written form, the understandings about the programming.

CO9: Continue updating their skill related to implementation for various applications during their life time.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-		3	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3		-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

R20

CHADALAWADA RAMANAMMA ENGINEERING COLLEGE

(AUTONOMOUS)

(Approved by AICTE | NAAC Accreditation with 'A' Grade | Permanently Affiliated to JNTUA)

Chadalawada Nagar, Tirupati - 517506, Andhra Pradesh.

OUTCOME BASED EDUCATION

WITH

CHOICE BASED CREDIT SYSTEM

BACHELOR OF TECHNOLOGY

ACADEMIC REGULATIONS – R20

UNDER AUTONOMOUS STATUS

B.Tech Regular Four Year Degree Programme

(for the batches admitted from the academic year 2020- 2021)

&

B.Tech (Lateral Entry Scheme)

(for the batches admitted from the academic year 2021 - 2022)

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

CONTENTS

"Take up one idea.
Make that one idea your life-think of it, dream of it, live on that idea. Let the brain muscles, nerves, every part of your body be full of that idea and just leave every other idea alone. **This is the way to success"**

Swami Vivekananda

VISION AND MISSION OF THE INSTITUTE

VISION

To be a top notch institution, imparting quality education in technology and management to produce globally competent professionals and address socio-economic issues through research and innovation.

MISSION

- Continuously update curricula and teaching learning process to meet the needs of industry and promote entrepreneurship.
- Inculcate research, development and innovation culture among students and faculty.
- Capacity to work in diverse fields and cultures with ethical practices to address socio-economic issues.

PRELIMINARY DEFINITIONS AND NOMENCLATURES

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two main semesters i.e., (one odd + one even) and one supplementary semester.

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Anantapuramu) and State Government.

Backlog Course: A course is considered to be a backlog course if the student has obtained a failure grade (F) in that course.

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry, Biology etc., are considered to be foundational in nature.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

Branch: Means specialization in a program like B.Tech degree program in Mechanical Engineering, B.Tech degree program in Computer Science and Engineering etc.

Certificate Course: It is a course that makes a student gain hands-on expertise and skills required for holistic development in a specific area/field.

Choice Based Credit System: The credit based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Commission: Means University Grants Commission (UGC), New Delhi.

Continuous Internal Examination: It is an examination conducted towards sessional assessment.

Course: A course is a subject offered by a department for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture/tutorial hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources, and processes for evaluating the attainment of Program Educational Objectives.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff and other resources in the process of study for a degree.

Dropping from the Semester: A student who doesn't want to register for any semester can apply in writing in prescribed format before commencement of that semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and/or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 - point scale.

Institute: Means CHADALAWADA RAMANAMMA ENGINEERING COLLEGE, Tirupati unless indicated otherwise by the context.

Massive Open Online Course (MOOC): MOOC courses inculcate the habit of self-learning. MOOC courses would be additional choices in all the elective group courses.

Pre-requisite: A course, the knowledge of which is required for registration into higher level course.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Professional Elective: It indicates a course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Means, Bachelor of Technology (B.Tech) degree program / PG degree program: M.Tech/ MBA.

Program Educational Objectives: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project work: It is a design or research based work to be taken up by a student during his/her final year to achieve a particular aim. It is a credit based course and is to be planned carefully by the student.

Re-Appearing: A student can reappear only in the semester end examination for the theory component of a course, subject to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester of a Program.

Regulations: The regulations, common to all B.Tech programs offered by Institute are designated as "CREC Regulations R-20" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. The odd Semester starts usually in July and even semester in December.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

S/he: Means "she" and "he" both.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means the Jawaharlal Nehru Technological University Anantapur, Anantapuramu.

FOREWORD

The autonomy is conferred to CHADALAWADA RAMANAMMA ENGINEERING COLLEGE (CREC), Tirupati by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like J N T University Anantapuramu (JNTUA), Anantapuramu and AICTE. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own curriculum, examination system and monitoring mechanism, independent of the affiliating University but under its observance.

CREC is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUA to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute to order to produce a quality engineering graduate to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

ACADEMIC REGULATIONS – R20

B.Tech. Regular Four Year Degree Programme

(For the batches admitted from the academic year 2020-21)

&

B.Tech. (Lateral Entry Scheme)

(For the batches admitted from the academic year 2021 - 22)

For pursuing four year undergraduate Bachelor Degree programme of study in Engineering (B.Tech) offered by CHADALAWADA RAMANAMMA ENGINEERING COLLEGE under Autonomous status and herein after referred to as CREC.

1.0. CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions (HEI's) are changing from the conventional course structure to Choice Based Credit System (CBCS) along with introduction to semester system at first year itself. The semester system helps in accelerating the teaching-learning process and enables vertical and horizontal mobility in learning.

The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

Choice Based Credit System (CBCS) is a flexible system of learning and provides choice for students to select from the prescribed elective courses. A course defines learning objectives and learning outcomes and comprises of lectures / tutorials / laboratory work / field work / project work / / seminars / assignments / alternative assessment tools / presentations / self-study etc. or a combination of some of these.

Under the CBCS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.

The CBCS permits students to:

- Choose electives from a wide range of elective courses offered by the departments.
- Undergo additional courses of interest.
- Adopt an interdisciplinary approach in learning.
- Make the best use of expertise of the available faculty.

2.0 MEDIUM OF INSTRUCTION

The medium of instruction shall be English for all courses, examinations, seminar presentations and project work. The curriculum will comprise courses of study as given in course structure, in accordance with the prescribed syllabi.

3.0 TYPES OF COURSES

Courses in a programme may be of three kinds: **Foundation / Skill, Core and Elective.**

3.1 Foundation / Skill Course:

Foundation courses are the courses based upon the content leads to enhancement of skill and knowledge as well as value based and are aimed at man making education. Skill subjects are those areas in which one needs to develop a set of skills to learn anything at all. They are fundamental to learning any subject.

3.2 Core Course:

There may be a core course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

3.3 Elective Course:

Electives provide breadth of experience in respective branch and applications areas. Elective course is a course which can be chosen from a pool of courses. It may be:

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student's proficiency/skill.

An elective may be discipline centric (Professional Elective) focusing on those courses which add generic proficiency to the students or may be chosen from an inter discipline called as "Open Elective".

There are FIVE professional elective groups; students can choose not more than two courses from each group. Overall, students can opt for FIVE professional elective courses which enhance their professional knowledge in line with latest industrial needs.

There are FOUR open elective groups; students can choose not more than two courses from each group consisting of four different subjects.

There are ONE humanities elective group, students can choose not more than two courses from each group consisting of three different subjects.

3.4 Mandatory Course:

Courses like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc., shall be included in the curriculum as non-credit mandatory courses. Environmental Sciences is to be offered compulsorily as mandatory course for all branches. A student has to secure 40% of the marks allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit courses.

4.0 SEMESTER STRUCTURE

Each academic year is divided into two semesters, students admitted on transfer from JNTU affiliated institutes, Universities and other institutes in the subjects in which they are required to earn credits so as to be on par with regular students as prescribed by concerned ‘Board of Studies’.

4.1 Each semester shall be of 21 weeks (Table 1) duration and this period includes time for registration of courses, course work, examination preparation and conduct of examinations.

4.2 Each semester shall have a minimum of 90 working days; out of which number of contact days for teaching / practical are 74 and 16 days for conduct of exams and preparation.

4.3 The academic calendar shown in Table 1 is declared at the beginning of the academic year.

Table 1: Academic Calendar

ZERO SEMESTER (I Year only) (3 weeks)	Physical Activities, Career Counseling, Orientating of respective branch, Proficiency Modules and Productivity Tools and Communicating Skills	3 weeks	3 weeks
ODD SEMESTER (21 weeks)	I Spell Instruction Period	8 weeks	19 weeks
	I Continuous Internal Examination (CIE-I)	1 week	
	II Spell Instruction Period	8 weeks	
	II Continuous Internal Examination (CIE-II)	1 week	
	Preparation and Practical Examinations	1 week	
	Semester End Examinations		2 weeks
Semester Break and Supplementary Exams			2 weeks
EVEN SEMESTER (21 weeks)	I Spell Instruction Period	8 weeks	19 weeks
	I Continuous Internal Examination (CIE-I)	1 week	
	II Spell Instruction Period	8 weeks	
	II Continuous Internal Examination (CIE-II)	1 week	
	Preparation and Practical Examinations	1 week	
	Semester End Examinations		2 weeks

5.0 REGISTRATION

5.1. Each student has to compulsorily register for course work at the beginning of each semester as per the schedule mentioned in the Academic Calendar. It is compulsory for the student to register for courses in time. The registration will be organized departmentally under the supervision of the Head of the Department.

5.2. In absentia registration will not be permitted under any circumstance.

5.3. At the time of registration, students should have cleared all the dues of Institute and Hostel of the previous semesters, paid the prescribed fees for the current semester and not been debarred from institute for a specified period on disciplinary or any other ground.

6.0 UNIQUE COURSE IDENTIFICATION CODE

Every course of the B.Tech program will be placed in one of the four groups of courses as listed in the Table 2. The various courses and their two-letter codes are given below;

Table 2: Group of Courses

S. No	Branch	Code
1.	Civil Engineering	01
2.	Electrical and Electronics Engineering	02
3.	Mechanical Engineering	03
4.	Electronics and Communication Engineering	04
5.	Computer Science and Engineering	05
6.	Computer Science and Engineering- Artificial Intelligence and Machine Learning	33
7.	Computer Science and Engineering -Artificial Intelligence	31

7.0 CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Foundation / Skill Courses, Core Courses, Elective Courses, Laboratory Courses, Mandatory Courses, skill courses, Internship and Project work. The list of elective courses may include subjects from allied disciplines also.

Contact Periods: Depending on the complexity and volume of the course, the number of contact periods per week will be assigned. Each Theory and Laboratory course carries credits, based on the number of hours/weeks as follows:

- Contact classes (Theory): 1credit per lecture hour per week.
- Tutorial Classes (Theory): 1credit per lecture hours per week.
- Laboratory Hours (Practical): 1 credit for 2 Practical hours.

1. There shall be mandatory student induction program for fresher’s, with three-week duration before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People,

Visits to local Areas, Familiarization to Dept./Branch & Innovations etc., shall be included in the guidelines issued by AICTE.

2. All undergraduate students shall register for NCC/NSS activities. A student will be required to participate in an activity for four hours in a month during second and third semesters.
3. There shall be 05 Professional Elective courses and 04 Open Elective courses. All the Professional & Open Elective courses shall be offered for 03 credits, wherever lab component is involved it shall be (2-0-2) and without lab component it shall be (3-0-0).
4. All Open Electives are offered to students of all branches in general. However, a student shall choose an open Elective from the list in such a manner that he/she has not studied the same course in any form during the Programme.
5. A student shall be permitted to pursue up to a maximum of two elective courses under MOOCs during the Programme. Each of the courses must be of minimum 12 weeks in duration. Attendance will not be monitored for MOOC courses. Student must pursue and acquire a certificate for a MOOC course only from the organizations/agencies approved by the Head of the department to earn the 3 credits. The Head of the department will give the list of such courses at the beginning of the semester.
6. The Department shall invite registration forms from the students at the beginning of the semester for offering professional and open elective courses. There shall be a limit on the minimum and maximum number of registrations based on class/section strength.
7. Students shall undergo mandatory summer internships for a minimum of six weeks duration, at the end of second and third year of the Programme. There shall also be mandatory full internship in the final semester of the Programme along with the project work.
8. There shall be 05 skill-oriented courses offered during II Year I Sem to IV Year I semester. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain courses and the remaining one shall be a soft skills course.
9. Undergraduate Degree with Honors/Minor shall be issued by the college to the students who fulfill all the academic eligibility requirements for the B. Tech program and Honors/Minor program. The objective is to provide additional learning opportunities to academically motivated students.

7.1 Credit distribution for courses offered is shown in Table 3.

Table 3: Credit distribution

S. No	Course	Hours	Credits
1	Theory Course (Core/Foundation/Elective)	3	3
2	Laboratory Course	2	1
3	MOOC Courses	-	3
4	Mandatory Course	2	0
5	Industrial Training/Internship	-	1.5/3
6	Skill Oriented Courses	1+2/2+0	2
7	Project	-	12

7.2 Course Structure

Every program of study shall be designed to have 36 theory courses and 18 laboratory courses. Every course of the B.Tech program will be placed in one of the nine categories with minimum credits as listed in the Table 4.In addition, a student has to carry out four socially Relevant Project, project work.

Table 4: Category Wise Distribution of Credits

S.No.	Category	Code	Suggested breakup of Credits (APSCHE)	Suggested breakup of Credits (AICTE)	Suggested breakup of Credits (CHDL)
1	Humanities and social science including Management courses	HS	10.5	12	9
2	Basic Science courses	BS	21	25	21
3	Engineering science courses	ES	24	24	24
4	Professional core Courses	PC	51	48	52.5
5	Open Elective Courses	OE	12	18	12
6	Professional Elective courses	PE	15	18	15
7	Internship/Seminar/Project wok	PROJ	16.5	15	16.5
8	Mandatory courses	MC	-	-	-
9	Skill Oriented Courses	SC	10	-	10
Total Credits			**160**	**160**	**160**

7.3 Semester-wise course break-up

For Four year Regular program:

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
I Year I Semester	5	3	19.5
I Year II Semester	5 + Mandatory Course	3	19.5
II Year I Semester	5 + Mandatory Course + Skill Oriented Course	3	21.5
II Year II Semester	5 + Skill Oriented Course + Honor/Minor Degree** (1 Course)	3	21.5 +4(Honor/Minor Degree)

III Year I Semester	5(3 Core + 1 Open Elective + 1 Professional Elective) + Mandatory Course + Skill Oriented Course + Honor/Minor Degree** (1 Course) + 1 Internship*	2	21.5 +4(Honor/Minor Degree)
III Year II Semester	5 (3 Core + 1 Open Elective + 1 Professional Elective) + Mandatory Course + Skill Oriented Course + Honor/Minor Degree** (1 Course)	3	21.5 +4(Honor/Minor Degree)
IV Year I Semester	6 (2 Open Elective + 3 Professional Elective + 1 HS Elective) + Skill Oriented Course+ 1 Internship* + Honor/Minor Degree** (1 Course)	0	23 +4(Honor/Minor Degree)
IV Year II Semester	Major Project (Project work, Seminar and Internship in industry)	0	12
Total	**36 (12 Foundation + 14 Core + 5 Professional Electives + 4 Open Electives+ 1 Humanities Elective) + 4 Mandatory + 5 Skill Oriented Course + Project + 3 Internships+ Honor/Minor Degree (4+2 MOOC Course)**	**17**	**160+ +16(Honor/Minor Degree)**

***The student should undergo Two Internship programs during IV and VI Semesters Summer Vacation break whose evaluation will be made in V and VII Semesters respectively.**
****Additionally, 2 MOOC Courses, which shall be domain specific, each with 2 credits with a minimum duration of 8/12 weeks should be acquired to fulfill Honor/Minor Degree from IV to VII Semester.**

7.4 For Three year lateral entry program:

Semester	No. of Theory Courses	No. of Lab Courses	Total Credits
II Year I Semester	5 + Mandatory Course + Skill Oriented Course	3	21.5
II Year II Semester	5 + Skill Oriented Course + Honor/Minor Degree** (1 Course)	3	21.5 +4(Honor/Minor Degree)
III Year I Semester	5(3 Core + 1 Open Elective + 1 Professional Elective) + Mandatory Course + Skill Oriented Course + Honor/Minor Degree** (1 Course) + 1 Internship*	2	21.5 +4(Honor/Minor Degree)
III Year II Semester	5 (3 Core + 1 Open Elective + 1 Professional Elective) + Mandatory Course + Skill Oriented Course + Honor/Minor Degree** (1 Course)	3	21.5 +4(Honor/Minor Degree)
IV Year I SIemester	6 (2 Open Elective + 3 Professional Elective + 1 HS Elective) + Skill Oriented Course+ 1 Internship* + Honor/Minor Degree** (1 Course)	0	23 +4(Honor/Minor Degree)
IV Year II Semester	Major Project (Project work, Seminar and Internship in industry)	0	12
Total	**26 (02 Foundation + 14 Core + 5 Professional Electives + 4 Open Electives+ 1 Humanities Elective) + 3 Mandatory + 5 Skill Oriented Course+ Project + 3 Internships + Honor/Minor Degree (4 + 2 MOOC Course)**	**11**	**121+ +16(Honor/Minor Degree)**

*** The student should undergo Two Internship programs during IV and VI Semesters Summer Vacation break whose evaluation will be made in V and VII Semesters respectively.**
****Additionally,2 MOOC Courses, which shall be domain specific, each with 2 credits with a minimum duration of 8/12 weeks should be acquired to fulfill Honor/Minor Degree from IV to VII Semester.**

8.0 EVALUATION METHODOLOGY

8.1 Theory Course:

Each theory course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIE+AAT) and 70 marks for Semester End Examination (SEE). Out of

30 marks allotted for Continuous Internal Assessment during the semester, final marks of CIE for 25 shall be arrived by considering 80% weightage to the better internal exam and 20% to the other. The remaining 05 Marks will be considered through Alternative Assessment Tool (AAT) after second internal examination. The AAT converts the classroom into an effective learning center. The AAT may include

1. Seminar – 1 Mark
2. Assignment– 2 Marks
3. Slip Test – 2 Marks

AAT helps the student for the improvement of self-learning and presentation skills.

8.1.1 Semester End Examination (SEE):

The syllabus for each theory course consists of FIVE units and each unit carries equal weightage in terms of marks distribution. The semester end examination is conducted for 70 marks of 3 hours duration.

The Semester End Examination (SEE) consists of two parts i.e. Part A and Part B. Part A consists of 12 short questions, student has to answer any ten questions, and each question carries two marks. Part B consists of five questions with 'either' 'or' choice will be drawn from each unit. Each question carries 10 marks. There could be a maximum of two subdivisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept
30 %	To test the analytical skill of the concept
20 %	To test the application skill of the concept

8.1.2 Continuous Internal Assessment (CIA):

For each theory course the Continuous Internal Assessment shall be conducted by the faculty/teacher handling the course as given in Table-5. Continuous Internal Assessment is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Alternative Assessment Tool (AAT).

Table-5: Assessment pattern for Theory Courses

COMPONENT	THEORY		TOTAL MARKS
Type of Assessment	CIE	AAT	
Max. Marks	25	05	30

8.1.2.1 Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8th and 17th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. The final CIE for 25 marks with weightage of 80% to better mid marks and 20% for the other. The valuation and verification of answer scripts of CIE exams shall be completed within a week after the conduct of the Internal Examination.

8.1.2.2 Alternative Assessment Tool (AAT)

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). This AAT enables faculty to design own assessment patterns during the CIA. The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. If properly applied, the AAT converts the classroom into an effective learning center. The AAT may include seminars(1Mark), assignments(2 Marks), slip tests (2 Marks).

8.2 Laboratory Course:

8.2.1 Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment. The semester end lab examination for 70 marks shall be conducted by two examiners. Internal Examiner nominated by the HOD and the External Examiner nominated by the Controller of Examinations from the panel of experts recommended by HOD. For supplementary lab examinations both the examiners will be nominated by HOD.

8.2.2 All the drawing related courses are evaluated in line with theory courses. The distribution shall be 30 marks for internal evaluation (15 marks for day–to–day work, and 15 marks for internal tests) and 70 marks for semester end lab examination.

8.3 Skill Oriented

8.3.1 For skill oriented/skill advanced course, one theory and 2 practical hours or two theory hours may be allotted.

8.3.2 Out of the five skill courses two shall be skill-oriented courses from the same domain and shall be completed in second year. Of the remaining 3 skill courses, one shall be necessarily be a soft skill course and the remaining 2 shall be skill-advanced courses either from the same domain or Job oriented skill courses, which can be of inter disciplinary nature.

8.3.3 The student shall be given an option to choose either the skill courses being offered by the department at the beginning of the semester or to choose a certificate course being offered by industries/Professional bodies/APSSDC.

8.3.4 If a student chooses to take a Certificate Course offered by industries/Professional bodies/APSSDC or any other accredited bodies,, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency/professional bodies.

8.3.5 If a student prefers to take a certificate course offered by external agency, the attendance of the student will not be considered. The student is deemed to have fulfilled the attendance requirement of the course and acquire the credits assigned to the course.

8.3.6 A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades. The recommended conversions and appropriate grades/marks.

8.4 Internships

8.4.1 Two summer internships each with a minimum of six weeks duration, done at the end of Internships each with a minimum of six weeks duration, done at the end of second and third years, respectively are mandatory. The internship can be done by the students at local industries, Govt. Organizations, construction agencies, Industries, Hydro and thermal power projects and also in software MNCs.

8.4.2 Evaluation of the summer internships shall be through the departmental committee. A Student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee. The report and the oral presentation shall carry 40% and 60% weightages respectively.

8.4.3 The Department shall monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

8.5 Project work

8.5.1 The project work will be done in IV Year II semester. Project shall be evaluated for 200 marks out of which 60 marks for internal evaluation and 140 marks for semester end evaluation. The student should mandatorily undergo internship and parallelly he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship.

8.5.2 The student must give a brief presentation to project review committee comprising the Head of the department, project supervisor and senior faculty member of the department. A minimum of 50% of maximum marks shall be obtained to earn the corresponding credits.

8.6 Honors Program

8.6.1 Students of a Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline.

8.6.2 A student shall be permitted to register for Honors program at the beginning of II Year II semester provided that the student must have acquired a minimum of 8.0 CGPA upto the end of 2 semesters without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.

8.6.3 Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.

8.6.4 In addition to fulfilling all the requisites of a Regular B.Tech Programme, a student shall earn 20 additional credits to be eligible for the award of B.Tech (Honors) degree. This is in addition to the credits essential for obtaining the Undergraduate Degree in Major Discipline (i.e. 160 credits).

8.6.5 Out of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs on providing a certificate from the agencies approved by the Head of the department with grading or marks or pass/fail from II year II semester to IV year I semester. MOOCs should be domain specific, each with 2 credits and with a minimum duration of 8/12 weeks. The attendance will not be monitored for MOOC courses.

8.6.6 It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.

8.6.7 The concerned department shall decide the minimum enrolments for offering Honors program. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department.

8.6.8 The concerned Head of the department shall also consider courses listed under professional electives of the respective B.Tech programs for the requirements of B.Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the programme.

8.6.9 A committee should be formed at the level of College to evaluate the grades/marks given by external agencies. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

8.6.10 If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate).

8.6.11 In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech degree only.

8.6.12 Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor’s degree.

8.7 Minor Program

8.7.1 Students who are desirous of pursuing their special interest areas other than the chosendisciplineofEngineeringmayoptforadditionalcoursesinminorspecialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme; he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering.

8.7.2 Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

8.7.3 The concerned Head of the department shall identify two tracks in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE, ME etc or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Robotics, VLSI etc.

8.7.4 The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective Head of the department.

8.7.5 The department can offer maximum of two Minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.

8.7.6 The Head of the department shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department.

8.7.7 A student shall be permitted to register for Minors program at the beginning of 4th semester provided that the student must have acquired a minimum of 8.0 CGPA upto the end of 2 semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Minors Programme stands cancelled and he/she shall continue with the regular Programme.

8.7.8 A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Undergraduate Degree in Major Discipline (i.e. 160 credits).

8.7.9 Out of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing four specified courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs on providing a certificate from the agencies approved by the Head of the department with grading or marks or pass/fail from II Year II semester to IV Year I semester. MOOCs should be domain specific, each with 2 credits and with a minimum duration of 8/12weeks.The attendance will not be monitored for MOOC courses.

8.7.10 Student can opt for the Industry relevant minor specialization as approved by the concerned department. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned HOD and should produce course completion certificate. The Head of the department of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.

8.7.11 A committee should be formed at the level of College to evaluate the grades/marks given by external agencies to a student which are approved by the Head of the Institution. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

8.7.12 If a student drops or is terminated from the Minors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate).

8.7.13 In case a student fails to meet the CGPA requirement for Degree with Minors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Minors and they will receive regular B.Tech degree only.

8.7.14 Minors must be completed simultaneously with a major degree program. A student cannot earn Minors after he/she has already earned bachelor's degree.

9.0 ATTENDANCE REQUIREMENTS AND DETENTION POLICY

9.1 It is desirable for a candidate to put on 100% attendance in each course. In every course (theory/laboratory), student has to maintain a minimum of 75% attendance including the days of attendance in sports, games, NCC and NSS activities to be eligible for appearing in Semester End Examination of the course.

9.2 A candidate shall put in a minimum required attendance of 75 % in that semester. Otherwise, s/he shall be declared detained and has to repeat semester.

9.3 For cases of medical issues, deficiency of attendance in each course to the extent of 10% may be permitted by the College Academic Committee (CAC) on the recommendation of Head of the department, if their attendance is between 75% and 65% in a semester, subjected to submission of medical certificate.

9.4 A prescribed fee shall be payable towards condonation of shortage of attendance.

9.5 A student shall be promoted to the next semester if he/she put minimum attendance of 50% in all the subject, otherwise he/she will be detained and may seek readmission into that semester when offered next.

9.6 A student shall not be promoted to the next semester unless he/she satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next.

9.7 Any student against whom any disciplinary action by the institute is pending shall not be permitted to attend any SEE in that semester.

10.0 CONDUCT OF SEMESTER END EXAMINATIONS AND EVALUATION

10.1. Semester end examination shall be conducted by the Controller of Examinations (COE) by inviting Question Papers from the External Examiners.

10.2. Question papers may be moderated for the coverage of syllabus, pattern of questions by an Examination Committee chaired by COE and senior subject expert before the commencement of semester end examinations. External Examiner shall prepare a detailed scheme of valuation.

10.3. The answer papers of semester end examination should be evaluated by the Examiners immediately after the completion of exam and the award sheet should be submitted to COE in a sealed cover.

10.4. The COE processes the evolution of all the end-semester answer scripts on a prescribed date(s).

10.5. Examinations Committee shall consolidate the marks awarded by the examiners.

11.0 SCHEME FOR THE AWARD OF GRADE

11.1. A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each theory course, if s/he secures

i. Not less than 35% marks for each theory course in the semester end examination, and

ii. A minimum of 40% marks for each theory course considering both internal and semester end examination.

11.2. A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each Lab / Project, if s/he secures

i. Not less than 40% marks for each Lab / Project course in the semester end examination,

ii. A minimum of 40% marks for each Lab / Project course considering both internal and semester end examination.

11.3. If a candidate fails to secure a pass in a particular course, it is mandatory that s/he shall register and reappear for the examination in that course, when examination is conducted in that course.

It is mandatory that s/he should continue to register and reappear for the examination till s/he secures a pass.

12.0 LETTER GRADES AND GRADE POINTS

12.1 Performances of students in each course are expressed in terms of marks as well as in Letter Grades based on absolute grading system. The UGC recommends a 10-point grading system with the following letter grades as given in the Table-6.

12.2 A student is deemed to have passed and acquired to correspondent credits in particular course if s/he obtains any one of the following grades: “A+”, “A”, “B”, “C”, “D”, “E”.

12.3 A student obtaining Grade F shall be considered Failed and will be required to reappear in the examination.

Table-6: Grade Points Scale (Absolute Grading)

Range of Marks	Level	Letter Grade	Grade Point
90 – 100	Outstanding	A+	10
80 – 89	Excellent	A	9
70 – 79	Very Good	B	8
60 – 69	Good	C	7
50 – 59	Fair	D	6
40 – 49	Satisfactory	E	5
Below 40	Fail	F	0
Absent	Absent	AB	0

12.4 For non-credit courses, ‘Satisfactory’ or “Not Satisfactory” is indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

12.5 At the end of each semester, the institute issues grade sheet indicating the SGPA and CGPA of the student. However, grade sheet will not be issued to the student if s/he has any outstanding dues.

13.0 COMPUTATION OF SGPA AND CGPA

The UGC recommends to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA). The credit points earned by a student are used for calculating the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA), both of which are important performance indices of the student. SGPA is equal to the sum of all the total points earned by the student in a given semester divided by the number of credits registered by the student in that semester. CGPA gives the sum of all the total points earned in all the previous semesters and the current semester divided by the number of credits registered in all these semesters. Thus,

$$SGPA = \sum_{i=1}^{n}(C_i G_i) / \sum_{i=1}^{n} C_i$$

where, C_i is the number of credits of the i^{th} course and $G_i$is the grade point scored by the student in the i^{th} course and n represent the number of courses in which a student is registered in the concerned semester.

$$CGPA = \sum_{j=1}^{m}\left(C_j S_j\right) / \sum_{j=1}^{m} C_j$$

where, S_j is the SGPA of the j^{th} semester and $C_j$is the total number of credits upto the semester and m represent the number of semesters completed in which a student registered upto the semester. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

14.0ILLUSTRATION OF COMPUTATION OF SGPA AND CGPA

14.1 Illustration for SGPA

Course Name	Course Credits	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	3	B	8	3 x 8 = 24
Course 2	4	C	7	4 x 7 = 28
Course 3	3	D	6	3 x 6 = 18
Course 4	3	A+	10	3 x 10 = 30
Course 5	3	E	5	3 x 5 = 15
Course 6	4	D	6	4 x 6 = 24
	20			**139**

$$Thus, SGPA = 139 / 20 = 6.95$$

14.2Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit: 20 SGPA: 6.9	Credit: 22 SGPA: 7.8	Credit: 25 SGPA: 5.6	Credit: 26 SGPA: 6.0
Semester 5	**Semester 6**		
Credit: 26 SGPA: 6.3	Credit: 25 SGPA: 8.0		

$$Thus,\ CGPA = \frac{20x6.9\ +\ 22x7.8\ +\ 25x5.6\ +\ 26x6.0\ +\ 26x6.3\ +\ 25x8.0}{144} = 6.73$$

15.0 RE-COUNTING/ REVALUATION/ CHALLENGE EVALUATION

15.1 Re-Counting

i. If student is aggrieved of Semester End Examination marks declared, he/she may apply for the recounting of marks in answer book by paying prescribed fee.

ii. Re-Counter shall see that examinee attempted the questions considering the internal choice and shall check the marks given by the evaluator are as per the marks allotted to the questions.

iii. Re-Counter shall see that all questions and sub questions are valued and awarded marks.
iv. Re-Counter shall report to COE in case of any discrepancy and COE shall get it corrected.

15.2 Revaluation: If student is aggrieved of Semester End Examination marks declared, he/she may apply for the revaluation of answer book by paying prescribed fee. All the cases of re-valuation where the change in marks occur, they should get corrected.

15.3 Challenge Evaluation: If student is not satisfied with Semester End Examination result, a facility to get evaluated by the external evaluator along with concerned subject teacher appointed for this purpose. He/she may apply for the challenge evaluation within five working days from the date of display of marks. The following procedure shall be followed.

i. A candidate desirous of challenge evaluation of the answer book(s) shall be required to apply in the prescribed form.
ii. The Xerox copy of answer script will be provided on demand of students for verification.
iii. The candidate shall be required to submit separate application for each course.
iv. The candidate shall have to submit application form within 05 days (both days inclusive) from the date of display of marks of the concerned course(s).
v. The candidate shall have to submit application to the office of COE after paying requisite fee per answer book or such fee as may be prescribed by the Institute from time to time.
vi. Candidate will be responsible for submitting application in prescribed time limit. An application form received after the last date will not be accepted.
vii. Upon receipt of the application, the paper is to be scrutinized for the following.
   a. Whether the total marks displayed in the given paper matches with the marks awarded to the candidate on the cover page of the answer book.
   b. Whether the question-wise marks awarded to all the questions inside the answer book are correctly carried over on the cover page.
   c. Whether the total of the question-wise marks on the cover page is correct.
   d. Whether all the answers in the answer book have been assessed by the examiner. If any question or part of it in the answer book is observed to be un-assessed, the same shall be got assessed from the examiner in the subject and additional marks, if any, awarded shall be then carried, noted and added on the cover page also and accordingly the total of the marks shall be corrected.
   e. The COE shall issue corrected statement of marks to the concerned department for display.
   f. The amount shall be refunded to the student if he/she got more than 15% of total marks in the respective subject.

16.0 PROMOTION POLICIES

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no. 09.

For students admitted into B.Tech (Regular) program

a) A student shall be promoted from first year to second year if he fulfils the minimum attendance requirements.

b) student will be promoted from II year to III year if he fulfils the academic requirement of 40% of credits up to either II year I-Semester or II year II-Semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II-year II semester.

C) A student shall be promoted from III year to IV year if he fulfils the academic requirements of 40% of the credits up to either III year I semester or III-year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III-year II semester.

17.0 GRADUATION REQUIREMENTS

The following academic requirements shall be met for the award of the B.Tech degree.

17.1 Student shall register and acquire minimum attendance in all courses and secure 160 credits for regular program and 121 credits for lateral entry program.

17.2 A student of a regular program, who fails to earn 160 credits within eight consecutive academic years from the year of his/her admission with less than or equal to 4.0 CGPA, shall forfeit his/her degree and his/her admission stands cancelled.

17.3 A student of a lateral entry program who fails to earn 121 credits within six consecutive academic years from the year of his/her admission with less than or equal to 4.0 CGPA, shall forfeit his/her degree and his/her admission stands cancelled.

18.0 AWARD OF DEGREE

18.1 Classification of degree will be as follows:

CGPA $\geq$ 7.5	CGPA $\geq$ 6.5 and < 7.5	CGPA $\geq$ 5.5 and < 6.5	CGPA $\geq$ 4.0 and < 5.5
First Class with Distinction	**First Class**	**Second Class**	**Pass Class**

18.2 In order to extend the benefit to the students with one/two backlogs after either III Year II semester or IV year II semester, GRAFTING option is provided to the students enabling their placements and fulfilling graduation requirements. Following are the guidelines for the Grafting:

a. Grafting will be done among the courses within the semester shall draw a maximum of 6 marks from the any one of the cleared courses in the semester and will be grafted to the failed course in the same semester.

b. Students shall be given a choice of grafting only once in the 4 years program, either after III year II semester (Option #1) or after IV year II semester (Option #2).

c. Option#1: Applicable to students who have maximum of TWO theory courses in III year I semester and / or III year II semester.

   Option#2: Applicable to students who have maximum of TWO theory courses in IV year I semester and / or IV year II semesters.

d. Eligibility for grafting:

   i. Prior to the conduct of the supplementary examination after the declaration of III year II semester or IV year II semester results.

   ii. S/he must appear in all regular or supplementary examinations as per the provisions laid down in regulations for the courses s/he appeals for grafting.

   iii. The marks obtained by her/him in latest attempt shall be taken into account for grafting of marks in the failed course(s).

18.3 By the end of VI semester, all the students shall complete the audit courses offered to them with acceptable performance.

All the candidates who register for the semester end examination will be issued grade sheet by the institute. Apart from the semester wise grade sheet, the institute will issue the provisional certificate and consolidated grade sheet subject to the fulfillment of all the academic requirements.

19.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

19.1 A candidate is normally not permitted to break the study. However, if a candidate intends to temporarily discontinue the program in the middle for valid reasons (such as accident or hospitalization due to prolonged ill health) and to rejoin the program after the break from the commencement of the respective semester as and when it is offered , s/he shall apply to the Principal in advance. Such application shall be submitted before the commencement of the semester and forwarded through the Head of the department stating the reasons for such withdrawal together with supporting documents and endorsement of his / her parent / guardian.

19.2 The institute shall examine such an application and if it finds the case to be genuine, it may permit the student to rejoin. Such permission is accorded only to those who do not have any outstanding dues like tuition fee etc.

19.3 The total period for completion of the program reckoned from the commencement of the semester to which the candidate was first admitted shall not exceed the maximum period specified in clause 17.0. The maximum period includes the break period.

20.0 TERMINATION FROM THE PROGRAM

The admission of a student to the program may be terminated and the student is asked to leave the institute in the following circumstances:

a. The student fails to satisfy the requirements of the program within the maximum period stipulated for that program.

b. A student shall not be permitted to study any semester more than three times during the entire Program of study.

c. The student fails to satisfy the norms of discipline specified by the institute from time to time.

21.0 WITH-HOLDING OF RESULTS

If the candidate has not paid any dues to the institute / if any case of indiscipline / malpractice is pending against him, the results of the candidate will be withheld. The issue of the degree is liable to be withheld in such cases.

22.0 GRADUATION DAY

The institute shall have its own annual Graduation Day for the award of Degrees to students completing the prescribed academic requirements in each case, in consultation with the University and by following the provisions in the Statute. The college shall institute prizes and medals to meritorious students and award them annually at the Graduation Day. This will greatly encourage the students to strive for excellence in their academic work.

23.0 DISCIPLINE

Every student is required to observe discipline and decorum both inside and outside the institute and not to indulge in any activity which will tend to bring down the honor of the institute. If a student indulges in malpractice in any of the theory / practical examination, continuous assessment examinations he/she shall be liable for punitive action as prescribed by the Institute from time to time.

24.0 GRIEVANCE REDRESSAL COMMITTEE

The institute shall form a Grievance Redressal Committee for each department with the two senior faculty and the HOD as the members. This Committee shall solve all grievances related to the courses under consideration.

25.0 TRANSITORY REGULATIONS

A candidate, who is detained or discontinued in a semester, on readmission shall be required to do all the courses in the curriculum prescribed for the batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed such courses in the earlier semester(s) s/he was originally admitted into and substitute subjects are offered in place of them as decided by the Board of Studies. However, the decision of the Board of Studies will be final.

a) Four Year B.Tech Regular course:

A student who is following Jawaharlal Nehru Technological University (JNTUA) curriculum and detained due to shortage of attendance at the end of the first semester shall join the autonomous batch of first semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUA curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses will be offered in place of them as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUA for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUA regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

b) Three Year B.Tech program under Lateral Entry Scheme:

A student who is following JNTUA curriculum and detained due to shortage of attendance at the end of the first semester of second year shall join the autonomous batch of third semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with Lateral Entry regular candidates of Autonomous stream and will be governed by the autonomous regulations.

A student who is following JNTUA curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester of second year or at the subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses are offered in place of them as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUA for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUA regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

c) **Transfer candidates (from non-autonomous college affiliated to JNTUA):**

A student who is following JNTUA curriculum, transferred from other college to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute courses are offered in their place as decided by the Board of Studies. The student has to clear all his backlog courses up to previous semester by appearing for the supplementary examinations conducted by JNTUA for the award of degree. The total number of credits to be secured for the award of the degree will be the sum of the credits upto previous semester under JNTUA regulations and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

d) **Transfer candidates (from an autonomous college affiliated to JNTUA):**

A student who has secured the required credits up to previous semesters as per the regulations of other autonomous institutions shall also be permitted to be transferred to this institute. A student who is transferred from the other autonomous colleges to this institute in third semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The total number of credits to be secured for the award of the degree will be the sum of the credits upto previous semester as per the regulations of the college from which he is transferred and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous status. The class will be awarded based on the academic performance of a student in the autonomous pattern.

26.0 REVISION OF REGULATIONS AND CURRICULUM

The Institute from time to time may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary and on approval by the Academic Council and the Governing Body shall come into force and shall be binding on the students, faculty, staff, all authorities of the Institute and others concerned.

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

B.TECH - PROGRAM OUTCOMES (POS)

PO-1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems (**Engineering Knowledge**).

PO-2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences **(Problem Analysis).**

PO-3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations **(Design/Development of Solutions).**

PO-4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions **(Conduct Investigations of Complex Problems).**

PO-5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations **(Modern Tool Usage).**

PO-6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice **(The Engineer and Society).**

PO-7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

(Environment and Sustainability).

PO-8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **(Ethics).**

PO-9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **(Individual and Team Work).**

PO-10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions **(Communication).**

PO-11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO-12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change **(Life-long learning).**

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

1. Who grants Autonomy? UGC, Govt., AICTE or University

In case of Colleges affiliated to a university and where statutes for grant of autonomy are ready, it is the respective University that finally grants autonomy but only after concurrence from the respective state Government as well as UGC. The State Government has its own powers to grant autonomy directly to Govt. and Govt. aided Colleges.

2 Shall CREC award its own Degree?

No. Degree will be awarded by Jawaharlal Nehru Technological University, Anantapuramu with a mention of the name CREC on the Degree Certificate.

3 What is the difference between a Deemed University and an Autonomy College?

A Deemed University is fully autonomous to the extent of awarding its own Degree. A Deemed University is usually a Non-Affiliating version of a University and has similar responsibilities like any University. An Autonomous College enjoys Academic Autonomy alone. The University to which an autonomous college is affiliated will have checks on the performance of the autonomous college.

4 How will the Foreign Universities or other stake – holders know that we are an Autonomous College?

Autonomous status, once declared, shall be accepted by all the stake holders. The Govt. of Andhra Pradesh mentions autonomous status during the First Year admission procedure. Foreign Universities and Indian Industries will know our status through our website.

5 What is the change of Status for Students and Teachers if we become Autonomous?

An autonomous college carries a prestigious image. Autonomy is actually earned out of our continued past efforts on academic performances, our capability of self- governance and the kind of quality education we offer.

6 Who will check whether the academic standard is maintained / improved after Autonomy? How will it be checked?

There is a built in mechanism in the autonomous working for this purpose. An Internal Committee called Academic Programme Evaluation Committee, which will keep a watch on the academics and keep its reports and recommendations every year. In addition the highest academic council also supervises the academic matters. The standards of our question papers, the regularity of academic calendar, attendance of students, speed and transparency of result declaration and such other parameters are involved in this process.

7 Will the students of CREC as an Autonomous College qualify for University Medals and Prizes for academic excellence?

No. CREC has instituted its own awards, medals, etc. for the academic performance of the students. However for all other events like sports, cultural on co-curricular organized by the University the students shall qualify.

8 Can CREC have its own Convocation?

No. Since the University awards the Degree the Convocation will be that of the University, but there will be Graduation Day at CREC.

9 Can CREC give a provisional degree certificate?

Since the examinations are conducted by CREC and the results are also declared by CREC, the college sends a list of successful candidates with their final Grades and Grade Point Averages including CGPA to the University. Therefore with the prior permission of the University the college will be entitled to give the provisional certificate.

10 Will Academic Autonomy make a positive impact on the Placements or Employability?

Certainly, the number of students qualifying for placement interviews is expected to improve, due to rigorous and repetitive classroom teaching and continuous assessment. Also the autonomous status is more responsive to the needs of the industry. As a result therefore, there will be a lot of scope for industry oriented skill development built-in into the system. The graduates from an autonomous college will therefore represent better employability.

11 What is the proportion of Internal and External Assessment as an Autonomous College?

Presently, it is 70 % external and 30% internal. As the autonomy matures the internal assessment component shall be increased at the cost of external assessment.

12 Is it possible to have complete Internal Assessment for Theory or Practicals?

Yes indeed. We define our own system. We have the freedom to keep the proportion of external and internal assessment component to choose.

13 Why Credit based Grade System?

The credit based grade system is an accepted standard of academic performance the world over in all Universities. The acceptability of our graduates in the world market shall improve.

14 What exactly is a Credit based Grade System?

The credit based grade system defines a much better statistical way of judging the academic performance. One Lecture Hour per week of Teaching Learning process is assigned One Credit. One hour of laboratory work is assigned half credit. Letter Grades like S,A+,A, B+,B,C,F etc. are assigned for a Range of Marks. (e.g. 90% and above is S, 80 to 89 % could be A+ etc.) in Absolute Grading System while grades are awarded by statistical analysis in relative grading system. We thus dispense with sharp numerical boundaries. Secondly, the grades are associated with defined Grade Points in the scale of 1 to 10. Weighted Average of Grade Points is also defined Grade Points are weighted by Credits and averaged over total credits in a Semester. This process is repeated for all Semesters and a CGPA defines the Final Academic Performance

15 What are the norms for the number of Credits per Semester and total number of Credits for UG/PG programme?

These norms are usually defined by UGC or AICTE. Usually around 25 Credits per semester is the accepted norm.

16 What is a Semester Grade Point Average (SGPA)?

The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the semester.

$$SGPA = \sum_{i=1}^{n} (C_i G_i) / \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the i^{th} course and $G_i$is the grade point scored by the student in the i^{th} course and i represent the number of courses in which a student registered in the concerned semester. SGPA is rounded to two decimal places.

17 What is a Cumulative Grade Point Average (CGPA)?

An up-to-date assessment of overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is weighted average of the grade points obtained in all the courses registered by the students since he entered the Institute.

$$CGPA = \sum_{j=1}^{m} (C_j S_j) / \sum_{j=1}^{m} C_j$$

Where, S_j is the SGPA of the j^{th} semester and C_j is the total number of credits up to the semester and m represent the number of semesters completed in which a student registered up to the semester. CGPA is rounded to two decimal places.

18 Is there any Software available for calculating Grade point averages and converting the same into Grades?

Yes, the institute has its own MIS software for calculation of SGPA, CGPA, etc.

19 Will the teacher be required to do the job of calculating SGPAs etc. and convert the same into Grades?

No. The teacher has to give marks obtained out of whatever maximum marks as it is. Rest is all done by the computer.

20 Will there be any Revaluation or Re-Examination System?

No. There will double valuation of answer scripts. There will be a makeup Examination after a reasonable preparation time after the End Semester Examination for specific cases mentioned in the Rules and Regulations. In addition to this, there shall be a ‘summer term’ (compressed term) followed by the End Semester Exam, to save the precious time of students.

21 How fast Syllabi can be and should be changed?

Autonomy allows us the freedom to change the syllabi as often as we need.

22 Will the Degree be awarded on the basis of only final year performance?

No. The CGPA will reflect the average performance of all the semester taken together.

23 What are Statutory Academic Bodies?

Governing Body, Academic Council, Examination Committee and Board of Studies are the different statutory bodies. The participation of external members in every body is compulsory. The institute has nominated professors from IIT, NIT, University (the officers of the rank of Pro-vice Chancellor, Deans and Controller of Examinations) and also the reputed industrialist and industry experts on these bodies.

24 Who takes Decisions on Academic matters?

The Governing Body of institute is the top academic body and is responsible for all the academic decisions. Many decisions are also taken at the lower level like Boards of Studies. Decisions taken at the Board of Studies level are to be ratified at the Academic Council and Governing Body.

25 What is the role of Examination committee?

The Examinations Committee is responsible for the smooth conduct of internal, End Semester and makeup Examinations. All matters involving the conduct of examinations spot valuations, tabulations preparation of Grade Cards etc, fall within the duties of the Examination Committee.

26 Is there any mechanism for Grievance Redressal?

The institute has grievance redressal committee, headed by Dean - Student affairs and Dean - IQAC.

27 How many attempts are permitted for obtaining a Degree?

All such matters are defined in Rules & Regulation

28 Who declares the result?

The result declaration process is also defined. After tabulation work wherein the SGPA, CGPA and final Grades are ready, the entire result is reviewed by the Moderation Committee. Any unusual deviations or gross level discrepancies are deliberated and removed. The entire result is discussed in the Examinations and Result Committee for its approval. The result is then declared on the institute notice boards as well put on the web site and Students Corner. It is eventually sent to the University.

29 Who will keep the Student Academic Records, University or CREC?

It is the responsibility of the Dean, Academics of the Autonomous College to keep and preserve all the records.

30 What is our relationship with the JNT University?

We remain an affiliated college of the JNT University. The University has the right to nominate its members on the academic bodies of the college.

31 Shall we require University approval if we want to start any New Courses?

Yes, It is expected that approvals or such other matters from an autonomous college will receive priority.

32 Shall we get autonomy for PG and Doctoral Programmes also?

Yes, presently our PG programmes also enjoying autonomous status.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

S.No	**Nature of Malpractices/Improper conduct**	**Punishment**
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall,	Expulsion from the examination hall and

	any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Controller of Examinations.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against

		him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Controller of Examinations /Additional Controller of Examinations/any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the COE or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the COE or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the Institute premises or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof	Expulsion from the examination hall and cancellation of performance in that subject and

	inside or outside the examination hall.	all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.

11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

CHADALAWADARAMANAMMA ENGINEERING COLLEGE
(AUTONOMOUS)
ELECTRONICS AND COMMUNICATION ENGINEERING
R20 - COURSE STRUCTURE

B.Tech I Year 0 Semester

Sl. No	Course Code	Course Title	Category	Hours per week			Credits	CIA	SEE	TOTAL
				L	T	P	C			
1	20CA56001	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0	0	6	0	-	-	-
2	20CA56002	Career Counselling	MC	2	0	2	0	-	-	-
3	20CA56003	Orientation to all branches -- career options, tools, etc.	MC	3	0	0	0	-	-	-
4	20CA04001	Orientation on admitted Branch - corresponding labs, tools and platforms	EC	1	0	4	0	-	-	-
5	20CA05001	Proficiency Modules & Productivity Tools	ES	2	1	2	0	-	-	-
6	20CA56004	Assessment on basic aptitude and mathematical skills	MC	1	0	4	0	-	-	-
7	20CA56005	Remedial Training in Foundation Courses	MC	2	1	2	0	-	-	-
8	20CA56006	Human Values & Professional Ethics	MC	3	0	0	0	-	-	-
9	20CA52001	Communication Skills – focus on Listening, Speaking, Reading, Writing skills	BS	2	1	2	0	-	-	-
Total Credits				**16**	**3**	**22**	**0**	-	-	-

B.Tech I Year I Semester

Sl. No	Course Code	Course Title	Category	Hours per week			Credits	CIA	SEE	TOTAL
				L	T	P	C			
1	20CA54101	Mathematics –I	BS	3	0	0	3	30	70	100
2	20CA51101	Engineering Chemistry	BS	3	0	0	3	30	70	100
3	20CA52101	Communicative English	HS	3	0	0	3	30	70	100
4	20CA03101	Engineering Graphics	ES	1	0	4	3	30	70	100
5	20CA03102	Basic Civil & Mechanical Engineering	ES	3	0	0	3	30	70	100
6	20CA52102	Communicative English Lab	HS	0	0	3	1.5	30	70	100
7	20CA51102	Engineering Chemistry Lab	BS	0	0	3	1.5	30	70	100
8	20CA03102	Engineering Workshop	ES	0	0	3	1.5	30	70	100
Total Credits				**13**	**0**	**13**	**19.5**	**240**	**560**	**800**

Category	Credits
Basic Science Courses	7.5
Engineering Science Courses	7.5
Humanities and Social Sciences	4.5
TOTAL CREDITS	**19.5**

B.Tech I Year II Semester

Sl. No	Course Code	Course Title	Category	Hours per week			Credits	CIA	SEE	TOTAL
				L	T	P	C			
1	20CA54201	Mathematics - II	BS	3	0	0	3	30	70	100
2	20CA55103	Applied Physics	BS	3	0	0	3	30	70	100
3	20CA02203	Network Analysis	ES	3	0	0	3	30	70	100
4	20CA05101	C Programming Language	ES	3	0	0	3	30	70	100
5	20CA04201	Digital Logic Design	ES	3	0	0	3	30	70	100
6	20CA55104	Applied Physics Lab	BS	0	0	3	1.5	30	70	100
7	20CA05102	C Programming Lab	ES	0	0	3	1.5	30	70	100
8	20CA02204	Network Analysis Lab	ES	0	0	3	1.5	30	70	100
9	20CA53201	Universal Human Values and Ethics (Mandatory Course- I)	MC	2	0	0	0	-	-	-
Total Credits				**15**	**0**	**13**	**19.5**	**240**	**560**	**800**

Category	Credits
Basic Science Courses	7.5
Engineering Science Courses	12
TOTAL CREDITS	**19.5**

B.Tech II Year I Semester

Sl. No	Course Code	Course Title	Category	Hours per week			Credits	CIA	SEE	TOTAL
				L	T	P	C			
1	20CA54301	Mathematics III	BS	3	0	0	3	30	70	100
2	20CA04301	Electronic Devices & Circuits	PC	3	0	0	3	30	70	100
3	20CA04302	Random Signals & Systems	PC	3	0	0	3	30	70	100
4	20CA04303	Analog Communications	PC	3	0	0	3	30	70	100
5	20CA02307	Principles of Electrical Engineering	ES	3	0	0	3	30	70	100
6	20CA04304	Electronic Devices & Circuits Lab	PC	0	0	3	1.5	30	70	100
7	20CA04305	Analog Communications Lab	PC	0	0	3	1.5	30	70	100
8	20CA04306	Basic Simulation & Electrical Engineering Lab	PC	0	0	3	1.5	30	70	100
9	SC-I	Skill Oriented Course-I	SC	2	0	0	2	50	-	-
10	20CA51201	Environmental Science (Mandatory Course- II)	MC	2	0	0	0	-	-	-
Total Credits				**19**	**1**	**9**	**21.5**	**290**	**560**	**850**

Category	Credits
Basic Science Courses	3
Engineering Science Courses	3
Professional Core Courses	13.5
Skill Oriented Course	2
TOTAL CREDITS	**21.5**

B.Tech II Year II Semester

Sl. No	Course Code	Course Title	Category	Hours per week			Credits	IM	SEE	TOTAL
				L	T	P	C			
1	20CA54401	Mathematics-IV	BS	3	0	0	3	30	70	100
2	20CA04401	Analog Electronic Circuits	PC	3	0	0	3	30	70	100
3	20CA04402	Digital Communications	PC	3	0	0	3	30	70	100
4	20CA04403	Electromagnetic & Transmission Lines	PC	3	0	0	3	30	70	100
5	20CA02401	Control Systems	ES	3	0	0	3	30	70	100
6	20CA52401	Advance Communicative English Lab	HS	0	0	3	1.5	30	70	100
7	20CA04404	Analog Electronic Circuits Lab	PC	0	0	3	1.5	30	70	100
8	20CA04405	Digital Communications Lab	PC	0	0	3	1.5	30	70	100
9	SC-II	Skill Oriented Course-II	SC	2	0	0	2	50	-	-
Total Credits				**17**	**0**	**9**	**21.5**	**290**	**560**	**850**
Internship 2 Months (Mandatory) during summer vacation										
Honors/Minor courses				4	0	0	4	-	-	-

Category	Credits
Basic Science Courses	3
Professional Core Courses	12
Engineering Science Courses	3
Humanities and Social Sciences	1.5
Skill Oriented Course	2
TOTAL CREDITS	**21.5**

B.Tech III Year I Semester

Sl. No	Course Code	Course Title	Category	Hours per week			Credits	CIA	SEE	TOTAL
				L	T	P	C			
1	20CA04501	Integrated Circuits & Applications	PC	3	0	0	3	30	70	100
2	20CA04502	Microprocessors & Microcontrollers	PC	3	0	0	3	30	70	100
3	20CA04503	Antennas & Wave Propagation	PC	3	0	0	3	30	70	100
4	20CA04504-20CA04507	Professional Elective- I	PE-1	3	0	0	3	30	70	100
5	OE-1	Open Elective- I	OE	3	0	0	3	30	70	100
6	20CA04509	Integrated Circuits &	PC	0	0	3	1.5	30	70	100

		Applications Lab								
7	20CA04510	Microprocessors & Microcontrollers Lab	PC	0	0	3	1.5	30	70	100
8	SC-III	Skill Advanced Course/ Soft Skill Course	SC	2	0	0	2	50	-	-
9	20CA52501	Indian Constitution	MC	2	0	0	0	-	-	-
	PROJ	Internship Evaluation-I		0	0	0	1.5	30	70	100
Total Credits				**19**	**0**	**6**	**21.5**	**290**	**560**	**850**
Honors/Minor courses				**4**	**0**	**0**	**4**	**-**	**-**	**-**

Category	**Credits**
Professional Core Courses	12
Professional Elective Courses	3
Open Elective Course/Job Oriented Elective	3
Skill Advanced Course/ Soft Skill Course*	2
Summer Internship	1.5
TOTAL CREDITS	**21.5**

B.Tech III Year II Semester

Sl. No	**Course Code**	**Course Title**	**Category**	**Hours per week**			**Credits**	**CIA**	**SEE**	**TOTAL**
				L	**T**	**P**	**C**			
1	20CA04601	Digital Signal Processing	PC	3	0	0	3	30	70	100
2	20CA04602	Satellite Communications	PC	3	0	0	3	30	70	100
3	20CA04603	Microwave Engineering	PC	3	0	0	3	30	70	100
4	20CA04604-20CA04607	Professional Elective- II	PE	3	0	0	3	30	70	100
5	OE-II	Open Elective- II	OE	3	0	0	3	30	70	100
6	20CA04609	Digital Signal Processing Lab	PC	0	0	3	1.5	30	70	100
7	20CA04610	VLSI & Embedded Systems Lab	PC	0	0	3	1.5	30	70	100
8	20CA04611	Microwave & Optical Communication Lab	PC	0	0	3	1.5	30	70	100
9	20CA52503	Soft Skills	SC	2	0	0	2	50	-	-
10	20CA52502	Essence of Indian Traditional Knowledge	MC	2	0	0	0	-	-	-
Total Credits				**19**	**0**	**9**	**21.5**	**290**	**560**	**850**
Industrial/Research Internship (Mandatory) 2 Months during summer vacation										
Honors/Minor Courses				**4**	**0**	**0**	**4**	**-**	**-**	**-**

Category	**Credits**
Professional Core Courses	13.5
Professional Elective Courses	3
Open Elective Course/Job Oriented Elective	3
Skill Advanced Course/ Soft Skill Course	2
TOTAL CREDITS	**21.5**

B.Tech IV Year I Semester

Sl. No	Course Code	Course Title	Category	Hours per week			Credits	CIA	SEE	TOTAL
				L	T	P	C			
1	20CA04701-20CA04704	Professional Elective- III	PE	3	0	0	3	30	70	100
2	20CA04705-20CA04708	Professional Elective- IV	PE	3	0	0	3	30	70	100
3	20CA04709-20CA04712	Professional Elective- V	PE	3	0	0	3	30	70	100
4	OE-III	Open Elective- III	OE	3	0	0	3	30	70	100
5	OE-IV	Open Elective- IV	OE	3	0	0	3	30	70	100
6	20CA52701	Understanding Harmony	HS	3	0	0	3	30	70	100
7	SC-IV	Skill Advanced Course/ Soft Skill Course	SC	2	0	0	2	50	-	-
	PROJ	Internship Evaluation-II (**Summer Internship 2 Months after third year**)		0	0	0	3	30	70	100
Total Credits				**20**	**0**	**0**	**23**	**260**	**490**	**750**
Honors/Minor Courses				**4**	**0**	**0**	**4**	**-**	**-**	**-**

Category	Credits
Professional Elective Courses	9
Open Elective Course/Job Oriented Elective	6
Humanities and Social Science Elective	3
Skill Advanced Course/ Soft Skill Course	2
Industrial/Research Internship	3
TOTAL CREDITS	**23**

B.Tech IV Year II Semester

Sl. No	Course Code	Course Title	Category	Hours per week			Credits	CIA	SEE	TOTAL
				L	T	P	C			
1	20CA04801	Project Project work, Seminar and Internship in Industry	PROJ	0	0	0	12	60	140	200
INTERNSHIP (6 MONTHS)										
Total Credits				**0**	**0**	**0**	**12**	**60**	**140**	**200**

PROFESSIONAL ELECTIVE-I

S. No.	Course Code	Course Title
1	20CA04504	Bio Medical Instrumentation
2	20CA04505	VLSI Design
3	20CA04506	Telecommunications Switching Theory and Applications
4	20CA04507	Advance 3G & 4G Communications

PROFESSIONAL ELECTIVE-II

S. No.	Course Code	Course Title
1	20CA04604	Computer Organization
2	20CA04605	Digital System Design
3	20CA04606	Data Communications and Networking
4	20CA04607	Analog IC Design

PROFESSIONAL ELECTIVE-III

S. No.	Course Code	Course Title
1	20CA04701	Radar Systems
2	20CA04702	Digital Signal Processors & Architecture
3	20CA04703	TV Engineering
4	20CA04704	Speech Processing

PROFESSIONAL ELECTIVE-IV

S. No.	Course Code	Course Title
1	20CA04705	Real Time Systems
2	20CA04706	Digital Image Processing
3	20CA04707	Cellular & Mobile Communications
4	20CA04708	Digital IC Design

PROFESSIONAL ELECTIVE-V

S. No.	Course Code	Course Title
1	20CA04709	RF System Design
2	20CA04710	Information Theory & Coding
3	20CA04711	Low Power VLSI Design
4	20CA04712	Pattern Recognition & Applications

OPEN ELECTIVE

S. No.	Course Code	Course Title
1.	20CA02509	Non Conventional Energy Sources
2.	20CA04508	Embedded Systems
3.	20CA03703	Total Quality Management
4.	20CA03713	Operations Research
5.	20CA03708	Auto machine Robotics
6.	20CA04608	Optical Communications
7.	20CA03704	Industrial Management
8.	20CA53501	Managerial Economics and Financial Analysis
9.	20CA04713	Wireless Communications
10.	20CA02610	Energy from Waste
11.	20CA04714	Neural Networks and Fuzzy Logic
12.	20CA05504	Python Programming,
13.	20CA05505	Object Oriented Programming through Java
14.	20CA05506	Database Management System
15.	20CA05507	Big Data
16.	20CA05508	Advanced Data Structures
17.	20CA05509	Software Testing
18.	20CA05510	Business Intelligence
19.	20CA05511	Internet of Things
20.	20CA54701	Quantitative Ability

HONOR DEGREE (16 SUBJECTS SHOULD BE INCLUDED)

S. No.	Course Code	Course Title
Elective I (B.Tech II Year II Semester)		
1.	20CA04406	Probability Theory and Stochastic Processes
2.	20CA04407	Pulse and Digital Circuits
3.	20CA04408	FPGA Architectures and Applications
4.	20CA04409	MATLAB Programming
Elective II (B.Tech III Year I Semester)		
5.	20CA04504	Bio Medical Instrumentation
6.	20CA04506	Telecommunications Switching Theory and Applications
7.	20CA04507	Advance 3G & 4G Communications
8.	20CA04511	Biomedical Signal Processing
Elective III (B.Tech III Year II Semester)		
9.	20CA04606	Data Communications and Networking
10.	20CA04612	Electronic Measurements and Instrumentation
11.	20CA04613	Digital Design through Verilog HDL
12.	20CA04614	Introduction to MEMS
Elective IV (B.Tech IV Year I Semester)		
13.	20CA04702	Digital Signal Processors & Architecture
14.	20CA04707	Cellular & Mobile Communications
15.	20CA04713	Artificial Intelligence
16.	20CA04714	Adaptive Signal Processing

MINOR DEGREE – (POOL – I) (4 SUBJECTS SHOULD BE INCLUDED)

S. No.	Course Code	Course Title
1.	**20CA04410** (B.Tech II Year II Semester)	Basic Electronic Devices
2.	**20CA04512** (B.Tech III Year I Semester)	Principles of Communication Systems
3.	**20CA04602** (B.Tech III Year II Semester)	Microprocessors and Microcontrollers
4.	**20CA04711** (B.Tech IV Year I Semester)	Low Power VLSI Design

MINOR DEGREE - (POOL – II) (4 SUBJECTS SHOULD BE INCLUDED)

S. No.	Course Code	Course Title
1	**20CA04411** (B.Tech II Year II Semester)	Fundamentals of Signals and Systems
2	**20CA04513** (B.Tech III Year I Semester)	Digital Electronics
3	**20CA04615** (B.Tech III Year II Semester)	Radar & Wireless Communications
4	**20CA04715** (B.Tech IV Year I Semester)	Computer Networks

Category-wise Breakup of Credits (ECE)

S. No	Category	Code	Suggested break up of Credits (**APSCHE**)	Suggested break up of Credits (**AICTE**)	Break up of Credits (**CREC-ECE**)
1	Humanities And Social Science	**HS**	**10.5**	**12**	**9**
2	Basic Science Courses	**BS**	**21**	**25**	**21**
3	Engineering Science Courses	**ES**	**24**	**24**	**25.5**
4	Professional Core Courses	**PC**	**51**	**48**	**51**
5	Open Elective Course/Job Oriented Elective	**OE**	**12**	**18**	**12**
6	Professional Elective Courses	**PE**	**15**	**18**	**15**
7	Internship, Seminar and Project work	**PROJ**	**16.5**	**15**	**16.5**
8	**Mandatory Courses**	**MC**	**00**	**00**	**00**
9	**Skill oriented Courses**	**SC**	**10**	**-**	**10**
	TOTAL		**160**	**160**	**160**

MATHEMATICS-1

B.Tech I Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
20CA54101	Foundation	3	0	0	3	30	70	100
Contact Classes:48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

COURSE OBJECTIVES:

The course should enable the students to :

1. This course will illuminate the students in the concepts of Calculus and Linear Algebra.
2. To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

UNIT-I	MATRICES	Classes: 10

Rank of a matrix by echelon form, system of homogeneous and non-homogeneous linear equations. Eigen values, Eigen vectors of Matrices, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem.

UNIT-II	QUADRATIC FORMS	Classes: 10

Symmetric matrix, Orthogonal matrices, Diagonalisation of a matrix by orthogonal process. Quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

UNIT-III	MEAN VALUE THEOREMS	Classes: 10

Rolle’s Theorem, Lagrange’s mean value theorem, Cauchy’s mean value theorem, Taylor’s and Maclaurin theorems with remainders (without proof); Properties and Problems.

UNIT-IV	MULTIVARIABLE CALCULUS	Classes: 09

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT-V	MULTIPLE INTEGRALS	Classes: 09

Double integrals, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves. Evaluation of triple integrals, change of variables between Cartesian and spherical polar co-ordinates.

Text Books:

1.E.Kreyszig, “Advanced engineering mathematics”, John wiley & Son’s publishers, New edition.
2.B.S.Grewal, “Higher engineering mathematics”, Khanna Publishers, New edition.

Reference Books:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2012.

Web References:

1.https://www.efunda.com/math/math_home/math.cfm
2.https://www.ocw.mit.edu/resources/#mathematics.

E-Text Books:

1.https://www.e-booksdirectory.com/detais.php?ebook=10166.
2.https://www.e-booksdirectory.com/details.php?ebook=7400re

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Calculate roots of algebraic and transcendental equations
CO2: Evaluate Interpolation.

CO3: Evaluate Numerical Integration and Apply the concepts of Ordinary Differential Equations on Numerical Methods.

CO4: Demonstrate the basic knowledge and apply the principles of Fourier Transforms to boundary value problems.

CO5: Analyze and Solve Z- Transforms in the field of engineering course.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	2	-	-	-	-	-	-	-	-	2	-
CO5	3	2	-	3	-	-	-	-	-	-	-	-	3	-
CO	**3**	**2.4**	**-**	**2.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.8**	**-**

ENGINEERING CHEMISTRY								
B.Tech I Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
20CA51101	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: 0**		**Practical Classes: 0**			**Total Classes: 48**		

COURSE OBJECTIVES:

1. To familiarize engineering chemistry and its applications
2. To train the students on the principles and applications of electrochemistry and polymers
3. To introduce instrumental methods

UNIT-I	**STRUCTURE AND BONDING MODELS:**	**Classes:08**

Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and $\Psi 2$, applications to hydrogen, molecular orbital theory – bonding in homo- and hetero nuclear diatomic molecules – energy level diagrams of O_2, N_2 CO and NO etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

Learning Outcomes:

At the end of this unit, the students will be able to

- Apply Schrodinger wave equation to hydrogen atom (L1)
- Illustrate the molecular orbital energy level diagram of different molecular species (L2)
- Explain the calculation of bond order of O_2, N_2 and CO, NO molecules (L2)
- Discuss the basic concept of molecular orbital theory (L3)

UNIT-II	**ELECTROCHEMISTRY AND APPLICATIONS**	**Classes:12**

Introduction to Electrochemistry, Electrodes – concepts, reference electrodes (Calomel electrode, Ag/AgCl electrode and glass electrode); Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, pH metry and applications of pH metry, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductometric titrations (acid-base titrations).

Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (Ni, Cad),and lithium ion batteries working of the batteries including cell reactions; Fuel cells-Hydrogen-oxygen, methanol fuel cells – working of the cells and Applications.

Learning Outcomes:

At the end of this unit, the students will be able to

- Apply Nernst equation for calculating electrode and cell potentials (L1)
- Differentiate between ph metry, potentiometric and conductometric titrations (L2)
- Explain the theory of construction of battery and fuel cells (L2)
- Solve problems based on cell potential (L3)

UNIT-III	**POLYMERS CHEMISTRY**	**Classes:10**

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation.

Plastics - Thermoplastics and Thermo settings, Preparation, properties and applications of – Bakelite, urea-formaldehyde, Nylon-66, Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline– mechanism of conduction and applications. Poly dispersity Index (Calculation of avg molecular weight of Polymers).

Learning Outcomes:

At the end of this unit, the students will be able to

- Explain the different types of polymers and their applications (L1)
- Explain the preparation, properties and applications of Bakelite, Nylon-6,6 (L2)
- Describe the mechanism of conduction in conducting polymers (L2)
- Discuss Buna-S and Buna-N elastomers and their applications (L2)

UNIT-IV	INSTRUMENTAL METHODS AND APPLICATIONS	Classes:10

Regions of Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible spectroscopy, IR, Chromatography - Basic principle and Solid-Liquid Chromatography–TLC, Retention time.

Learning outcomes:

After completion of Unit IV, students will be able to:

- Explain the different types of spectral series in electromagnetic spectrum (L1)
- Understand the principles of different analytical instruments (L2)
- Explain the different applications of analytical instruments (L2)

UNIT-V	MODERN ENGINEERING MATERIALS	Classes:08

Coordination compounds: Crystal field theory – salient features – splitting in octahedral and tetrahedral geometry.

Semiconductor materials, super conductors- basic concept, band diagrams for conductors, Semi conductors and insulators, Effect of doping on band structures.

Super capacitors: Introduction, Basic concept-Classification – Applications.

Nano chemistry: Introduction, classification of nano meterials, properties and applications of Fullerenes, carbonnano tubes and Graphines, nano particles.

Learning outcomes:

At the end of this unit, the students will be able to

- Explain splitting in octahedral and tetrahedral geometry of complexes (L1).
- Explain the band theory of solids for conductors, semiconductors and insulators (L2)
- Demonstrate the application of Fullerenes, carbon nano tubes and Graphines nano particles (L2).

Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.

Reference Books:

1. G.V.Subba Reddy, K.N.Jayaveera and C. Ramachandraiah, Engineering Chemistry, Mc Graw Hill, 2020.
2. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
3. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
4. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman,1992.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: **Exhibits the knowledge on the** behavior of interaction between matter and energy at both the atomic and molecular levels and apply the Schrodinger equation.

CO2: **Exhibits** the **knowledge** of the various materials to construction of batteries and electrochemical sensors.

CO3: **Apply the knowledge** on preparation, properties of thermoplastic and thermo setting elastomers and conducting polymers.

CO4: **Demonstrate the knowledge** on the principles of spectro photometry, SLC in separation of solid and liquid mixtures.

CO5: **Analyze** the concept of nano materials in various applications (sensors and catalysis).

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO2	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO3	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO4	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO5	3	2	-	-	-	2	2	-	-	-	-	-	-	-
CO	**3**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

<table>
<tr><th colspan="9">COMMUNICATIVE ENGLISH</th></tr>
<tr><td colspan="9">B.Tech I Year I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20CA52101</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 48</td><td>Tutorial Classes:Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

1. Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers.
2. Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials.
3. Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations.
4. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information.
5. Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing.

UNIT-I	**Lesson: On the Conduct of Life: William Hazlitt**	**Classes:10**

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.
Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.
Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.
Reading for Writing: Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.
Grammar and Vocabulary: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.

Learning Outcomes
At the end of the module, the learners will be able to

- Understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- Ask and answer general questions on familiar topics and introduce oneself/others
- Employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- Recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- Form sentences using proper grammatical structures and correct word forms

UNIT-II	**Lesson: The Brook: Alfred Tennyson**	**Classes:10**

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts.
Speaking: Discussion in pairs/ small groups on specific topics followed by short structured talks.
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.
Writing: Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters.
Grammar and Vocabulary: Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.
Learning Outcomes

At the end of the module, the learners will be able to

- Comprehend short talks on general topics
- Participate in informal discussions and speak clearly on a specific topic using suitable discourse markers
- Understand the use of cohesive devices for better reading comprehension
- Write well structured paragraphs on specific topics
- Identify basic errors of grammar/ usage and make necessary corrections in short texts

UNIT-III	**Lesson: The Death Trap: Saki**	**Classes:10**

Listening: Listening for global comprehension and summarizing what is listened to.
Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed **Reading:** Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.
Grammar and Vocabulary: Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.
Learning Outcomes
At the end of the module, the learners will be able to

- Comprehend short talks and summarize the content with clarity and precision
- Participate in informal discussions and report what is discussed
- Infer meanings of unfamiliar words using contextual clues
- Write summaries based on global comprehension of reading/listening texts
- Use correct tense forms, appropriate structures and a range of reporting verbs in speech and writing

UNIT-IV	**Lesson: Innovation: Muhammad Yunus**	**Classes:09**

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
Reading: Studying the use of graphic elements in texts to convey information, reveal 46 trends/patterns/relationships, communicate processes or display complicated data.
Writing: Letter Writing: Official Letters/Report Writing

Grammar and Vocabulary: Quantifying expressions - adjectives and adverbs; comparing and contrasting; Voice - Active & Passive Voice
Learning Outcomes
At the end of the module, the learners will be able to
- Infer and predict about content of spoken discourse
- Understand verbal and non-verbal features of communication and hold formal/informal conversations
- Interpret graphic elements used in academic texts
- Produce a coherent paragraph interpreting a figure/graph/chart/table
- Use language appropriate for description and interpretation of graphical elements

UNIT-V	**Lesson: Politics and the English Language: George Orwell**	**Classes:09**

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides.
Reading: Reading for comprehension.
Writing: Writing structured essays on specific topics using suitable claims and evidences
Grammar and Vocabulary: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)
Learning Outcomes
At the end of the module, the learners will be able to

- Take notes while listening to a talk/lecture and make use of them to answer questions
- Make formal oral presentations using effective strategies
- Comprehend, discuss and respond to academic texts orally and in writing
- Produce a well-organized essay with adequate support and detail
- Edit short texts by correcting common errors

Text Books:

1. Language and Life: A Skills Approach – I Edition 2019, Orient Black Swan

Web References:

1. www.englishclub.com
2. www.easyworldofenglish.com
3. www.languageguide.org/english/
4. www.bbc.co.uk/learningenglish
5. www.eslpod.com/index.html
6. www.myenglishpages.com

Reference Books:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Raymond Murphy's English Grammar in Use Fourth Edition (2012) E-book.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. Oxford Learners Dictionary, 12th Edition, 2011.
6. Norman Lewis Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary (2014).
7. Speed Reading with the Right Brain: Learn to Read Ideas Instead of Just Words by David Butler.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate to overcome the barriers in communication process using non-verbal language suitable to different situations in professional life to become effective technical communicator.

CO2: Apply the knowledge on social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information.

CO3: Exhibit the knowledge on cohesive devices for better conversation in informal discussions and speak clearly on a specific topic using suitable discourse markers.

CO4: Apply the concepts of Entrepreneurship Skills and Analyze discourse markers to speak clearly on a specific topic in informal discussions and create coherent paragraph writing.

CO5: Apply the Knowledge to recognize the need of ability to engage in independent and life-long learning communication effectively in English over speech.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	2	3	-	-	3	3
CO2	3	2	-	-	-	-	-	-	3	3	-	-	3	3
CO3	3	-	-	-	-	-	-	-	2	3	-	-	3	3
CO4	3	2	-	-	-	-	-	-	3	3	-	-	3	3
CO5	3	-	-	-	-	-	-	-	-	3	-	2	3	3
CO	**3**	**2**	-	-	-	-	-	-	**2.5**	**3**	-	**2**	3	3

ENGINEERING GRAPHICS

B.Tech I Year I Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
20CA03101	Foundation	1	0	4	3	30	70	100
Contact Classes:16	Tutorial Classes: Nil			Practical Classes: 64		Total Classes: 80		

COURSE OBJECTIVES:

1. To know the basics of Engineering Drawing and its applications.
2. To understand the projection of solids.
3. To understand the Isometric Projections of Regular Solids.
4. To analyze the orthographic projections.

UNIT – I	INTRODUCTION ENGINEERING GRAPHICS	Classes: 16

Introduction to drawing instruments & principles of Engineering Drawing - Conventions in Drawing-Lettering – BIS Conventions. Curves used in Engineering Practice. a) Parabola, Ellipse, Hyperbola and Rectangular Hyperbola (General method only) b) Cycloid, Epicycloid and Hypocycloid.

UNIT – II	PROJECTION OF POINTS & LINES	Classes: 16

Projection of points: Positions, notation system and projections in any quadrant.
Projection of Lines: Projection of lines parallel to one plane and perpendicular to the other, parallel to both planes, inclined to one plane or both planes.

UNIT– III	PROJECTIONS OF PLANES	Classes: 16

Projection of planes: Parallel to on plane and perpendicular to the other, perpendicular to both planes, inclined to one or both planes.

UNIT – IV	PROJECTIONS OF SOLIDS	Classes: 16

Projection of solids: Projections of regular solids inclined to one or both planes by rotational or auxiliary views method.

UNIT – V	ISOMETRIC PROJECTIONS	Classes: 16

Principles of isometric projection- Isometric scale; Isometric views: planes, simple solids. Conversion of orthographic to isometric view Vice Versa.

Text Books:

1. D.M Kulkarni, A.P. Rastogi and A.M. Sarkar, Engineering Graphics with Auto CAD, PHI learning Private Limited, New Delhi 2009.
2. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
3. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

References

1. Dhanajay A Jolhe, Engineering Drawing: with an introduction to Auto CAD, Tata McGraw-Hill, 2008
2. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009
3. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

Web References:

1. Youtube: http-sewor, Carleton.cag, kardos/88403/drawings.html conic sections-online, red yoods.edu

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Understand the concepts of Conic Sections, cycloidal curves and the application of industry standards.

CO2: Understand the Orthographic Projections of Points and Lines and are able to improve their visualization skills so that they can apply these skills in developing the new products.

CO3: Understand and apply Orthographic Projections of Planes wherever necessary.
CO4: Understand and analyze the Orthographic Projections of Solids.
CO5: Employ freehand 3D pictorial sketching to aid in the visualization process and efficiently communicate ideas graphically.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	-	-	-	-	2	-	-	1	-	-	-	-	-
CO2	2	-	-	-	-	2	-	-	1	-	-	-	-	-
CO3	2	-	3	2	-		-	-	3	-	-	-	-	-
CO4	2	2	3	-	-	2	-	-	3	-	-	-	-	-
CO5	2	-	2	-	-	2	-	-	2	-	-	-	-	-
CO	**2**	**2**	**2.66**	**2**	**-**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**

BASIC CIVIL AND MECHANICAL ENGINEERING

B.Tech I Year I Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
20CA03102	Foundation	3	0	0	3	30	70	100
Contact Classes:48	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes:48			

COURSE OBJECTIVES:

1. Impart basic principles of stress, strain, shear force, bending moment and torsion.
2. To teach principles of strain measurement using electrical strain gauges
3. Describe technical details of power plants, gas turbines, hydro power plants and nonconventional energy sources.
4. Teach different types of drives for power transmission
5. Impart concepts of CAD, CAM & CIM

UNIT – I | **BEAMS** | **Classes:10**

Basic Definitions of Force – Stress – Strain – Elasticity. Shear force – Bending Moment – Torsion. Shear force Diagram and Bending moment Diagram for cantilever and simply supported beams.

UNIT – II | **INTERNAL COMBUSTION ENGINES** | **Classes:10**

Classification – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines.

UNIT – III | **POWER PLANT ENGINEERING** | **Classes:10**

Classification of Power plants – Steam Power Plants – Nuclear Power Plants – Gas turbines – Hydro Power Plants – Solar energy – wind energy.

UNIT - IV | **BELT DRIVES** | **Classes:09**

Transmission of Power – Belt and Rope Drives – Types of Belts – Materials – Velocity ratio – Speed Ratio – V-Belt – Flat Belt.

UNIT –V | **MANUFACTURING PROCESSES** | **Classes:09**

Foundry - green sand mould casting. Metal forming - forging, rolling, extrusion, drawing, Metal joining – Metal Arc welding (MIG&TIG) and Gas welding (Oxy-acetylene). Basic Metal machining- Turning, Facing, Knurling & Thread cutting (operation only).

Text Books:

1. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", Tata McGraw Hill Publishing Co., New Delhi.
2. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd.

References:

1. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies.
2. Venugopal K. and Prahu Raja V., "Basic Mechanical Engineering", Anuradha Publishers, Kumbakonam.
3. Shantha Kumar S R J., "Basic Mechanical Engineering", Hi-tech Publications, Mayil.
4. Er. R. Vaishnavi, Basic Civil and Mechanical Engineering, 2/e, S.Chand Publications.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on principles of Stress and Strain and supported beams and cantilever beams

CO2: Analyze working principle of Petrol and Diesel engines

CO3: Exhibit the knowledge the concepts of various power plants

CO4: Analyze the belt and rope drives and apply the concepts of velocity ratio in power transmission

CO5: Analyze the basic principles of manufacturing processes

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	2	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**2.6**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

COMMUNICATIVE ENGLISH LABORATORY								
B.Tech I Year I Semester								
Course Code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
20CA52102	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		0	**0**	**3**	**1.5**	**30**	**70**	**100**
Contact classes: 0	**Tutorial Classes:0**	**Practical Classes:48**				**Total Classes:48**		

COURSE OBJECTIVES:

The course should enable the

1. Students will be exposed to a variety of self instructional, learner friendly modes of language learning.
2. Students will learn better pronunciation through stress, intonation and rhythm.
3. Students will be trained to use language effectively to face interviews, group discussions, public speaking.
4. Students will be initiated into greater use of the computer in resume preparation, report writing, format making etc.

List of Topics

1. Phonetics
2. Reading comprehension
3. Describing objects/places/persons
4. Role Play or Conversational Practice
5. JAM
6. Etiquettes of Telephonic Communication
7. Information Transfer
8. Note Making and Note Taking
9. E-mail Writing
10. Group Discussions-1
11. Resume Writing
12. Debates
13. Oral Presentations
14. Poster Presentation
15. Interviews Skills-1

Minimum Requirements for ELCS Lab:

The English Language Lab shall have two parts:

1. Computer Assisted Language Learning (CALL) Lab: The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self study by learners.
2. The Communication Skills Lab with movable chairs and audio-visual aids with a P.A. system, Projector, a digital stereo-audio & video system and camcorder etc.

System Requirement (Hardware component):

Computer network with LAN with minimum 60 multimedia systems with the following specifications:

i) P – IV Processor
   a) Speed – 2.8 GHZ
   b) RAM – 512 MB Minimum
   c) Hard Disk – 80 GB

ii) Headphones of High quality

Suggested Software:

1. Clarity Pronunciation Power – Part I (Sky Pronunciation)
2. Clarity Pronunciation Power – part II
3. K-Van Advanced Communication Skills
4. Walden InfoTech Software.
5. Orel
6. Young India Films

References:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. A Textbook of English Phonetics for Indian Students by T.Balasubramanyam

Web Links

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Exhibit the skills on the different aspects of the English Language proficiency with emphasis on LSRW skills.

CO2: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking by group discussion.

CO3: Conduct investigation and Analyze communication ability.

CO4: Use of modern computing facilities and suitable software tools to improve communication skills and elocution.

CO5: Follow ethical principles in listening, writing, presenting and communicative ability towards jobs.

CO6: Do experiments effectively as an individual and as a member in a group.

CO7: Communicate verbally and in written form, the understandings about the experiments.

CO8: Continue updating their written communication skills among learners for both academic and professional purposes during their life time.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO	**3**	**3**	**-**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

<table>
<tr><th colspan="9">ENGINEERING CHEMISTRY LABORATORY</th></tr>
<tr><td colspan="9">B.Tech I Year I Semester</td></tr>
<tr><td>Course code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20CA51102</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes:48</td><td colspan="3">Total Classes:48</td></tr>
</table>

COURSE OBJECTIVES:

The course should enable the

1. Verify the fundamental concepts with experiments.

List of Experiments

Exp. 1	Estimation of Ferrous Iron by Dichrometry
Exp. 2	pH metric titration of strong acid vs. strong base
Exp. 3	Estimation of Copper in brass by Iodometric Titration
Exp. 4	Determination of cell constant and conductance of solutions
Exp. 5	Determination of Surface tension of a liquid using Stalagmometer
Exp. 6	Verify Lambert-Beer’s law
Exp. 7	Preparation of Polymer
Exp. 8	Conductometric titration of Strong acid vs. strong base
Exp. 9	Potentiometry - determination of redox potentials and emfs
Exp. 10	Determination of Strength of an acid in Pb-Acid battery

References:

1. Laboratory Manual on Engineering Chemistry ,by Dr. Sudha Rani , Dhanpat Rai publishing house 2009.
2. A Text book on experiments and calculations in engineering chemistry ,by SS Dara , S .Chand publications 2015.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate knowledge on analytical chemistry techniques to address the water related problems technically.

CO2: Analyze and acquire practical skills to handle the chemistry experiments.

CO3: Investigate and analyze different chemistry experiments.

CO4: Analyze the impact of contamination of various chemicals for various experiments in environmental contexts, and need for sustainable development.

CO5: Follow ethical principles in preparation of various chemicals compositions related to the every experiment in the lab.

CO6: Do experiments effectively as an individual and as a member in a group

CO7: Communicate verbally and in written form, of the every experiment in the laboratory.

CO8: Continue updating their skill related to Various titrations for industrial application during their life time

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO	**3**	**3**	**-**	**3**	**-**	**-**	**3**	**3**	**3**	**3**	**-**	**3**	**-**	**-**

ENGINEERING WORKSHOP

B.Tech I Year I Semester

<table>
<tr><th rowspan="2">Course Code</th><th rowspan="2">Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>C</th><th>CIA</th><th>SEE</th><th>Total</th></tr>
<tr><td>20CA03102</td><td>Foundation</td><td>0</td><td>0</td><td>3</td><td>1.5</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td colspan="3">Tutorial Classes: Nil</td><td colspan="2">Practical Classes:48</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

1. Identify and use of tools, types of joints in carpentry, fitting, tin smithy welding and foundry operations.
2. Understand of electrical wiring and components.

LIST OF EXPERIMENTS (Any 10 of the following experiments has to be performed)

S. No	Name of the Experiment
CARPENTRY	
Exp. 1	Preparation of dove tail joint as per given taper angle.
Exp. 2	Preparation of lap joint as per given dimensions.
Exp. 3	Preparation of Cross Lap joint as per given taper angle.
FITTING	
Exp. 4	Make a square fit for given sizes.
Exp. 5	Make a V Joint for given dimensions.
Exp. 6	Make a half round fit for given dimensions.
TIN SMITHY	
Exp. 7	Prepare the development of a surface and make a rectangular tray.
Exp. 8	Prepare the development of a surface and make a round tin.
FOUNDRY	
Exp. 9	Prepare a single Piece pattern.
Exp. 10	Prepare a Split pattern.
WELDING	
Exp. 11	Preparation of V butt joint
Exp. 12	Preparation of Lap joint
Exp. 13	Preparation of T fillet joint

References:

1. K. C. John, "Mechanical Workshop Practice", PHI, 2nd Edition, 2010.
2. H.S. Bawa, "Workshop Practice", Tata McGraw Hill Publishing Company Limited, 2nd Edition 2009.
3. S. K. Hajra Choudhury, A. K. Hajra Choudhury, "Elements of Workshop Technology", Media promoters, 1st Edition, 2009.
4. Engineering Work shop practice for JNTU, V. Ramesh Babu, VRB Publishers Pvt. Ltd., 2009
5. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on differ tools used in carpentry, fitting, sheet metal, basic machining process, foundry and welding.

CO2: Analyze the basic principle of carpentry, fitting, sheet metal, basic machining process, foundry and welding.

CO3: Design small components using different materials include wood, GI sheet, MS plates, foundry and welding.

CO4: Apply basic carpentry, fitting, sheet metal, basic machining process, foundry and welding.

CO5: Follow the ethical principles in while doing the exercises.

CO6: Do the exercises effectively as an individual and as a team member in a group.

CO7: Communicate verbally among team members and in written form, the understanding about the trade exercises.

CO8: Continue updating their skill related to trades.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO 4	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO 5	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO 6	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO 7	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO 8	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO	**3**	**3**	**-**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**-**	**-**

<table>
<tr><td colspan="11">MATHEMATICS-II</td></tr>
<tr><td colspan="11">B.Tech I Year II Semester</td></tr>
<tr><td rowspan="1">Course Code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20CA54201</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:48</td><td>Tutorial Classes:Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes:48</td></tr>
</table>

COURSE OBJECTIVES:

The course should enable the students to

1. To enlighten the learners in the concept of differential equations and multivariable calculus.
2. To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

UNIT-I	**FIRST AND HIGHER ORDER DIFFERENTIAL EQUATIONS**	**Classes:10**

Exact differential equations, Homogeneous and non homogeneous linear higher order differential equations, complementary functions, particular integral for e^{ax}, sin ax, cos ax polynomials, x v(x), general solutions, Method of variation of parameters.

UNIT-II	**PARTIAL DIFFERENTIAL EQUATIONS**	**Classes:10**

Introduction and formation of Partial Differential Equations: with arbitrary constants, functions, solutions of first order linear equations using Lagrange's method.

UNIT-III	**APPLICATION OF PARTIAL DIFFERENTIAL EQUATIONS**	**Classes:10**

Classification of higher order PDE, method of separation of variables for second order equations. One dimensional Wave equation, One dimensional Laplace equation.

UNIT-IV	**VECTOR DIFFERENTIATION**	**Classes:09**

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT-V	**VECTOR INTEGRATION**	**Classes:09**

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

Text Books:

1. E.Kreyszig," Advanced engineering mathematics", John wiley & Son's publishers, New edition.
2. B.S.Grewal,"Higher engineering mathematics", Khanna publishers, New edition.

Reference Books:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
5. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.

Web References:

1.https://www.efunda.com/math/math_home/math.cfm.

2.https://www.ocw.mit.edu/resources/#mathematics.

E-Text Books:

1.https://www.e-booksdirectory.com/detais.php?ebook=10166.

2.https://www.e-booksdirectory.com/details.php?ebook=7400re

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Solve system of equations and matrix and evaluate Eigen values, Eigen vectors of a matrix.

CO2: Find the nature of the Quadratic forms and solve Mean value theorems

CO3: Solve the Mean value theorem problems and apply expand.

CO4: Solve and Evaluate of Partial derivatives, Jacobian, maxima & minima for functions of single, two and three variables

CO5: Evaluate of Double and triple integrals and change of order of integration.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

APPLIED PHYSICS									
B.Tech I Year II Semester									
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**			
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**	
20CA55103	**Foundation**	**3**	**0**	**0**	**3**	**30**	**70**	**100**	
Contact Classes:48	**Tutorial Classes: 0**	**Practical Classes: 0**				**Total Classes: 48**			

COURSE OBJECTIVES:

The course should enable the students to

1. To develop students with sufficient knowledge in interference and diffraction and also to know the importance of the optical phenomenon in real time applications.
2. To develop basic concepts of light waves (Lasers) and its propagation through optical fibers along with its engineering applications.
3. To know the importance of dielectric and magnetic materials by learning the concepts which lead to design and develop novel materials.
4. To develop students with sufficient knowledge in semiconductors in the functioning of electronic devices.
5. To know the importance of superconductors and nanomaterials by learning the basic concepts this could be useful to design novel materials in relevant engineering branches.

UNIT – I	**WAVE OPTICS**	**Classes: 09**

Interference: Principle of superposition – Interference of light – Conditions for sustained interference – Interference in thin films (in reflected light) – Newton's Rings – Determination of wavelength – Engineering applications of interference.

Diffraction: Principle – Types of diffraction – Difference between interference and diffraction – Fraunhofer diffraction - Single slit and double slit diffraction – Diffraction grating – Grating spectrum – Engineering applications of diffraction.

UNIT – II	**LASERS AND FIBER OPTICS**	**Classes:10**

Lasers: Introduction- Characteristics – Absorption, spontaneous and stimulated emission of radiation – Einstein's A and B coefficients –Population of Inversion, He-Ne laser and semiconductor diode laser – Applications of lasers.

Optical Fibers: – Introduction- Total internal reflection – Acceptance angle - Numerical aperture- Classification of optical fibers - Block diagram of fiber optic communication system –Attenuation Losses - Applications of optical fibers.

UNIT – III	**DIELECTRICS AND MAGNETIC MATERIALS**	**Classes:10**

Dielectrics*:* Dielectric polarization – Dielectric polarizability – Susceptibility and Dielectric constant – Types of polarizations: Electronic and Ionic (quantitative), Orientation polarizations (qualitative) – Frequency dependence of polarization – Lorentz (internal) field – Claussius - Mosotti equation – Applications of Dielectrics- Ferro electricity and hysteresis.

Magnetic materials*:* Magnetic dipole moment – Magnetization – Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Classification of magnetic materials – Hysteresis – soft and hard magnetic materials – Applications of magnetic materials.

UNIT – IV	**SEMICONDUCTOR PHYSICS**	**Classes:10**

Classification of solids based on energy bands – Intrinsic semiconductors – density of charge carriers – Fermi energy – Electrical conductivity – extrinsic semiconductors – P - type & N - type – Density of charge carriers – Dependence of Fermi energy on carrier concentration and temperature – Drift and diffusion currents – Einstein's relation – Hall effect – Direct and Indirect band gap semiconductors – Formation of PN junction – Forward bias and reverse bias –Applications of Semiconductors.

UNIT – V	**SUPERCONDUCTORS AND NANOMATERIALS**	**Classes:09**

Superconductors: Introduction – Properties – Meissner effect – Types of superconductors – BCS Theory – Josephson effect (AC & DC) – Applications of superconductors.

Nanomaterials: Significance of nanoscale – Physical, mechanical, magnetic and optical properties of nanomaterials – Synthesis of nanomaterials: top down – ball milling – Bottom up –Chemical vapor deposition – Tools for characterization of nanomaterials: X-ray diffraction (XRD) – Scanning Electron Microscope (SEM) – Applications of nano materials.

Text books

1. "A Text book of Engineering Physics" – M. N. Avadhanulu, P. G. Kshirsagar, TVS Arun Murthy, S. Chand Publications, 11th Edition, 2019.
2. Engineering Physics – B. K. Pandy and S.Chaturvedi, Cengage Learning, 2012.

References

1. Engineering Physics – K. Thyagarajan, McGraw Hill Publishing Company Ltd, 2016.
2. Engineering Physics – Shatendram Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Introduction to Electrodynamics – David J. Griffiths, 4th edition, Pearson Education, 2014.
4. "A Text book of Nano Science and Nano Technology" – T Pradeep,Tata Mc GrawHill, 2013.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: **Demonstrate** knowledge and analyze the basic concepts of wave optics &diffractions.
CO2: **Apply** the knowledge and analyze the concepts of lasers and fiber optics.
CO3: Exhibit the **knowledge** and analyze the dielectrics, magnetic materials.
CO4: Apply and **analyze** the basic principles of semiconductors and their applications.
CO5: **Analyze** the basic concepts of superconducting materials and applications of nonmaterial's.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	2	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	2	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	2	-	-	-	-	-	1	-	-
CO	**2.6**	**2.4**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

NETWORK ANALYSIS

B.Tech I Year II Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
20CA02203	Foundation	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes:48	Tutorial Classes:Nil	Practical Classes: Nil				Total Classes: 48		

COURSE OBJECTIVES:

The course should enable the students to:

1. Implement different circuits and verify circuit concepts.
2. Study the concepts of mesh and nodal analysis in electrical circuits.
3. Design electric circuits to verify network theorems.
4. Gain knowledge about resonance and magnetic circuit.

UNIT – I	INTRODUCTION TO ELECTRICAL CIRCUITS	Classes: 10

Circuit Concept: R, L, C Parameters, voltage and current sources, independent and dependent sources, Ohms law at constant temperature, voltage current relationship for passive elements (for different input signal Square, Ramp, Saw tooth and Triangular), source transformation, star to delta and delta to star transformation, network reduction techniques series, parallel and series parallel circuits.

UNIT – II	ANALYSIS OF ELECTRICAL CIRCUITS & NETWORK THEOREMS	Classes:10

Kirchhoff's laws - Mesh analysis using Kirchhoff's laws, mesh equations by inspection method, super mesh analysis, nodal analysis using KCL, nodal equations by inspection method, super node analysis;

Theorems: Tellegen's, superposition, reciprocity, Thevenin's, Norton's, maximum power transfer, Milliman's and compensation theorems for DC & AC excitations, numerical problems.

UNIT – III	SINGLE PHASE A.C. CIRCUIT	Classes:10

RMS and average values and form factor for different periodic wave forms, steady state analysis of RL and RC (in series, parallel and series parallel combinations) with sinusoidal excitation; Phasor Relationship of R, L & C. Concept of Reactance: impedance, susceptance and admittance, phase and phase difference, concept of power factor, real, reactive and complex power, rectangular and polar forms of representation, steady state analysis of RLC circuits.

UNIT – IV	RESONANCE AND MAGNETIC CIRCUITS	Classes:09

Series, parallel circuits, concept of band width and Q factor;

Magnetic circuits: Faraday's laws of electromagnetic induction, concept of self and mutual inductance, dot convention, coefficient of coupling, composite magnetic circuit, analysis of series and parallel magnetic circuits.

UNIT – V	FILTERS & TWO PORT NETWORK	Classes:09

Filters: Introduction to nepers and decibal - Design Filter - Low pass, high pass, band pass, band elimination filters, introduction to active filter.

Two port network parameters: Z, Y, ABCD, hybrid and inverse hybrid parameters, conditions for symmetry and reciprocity, inter relationships of different parameters. Series and parallel connection of two port networks.

Text books

1. A Chakrabarthy, "Electric Circuits", Dhanipat Rai & Sons, 6th Edition, 2010.
2. A Sudhakar, Shyammohan S Palli, "Circuits and Networks", Tata McGraw Hill, 4th Edition, 2010.
3. M E Van Valkenberg, "Network Analysis", PHI, 3 rd Edition, 2014.

References

1. John Bird, "Electrical Circuit Theory and Technology", Newnes, 2nd Edition, 2003.
2. C L Wadhwa, "Electrical Circuit Analysis Inclucing Passive Network Synthesis", New

Age International, 2nd Edition, 2009.
3. David A Bell, “Electric circuits”, Oxford University Press, 7th Edition, 2009.

Web References

1. https://www.igniteengineers.com
2. https://www.ocw.nthu.edu.tw
3. https://www.uotechnology.edu.iq
4. https://www.crectirupati.com

E-Text Books

1. https://www.bookboon.com/en/concepts-in-electric-circuits-ebook
2. https://www.www.jntubook.com
3. https://www.allaboutcircuits.com
4. https://www.archive.org
5. https://www.bookboon.com/en/concepts-in-electric-circuits-ebook
6. https://www.www.jntubook.com
7. https://www.allaboutcircuits.com
8. https://www.archive.org

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate knowledge in electrical circuits and analyze network reduction techniques.
CO2: Investigate and analyze network theorems.
CO3: Investigate and analyze the study state response of R,L, C, R-L, R-C, R-L-C series and parallel circuits.
CO4: Analyze resonance and Magnetic circuits.
CO5: Analyze and design the passive and active filters and two port network parameters.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

C PROGRAMMING LANGUAGE

B.Tech I Year II Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
20CA05101	Foundation	3	0	0	3	30	70	100
Contact Classes:48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:48		

COURSE OBJECTIVES:

1. To acquire problem solving skills.
2. To be able to develop flowcharts and algorithms for the given problem.
3. To learn how to write modular programs in C.
4. To enable them to use arrays, pointers, strings and structures in solving problems.

UNIT - I	INTRODUCTION	Classes:10

Introduction to C Language Elements, Variables, Data Types, Operators and Expressions, Constants, Declarations, Operators, Type Conversions, Operator Precedence and Order of Evaluation. Statements: Selection Statements, Iteration Statements, Jump statements: Break, Continue, go to.

UNIT - II	ARRAYS	Classes:10

Accessing Array Elements, Single & Multi Dimensional Arrays. Strings: Declaring, Initialization of a String, Reading and Writing Strings, String manipulation functions from the standard Library, String I/O Functions: gets(), puts().

UNIT - III	FUNCTIONS	Classes:10

Definition, Function Call- Call by Value, Storage Class Specifiers, Understanding the scope of Functions with its Types, the Return Statement, Recursion, Command Line Arguments.

UNIT - IV	POINTERS	Classes:9

Pointer Variables, Pointer Expressions, Pointers And Arrays, Pointers to Strings, Call by Reference, Dynamic Memory Allocation Functions, Problems with Pointers, Dangling pointers.

UNIT –V	STRUCTURES AND UNIONS	Classes:9

Accessing structure members, Array of structures, Passing Structures to Functions, Structure Pointers, Self Referential Structures, Structures within Structures, Bit Fields, Enumerations, Typedef.
Files handling in C, File oriented operations.

Text Books:

1. C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage.

References:

1. The Complete Reference C, Fourth Edition, Herbert Schildt, McGraw-Hill Education.
2. Programming with C, Second Edition, Byron Gottfried, Schaum's outline, McGraw-Hill Education.
3. Computer Fundamentals and C programming, B. L Juneja, A Seth, Cengage Learning India.
4. Programming in C and Data Structures", Hanly, Koffman, Kamthane, Ananda Rao, Pearson.
5. Programming in ANSI C, 8/e , by E Balagurusamy
6. The C Programming Language" Second Edition, Brain W. Kernighan, Dennis M. Ritchie, Prentice Hall, India.

Web References

1. https://www.tutorialspoint.com/cprogramming/
2. www.studytonight.com/c/
3. fresh2refresh.com/c-programming/
4. www.cprogramming.com/tutorial/c/

E-Text Books:

1. bookboon.com/en/c-cpp-csharp-ebooks

2. electronicsforu.com › Resources › Cool Stuff
3. https://en.wikibooks.org/wiki/C_Programming
4. www.e-booksdirectory.com › Computers & Internet

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Understand the Role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language.

CO2: Analyze the concepts of Arrays and Strings.

CO3: Decompose a problem into functions and synthesize complete program efficiency.

CO4: Use Pointer to increase efficiency of programs.

CO5: Understand the concepts of Structures and File handling using C Programming Language.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	1	-	-	-	-	-	3	-	-
CO2	2	3	-	2	-	1	-	-	-	-	-	3	-	-
CO3	2	2	3	2	-	1	-	-	-	-	-	3	-	-
CO4	3	2	3	-	-	1	-	-	-	-	-	3	-	-
CO5	3	2	2	-	-	1	-	-	-	-	-	3	-	-
CO	**2.6**	**2.2**	**2.6**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

DIGITAL LOGIC DESIGN

B.Tech I Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
20CA04201	Foundation	3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

COURSE OBJECTIVES:

1. Understanding basic number systems, codes and logical gates.
2. Acquiring the skills to manipulate on different simplification methods for minimizing Boolean functions.
3. To outline procedures for the analysis and design of combinational and sequential logic circuits.
4. Obtaining the knowledge about various types of memories.

UNIT-I | FUNDAMENTALS OF DIGITAL SYSTEMS | Classes: 10

Review of Number systems: Binary, Octal, Decimal, and Hexa decimal, Number Base Conversions methods, Complements of Numbers, Signed Binary Numbers binary codes: Binary coded decimal, excess-3, gray codes, error detecting and error correcting codes.

UNIT-II | BOOLEAN ALGEBRA AND MINIMIZATION | Classes: 09

Boolean algebra: Postulates and theorems, Logic gates and truth tables, Representation of switching functions, sum of products and product of sums forms, NAND& NOR Implementation, karnaugh map representation, simplification of logic functions using Karnaugh maps, Don't Care Conditions, Quine - McClusky method.

UNIT-III | COMBINATIONAL CIRCUITS | Classes: 10

Introduction and Design of Combinational Circuits using conventional logic gates, Half adder, full adder, Subtractor, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers and DeMultiplexers.

UNIT-IV | SEQUENTIAL CIRCUITS | Classes: 10

Synchronous Sequential Circuits: Latches, Flip-flops, analysis of clocked sequential circuits,
Register and Counters: Registers, Shift registers, Ripple counters, Synchronous counters and other counters.

UNIT-V | PROGRAMMABLE LOGIC DEVICES | Classes: 09

Memory and Programmable Logic: Introduction to Random Access Memory, Memory Decoding, Read Only Memory, Programmable Logic Array, Programmable Array Logic and Sequential Programmable Devices.

Text Books:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 4th Edition, Pearson Education, 2013.
2. Z. Kohavi and N. K. Jha, "Switching and Finite Automata Theory", 3rd Edition, Tata McGraw Hill, 2010.
3. A. Anand Kumar, "Switching Theory and Logic Design", Prentice Hall of India, 1st Edition, 2014.

Reference Books:

1. Roth, "Fundamentals of Logic Design", Cengage learning, 5th edition, 2004.
2. John M. Yarbrough, "Digital logic applications and design", Thomson publications, 2nd Edition, 2006.

E-Text Books:

1. https://books.google.co.in/books/about/Switching_Theory_and_Logic_Design
2. https://www.smartzworld.com/notes/switching-theory-and-logic-design-stld
3. https://www.researchgate.net/.../295616521_Switching_Theory_and_Logic_Design
4. https://books.askvenkat.com/switching-theory-and-logic-design-textbook-by-anand-kumar/
5. http://www.springer.com/in/book/9780387285931

Course Outcomes:

Up on successful completion of this course, the student will able,

CO1. Exhibit the knowledge on number systems and analyze different coding techniques

CO2.Demonstrate the basic knowledge on the fundamental postulates and theorems and analyze various minimization techniques. Design the minimized circuits with gates.

CO3. Analyze various combinational logic circuits and design different circuits with combinational logic principles.

CO4. Analyze SR, JK, D and T flip-flops and design synchronous sequential circuits with flipflops.

CO5. Investigate and analyze various Programmable Logic Devices and digital integrated circuits and design combinational circuits with the Programmable Logic Devices.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	2	-
CO	**3**	**2.6**	**3**	**2.25**	-	-	-	-	-	-	-	-	**2.8**	-

APPLIED PHYSICS LAB

B.Tech I Year II Semester

<table>
<tr><th rowspan="1">Course Code</th><th>Category</th><th colspan="3">Hours/Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">20CA55104</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td colspan="2">Tutorial Classes: Nil</td><td colspan="3">Practical Classes: 48</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

1. To understand the role of optical fiber parameters in communication.
2. To understand the mechanical properties of materials.
3. Recognize the importance of laser by studying the laser characteristics and its applications.
4. Illustrates the magnetic and dielectric materials applications.
5. To apply the principles of optical fibers to calculate the properties of fibers.

COURSE OUT COMES:

1. Operate various optical experiments like microscope and spectroscope (L2).
2. Determine wavelength of laser and particle size of laser (L2).
3. Estimate the susceptibility and related magnetic parameters of magnetic materials (L2).
4. Plot the intensity of the magnetic field of circular coil carrying current with distance (L3).
5. Evaluate the acceptance angle and numerical aperture of an optical fiber (L3).
6. Determine magnetic susceptibility of the material and its losses by B-H curve (L3).
7. Determine of pressure and temperature variations using the sensors (L3).
8. Apply the concepts of sensors for various applications (L3).
9. Identity the type of semiconductor i.e. n-type or p-type using Hall Effect (L3).
10. Calculate the band gap of a given semiconductor (L3).

List of experiments(Any 10 experiments should be performed()

Expt. 1	Determination of Diameter of thin wire using air-wedge method.
Expt. 2	Determination of radius of curvature of plano-convex lens - Newton's rings.
Expt. 3	Determination of wavelength of different colors using diffraction grating-Spectrometer.
Expt. 4	Determination of dispersive power of prism using spectrometer.
Expt. 5	Determination of resolving power of grating.
Expt. 6	Determination of dielectric constant by charging and discharging method.
Expt. 7	Determination of magnetic field along the axis of a circular coil carrying current-using Stewart and Gee's method.
Expt. 8	Determination of self inductance of the coil (L) using Anderson's bridge.
Expt. 9	Study of variation of B with H of magnetic material using B-H curve method.
Expt. 10	Determination of numerical aperture and acceptance angle of given optical fiber.
Expt. 11	Measurement of magnetic susceptibility by Gouy's method.
Expt. 12	Determination of Charge density and Hall coefficient or magnetic flux density – Hall effect.
Expt. 13	Determination of resistivity of semiconductor by four probe method.
Expt. 14	Determination of band gap of semiconductor (using Thermister).
Expt. 15	Measurement of temperature co-efficient of resistance.

References

1. A Text book of practical physics – S. Balasubramanian, M. N. Srinivasan, S. Chand Publishers, 2017.
2. http://vlab.amrita.edu/index/php - virtual labs, Amrita University.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO 1: Demonstrate on various optical instruments, material properties and magnetic properties.

CO 2: Analyze the various magnetic properties, material properties.

CO 3: Formulate the properties of dielectric materials and optical fiber materials.

CO 4: Follow ethical values during conducting of Experiments.

CO 5: Work individually or in a team effectively.

CO 6: Communicate verbally and in written form pertaining to results of the Experiments.

CO 7: Perform experiments involving physical Phenomena in future years.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-		-	-	-	-	-	-	-	-	-	-
CO2	-	3	-		-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-		-	-	-	3	-	-	-	-	-	-
CO5	-	-	-		-	-	-	-	3	-	-	-	-	-
CO6	-	-	-		-	-	-	-	-	3	-	-	-	-
CO7	-	-	-		-	-	-		-	-	-	3	-	-
CO	**3**	**3**	-	**3**	-	-	-	**3**	**3**	**3**	-	**3**	-	-

C PROGRAMMING LAB									
B.Tech I Year II Semester									
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**			
20CA05102	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**	
		0	**0**	**3**	**1.5**	**30**	**70**	**100**	
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 48**				**Total Classes:48**			

COURSE OBJECTIVES:

1. Learn C Programming language.
2. To make the student solve problems, implement algorithms using C language.
3. To write diversified solutions using C language.

LIST OF PROGRAMS

Week -l

Write C program to

a) Print the size of all data types.
b) Find the Sum of three numbers
c) Exchange (swap) of two numbers by using third variable.
d) Exchange (swap) of two numbers without using third variable.

Week - 2

a) Develop a calculator to convert time, distance, area, volume and temperature from one unit to another.
b) Write a C program to find the Priority and associativity of operators using expressions. Take the expressions with different operators.
c) Write a C program to swap two numbers using bitwise operators.

Week - 3

a) Write a C program to find whether the given integer is odd or even.
b) Write a C program to find the Maximum of three numbers.
c) Write a C program to print 'hello world' without using semicolon.
d) Write a C program to find whether the given number is odd or even using bitwise operator.
e) Write a C program to find the maximum of two numbers using Conditional operator.
f) Write a program which takes two integers and one arithmetic operator from the user, and performs the operation and then prints the result by using **switch-case**.(Operators : +, -, *, /, %)

Week -4

a) Write a C program to generate the required multiplication table.
b) Write a C program to find the Factorial of a given integer.
c) Write a C program to compute x power of n (x^n) without using built in functions.
d) Write a C program to check whether the given integer is prime or not.
e) Write a C program to find GCD

Week - 5

a) Write a C program to find the sum of the digits of an integer.
b) Write a C program to find whether the given integer is a Palindrome or not.
c) Write a C program to generate Fibonacci numbers in the given range.

Week - 6

a) Write a C program to print the following pattern.

1
2 2
3 3 3

b) Print multiplication tables up to the given table.
c) Write a C program to print series of prime numbers in the given range.

Week - 7

a) Write a C program to check whether the given integer is strong number or not.
b) Write a C program to evaluate the sum of the following series up to ‘n’ terms

$e^x = 1 + x + x^2/2! + x^3/3! + x^4/4! + \text{--------}$

Week - 8

a) Compute the maximum, minimum and average of N numbers.
b) Write a C program to find the sum of positive and negative numbers in a given set(Array) of numbers.
c) Write a program to implement linear search technique
d) Write a C program to read two matrices and find
i) Sum. ii) Product and display the result in the matrix form.

Week -9

a) Write a C program to read a matrix and perform the following operations
i) Find the sum of Diagonal Elements of a matrix.
ii) Print Transpose of a matrix.
iii) Print sum of even and odd numbers in a given matrix.

Week - 10

a) Write a C program to read two strings and perform the following operations without using built-in string library functions.
i) String length determination.
ii) Compare Two Strings.
iii) Concatenate Two Strings.
iv) String reversing
v) Determining whether a string is a palindrome or not
b) Write a C program to accept a line of characters and print the number of Vowels, Consonants, blank spaces, digits and special characters.
c) Write a C program to read a set of strings and sort them in alphabetical order.

Week -11

a) Write a C program to illustrate the following types of functions
i) Function with no arguments and no return values
ii) Function with arguments and no return value
iii) Function without arguments and with return value
iv) Function with arguments and with return value

Week - 12

a) Write a C program to exchange two numbers using pointers.
b) Write a program to print the elements of an array in reverse order using pointers.

Week - 13

a) Write a C program to express a four digit number in words. For example 1546 should be written as one thousand five hundred and forty six
b) Write a C program using recursion for finding Factorial of a number
c) Calculate the greatest common divisor using recursion for two numbers as specified by

the user

d) Write a C program to illustrate the Dynamic Memory allocation function malloc( )

Week -14

a) Declare a structure time that has three fields, hours, minutes, and seconds. Create two structure variables start_time and end_time. Input their values from the user. Then, if the start_time is not equal to end_time
display HELLO CREC on the screen.
b) Write a C program to read student roll no, name and marks in six subjects for n number of students and give class of each student by following the required conditions.
c) Write a C program to demonstrate self referential structures.

Week -15

a) Write a program to create a file and write some text data on the file. Then display the contents of the file and also print number of characters, number of words, number of lines in the file.
b) Write a C program to merge two files.

Week-16

a) Write a C program to create a text file and write data on it, then display every 5^{th} c character in that file.
b) Write a program to read student records into a file. Record consists of rollno, name and marks of a student in six subjects and class. Class field is empty initially. Compute the class of a student.
c) The calculation of the class is as per CREC rules. Write the distinction, first class, second class, third class and failed students lists separately to another file.

Reference Books:

1. How to solve it by Computer, R.G. Dromey, Pearson.
2. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, Pearson.
3. Let Us C, Yeswant Kanetkar, BPB Publications
4. Pointers in C, Yeswant Kanetkar, BPB Publications.
5. Programming In C And Data Structures, J.R.Hanly, Ashok N. Kamthane And A.Ananda Rao, Pearson Education.

Web References:

1. https://www.programiz.com/
2. https://www.programmingsimplified.com
3. https://www.techcrashcourse.com
4. https://www.sanfoundary.com/

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Apply the Knowledge to design the algorithm and flowchart for the given problem
CO2: Analyze the concepts of control statements and arrays
CO3: Design the programs for functions and strings
CO4: Solve the memory access problems by using pointers and design the programs on structures and unions
CO5: Select appropriate procedure to solve given problem
CO6: Follow the ethical principles in implementing the programs
CO7: Do experiments effectively as an individual and as a team member in a group.
CO8: Communicate verbally and in written form, the understandings about the experiments.
CO9: Continue updating their skill related to loops, pointers and files Implementing programs in future.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3		-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO7	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO	**3**	**3**	**3**	**3**	**3**	-	-	**3**	**3**	**3**	-	**3**	-	-

NETWORK ANALYSIS LAB									
B.Tech I Year II Semester									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**			
20CA02204	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**	
		0	**0**	**3**	**1.5**	**30**	**70**	**100**	
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes:48**				**Total Classes: 48**			

COURSE OBJECTIVES:

The course should enable the students to:

1. Implement different circuits and verify circuit concepts.
2. Study the concepts of mesh and nodal analysis in electrical circuits.
3. Design electric circuits to verify network theorems.
4. Gain knowledge about resonance and magnetic circuits.

LIST OF EXPERIMENTS

Exp. 1	**KIRCHOFF'S LAWS**
Verification of KCL & KVL for any network.	
Exp. 2	**NETWORK THEOREM**
Verification of Superposition Theorem with analysis.	
Exp. 3	**NETWORK THEOREM**
Verification of Thevenin's Theorem with analysis.	
Exp. 4	**NETWORK THEOREM**
Verification of Norton's Theorem with analysis.	
Exp. 5	**NETWORK THEOREM**
Verification of Maximum Power Transfer Theorem with analysis.	
Exp. 6	**ANALYSIS OF NETWORKS**
Analysis of RL & RC circuits for pulse excitation.	
Exp. 7	**RESONANCE CIRCUITS**
Frequency response of series resonance circuit with analysis and design.	
Exp. 8	**RESONANCE CIRCUITS**
Frequency response of parallel resonance circuit with analysis and design.	
Exp. 9	**COMPENSATION THEOREM**
Verification of COMPENSATION THEOREM with analysis.	
Exp. 10	**MILLIMAN'S THEOREM**
Verification of Milliman's theorem using hardware and digital simulation.	

Reference Books:

1. A Chakrabarti, "Circuit Theory", Dhanpat Rai Publications, 6th Edition, 2006.
2. William Hayt, Jack E Kemmerly S.M. Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 7th Edition, 2010.
3. K S Suresh Kumar, "Electric Circuit Analysis", Pearson Education, 1st Edition, 2013.

Web References:

1. https://www.ee.iitkgp.ac.in
2. https://www.citchennai.edu.in
3. https://www.crectirupati.com
4. https://www.bookboon.com/en/concepts-in-electric-circuits-ebook
5. https://www.www.jntubook.com
6. https://www.allaboutcircuits.com
7. https://www.archive.org

COURSE OUTCOMES:
Upon the successful completion of the course, the student will be able to

CO1: **Demonstrate the knowledge Network Theorems.**
CO2: **Analyze** the practical Network Theorems.
CO3: **Demonstrate the knowledge series and parallel** resonances.
CO4: **Investigate and Analyze** the Network Theorems for future applications.
CO5: Follow **ethical** principles in designing circuits and measuring.
CO6: Do experiments effectively as an **individual** and as a member in a **group**.
CO7: **Communicate** verbally and in written form, the understandings about the experiments.
CO8: Continue updating their skill related to electronic devices and their applications during their **life time.**

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3		-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3		3
CO	**3**	**3**	**3**	**3**	-	-	-	**3**	**3**	**3**	-	**3**	**3**	**3**

MATHEMATICS III								
B.Tech II Year I Semester								
Course Code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
20CA54301	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes:48	**Tutorial Classes:Nil**	**Practical Classes:Nil**				**Total Classes:48**		

COURSE OBJECTIVES:

The course should enable the students to :

1. Understand the analyticity of complex functions and conformal mappings.
2. Apply Cauchy's integral formula and Cauchy's integral theorem to evaluate improper integrals along contours.

UNIT-I	**LAPLACE TRANSFORMS**	**Classes:10**

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function– Second shifting theorem – Dirac's delta function –Laplace transform of Periodic function. Differentiation of transform.

UNIT-II	**INVERSE LAPLACE TRANSFORMS**	**Classes:9**

Inverse Laplace transform by different methods; Convolution theorem (with proof); Applications of Laplace transforms to ordinary differential equations of first and second order with constant coefficients.

UNIT-III	**FOURIER SERIES**	**Classes:10**

Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions.

UNIT-IV	**COMPLEX VARIABLE – DIFFERENTIATION**	**Classes:10**

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method-Conformal mappings-standard and special transformations (sin z, e^z, cos z, z^2) Mobius transformations (bilinear) and their properties.

UNIT-V	**COMPLEX VARIABLE – INTEGRATION**	**Classes:09**

Line integral-Contour integration, Cauchy's integral theorem, Cauchy Integral formula, power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

Text Books:

1. B.S.Grewal, "Higher Engineering Mathematics", KHANNA Publishers, 43rd edition
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India,10th edition.

Reference Books:

1. B.V.Ramana, "Higher Engineering Mathematics", Mc Graw-Hill Publishing company,6th reprint, 2008,
2. Numerical methods by P. Kandasamy, K.Thilagavathy, K. Gunavathuy: S. Chand & company Ltd, 2008.
3. Mathematical Methods By Dr T.K.V. Iyengar, Dr. B.Krishna Gandhi, S.Ranganatham and Dr. M.V.S.S.N.Prasad, S. Chand & company,7th revised edition, 2012.

Web References:

1. https://www.efunda.com/math/math_home/math.cfm
2. https://www.ocw.mit.edu/resources/#mathematics.

E-Text Books:

1. https://www.e-booksdirectory.com/detais.php?ebook=10166.

2. https://www.e-booksdirectory.com/details.php?ebook=7400re

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the basic knowledge and apply the principle of Laplace Transforms in the field of engineering course.

CO2: Evaluate Inverse Laplace Transforms and it's applications in the field of engineering course.

CO3: Demonstrate and solve Fourier series, even and odd functions and half range sine, cosine series.

CO4: Analyze of complex variables and conformal mappings.

CO5: Apply Cauchy's integral formula and Cauchy's theorem to evaluate improper integrals along contours

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	2	-	-	-	-	-	-	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**2.6**	-	-	-	**2**	-	-	-	-	-	-	**3**	**2**

ELECTRONIC DEVICES & CIRCUITS

B.Tech II Year I Semester

Course Code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
20CA04301	Core	3	0	0	3	30	70	100
Contact Classes:48	Tutorial Classes:Nil	Practical Classes: Nil				Total Classes:48		

COURSE OBJECTIVES:

The course should enable the students to :

1. To acquire fundamental knowledge and expose to the field of semiconductor theory and devices and their applications.
2. To introduce different types of semiconductor devices, viz., diodes and special diodes.
3. To explain application of diodes as rectifiers, clippers, clampers and regulators.
4. To describe operation and characteristics of Bipolar Junction Transistor & Field Effect Transistor.
5. To analyze the various biasing circuits using BJTs & FETs.

UNIT-I	SEMICONDUCTOR DIODE	Classes:10

Intrinsic and Extrinsic semiconductors, Open circuited PN junction, PN junction diode with applied voltage, Energy Band diagram of PN Diode, Diode current equation and its mathematical derivation, Temperature dependence of volt-ampere characteristics, Static and Dynamic resistances, Diffusion and Transition capacitances.

UNIT-II	SPECIAL ELECTRONIC DEVICES	Classes:09

Zener diode and its V-I characteristics, Avalanche and Zener breakdown, Principle of operation and characteristics of Tunnel Diode, Photo Diode, LED, Varactor diode, SCR and its V-I characteristics, DIAC, TRAIC, Schottky barrier diode, UJT and its V-I characteristics, Problem solving.

UNIT-III	DIODE APPLICATIONS	Classes:09

Diode as a Switch, **Rectifiers**- Half wave rectifier, Full wave rectifier, Bridge rectifier and their analysis, **Filters**-Inductor and Capacitor filters, L-Section filter, pi-filter, Zener diode as a voltage regulator, Series and Shunt diode clippers, Clipping at two independent levels, Clamping circuits and its operation.

UNIT-IV	BJT AND ITS BIASING	Classes:10

Bipolar Junction Transistor: Physical operation, Symbols, NPN and PNP transistors, Current components and their relationships, Input and output characteristics of Common Base, Common Emitter and Common Collector configurations.

BJT Biasing: Need for Biasing, Operating point, DC and AC load lines, Fixed Bias, Collector to Base bias, Self Bias, Bias stability, Stabilization against variations in I_{CO}, V_{BE} and β, Bias Compensation Techniques, Thermal runaway, Thermal stability, Problem Solving.

UNIT-V	FET AND ITS BIASING	Classes:10

Field effect Transistor: JFET Construction, Symbols and conventions, V-I characteristics of JFET, JFET parameters, Comparison of JFET with BJT, MOSFET types and their construction, V-I Characteristics of Depletion mode and Enhancement mode MOSFET, Comparison of JFET with MOSFET.

Biasing using JFET and MOSFET: Different biasing circuits- Fixed Bias, Self Bias, Voltage divider Bias using JFETs and MOSFETs, Problem Solving.

Text Books:

1. Millman and Halkias: Integrated Electronics, Tata Mc.Graw Hill, 2004.
2. R E Boylstead and L Nashelsky: Electronic Devices and Circuit Theory, 9/e, Pearson Education.
3. Electronic Devices and Circuits, David A. Bell – 5^{th} Edition, Oxford.
4. S. Salivahanan, N. Suresh Kumar,A. Vallavaraj, “Electronic Devices and Circuits”, Tata McGraw Hill, 2^{nd} edition, 2011.

Reference Books:

1. Sedra and Smith: Microelectronic Circuits, 4/e, Oxford University Press 1998.
2. Donald A Neamen. : Electronic Circuit Analysis and Design, 3/e, Tata Mc.Graw Hill.
3. B. Razavi , "Fundamentals of Microelectronics", Wiley.

Web References:

1. http://www-mdp.eng.cam.ac.uk/web/library/enginfo/electrical/hong1.pdf
2. https://archive.org/details/ElectronicDevicesCircuits
3. http://www.vidyarthiplus.in/2011/11/electronic-device-and-circuits-edc.html
4. http://www.satishkashyap.com/2013/03/video-lectures-on-electron-devices-by.html

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on PN junction operation and analyze the PN junction Diode characteristics and current equation.

CO2: Analyze various special purpose devices and their applications.

CO3: Demonstrate the knowledge on rectifier operation and analyze basic rectifiers and filters

CO4: Exhibit the knowledge on basic concepts of BJT and its biasing and analyze the biasing circuits using BJT.

CO5: Exhibit the knowledge on basic concepts of FET and its biasing and analyze the biasing circuits using FET.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	2	-	-	-	-	-	-	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**2.6**	-	-	-	**2**	-	-	-	-	-	-	**3**	**2**

RANDOM SIGNALS & SYSTEMS								
B.Tech II Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
20CA04302	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

COURSE OBJECTIVES:

1. To gain basic concepts about signals and systems.
2. To understand the behavior of signals and systems in both time and frequency domain.
3. To understand the stability of systems through the concept of ROC.
4. To get an in-depth knowledge about signals, systems and analysis of the same using various transforms.

UNIT - I	**INTRODUCTION TO SIGNALS & SYSTEMS**	**Classes: 10**

Analogy between vectors and signals – Orthogonality - Mean Square Error, Definition and classification of signal and systems (Continuous time and Discrete time), Elementary signals such as Dirac delta, unit step, ramp, sinusoidal and exponential and operations on signals. Fourier Series Representation of Periodic Signals: Representation of Fourier series, Dirichlet's conditions, Trigonometric & Exponential Fourier series.

UNIT - II	**FOURIER TRANSFORM**	**Classes: 10**

CONTINUOUS TIME FOURIER TRANSFORM: Deriving Fourier transform from Fourier series, Definition, Computation and properties of Fourier Transform for different types of signals. Statement and proof of sampling theorem of low pass signals and systems.
DISCRETE TIME FOURIER TRANSFORM: Definition, Computation and properties of Fourier Transform for different types of signals.

UNIT - III	**SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS**	**Classes: 10**

Linear system, impulse response, Response of a linear system, linear time-invariant (LTI) system, linear time variant (LTV) system, Transfer functions of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, Relationship between bandwidth and rise time. Energy and Power Spectral Densities.

UNIT - IV	**LAPLACE TRANSFORM**	**Classes: 10**

Definition, ROC, ROC-Properties, Inverse Laplace transforms: S-plane, BIBO stability, Transfer functions, System Response to standard signals, Solution of differential equations with initial conditions, Relation between Laplace transforms and Fourier transform of a signal.

UNIT - V	**Z–TRANSFORM**	**Classes: 08**

Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform.
Z-Transform Properties: Linearity, time shifting, change of scale, Z-domain differentiation, differencing, accumulation, convolution in discrete time, initial and final value theorems. Poles and Zeros in Z –plane, inverse Z-Transform.
System analysis: Transfer function, BIBO stability, System Response to standard signals, Solution of difference equations with initial conditions.

Text Books:

1. Signals, Systems & Communications - B.P. Lathi, 2009, BS Publications.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2ndEdn.
3. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2^{nd} Edition

Reference Books:

1. Signals and Systems – A. Ramakrishna Rao - 2008, TMH.

2. Linear Systems and Signals – B. P. Lathi, Second Edition, Oxford University press, 2008.
3. Fundamentals of Signals and Systems Michel J. Robert, MGH International Edition, 2008.
4. Signals, Systems and Transforms - C. L. Philips, J. M. Parr and Eve A. Riskin, Pearson education 3rdEdition.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on the basic concepts of signals and sysytems and analyze various types of signals and systems.

CO2: Investigate and analyze the Continuous-time & discrete –time FT of various signals

CO3: Exhibit the knowledge on LTI systems and analyze various filters, Causality and Poly-Wiener criterion.

CO4: Demonstrate the knowledge on the basic concepts of Laplace Transforms. Analyze Laplace Transforms and inverse laplace Transforms of different functions.

CO5: Demonstrate the knowledge on the basic concepts of Z Transforms. Analyze Z Transforms and inverse Z Transforms of different functions.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

ANALOG COMMUNICATIONS

B.Tech II Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
20CA04303	Core	3	0	0	3	30	70	100

Contact Classes:48	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 48

COURSE OBJECTIVES:

1. Develop skills for analyzing different types of signals in terms of their properties such as energy, power, and correlation and apply for analysis of linear time invariant systems.
2. Analyze various techniques of generation and detection of amplitude modulation (AM), frequency modulation (FM) and phase modulation (PM) signals.
3. Differentiate the performance of AM, FM and PM systems in terms of Power, Bandwidth and SNR (Signal-to-Noise Ratio).
4. Evaluate Analog Communication system in terms of the complexity of the transmitters and receivers.

UNIT-I	AMPLITUDE MODULATION AND DEMODULATION	Classes: 10

Definition and classification of signal and systems, Definition, Computation and properties of Continuous Time Fourier Transform for Dirac delta and sinusoidal signals.
Introduction to communication system, need for modulation, frequency division multiplexing; Amplitude modulation, definition; Time domain and frequency domain description, single tone modulation, power relations in amplitude modulation waves; Generation of amplitude modulation wave using square law and switching modulators; Detection of amplitude modulation waves using square law and envelope detectors. Noise in amplitude modulation.

UNIT-II	DOUBLE SIDE BAND SUPPRESSED CARRIER MODULATION	Classes: 10

Double side band modulation: Double side band suppressed carrier time domain and frequency domain description; Generation of double side band suppressed carrier waves using balanced and ring modulators; Coherent detection of double side band suppressed carrier modulated waves; Costas loop, Noise in double side band suppressed carrier.

UNIT-III	SINGLE SIDE BAND AND VESTIGIAL SIDE BAND MODULATION	Classes: 10

Frequency domain description, frequency discrimination method for generation of amplitude modulation single side band modulated wave; time domain description; Phase discrimination method for generating amplitude modulation single side band modulated waves; Demodulation of single side band waves.
Noise in single side band suppressed carrier; Vestigial side band modulation: Frequency description, generation of vestigial side band modulated wave; Time domain description; Envelope detection of a vestigial side band modulation wave pulse carrier; Comparison of amplitude modulation techniques; applications of different amplitude modulation systems.

UNIT-IV	ANGLE MODULATION	Classes: 09

Basic concepts, frequency modulation: Single tone frequency modulation, spectrum analysis of sinusoidal frequency modulation wave, narrow band frequency modulation, wide band frequency modulation, transmission bandwidth of frequency modulation wave, phase modulation, comparison of frequency modulation and phase modulation; Generation of frequency modulation waves, direct frequency modulation and indirect frequency modulation, detection of frequency modulation waves: Balanced frequency discriminator, Foster Seeley discriminator, ratio detector, zero crossing detector, phase locked loop, comparison of frequency modulation and amplitude modulation; Noise in angle modulation system, threshold effect in angle modulation system, pre-emphasis and de-emphasis.

UNIT-V	RECEIVERS AND SAMPLING THEORM	Classes: 09

Receivers: Introduction, tuned radio frequency receiver, super heterodyne receiver, radio frequency amplifier, mixer, local oscillator, intermediate frequency amplifier, automatic gain control; Receiver characteristics: Sensitivity, selectivity, image frequency rejection ratio, choice of intermediate frequency, fidelity; Frequency modulation receiver, amplitude limiting, automatic frequency control, comparison with amplitude modulation receiver; Sampling: Sampling theorem, graphical and analytical proof for band limited signals, types of sampling, reconstruction of signal from its samples.

Text Books:

1. B.P. Lathi, "Signals, Systems and Communications", BS Publications, 5th Edition, 2009.
2. S. S. Haykin, "Communication Systems", Wiley Eastern, 2nd Edition, 2006.
3. Taub, Schilling, "Principles of Communication Systems", Tata McGraw-Hill, 4th Edition, 2013.

Reference Books:

1. B.P. Lathi, "Communication Systems", BS Publication, 2nd Edition, 2006.
2. John G. Proakis, Masond, Salehi, "Fundamentals of Communication Systems", PEA, 1st Edition, 2006.
3. George Kennedy, Bernard Davis, "Electronics and Communication System", Tata McGraw Hill, 5th Edition, 2011.
4. B.P. Lathi, Zhi Ding, "Modern analog and digital Communication Systems", Oxford Publication, 4th Edition, 2011.

Web References:

1. http://www.web.eecs.utk.edu
2. https://everythingvtu.wordpress.com
3. http://nptel.ac.in/
4. http://www.iare.ac.in

E-Text Books:

1. http://www.bookboon.com/
2. http://www.jntubook.com
3. http://www.smartzworld.com
4. http://www.archive.org

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate knowledge on principle of communication system, formulate the power relations of AM and analyze the different type of modulation and demodulations.

CO2: Analyze the DSB SC modulation, the power relations of DSB SC and noise calculations in DSB SC.

CO3: Exhibit knowledge on the SSB and VSB modulation and demodulation techniques and analyze the power relations and noise calculations in SSB and VSB modulation

CO4: Exhibit knowledge on the angle modulation types and their modulation and demodulation procedures and analyze the power relations and noise calculations in them

CO5: Investigate and analyze the different types of radio receivers and sampling theorem and its types.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

PRINCIPLES OF ELECTRICAL ENGINEERING

B.Tech II Year I Semester

Course code	Category	Hours/week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	TOTAL
20CA02307	Foundation	3	0	0	3	30	70	100

Contact Classes:48	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes:48

COURSE OBJECTIVES:

The course should enable the students to :

1. Understand the concepts Dc and Ac generators, Motors ,Single phase transformers and Induction motors.
2. To study their performance aspects of all machines and their applications.

UNIT-I — DC GENERATORS — Classes:10

D.C. Generators – Principle of Operation – Constructional Features – E. M.F Equation– Numerical Problems – Methods of Excitation – Separately Excited and Self Excited Generators – Build-Up of E.M.F –Magnatisation characteristics Critical Field Resistance and Critical Speed - Load Characteristics of Shunt, Series and Compound Generators and their Applications

UNIT-II — D.C. MOTORS — Classes:10

D.C Motors – Principle of Operation – Back E.M.F. –Torque Equation – Characteristics and Application of Shunt, Series and Compound Motors-Speed Control of D.C. Motors: Armature Voltage and Field Flux Control Methods. Three Point Starter-Losses – Constant & Variable Losses – Calculation of Efficiency - Swinburne‟s Test.

UNIT-III — SINGLE PHASE TRANSFORMERS — Classes:09

Single Phase Transformers - Constructional Details- Emf Equation - Operation on No Load and on Load - Phasor Diagrams-Equivalent Circuit - Losses and Efficiency - Regulation-OC and SC Tests – Sumpner‟s Test - Predetermination of Efficiency and Regulation.

UNIT-IV — 3-PHASE INDUCTION MOTORS — Classes:09

Polyphase Induction Motors-Construction Details of Cage and Wound Rotor Machines - Principle of Operation – Slip- Rotor Emf and Rotor Frequency- Losses and efficiency - Torque Equation- Torque Slip Characteristics.

UNIT-V — SYNCHRONOUS MACHINES — Classes:10

Principle and Constructional Features of Salient Pole and Round Rotor Machines – Distribution(Kd) and coil span(Kc) factors- E.M.F Equation- Voltage Regulation by Synchronous Impedance Method- Theory of Operation of Synchronous Motor.

Text Books:

1. Basic Electrical Engineering, V. N. Mittle and Arvind Mittle, Mc Graw Hill (India) Pvt. Ltd., 2nd Edition, 2005.
2. Basic Electrical Engineering, T.K.Nagsarkar and M.S. Sukhija, Oxford University Press, 2nd Edition, 2011.

Reference Books:

1. Basic Electrical Engineering, M.S.Naidu and S. Kamakshiah, Tata Mc Graw Hill, 3rd Edition, 2009.
2. Electrical and Electronic Technology, Hughes, Pearson Education.

Web References:

1. https://nptel.ac.in/courses/108/105/108105155/
2. https://nptel.ac.in/courses/108/102/108102146/
3. https://www.elprocus.com/three-phase-ac-induction-motor-control-using-svpwm/#:~:text=The%20three%2Dphase%20AC%20induction,on%20a%20three%2Dphase%20supply.&text=These%20AC%20motors%20are%20of,of%20a%20rotating%20magnetic%20field.
4. https://people.ucalgary.ca/~aknigh/electrical_machines/other/spim.html
5. https://www.watelectrical.com/what-is-synchronous-generator-construction-working-its-applications/

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Investigate and Analyze the DC Generators.

CO2: Investigate and Analyze the DC motors. CO3: Exhibit the knowledge on SINGLE PHASE TRANSFORMERS and analyze its tests CO4: Apply the knowledge on 3-PHASE INDUCTION MOTORS and analyze its loses & Characteristics. CO5: Demonstrate the knowledge on SYNCHRONOUS MACHINES and analyze its Voltage Regulation.

CO-PO/PSO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-	-

ELECTRONIC DEVICES & CIRCUITS LABORATORY

B.Tech II Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
20CA04304	Core	L	T	P	C	CIA	SEE	Total
		0	0	3	1.5	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 48				Total Classes: 48		

COURSE OBJECTIVES:

The course should enable the students to:

1. To provide exposure to the students with hands on experience on basic engineering practices in electronics engineering.
2. Understand the nature and scope of modern electronics.
3. To study basic electronic components.
4. To observe the characteristics of electronic devices.

LIST OF EXPERIMENTS

PART-A (ELECTRONIC WORKSHOP PRACTICE)

1. Identification, specifications, testing of R, L, C components (Color Codes), Potentiometers, Gang condensers, Relays, Bread boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, SCR, UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function Generator, Regulated Power Supply and CRO.

PART-B (ANY TEN EXPERIMENTS)

1	PN Junction Diode Characteristics.
2	Zener Diode Characteristics.
3	Half Wave Rectifiers (with and without filters).
4	Full Wave Rectifiers (with and without filters).
5	Clipper and Clamper Circuits using Diodes.
6	Common Base Input and Output Characteristics.
7	Common Collector Input and Output Characteristics.
8	FET Input and Output Characteristics.
9	UJT Characteristics.
10	SCR Characteristics.
11	Emitter follower
12	JFET amplifier.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on identification & testing of passive components along with active devices.

CO2: Analyze the practical characteristics of diodes and transistors with different configurations.

CO3: Design various amplifier circuits and verify the results.

CO4: Investigate and Analyze the amplifiers for future applications.

CO5: Follow ethical principles in designing circuits and measuring.

CO6: Do experiments effectively as an individual and as a member in a group.

CO7: Communicate verbally and in written form, the understandings about the experiments.

CO8: Continue updating their skill related to electronic devices and their applications during their life time.

LIST OF EQUIPMENT REQUIRED FOR A BATCH

S. No	Name of the Equipment	Range
1	Cathode Ray Oscilloscope	0-25 MHz
2	Function generator	0-1MHz
3	Function generator	0-2MHz
4	Regulated Power supplies	---
5	Digital Multimeters	---
6	Decade Résistance Boxes/Rheostats	---
7	Decade Capacitance Boxes	---
8	Digital multimeter	0-20V/ 0-200mA/10 Ω -10k Ω
9	Active & Passive Electronic Components	---

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3		-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

ANALOG COMMUNICATIONS LABORATORY								
B.Tech II Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
20CA04305	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	**0**	**3**	**1.5**	**30**	**70**	**100**
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 48**				**Total Classes: 48**		

COURSE OBJECTIVES:

1. Implement various modulation techniques in communications.
2. Analyze various spectrums of analog modulation using spectrum analyzer.
3. Understand the importance of automatic gain control and Phase locked loop.
4. Explore receiver characteristics.

LIST OF EXPERIMENTS

MINIMUM OF TEN EXPERIMENTS TO BE CONDUCTED (FIVE FROM EACH PART)

EXPERIMENTS CAN BE PERFORMED USING HARDWARE

Exp. 1	**AMPLITUDE MODULATION AND DEMODULATION**
Generation of amplitude modulation and demodulation using hardware.	
Exp. 2	**FREQUENCY MODULATION AND DEMODULATION**
Generation of frequency modulation and demodulation using hardware	
Exp. 3	**PRE-EMPHASIS AND DE-EMPHASIS**
Verification of pre-emphasis and de-emphasis to boost high frequency modulating signal using hardware.	
Exp. 4	**TIME DIVISION MULTIPLEXING**
Generation of Time division multiplexing using hardware.	
Exp. 5	**CHARACTERISTICS OF MIXER**
Verification of characteristics of mixer using hardware.	
Exp. 6	**FREQUENCY SYNTHESIZER**
Frequency synthesizer using hardware.	

EXPERIMENTS CAN BE PERFORMED USING SOFTWARE

Exp. 7	**LTI SYSTEM AND ITS RESPONSE**
a) Verification of linearity, time invariance, stability properties of a given system b) Computation of impulse, step, sinusoidal response of a given linear time invariant system using MATLAB	
Exp. 8	**AMPLITUDE MODULATION AND DEMODULATION**
Generation of amplitude modulation and demodulation using MATLAB	
Exp. 9	**BALANCED MODULATOR AND SYNCHRONOUS DETECTOR**
Generation of double side band suppressed carrier modulation and demodulation using MATLAB	
Exp. 10	**SINGLE SIDE BAND MODULATION AND DEMODULATION**
Generation of single side band suppressed carrier modulation and demodulation using hardware and MATLAB	
Exp. 11	**FREQUENCY MODULATION AND DEMODULATION**
Generation of frequency modulation and demodulation using MATLAB	
Exp. 12	**GENERATION OF DOUBLE SIDE BAND SUPPRESSED**
Generation of double side band suppressed modulation using MATLAB.	

Reference Books:

1. B.P. Lathi, “Signals, Systems and Communications”, BS Publications, 5th Edition, 2009.
2. S.S.Haykin, “Communication Systems”, Wiley Eastern, 2nd Edition, 2006.
3. Taub, Schilling, “Principles of Communication Systems”, Tata McGraw-Hill, 4th edition, 2013.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate knowledge on modulation, demodulation, SSB, DSBSC, FM, etc.

CO2: Analyze the functionality of generation and degeneration of modulation techniques.

CO3: Design the circuits or develop the program for modulation and demodulation techniques DSBSC, SSB, FM, etc.

CO4: Investigate and analyze modulation and demodulation techniques DSBSC, SSB, FM, etc.

CO5: Follow ethical principles in analyzing and implementing various base band and band pass modulation techniques.

CO6: Do experiments effectively as an individual and as a member in a group.

CO7: Communicate verbally and in written form, the understandings about the experiments.

CO8: Continue updating their skill related to communication for various applications during their life time.

SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS

HARDWARE: Desktop Computer Systems 18 Nos

SOFTWARE : MATLAB

LIST OF EQUIPMENT REQUIRED

S. No	Name of the Equipment	Range
1	Cathode ray oscilloscope	0-25
2	RF generator	0-300 MHz
3	Function generator	0-1 MHz
4	Function generator	0-2 MHz
5	Amplitude modulation and demodulation kit	--
6	Frequency modulation and demodulation kit	--
7	Single side band & suppressed carrier kit	--
8	Balanced modulator kit	--
9	Double side band and suppressed carrier kit	--
10	Pre-emphasis and de-emphasis kit	--
11	Time division multiplexing and demultiplexing kit	--
12	Frequency division multiplexing and demultiplexing kit	--
13	Synchronous detector kit	-
14	Characteristics of mixer kit	-
15	Frequency Synthesizer kit	-
16	Phase locked loop kit	-
17	Automatic gain control kit	
18	Digital multimeter	0-20V/ 0-200mA/10 Ω -
19	Spectrum analyzer	0-500 MHz

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	3		-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO	**3**	**3**	**3**	**3**	-	-	-	**3**	**3**	**3**	-	**3**	3	3

<table>
<tr><th colspan="10">BASIC SIMULATION & ELECTRICAL ENGINEERING LABORATORY</th></tr>
<tr><td colspan="10">B.Tech II Year I Semester</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>20CA04306</td><td>Core</td><td>0</td><td>0</td><td>3</td><td>1.5</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 48</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

The course should enable the students to:

1. To apply knowledge of mathematics for the analysis and processing of signals and to generate various continuous and discrete time signals using MATLAB tool.
2. To analyze a continuous time LTI/LTV systems using convolution.
3. An ability to design and conduct experiments on transform for any given signals.
4. Evaluate losses and determine the efficiency of DC machines.
5. Determine the voltage regulation, efficiency in transformers.
6. Determine performance characteristics of Motor

BASIC SIMULATION - LIST OF EXPERIMENTS

Exp. 1	Basic operations on Matrices.
Exp. 2	Generation of various signals and sequences such as unit impulse, unit step, triangular, sawtooth, sinusoidal and sinc.
Exp. 3	Operations on signals and sequences such as addition, multiplication, scaling, shifting, folding.
Exp. 4	Verification of linearity and time invariance property of a given continuous/discrete system.
Exp. 5	Finding the Fourier Transforms of given signal and plotting its magnitude and phase spectrum.
Exp. 6	Waveform synthesis using Laplace Transform

ELECTRICAL ENGINEERING- LIST OF EXPERIMENTS

Exp. 1	Open Circuit Characteristics of DC Shunt Generator
Exp. 2	Load Test on Dc Shunt Generator
Exp. 3	No Load Test on DC Shunt Machine (Swinburne’s Test)
Exp. 4	Brake Test on DC Shunt Motor
Exp. 5	OC and SC Test on Single Phase Transformer

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the basic knowledge on the fundamental concepts of DC Generators, Motors, transformers and MATLAB programs.

CO2: Analyze the DC Generators, transformers, Motors and MATLAB programs on signals analysis.

CO3: Develop a MATLAB program to analyse various systems with different signals.

CO4: Investigate and analyze different Tests on DC Generators, Motors, transformers and MATLAB programs on signal analysis.

CO5: Follow the ethical values in connecting the circuit and Developing a MATLAB program

CO6: Do experiments effectively as an individual and as a member in a group.

CO7: Communicate verbally and in written form, the understandings about the experiments.

CO8: Continue updating their analysis and skills related to various machines and programs based on application during their life time.

LIST OF EQUIPMENT REQUIRED FOR A BATCH

HARDWARE	Desktop Computer Systems 36 Nos
SOFTWARE	MATLAB

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-		3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-		-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-		-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

<table>
<tr><th colspan="10">ENVIRONMENTAL SCIENCE</th></tr>
<tr><td colspan="10">B.Tech II Year I Semester</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">20CA51201</td><td rowspan="2">Mandatory Course</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Contact Classes:32</td><td colspan="2">Tutorial Classes: Nil</td><td colspan="3">Practical Classes: Nil</td><td colspan="3">Total Classes: 32</td></tr>
</table>

COURSE OBJECTIVES:

1. To make the students to get awareness on environment, to understand the importance of protect in natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers.
2. To understand the impacts of developmental activities and mitigation measures along with the environmental policies and regulations.

UNIT-I	**NATURAL RESOURCES**	**Classes:7**

Definition, Scope and Importance of Environment – Need for Public Awareness. Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies –Timber extraction – Mining, dams and other effects on forest and tribal people –Water resources –Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams –benefits and problems – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, case studies. – Energy resources.

UNIT-II	**ECOSYSTEMS**	**Classes:7**

Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem — Food chains, food webs and ecological pyramids Ecological succession– Introduction, types, characteristic features, structure and function of the following ecosystem a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems**(**Pond, River, Oceans**).**

UNIT-III	**BIODIVERSITY AND ITS CONSERVATION**	**Classes:6**

Introduction, Definition, genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity, consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity, habitat loss, poaching of wildlife, man-wildlife conflicts– Conservation of biodiversity In-situ and Ex-situ conservation of biodiversity.

UNIT-IV	**ENVIRONMENTAL POLLUTION**	**Classes-6**

Definition, Cause, effects and control measures of:
a. Air Pollution, b. Water pollution, c. Soil pollution, d. Marine pollution, e. Noise pollution,
f. Thermal pollution, d. Nuclear hazards.
Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.
Climate change: global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.

UNIT-V	**HUMAN POPULATION AND SOCIAL ISSUES IN THE ENVIRONMENT**	**Classes:6**

(A) HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Programmes – Environment and human health – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

(B) SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions. Environment Protection Act – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

FIELD WORK: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site- Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Text Books:

1. Text Book of Environmental Studies for Undergraduate Course, Erach Bharucha, Universities. Press Pvt Ltd, Hyderabad. 2nd Edition 2013.
2. Environmental Studies by Kaushik, New Age Publishers.
3. Environmental Chemistry Paperback – 1 January 2014. by B.K. Sharma.
4. Environmental Chemistry. Author, A. K. De. Edition, 8. Publisher, New Age International (P) Limited, Publishers, 2017.

Reference Books:

1. Environmental Studies by Rajagopalan, Oxford Publishers.
2. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela Printice hall of India Private limited.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Exhibits the knowledge on the required information on various natural resources that will clarify modern environmental concepts like equitable use of natural resources, more sustainable living styles etc.

CO2: Analyze various ecosystem problems and will change their approach to perceive one's own environmental issues based on observation and self learning.

CO3: Enrich the **knowledge** on biodiversity that make them conversant with concern for their environment triggering pro-environmental action like practicing daily activities to protect it.

CO4: Exhibits the knowledge on the various pollutions, waste management and climatic change thereby suggesting effective measures in containing them.

CO5: Summarize the environmental sciences for better exposure to safeguarding the same by offering proactive solutions to various socio-economic and other environmental problems associated with it.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	2	-	-	-	2	2	2	-	2	-	-
CO	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**2**	**-**	**2**	**-**	**-**

MATHEMATICS-IV								
B.Tech II Year II Semester								
Course code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
20CA54401	**Foundation**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**TOTAL**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes:48	**Tutorial Classes: Nil**		**Practical Classes: Nil**			**Total Classes:48**		

COURSE OBJECTIVES:

The course should enable the students to :

1. Use various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

UNIT-I	**SOLUTION OF ALGEBRAIC & TRANSCENDENTAL EQUATIONS**	**Classes:10**

Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method- System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.

UNIT-II	**INTERPOLATION**	**Classes:10**

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's interpolation formulae. Gauss forward and backward formula.

UNIT-III	**NUMERICAL INTEGRATION & SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**	**Classes:09**

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.

UNIT-IV	**FOURIER TRANSFORMS**	**Classes:10**

Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem.

UNIT-V	**Z -TRANSFORMS**	**Classes:09**

Z – transforms, inverse Z– transforms, damping rule, shifting rule, initial and final value theorems. Convolution theorem (without proof), solution of difference equations by Z– transforms.

Text Books:

1. B.S.Grewal, "Higher Engineering Mathematics", KHANNA Publishers, 43rd edition
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 10th edition.

Reference Books:

1. B.V.Ramana, "Higher Engineering Mathematics", Mc Graw-Hill Publishing company,6th reprint,2008,
2. Numerical methods By P. Kandasamy , K.Thilagavathy, K. Gunavathuy: S. Chand&company Ltd,2008.
3. Mathematical Methods By Dr T.K.V. Iyengar,Dr. B.Krishna Gandhi, S.Ranganatham and Dr.M.V.S.S.N.Prasad, S. Chand& company,7th revised edition, 2012.

Web References:

1. https://www.efunda.com/math/math_home/math.cfm
2. https://www.ocw.mit.edu/resources/#mathematics.

E-Text Books:

1. https://www.e-booksdirectory.com/detais.php?ebook=10166.
2. https://www.e-booksdirectory.com/details.php?ebook=7400re

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: **Demonstrate** numerical methods to solve algebraic and transcendental equations by various mathematical methods.
CO2: **Demonstrate and analyze** interpolating polynomials using interpolation formulae.
CO3: **Apply the knowledge** in higher order linear differential equations and develop analytical skills in solving problems involving higher order non-homogeneous linear differential equations.
CO4: **Demonstrate** and **analyze** Fourier Transform pairs for different types of signals with their properties, which can be used in communications and signal and image processing and data processing
CO5: **Exhibit the knowledge** on Z-transforms with their properties and develop analytical skills in solving problems involving initial value problems for differential equations using z-transform.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	3	1
CO	**3**	**3**	**2**	**2**	-	-	-	-	-	-	-	**1**	3	1

ANALOG ELECTRONIC CIRCUITS

B.Tech II Year II Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
20CA04401	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

COURSE OBJECTIVES:

The course should enable the students to :

1. To perform analysis of FET and BJT amplifiers at low & high frequencies, cascade and Darlington amplifiers.
2. To familiarize with the feedback concept in amplifiers and stability issues.
3. To perform analysis of Oscillators, Power and Tuned amplifiers.
4. To familiarize with the operation and characteristics of multivibrators, time base generators and sweep circuits.

UNIT-I — SINGLE STAGE AND MULTISTAGE AMPLIFIERS — Classes: 10

Classification of amplifiers, Various types of distortions in amplifiers, Analysis of CB, CE and CC transistor amplifiers circuit using simplified h-parameter model, Millers theorem and its dual, Design of Single stage RC coupled amplifier using BJT, Low frequency response of BJT amplifier, Effect of coupling and bypass capacitor.

Multistage amplifiers: Different coupling schemes used in amplifiers, RC coupled amplifiers, Transformer coupled amplifiers and Direct coupled amplifiers, Cascode amplifier, Analysis of Cascaded RC coupled amplifiers, Darlington pair amplifier, Analysis of Multi-stage CS and CD amplifiers using FET.

UNIT-II — HIGH FREQUENCY RESPONSE OF TRANSISTOR — Classes: 08

The hybrid-π Common Emitter transistor model, Hybrid-π conductance and Hybrid-π capacitances, Common Emitter short circuit current gain, Current gain with resistive load, α and β cut-off frequencies, Gain Bandwidth product, Emitter follower at high frequencies, Analysis of CS and CD amplifiers at high frequencies.

UNIT-III — FEEDBACK AMPLIFIERS AND OSCILLATORS — Classes: 10

Feedback amplifiers: Concept of feedback, Classification of feedback amplifiers, General characteristics of negative feedback amplifiers, Analysis of voltage series, voltage shunt, current series and current shunt feedback configurations.

Oscillators: Classification of Oscillators, Conditions for oscillations, Generalized analysis of LC oscillators, Hartley and Colpitt's oscillators, RC phase shift oscillator, Wien bridge and Crystal oscillators, Frequency and Amplitude stability of oscillators.

UNIT-IV — LARGE SIGNAL AND TUNED AMPLIFIERS — Classes: 09

LARGE SIGNAL AMPLIFIERS: Class A large signal amplifier, Transformer coupled Class A audio power amplifiers, Efficiency of Class A amplifier, Class B amplifier, Class B push-pull amplifier, Complementary symmetry Class B push-pull amplifier, Efficiency of Class B amplifier, Phase inverters, Thermal stability and Heat sinks.

TUNED AMPLIFIERS: Series and Parallel resonant circuits, Q - factor, Small Signal Tuned amplifiers, Effect of cascading Single and Double Tuned amplifiers on bandwidth, Staggered Tuned amplifiers, and Stability of Tuned amplifiers.

UNIT-V — MULTIVIBRATORS AND TIME BASE GENERATORS — Classes: 08

MULTIVIBRATORS: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors.

TIME BASE GENERATORS: General features of a Time base Signal, Methods of Generating Time Base Waveform, Transistor Miller Time Base generator, Transistor Bootstrap Time Base Generator, UJT Sawtooth generator.

Text Books:

1. Jacob Millman, Christor C Halkias, "Integrated Electronics", Tata McGraw Hill, 1st Edition, 2008.
2. Sedra A.S., K.C. Smith, "Micro Electronic Circuits", Oxford University Press, 6th Edition, 2013.
3. Donald A Neamen, "Electronic Circuits Analysis and Design", Tata McGraw Hill, 3rd Edition, 2007.

Reference Books:

1. David A. Bell "Electronic Devices & Circuits" 5th Edition, Oxford university press, 7th Edition, 2009.
2. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuits Theory", Pearson education, 9th Edition, 2008.
3. S.Salivahana, N. Suresh kumar, "Electronic circuit analysis", McGraw Hill education, 1st Edition, 2011.
4. B.Razavi, "Fundamentals of Micro electronics", Wiley.

Web References:

1. http://www.igniteengineers.com
2. http://www.ocw.nthu.edu.tw
3. http://www.uotechnology.edu.iq

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: **Demonstrate** the concept of single stage and multistage amplifiers and **analyze** various parameters using frequency response of transistor in CE configuration.

CO2: Demonstrate the hybrid-Π model on CE configuration of a transistor to formulate the gain, bandwidth and gain bandwidth product and Analyze its frequency response at higher frequencies.

CO3: Analyze the concept of feedback in amplifiers using negative feedback and frequency of oscillators for audio and radio frequency ranges.

CO4: Demonstrate and Analyze various power and tuned amplifiers to measure the efficiency and formulate the Q-factor and Bandwidth.

CO5: Able to Identify appropriate Multivibrator and Time base circuit based on the application in display devices.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

DIGITAL COMMUNICATIONS									
B.Tech II Year II Semester									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**			
20CA04402	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**	
		3	**0**	**0**	**3**	**30**	**70**	**100**	
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**			

COURSE OBJECTIVES:

1. Understand different pulse digital modulation techniques and their comparison
2. Familiarize various digital modulation techniques and calculation of their error probabilities
3. To discuss Inter Symbol Interference problem in digital communication and to derive the Nyquist Criteria for zero ISI in data transmission.
4. To discuss about principles of block codes and convolution codes.

UNIT-I	**PULSE DIGITAL MODULATION**	**Classes: 10**

Pulse Digital Modulation: Introduction, PCM Generation and Reconstruction, Line codes, Quantization error, Companding in PCM systems. Differential PCM systems (DPCM). Delta modulation, its draw backs, adaptive delta modulation, comparison of PCM and DM systems, noise in PCM and DM systems.

UNIT-II	**BAND LIMITED CHANNELS**	**Classes: 10**

Pulse Shaping: Inter-symbol Interference (ISI), Nyquist's criterion for distortion less baseband binary transmission, Ideal Nyquist channel, Raised cosine filter & its spectrum, Correlative coding – Duo binary & Modified duo binary signaling schemes, Eye diagrams.

UNIT-III	**SIGNAL SPACE ANALYSIS**	**Classes: 10**

Introduction, Geometric representation of signals, Gram-Schmidt orthogonalization procedure, Conversion of the Continuous AWGN channel into a vector channel, Coherent detection of signals in noise, Correlation receiver, Equivalence of correlation and Matched filter receivers.

UNIT-IV	**PASS BAND DATA TRANSMISSION**	**Classes: 09**

Introduction, Passband transmission model, Binary phase shift keying (BPSK), Quadrature shift keying (QPSK), Binary Frequency shift keying (BFSK), Probability of error for PSK, FSK and QPSK, Non-coherent orthogonal modulation schemes -Differential PSK, Binary FSK, Comparison of all the above schemes.

UNIT-V	**LINEAR BLOCK CODES AND CONVOLUTION CODES**	**Classes: 09**

Linear Block Codes: Introduction to Error control coding, Matrix Description of linear block codes, error detection and correction capabilities of linear block codes, Hamming Code, Binary cyclic codes, algebraic structure, encoding, syndrome calculation and decoding, Convolution codes: Introduction, Encoding of Convolutional Codes, Time domain approach, Transform domain approach, General approach, State, Tree and Trellis Diagram, Decoding using viterbi algorithm

Text Books:

1. Simon Haykin, "Communication Systems," Wiley India Edition, 4th Edition, 2011.
2. B.P. Lathi & Zhi Ding, "Modern Digital & Analog Communication Systems", Oxford University Press, International 4th edition, 2010.

Reference Books:

1. Sam Shanmugam, "Digital and Analog Communication Systems", John Wiley, 2005.
2. A. Bruce Carlson, & Paul B. Crilly, "Communication Systems – An Introduction to Signals & Noise in Electrical Communication", McGraw-Hill InternationalEdition,5th Edition, 2010
3. Bernard Sklar, "Digital Communications", Prentice-Hall PTR, 2nd edition, 2001.
4. Herbert Taub& Donald L Schilling, "Principles of Communication Systems", Tata McGraw-Hill, 3rd Edition, 2009.
5. J. G. Proakis, M Salehi, Gerhard Bauch, "Modern Communication Systems UsingMATLAB," CENGAGE, 3rd Edition, 2013.

Web References:
1. http://nptel.ac.in/courses/117101051/ 2. https://ocw.mit.edu/courses/electrical.../6...digital-communications.../lecture-notes 2. https://everythingvtu.wordpress.com

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate **knowledge** on difference between analog and digital communication system, **Analyze** the performance of base band digital modulation techniques and **Formulate** the SNR for PCM & DM systems.

CO2: **Demonstrate** the principle of multiplexing & base band digital modulation system, **Analyze** probability of error performance and **Design** digital communication systems.

CO3: **Demonstrate** the basics of information theory **analyze** the mutual information & channel capacity using entropy and formulate the transmission efficiency for Source encoding techniques.

CO4: **Analyze** and compare the Band pass digital modulation techniques, **design** the constellation diagrams and calculate/formulate the probability error of all digital modulation techniques.

CO5: **Apply** the basic concepts to know the difference between source coding, channel coding techniques such as block, cyclic and convolutional codes in the **analysis and design** of digital communication systems.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	-	2	-	-	-	-	-	-	-	-	2	-
CO4	3	2	2	2	-	-	-	-	-	-	-	-	2	-
CO5	3	2	2	2	-	-	-	-	-	-	-	-	2	-
CO	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**

ELECTROMAGNETIC & TRANSMISSION LINES

B.Tech II Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
20CA04403	Core	3	0	0	3	30	70	100
Contact Classes:48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

COURSE OBJECTIVES:

The course should enable the students to :

1. To introduce fundamentals of static and time varying electromagnetic fields.
2. To teach problem solving in Electromagnetic fields using vector calculus.
3. To demonstrate wave concept with the help of Maxwell's equations.
4. To introduce concepts of polarization and fundamental theory of electromagnetic waves in transmission lines and their practical applications.
5. To analyze reflection and refraction of electromagnetic waves propagated in normal and oblique incidences.

UNIT-I	ELECTROSTATICS	Classes: 10

Vector Analysis: Coordinate systems and transformation-Cartesian, Cylindrical and Spherical coordinates.
Vector Calculus: Differential length area and volume, line surface and volume integrals, del operator, gradient, divergent and curl operations.
Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Divergence Theorem, Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.

UNIT-II	MAGNETOSTATICS &MAXWELL'S EQUATIONS	Classes: 09

Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Magnetic dipole, Ampere's Force Law, Inductances and Magnetic Energy, Illustrative Problems.
Faraday's Law and Transformer emf, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's equations for time varying fields, Maxwell's Equations in Different Final Forms and Word Statements, Illustrative Problems.

UNIT-III	ELECTROMAGNETIC WAVE CHARACTERISTICS-I	Classes: 10

Boundary Conditions of Electromagnetic fields: Dielectric-Dielectric and Dielectric-Conductor Interfaces, Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations between E & H, Sinusoidal Variations, Wave Propagation in Lossless
and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization, Illustrative Problems.

UNIT-IV	ELECTROMAGNETIC WAVE CHARACTERISTICS-II	Classes: 09

Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector, and Poynting Theorem – Applications, Power Loss in a Plane Conductor, Illustrative Problems.

UNIT-V	TRANSMISSION LINES	Classes: 10

Introduction, Transmission line parameters, Transmission line equivalent circuit, Transmission line equations and their solutions in their phasor form, input impedance, standing wave ratio, Transmission of finite length-half wave, quarter wave transmission line, Smith chart, graphical analysis of transmission lines using Smith chart, stub matching- single and double stub matching, Illustrative Problems.

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics", 4th edition. Oxford Univ. Press, 2008.
2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics", 7th edition, TMH, 2006.

Reference Books:

1. E.C. Jordan and K.G. Balmain, “Electromagnetic Waves and Radiating Systems”, 2nd Edition, PHI, 2000.
2. John D. Krauss, “Electromagnetics”, 4th Edition, McGraw- Hill publication1999.
3. Electromagnetics, Schaum’s outline series, 2nd Edition, Tata McGraw-Hill publications, 2006.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: **Demonstrate** different coordinate systems and **Analyze** the fundamental laws of electrostatic fields to **Solve** the Field intensity and Flux density of various charge distributions and **design** the models of capacitors.

CO2: **Demonstrate** Biot-Savart’s law and Ampere’s Circuit law to determine forces due to magnetic fields and **Formulate** the energy relations for electric and magnetic fields and **apply** the Maxwell’s equations to time varying fields.

CO3: **Demonstrate and analyze** the wave equations for good conductors and good dielectrics and formulate the Characteristics for several practical media of interest.

CO4: **Analyze** the polarization features, reflection and transmission coefficients for propagation, distinguish between Brewster and Critical Angles, by acquiring the knowledge on their applications.

CO5: **Exhibit the knowledge** on transmission lines and **analyze** them under Loss less / Distortion less condition to get minimum attenuation by using Smith chart.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

CONTROL SYSTEMS

<table>
<tr><td colspan="9">B.Tech II Year II Semester</td></tr>
<tr><td>Course code</td><td>Category</td><td colspan="3">Hours/week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20CA02401</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes:48</td><td colspan="2">Tutorial Classes: Nil</td><td colspan="3">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

COURSE OBJECTIVES:

The course should enable the students to:

1. Organize modeling and analysis of electrical and mechanical systems.
2. Analyze control systems by block diagrams and signal flow graph technique.
3. Demonstrate the analytical and graphical techniques to study the stability.
4. Illustrate the frequency domain and state space analysis

UNIT-I	INTRODUCTION AND MODELING OF PHYSICAL SYSTEMS	Classes: 10

Control systems: Introduction, open loop and closed loop systems, examples, mathematical models concept of transfer function, translational and rotational mechanical systems, electrical systems, force voltage and force current analogy.

UNIT-II	REDUCTION TECHNIQUES AND TIME RESPONSE ANALYSIS	Classes: 10

Block Diagrams: Block diagram representation of various systems, block diagram algebra, signal flow graph, Mason’s gain formula

Time response analysis: Standard test signals, shifted unit step, ramp and impulse signals, shifting theorem, convolution integral, impulse response, unit step response of first and second order systems, time domain specifications, steady state errors and error constants.

UNIT-III	CONCEPT OF STABILITY AND ROOT LOCUS TECHNIQUE	Classes: 10

Concept of stability: Necessary and sufficient conditions for stability, Routh’s and Routh Hurwitz stability criterions and limitations. Root locus technique: Introduction, root locus concept, construction of root loci, graphical determination of ‘k’ for specified damping ratio, relative stability, effect of adding zeros and poles on stability.

UNIT-IV	FREQUENCY DOMAIN ANALYSIS	Classes: 09

Frequency domain analysis: Introduction, frequency domain specifications, stability analysis from Bode plot, Polar plot, Nyquist plot, calculation of gain margin and phase margin, determination of transfer function from Bode plot.

UNIT-V	STATE SPACE ANALYSIS	Classes: 09

State Space Analysis: Concept of state, state variables and state model, derivation of state models from block diagrams, Diagonalization, solving the time invariant state equations, state transition matrix and properties, concept of controllability and Observability.

Text Books:

1. I J Nagrath, M Gopal, “Control Systems Engineering”, New Age International Publications, 3rd Edition, 2007.
2. K Ogata, “Modern Control Engineering”, Prentice Hall, 4th Edition, 2009.
3. N C Jagan, “Control Systems”, B S Publications, 1st Edition, 2007.

Reference Books:

1. A Anand Kumar, “Control Systems”, PHI Learning, 1st Edition, 2007.
2. S Palani, “Control Systems Engineering”, Tata McGraw Hill Publications, 1st Edition, 2001.
3. N K Sinha, “Control Systems”, New Age International Publishers, 1st Edition, 2002.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: **Demonstrate** the basic concepts of Control Systems and **analyze** block diagram reduction technique and Mason's gain formula to find the transfer function of a system.

CO2: **Demonstrate** the different standard test input signals for the performance analysis of second order systems and steady state errors and **analyze** the time domain analysis to predict transient response specifications of the system for system stability.

CO3: **Analyze** and **design** the time response of the system for system stability using R-H criterion and root locus techniques.

CO4: **Analyze** and **Design** the stability of second order systems using frequency domain concept to increase the steady state of the system.

CO5: **Exhibit the knowledge** on Controllability and observability **and analyze** the stability of second order system and state space analysis.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**3**	**2.5**	**2.66**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

ADVANCE COMMUNICATIVE ENGLISH LABORATORY

B.Tech II Year II Semester

Course code	Category	Hours/week			Credits	Maximum Marks		
20CA52401	Foundation	L	T	P	C	CIA	SEE	TOTAL
		0	0	3	1.5	30	70	100
Contact Classes:Nil	Tutorial Classes: Nil		Practical Classes:48			Total Classes:48		

OBJECTIVES:

The course should enable the students to :

1. The course allows the students to use multi-media instruction for language development
2. To improve the students' fluency in English and enable them to listen the English spoken at normal conversational speed by
   educated English speakers and respond appropriately in different socio-cultural and
   Professional contexts.
3. Further, they would be required to communicate their ideas relevantly and coherently in writing and placing MNCs.

List of Topics

1. Syllables, stress & Intonation
2. Listening Skills
3. Report writing
4. Book review
5. Film review
6. Grooming
7. Non-verbal skills(Body Language)
8. Power Point Presentation(Ppt)
9. Group Discussion II
10. Time management
11. Stress management
12. Problem solving & Decision Making
13. Corporate Etiquettes
14. SWOT Analysis
15. Interview Skills II

Minimum Requirements for SOFT SKILLS Lab:

Soft Skills Laboratory shall have the following infra-structural facilities to accommodate at least 60 students in the lab:

1. Spacious room with appropriate acoustics.
2. Round Tables with movable chairs
3. Audio-visual aids
4. LCD Projector
5. Public Address system
6. P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
7. T. V, a digital stereo & Camcorder
8. Headphones of High quality

Suggested Software:

1. **Walden Info tech: Advanced English Communication Skills Lab**
2. **K-VAN SOLUTIONS-Advanced English Language Communication Skills lab**
3. **DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.**
4. **TOEFL & GRE**(KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
5. **Train2success.com**

References:

1. **Objective English for Competitive Exams**, Hari Mohana Prasad, 4th edition, Tata Mc Graw Hill.
2. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, O U Press 3rdEdn. 2015.
3. **Essay Writing for Exams, Audrone Raskauskiene, Irena Ragaisience & Ramute Zemaitience, OUP, 2016**
4. **Soft Skills for Everyone,** Butterfield Jeff, Cengage Publications, 2011.
5. **Management Shapers Series** by Universities Press (India) Pvt. Ltd., Himayatnagar, Hyderabad 2008.
6. **Campus to Corporate,** Gangadhar Joshi, Sage Publications, 2015
7. **Communicative English,** E Suresh Kumar & P. Sreehari, Orient Black swan, 2009.
8. **English for Success in Competitive Exams,** Philip Sunil Solomon OUP, 2015

Outcomes:

On successful completion of this course, the students will be able to:

CO1: Demonstrate the skill to write in English without grammatical error, accomplishment in tone and pitch of voice in students communication.

CO2: Relate the importance of speaking with effective communication through academic and professional presentations by applying skills.

CO3: Formulate and exhibit acceptable etiquette essential in social and professional settings.

CO4: Create awareness on Time and Stress management in order to improve Problem solving technique, Enhanced job prospects and better sustainability skills.

CO5: Choose appropriate methods of learning advanced vocabulary and grammar competently for use in real life context.

CO6: Follow ethical principles in listening, writing, presenting and communicative ability towards jobs.

CO7: Do experiments effectively as an individual and as a member in a group.

CO8: Communicate verbally and in written form, the understandings about the experiments.

CO9: Continue updating their written communication skills among learners for both academic and professional purposes during their life time.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
C09	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

ANALOG ELECTRONIC CIRCUITS LABORATORY								
B.Tech II Year II Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
20CA04404	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	**0**	**3**	**1.5**	**30**	**70**	**100**
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 48**				**Total Classes: 48**		

COURSE OBJECTIVES:

The course should enable the students to:

1. Operate electronic test equipment and hardware/software tools to characterize the behaviour of devices and circuits.
2. Design and construct amplifier circuits.
3. Design and Implement Multivibrators using Transistors.
4. Design negative feedback amplifier circuits and oscillators.

LIST OF EXPERIMENTS (ANY TEN EXPERIMENTS)

1	Cascade Amplifier.
2	Darlington Amplifier.
3	Voltage Series and Voltage Shunt negative feedback Amplifier.
4	RC phase shift Oscillators.
5	Colpitts and Hartley Oscillators.
6	Class A Power amplifier.
7	Class B Complementary symmetry Power amplifier.
8	Single Tuned Amplifier.
9	Astable Multivibrator.
10	Schmitt Trigger.
11	Bootstrap sweep generator.
12	UJT saw tooth generator.

COURSE OUTCOMES:

CO1: **Demonstrate** the concepts of Small, large signal amplifiers and oscillators.
CO2: **Analyze** various amplifiers and oscillators in hardware and verify the results through simulation.
CO3: **Design** and test various amplifiers and oscillators results through simulation.
CO4: **Conduct investigation** and test the functionality on implementation of amplifiers and oscillators
CO5: **Select appropriate tools** as Multisim PSPICE simulation package tool and procedure to simulate and implement amplifiers and oscillators.
CO6: Follow **ethical** principles in designing, simulating and implementing circuits.
CO7: Do experiments effectively as an **individual** and as a member in a **group**.
CO8: **Communicate** verbally and in written form, the understandings about the experiments.
CO9: Continue updating their skill related to implementation for various application during their life time.

Equipment required for Laboratory:

Software:

i. Multisim/ Pspice/Equivalent Licensed simulation software tool.
ii. Computer Systems with required specifications.

Hardware:

1. Regulated Power supplies.
2. Analog/Digital Storage Oscilloscopes.
3. Analog/Digital Function Generators.
4. Digital Multimeters.
5. Decade Résistance Boxes/Rheostats.
6. Decade Capacitance Boxes.
7. Ammeters and Voltmeters (Analog or Digital).
8. Active & Passive Electronic Components.

9. Connecting Wires.
10. CRO Probes etc.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	3	
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-		3	-	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-		-	3	-	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

DIGITAL COMMUNICATIONS LABORATORY									
B.Tech II Year II Semester									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
20CA04405	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	**0**	**3**	**1.5**	**30**	**70**	**100**
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 48**				**Total Classes:48**		

COURSE OBJECTIVES:

1. Understand the sampling theorem for different rates.
2. Experience real time behavior of different digital modulation schemes.
3. Understand the spectra of different digital modulation schemes

LIST OF EXPERIMENTS	
MINIMUM OF TEN EXPERIMENTS TO BE CONDUCTED (FIVE FROM EACH PART)	
EXPERIMENTS CAN BE PERFORMED USING HARDWARE	
1	**TIME DIVISION MULTIPLEXING.**
To design Time Division Multiplexing using hard ware.	
2	**PULSE CODE MODULATION.**
To design Pulse Code Modulation using hard ware.	
3	**DIFFERENTIAL PULSE CODE MODULATION.**
To design Differential Pulse Code Modulation using hard ware.	
4	**DELTA MODULATION.**
To design Delta Modulation using hard ware.	
5	**FREQUENCY SHIFT KEYING.**
To design Frequency Shift Keying using hard ware.	
6	**DIFFERENTIAL PHASE SHIFT KEYING.**
To design Differential Phase Shift keying using hard ware.	
EXPERIMENTS CAN BE PERFORMED USING SOFTWARE	
7	**SAMPLING THEOREM – VERIFICATION.**
To verify Sampling Theorem using MATLAB	
8	**PULSE CODE MODULATION.**
To verify Pulse Code Modulation using MATLAB	
9	**DIFFERENTIAL PULSE CODE MODULATION**.
To verify Differential Pulse Code Modulation using MATLAB	
10	**FREQUENCY SHIFT KEYING**.
To verify Frequency Shift Keying using MATLAB	
11	**PHASE SHIFT KEYING.**
To verify Phase Shift Keying using MATLAB	
12	**DIFFERENTIAL PHASE SHIFT KEYING.**
To verify Differential Phase Shift keying using MATLAB	

Reference Books:

1. John Proakis, “Digital Communications”, TMH, 2nd Edition1983.
2. B.P.Lathi, “Modern Analog and Digital Communication”, Oxford reprint, 3rd Edition,2004
3. Singh,Sapre, “Communication Systems Analog and Digital”, TMH, 2ndEdition

LIST OF EQUIPMENT REQUIRED

S. No	Name of the Equipment	Range
1	Regulated Power Supply	0-30V DC
2	CRO	0-20 MHz
3	Function Generator	0-1 MHZ
4	RF Generators (3 Nos)	0-1000 MHZ
5	Multimeters	---
6	Arbitrary Wave Form Generators	2 Nos
7	Licensed MATLAB Software	30 USERS

COURSE OUTCOMES:

After completion of the course the students will be

CO1: **Demonstrate** the basic theories of digital communication systems.

CO2: **Analyze** the performance of different modulation and demodulation techniques of digital communication systems.

CO3: **Design** and implement the practical circuit's different modulation and demodulation techniques of digital communication systems.

CO4: **Conduct investigation** and test the functionality on implementation of modulation and demodulation circuits.

CO5: Select **appropriate trainer tool kit** to analyze and implement various digital modulation techniques.

CO6: Follow **ethical** principles in designing, simulating and implementing circuits.

CO7: Do experiments effectively as an **individual** and as a member in a **group**.

CO8: **Communicate** verbally and in written form, the understandings about the experiments.

CO9: Continue updating their skill related to implementation for various application during their **life time.**

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-	-	-	3		3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	-	**3**	**3**	**3**

INTEGRATED CIRCUITS & APPLICATIONS

B. Tech III Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
20CA04501	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

Course Objectives:
The course should enable the students:

1. To apply the techniques for the design of comparators, instrumentation amplifier, integrator, differentiator, multivibrators, waveform generators,log and anti-log amplifiers.
2. To Analyze and design filters, timer, analog to digital and digital to analog Converters.
3. To Understand the functionality and characteristics of commercially available digital integrated circuits

UNIT-I	**INTEGRATED CIRCUITS**	**Classes: 10**

Integrated Circuits: Classification of integrated circuits, Package types and temperature ranges; **Differential Amplifier**: DC and AC analysis of Dual input Balanced output Configuration; Properties of differential amplifier configuration: Dual Input Unbalanced Output, Single Ended Input, Balanced/ Unbalanced Output; DC Coupling and Cascade Differential Amplifier Stages, Level translator.

Introduction to OP-Amps: Op-amp Block Diagram, ideal and practical Op-amp specifications, DC and AC characteristics, 741 op-amp & its features; Op-Amp parameters & Measurement: Input & Out put Off set voltages & currents, slew rate, CMRR, PSRR, drift. Introduction to dual op-amp TL082 as a general
purpose JFET input operational amplifier.

UNIT-II	**APPLICATIONS OF OP-AMPS USING IC741**	**Classes**: **9**

Linear applications of Op- Amps: Inverting and non-inverting amplifier, integrator, differentiator, instrumentation amplifier, AC amplifier;

Non-linear applications of Op-Amps: Comparators, multivibrators, triangular and square wave generators, non- linear function generation, log and anti log amplifiers. Analog multiplier, attenuators.

UNIT-III	**ACTIVE FILTERS AND WAVE SHAPING CIRCUITS**	**Classes: 9**

Wave Shaping Circuits : Clippers, Clampers
Passive Filter : RC Response
Active Filters: Classification of filters, 1^{st} order low pass and high pass filters, 2^{nd} order low pass, highpass, band pass, band reject and all pass filters.

UNIT-IV	**TIMERS**	**Classes: 10**

Timers: Introduction to 555 timer, functional diagram, mono-stable, astable operations and applications,Schmitt Trigger.
PLL: Introduction, block schematic, principles and description of individual blocks, 565 PLL. Application of PLL.

UNIT-V	**DATA CONVERTERS**	**Classes: 10**

Data Converters: Introduction, classification, need of data converters.
DAC Techniques: Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC,DAC characteristics.
ADC Techniques: Integrating, successive approximation, flash converters, A/D characteristics.

Text Books:

1. D. Roy Chowdhury, "Linear Integrated Circuits", New age International (p) Ltd, 2^{nd} Edition, 2003.
2. Ramakanth A. Gayakwad, "Op-Amps & linear ICs", PHI, 3^{rd} Edition, 2003.

Reference Books:

1. Salivahanan, "Linear Integrated Circuits and Applications", TMH, 1^{st} Edition, 2008.

Web References:

1. https://www.nptel.ac.in
2. https://www.svecw.edu.in
3. https://www.smartzworld.com

4. https://www.crectirupati.com

E-Text Books:

1. https://books.google.co.in/books?isbn=8122414702
2. https://books.google.co.in/books?isbn=013186389

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Apply the concept of operational amplifiers and formulate its DC and AC characteristics.

CO2: Apply the principle to construct an op-amp as for the design of comparators, instrumentation amplifier, integrator, differentiator, multivibrators, waveform generators, log, anti-log amplifiers, etc

CO3: Analyze and design various types of active filters and Passive filters using op-amp and formulate its characteristics.

CO4: Apply the knowledge on Timers, analyze the PLLs and design the multivibrators using IC555 timer.

CO5: Analyze and design analog and digital data converters for data processing applications.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	2	-	-	-	-	-	-	-	3	-
CO	**3**	**2.8**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

MICROPROCESSORS AND MICROCONTROLLERS

B.Tech III Year I Semester									
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum**		
20CA04502	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

Course Objectives:

The course should enable the students :

1. To understand the architecture of 8086 MICROPROCESSOR.
2. To learn various8086 Instruction set and Assembler Directives.
3. To learn basics of MSP430 design and programming.
4. To learn ports, RTC, ADC and its concepts.
5. To learn the basic interfaces of serial communication.

UNIT-I	INTRODUCTION	Classes: 10

Introduction to microprocessors, 8086 Architecture-Block Diagram, Pin Diagram, Register Organization, Flag Register, Timing and Control Signals, System Timing Diagrams, Memory Segmentation, Interrupt structure of 8086 and Interrupt Vector Table, Memory organization and memory banks accessing.

UNIT-II	INSTRUCTIONSET&PROGRAMMING	Classes: 10

Addressing Modes-Instruction Set of 8086, Assembler Directives- Macros and Procedures- Sorting, Multiplication, Division and multi byte arithmetic code conversion. String Manipulation instructions-Simple ALPs.

UNIT-III	INTRODUCTION TO MICROCONTROLLERS	Classes:10

Introduction to 8051, Block diagram, features and architecture, Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, MSP430x5xseries block diagram, Addressing modes, Instruction set Memory address space, on-chip peripherals (analog and digital), and Register sets. Sample embedded system on MSP430 microcontroller

UNIT-IV	I/OPORTS	Classes: 10

I/O ports pull up/down resistors concepts, Interrupts basics and applications, characteristics, block diagram. Watch dog timer, System clocks. Low Power aspects of MSP430: low power modes, Active vs Stand by current consumption, FRAM vs Flash for low power & reliability Timer & Real Time Clock (RTC), PWM control, timing generation and measurements. Analog interfacing and data acquisition: ADC and Comparator in MSP430, data transfer using DMA

UNIT-V	SERIALCOMMUNICATION	Classes: 08

Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and I2C). UART protocol, I2C protocol, SPI protocol. Implementing and programming UART, I2C, SPI Interface using MSP430, Interfacing external devices. Implementing Embedded Wi-Fi using CC3100

TextBooks:

1. "Microprocessor and Microcontrollers", N. Senthil Kumar, M. Saravanan, S. Jeevanathan, OxfordPublishers.1stEdition, 2010.
2. "The X86 Microprocessors, Architecture, Programming and Inerfacing" , Lyla B. Das, PearsonPublications,2010.
3. MSP430 microcontroller basics. John H.Davies, Newnes Publication, 1st Edition,2008.

Reference Books:

1. http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode
2. http://processors.wiki.ti.com/index.php/MSP430_16-Bit_Ultra-Low_Power_MCU_Training

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the architecture and different modes of operations of 8086 microprocessor and analyze their timing diagram.

CO2: Analyze different addressing modes and instructions of 8086, design and develop assembly language programs using software interrupts, subroutines and macros.

CO3: Exhibit the concepts of MSP430 family and their register set, addressing modes. CO4: Analyze the concepts of I/O ports, Low power aspects of MSP430. CO5: Design and Programming of serial communication Interface like UART, USB, SPI, and I2C using MSP430.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	1	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**2**	-	-	-	-	-	-	-	-	-	**3**	-

ANTENNAS & WAVE PROPAGATION

<table>
<tr><td colspan="11">B. Tech III Year I Semester</td></tr>
<tr><td rowspan="3">Course Code
20CA04503</td><td rowspan="3">Category
Core</td><td colspan="3">Hours /</td><td>Credit</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 48</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

Course Objectives:
The course should enable the students:

1. To be Proficient in the radiation phenomena associated with various types of antennas and understand basic terminology and concepts of antennas along with emphasis on their applications.
2. To analyze the electric and magnetic field emission from various basic antennas with mathematicalformulation of the analysis.
3. To explain radiation mechanism of different types of antennas and their usage in real time field.
4. To justify the propagation of the waves at different frequencies through different layers in the existinglayered free space environment structure.

UNIT-I	**ANTENNA BASICS & THIN WIRE ANTENNAS**	**Classes: 10**

Antenna Basics: Introduction, Basic antenna parameters- patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective height, Fields from oscillating dipole, Field Zones, Shape-Impedance considerations, Polarization – Linear, Elliptical, & Circular polarizations, Antenna temperature, Antenna impedance, Front–to-back ratio, Antenna theorems.
Thin Wire Antennas: Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipoles, Field Components, Radiated power, Radiation Resistance, Beam width, Natural current distributions, far fields and patterns of Thin Linear Center-fed Antennas of different lengths, Illustrative problems.

UNIT-II	**LOOP ANTENNAS AND ANTENNA ARRAYS**	**Classes: 10**

Loop Antennas: Introduction, small loop, Comparison of Far fields of small loop and short dipole, Radiation resistances and directivities of small and large loops.
Antenna Arrays: Point sources, definition, patterns; Arrays of 2 isotropic sources, different cases, Principle of pattern multiplication, Uniform linear arrays - Broadside arrays; End-fire arrays; EFA with increased directivity, Derivation of their characteristics and comparison; BSAs with non-uniform amplitude distributions, General considerations and Binomial arrays, Folded Dipoles and their characteristics, Arrays with parasitic elements, Yagi-Uda array, Helical antennas-Helical geometry, Helix modes, Practical design considerations for monofilar Helical antenna in axial and normal modes.

UNIT-III	**RADIO WAVE PROPAGATION**	**Classes: 10**

Introduction, definitions, general classifications, different Modes of Wave Propagation, Ground wave propagation- Introduction, plane earth reflections, space and surface waves, wave tilt, curved earth reflections, Space wave propagation- Introduction, field strength variation with distance and height, effect of earth's curvature, absorption, super refraction, duct propagation, scattering phenomena, tropospheric propagation, Sky wave propagation- Introduction, structure of ionosphere, refraction and reflection of sky waves by ionosphere, Ray path, critical frequency, MUF, LUF, OF, virtual height and skip distance, Relation between MUF and skip distance, Multi-hop propagation.

UNIT-IV	**VHF, UHF AND MICROWAVE ANTENNAS**	**Classes: 10**

Horn antennas: Types, Fermat's principle, optimum horns, design considerations of pyramidal horns, Illustrative problems.
Lens antennas: Introduction, types of lens antennas, geometry of metallic and Non-metallic dielectric lenses, zoning, tolerances, applications.
Slot & Microstrip antennas: Introduction, features, advantages and limitations, its pattern, Babinet's principle, impedance of slot antennas, Rectangular patch antennas- geometry and parameters, characteristics of microstrip antennas, Impact of different parameters on characteristics.

UNIT-V	**REFLECTOR ANTENNAS AND ANTENNA MEASUREMENTS**	**Classes: 8**

Reflector Antennas: Introduction, flat sheet and corner reflectors, Paraboloidal reflectors- Geometry, pattern characteristics, feed methods, Related features, Illustrative problems.

Antenna Measurements: Introduction, concepts, reciprocity near and far fields, sources of errors patterns to be measured, Pattern measurement arrangement, directivity measurement, Gain measurements- Comparison method, absolute and 3-antenna methods.

Text Books:

1. John D. Kraus, Ronald J. Marhefka, Ahmad S. Khan, "Antennas and Wave Propagation", TMH, 4th Edition, 2010.
2. C.A. Balanis, "Antenna Theory", John Wiley and Sons, 2nd Edition, 2001.

Reference Books:

1. E.C. Jordan, K.G. Balmain, "Electromagnetic Waves and Radiating Systems", PHI, 2nd Edition, 2000.
2. E.V.D. Glazier, H.R.L. Lamont, "Transmission and Propagation", Her Majesty's StationeryOffice, 1958.
3. F.E. Terman, "Electronic and Radio Engineering", McGraw-Hill, 4th Edition, 1955.
4. K.D. Prasad, Satya Prakashan, "Antennas and Wave Propagation", Tech India Publications, 1st Edition, 2001.

Web References:

1. http:// web.stanford.edu/class
2. http://www.electronicagroup.com
3. http://www.cpri.in/about-us/departmentsunits/library-and-information-centre/digital-library-links.html
4. http://nptel.ac.in/courses/antennas

E-Text Books:

1. http://www.ebookgalaxy.in/2016/01/antennas-and-wave-propagation-by-g-s-n.html#.WBGI7NJ97IU
2. https://www.jntubook.com/antennas-wave-propagation-textbook
3. http://117.55.241.6/library/E-Books/Antennas_mcgraw-hill_2nd_ed_1988-john_d_kraus.pdf

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Apply the concept of mechanism of radiation, analyze various types of antennas with field components and configure their current distributions.

CO2: Demonstrate the loop antennas and antenna arrays, analyze their characteristic parameters and design yagiuda and helical antenna for realtime applications .

CO3: Apply the concept of wave propagation theory and Analyze crictical frequency, MUF, Skip distance in various applications.

CO4: Exhibit the knowledge on High frequency Antennas, Analyze their characteristics and design with relavant parameters.

CO5: Demonstrate reflector antennas, identify the requirements and carry out the design with sutitable precautions and familiarize with the procedure to enable antenna measurements.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-		-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	2	-	-	-	-	-	-	3	2
CO3	2	1	2	-	-	2	2	-	-	-	-	-	2	2
CO4	3	2	2	-	-	-	-	-	-	-	-	-	2	-
CO5	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO	**2.8**	**2.4**	**1.8**	-	-	**2**	**2**	-	-	-	-	-	**2.4**	**2**

BIOMEDICAL INSTRUMENTATION
(PROFESSIONAL ELECTIVE-I)

B. Tech III Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
20CA04504	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

Course Objectives:

The course should enable the students:

1. To get the basic idea of measurements and the errors associated with measurement.
2. To know about the various types of transducers.
3. To understand the function of signal generators and analyzers.
4. To gain knowledge on functioning of the various measuring instruments, display devices and application on the biomedical devices.

UNIT-I MEDICAL INSTRUMENTATION **Classes: 11**

Amplifiers, high input impedance, active filters, timers ADC and DAC circuits electrodes and transducers, application in medicine.

UNIT-II BIOMEDICAL TRANSDUCERS & BIOELECTRODES **Classes: 10**

Bioelectrodes for ECG (EKG), EEG. EMG, study of ECG in detail as sample case biomedical transducers-pressure, temperature, humidity and moisture, transducers for respiratory measurements, blood pressure measurements (Mercury and Aneroid Types) Skin resistance measurements.

UNIT-III ANALYTICAL INSTRUMENTS **Classes: 09**

PH meters, Color meter, Bomb calorimeter, measurements of specific gravity, viscosity, Auto analysers, cell counters, UV- visible Spectrophotometers and infrared spectrophotometer, Flame photometers, Densitometers, Electrophoresis.

UNIT-IV BIOSENSORS **Classes: 09**

Electrochemical Biosensors (Enzyme-Based Biosensors, Immuno sensors, Microbial Sensors), Chemical Biosensors, Chemical Fibro sensors, Ion-Selective Field-Effect Transistor (ISFET).

UNIT-V MEMS and NEMS **Classes: 09**

MEMS - Microsystems (Introduction, Working Principles, micro sensors and actuators, Engineering design, fabrication and packaging), Scaling Laws in Miniaturization, Overview of Micro manufacturing. NEMS - Introduction, architecture - carbon nano tube electronics - modeling analysis and simulation - simulation of Actuators, FET, Pressure transducer. Quantum mechanics, Molecular Wires and Molecular Circuits.

Text Books:

1. "Handbook of Biomedical Engineering", R.S. Khandpur
2. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.

Reference Books:

1. Leslie Cromwell, Fred J. Weibell, Erich. AP feiffer", Biomedical Instrumentation and Measurements" second Edition published by PEARSON Education.
2. Marc Madou, Fundamentals of Microfabrication, CRC press 1997.
3. Stephen D. Senturia, Micro system Design, Kluwer Academic Publishers, 2001.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate knowledge on the functioning of Human Cell and analyze its electrical characteristics.

CO2: Exhibit the knowledge on cardiovascular measurement and analyze circulatory System of heart.

CO3: Demonstrate knowledge on pace makers and analyze different Defibrillators electrodes.

CO4:Demonstrate knowledge on electrical hazards that may occur during the usage of medical instruments and analyze safety equipment.

CO5:Demonstrate knowledge on Basic principles and analyze x-ray machine, x-ray computed topography (C.T. Scanner) and apply different recent tools for scan.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	1	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	1	3	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**-**	**1.5**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

VLSI DESIGN
(PROFESSIONAL ELECTIVE-I)

B. Tech III Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
20CA04505	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

Course Objectives:
The course should enable the students:

1. To understand the concepts of MOS devices for the fabrication of integrated chips.
2. To understand VLSI circuit design processes.
3. To understand basic circuit concepts and designing Arithmetic Building Blocks.
4. To have an overview of Low power VLSI.

UNIT-I	**INTRODUCTION TO MOS CHARACTERISTICS**	**Classes: 10**

Introduction: Basic steps of IC fabrication, PMOS, NMOS, CMOS & BiCMOS process technologies, MOS transistors - MOS transistor switches.
Basic Electrical Properties of MOS and BiCMOS Circuits: Working of MOS transistors – threshold voltage; MOS design equations: I_{ds}–V_{ds} relationships, Threshold Voltage, Body effect, Channel length modulation , g_m, g_{ds}, figure of merit ω_0; Pass transistor, NMOS Inverter, CMOS Inverter analysis and design, Various pull ups loads, Bi-CMOS Inverters.

UNIT-II	**VLSI CIRCUIT DESIGN PROCESSES VLSI DESIGN STYLES**	**Classes: 10**

Basic Circuit Concepts: Capacitance, resistance estimations- Sheet Resistance R_s, MOS Device Capacitances, routing Capacitance, Analytic Inverter Delays, Driving large Capacitive Loads, Fan-in and fan-out.
VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2µm CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

UNIT-III	**DESIGN AND IMPLEMENTATION STRATEGIES**	**Classes: 10**

Gate level Design: Logic gates and other complex gates, Switch logic: Pass Transistor, Transmission Gate, Tri-State Circuit, Alternate gate circuits: Pseudo NMOS Logic, Dynamic CMOS Logic, CMOS Domino Logic, Clocked CMOS Logic, DCVS Logic.
Physical Design: Floor-Planning, Placement, routing, Clock and Power routing.

UNIT-IV	**SUB SYSTEM DESIGN & STYLES**	**Classes: 09**

Subsystem Design: Shifters, Adders, ALUs, Multipliers, High Density Memory Elements.
VLSI Design styles: Standard Cells, FPGAs, CPLDs and Design Approach for Full-custom and Semi-custom devices.

UNIT- V	**VHDL SYNTHESIS AND TESTING**	**Classes: 09**

VHDL Synthesis: VHDL Synthesis, Circuit Design Flow, Circuit Synthesis, Simulation, Layout,Design capture tools, Design Verification Tools.
Test and Testability: Fault-modeling and simulation, test generation, design for testability, Built-in-self-test.

Text Books:

1. Kamran Eshraghian, Eshraghian Douglas and A. Pucknell, “Essentials of VLSI circuits andsystems”, PHI, 2013 Edition.
2. K.Lal Kishore and V.S.V. Prabhakar, “VLSI Design”, IK Publishers, 2009.

Reference Books:

1. Weste and Eshraghian, “Principles of CMOS VLSI Design”, Pearson Education, 1999.
2. Wayne Wolf, “Modern VLSI Design”, Pearson Education, 3rd Edition, 1997.
3. John P. Uyemura, “Introduction to VLSI Circuits and Systems”, John wiley, 2003.
4. John M. Rabaey, “Digital Integrated Circuits”, PHI, EEE, 1997.

Web References:

1. http://www.nptel.ac.in/downloads/117101058/
2. https://www.tutorialspoint.com/vlsi_design/vlsi_design_digital_system.html

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on MOS devices for the fabrication of integrated chips.

CO2: Analyze the various VLSI circuit design processes and their styles.

CO3: Implement Gate level design and physical design strategies.

CO4: Analyze the various subsystem design and VLSI design styles.

CO5: Investigate and Analyze VHDL Synthesis and testing.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**2.6**	**1.6**	-	-	-	-	-	-	-	-	-	**2.8**	-

TELECOMMUNICATIONS SWITCHING THEORY AND APPLICATIONS (PROFESSIONAL ELECTIVE-I)

B. Tech III Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
20CA04506	**Elective**	**3**	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

Course Objectives:

The course should enable the students :

1. To Learn to consider tele-traffic demands, quality of service, scalability, performance and cost into consideration to develop requirements and architectures.
2. To understand the switching technologies and applications including wireless communications, including mobility, optical communications, wavelength routing, packet networks and the Internet.
3. To understand CS 440 and computer networks, where communications protocols and the TCP/IP protocols suite are addressed.

UNIT-I INTRODUCTION — **Classes: 10**

Introduction: Evolution of telecommunications, simple telephone communication, manual switching system, major telecommunication networks, strowger switching system, crossbar switching; Electronic Space Division Switching: Stored program control, centralized SPC, distributed SPC, enhanced services, two stage networks, three stage network n-stage networks.

UNIT-II TIME DIVISION SWITCHING — **Classes: 10**

Time Division Switching: Time multiplexed space switching, time multiplexed time switching, combination Switching, three stage combination switching, n-stage combination switching; Traffic Engineering: Network traffic load and parameters, grade of service and blocking probability, modeling switching systems, incoming traffic and service time characterization, blocking models and loss estimates, delay systems.

UNIT-III DATA NETWORKS — **Classes: 10**

Data networks: Block diagram, features, working of EPABX systems, Data transmission in PSTNs, data rates in PSTNs, modems, switching techniques for data transmission, circuit switching, store and forward switching data communication architecture. ISO-OSI reference model, link to link layers, physical layer, data link layer, network layer, end to end layers, transport layer, session layer,
presentation layer, Satellite based data networks, LAN, metropolitan area network, fiber optic networks, and data network standards.

UNIT-IV TELEPHONE NETWORKS — **Classes: 09**

Telephone Networks: Subscriber loop systems, switching hierarchy and routing, transmission plan, Transmission systems, numbering plan, charging plan, signaling techniques, in channel signaling, common channel signaling, cellular mobile telephony.

UNIT-V INTEGRATED SERVICES DIGITAL NETWORKS — **Classes: 09**

Integrated Services Digital Networks: Motivation for ISDN, new services, network and protocol architecture, transmission channels, user network interface, signaling, numbering and addressing, service characterization, interworking, ISDN standards, broadband ISDN ,voice data Integration.

Text Books:

1. Thiagarajan Vishwanathan, “Telecommunication Switching Systems and Networks”, PHI Publications, 1992.
2. John C. Bellamy, “Digital Telephony”, Wiley Publications, 3rd Edition, 2000.

Reference Books:

1. Wayne Tomasi, “Electronic Communications Systems”, Pearson Education, 5th Edition, 2009.
2. William C.Y.Lec, Mobile Cellular Telecommunication, Analog and Digital Systems, McGraw Hill Inc, 2nd Edition, 1995.
3. KavehPahlavan, Allen H. Levesque" Wireless Information Networks", Wiley Series, John Wiley and Sons Inc, 1st Edition, 2005.

Web References:

1. http://www.ie.itcr.ac.cr/
2. http://www.neduet.edu.pk/
3. http://www.researchgate.net
4. http://www.mitpress.mit.edu

E-Text Books:

1. http://www.e-booksdirectory.com/listing.php?category=292
2. link.springer.com/book/10.1007%2F978-1-4899-2215
3. www.ie.itcr.ac.cr/acotoc/Maestria_en_Computacion/Sistemas_de
4. https://www.crcpress.com/...Communications-Theoretical...Applications

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Analyze, interpret and explain the main concepts of telecommunication network.

CO2: Exhibit the knowledge on the fundamental telecommunication switching network configurations models.

CO3: Analyze the significance of basic modern signalling system.

CO4: Analyze concepts of OSI/ISO and explain its role in design of telephone network.

CO5: Demonstrate the knowledge on the concepts Integrated Services Digital Networks, types of networks, charging procedures and routing mechanisms.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	-	-	-	-	-	-	-	-	-	-	**3**	-

ADVANCE 3G & 4G COMMUNICATIONS
(PROFESSIONAL ELECTIVE-I)

B. Tech III Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
20CA04507	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

Course Objectives:
The course should enable the students to:

1. Build an understanding of the fundamental concepts of communications
2. Familiarize the student with the basic taxonomy and terminology of the Mobile communications.
3. Introduce the student to advanced wireless communication concepts, preparing the student for entry Advanced courses in wireless communications.
4. Allow the student to gain expertise in some specific areas of communications such as 3G & 4G.

UNIT-I	WIRELESS COMMUNICATIONS AND DIVERSITY	Classes: 9

Introduction to 3G/4G Standards, Wireless Channel and Fading, Rayleigh Fading and BER of Wired
Communication, BER for Wireless Communication, Introduction to Diversity, Multi-antenna MaximalRatio Combiner, BER with Diversity, Spatial Diversity and Diversity Order

UNIT-II	BROADBAND WIRELESS CHANNEL MODELLING AND CELLULARCOMMUNICATION	Classes: 10

Wireless Channel and Delay Spread, Coherence Bandwidth of the Wireless Channel, ISI and Doppler in Wireless Communications, Doppler Spectrum and Jakes Model, Introduction to Cellular Communications, Frequency reuse, Multiple Access Technologies, Cellular Processes - Call Setup, Handover etc., Teletraffic
Theory.

UNIT-III	CDMA AND OFDM	Classes: 9

Introduction to CDMA, Walsh codes, Variable tree OVSF, PN Sequences, Multipath diversity, RAKE Receiver, CDMA Receiver Synchronization. Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues – PAPR, Frequency and Timing Offset Issues.

UNIT-IV	MIMO AND UWB (ULTRA WIDE BAND)	Classes: 10

Introduction to MIMO, MIMO Channel Capacity, SVD and Eigenmodes of the, MIMO Channel , MIMO Spatial Multiplexing – BLAST, MIMO Diversity – Alamouti, OSTBC, MRT, MIMO - OFDM. UWB Definition and Features, UWB Wireless Channels, UWB Data Modulation, Uniform Pulse Train, Bit-Error
Rate Performance of UWB.

UNIT-V	3G AND 4G WIRELESS STANDARDS	Classes: 10

GSM, GPRS, WCDMA, WiFi, UMTS, LTE, LTE-A, WiMAX.

TEXT BOOKS:

1. Principles of Modern Wireless Communication Systems-Aditya K. Jagannatham, Publisher-McGraw Hill,2015.
2. Fundamentals of Wireless Communications – David Tse and PramodViswanath, Publisher - Cambridge University Press,2005.

REFERENCE BOOKS:

1. Wireless Communications: Principles and Practice –Theodore Rappaport - Prentice Hall,2014.
2. MIMO Wireless Communications – EzioBiglieri – Cambridge University Press,2010.
3. Wireless Communications: Andrea Goldsmith, Cambridge University Press,2005.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: **Analyze** the concepts of advanced 3G and 4G wireless communication and diversity.

CO2: **Analyze** the wireless channel and different multiple access technologies.

CO3: **Investigate and analyze** Multiuser Systems, CDMA, WCDMA network planning and OFDM Concepts.

CO4: **Investigate and analyze** concepts of MIMO and UWB.

CO5: **Interpret** and describe the 3G and 4G wireless standards, LTE, LTE-A, WiMAX.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	2	-	-	-	-	-	-	-	-	3	-
CO	**3**	**2.8**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

INTEGRATED CIRCUITS & APPLICATIONS LABORATORY

B.Tech III Year I Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
20CA04509	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		0	**0**	**3**	**1.5**	**30**	**70**	**100**
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 48**				**Total Classes:48**		

Course Objectives:

The course should enable the students :

1. To implement different circuits and verify circuit concepts.
2. To Study the concepts of multivibrators and filters.
3. To verify the operations of the timers and PLLs and their applications.
4. To design and verify combinational and sequential circuits.

LIST OF EXPERIMENTS

MINIMUM OF TEN EXPERIMENTS TO BE CONDUCTED

1	Design of Inverting, Non-Inverting and Unity Gain amplifier
2	Design of Integrator and Differentiator
3	Design of Log, Antilog and Instrumentation Amplifier
4	Design of Adder and Subtractor
5	Design of function generator
6	Design of Comparator and Schmitt Trigger
7	Design of Analog filters
8	Design of Phase Locked loop (PLL)
9	Design of Astable multivibrator
10	Design of Low drop out regulator
11	Design of DC-DC converter
12	Design of R-2R Ladder DAC

Reference Books:

1. D. Roy Chowdhury, “Linear Integrated Circuits”, New age international (p) Ltd, 2nd Edition, 2003.
2. Ramakanth A. Gayakwad, “Op-Amps & linear ICs”, PHI, 3rd Edition,2003.
3. John F. Wakerly, “Digital Design Principles and Practices”, Prentice Hall, 3rd Edition, 2005.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Apply the concepts of Operational Amplifiers in Linear and Non-linear applications, PLL, Combinational & Sequential Logic circuits.

CO2: Analyze the characteristics of Operational Amplifiers in Linear and Non-linear applications, PLL, Combinational & Sequential Logic circuits.

CO3: Design the Operational Amplifiers in Linear and Non-linear applications, PLL, Combinational & Sequential Logic circuits.

CO4: Conduct investigation and test the functionality on design of Various Operational amplifiers in Linear and Non-linear applications, PLL, Combinational & Sequential Logic circuits.

CO5: Follow ethical principles in designing circuits.

CO6: Do experiments effectively as an **individual** and as a member in a group.

CO7: Communicate verbally and in written form, the understandings about the experiments.

CO8: Continue updating their skill related to implementation for various applications during their life time**.**

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-		-	-	-	-	3	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO6	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO*	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

MICROPROCESSORS & MICROCONTROLLERS LABORATORY

B.Tech III Year I Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
19CA04511	Core	0	0	3	1.5	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 48				Total Classes: 48		

COURSE OBJECTIVES:

The course should enable the students to:

1. Develop assembly language programs and provide the basics of the microprocessors.
2. Understanding the interfacing of external devices to the processor and controller for various applications.
3. Learn Embedded C programming using MSP430microcontroller.
4. Develop ability in programming using microprocessor and microcontroller.

LIST OF EXPERIMENTS

WEEK – l **DESIGN A PROGRAM USING WIN862**

Design and develop an Assembly language program using 8086 microprocessor and to show the following aspects.

a) Programming b)Execution c)Debugging

To Demonstrate the MASM/TASM software and Trainer kit for 8086 Microprocessor.

WEEK-2 **16 –BIT ARITHMETIC AND LOGICAL OPERATIONS**

Write an ALP program to perform 16 Bit arithmetic and logical operations.

WEEK-3 **MULTIBYTE ADDITION AND SUBRACTION**

Write an ALP program to perform multi byte addition and subtraction.

WEEK -4 **PROGRAMS TO SORT NUMBERS**

a) Write an ALP program to perform ascending order using 8086.
b) Write an ALP program to perform descending order using 8086.

WEEK -5 **PROGRAMS FOR STRING MANIPULATIONS OPERATIONS**

a) Write an ALP program to insert or delete a byte in the given string.
b) Write an ALP program to search a number/character in a given string.
c) Write an ALP program to move a block of data from one memory location to the other
d) Write an ALP program for reverse of a given string.

WEEK -6 **CODE CONVERSIONS**

Write an ALP program to convert packed BCD to Unpacked BCD.

WEEK -7 **INTERFACING AND PROGRAMMING GPIO PORTS IN Embedded C USING MSP430**

Interfacing and programming GPIO ports in Embedded C using MSP430 (blinking LEDs).

WEEK -8	**INTERFACING AND PROGRAMMING GPIO PORTS IN Embedded C USING MSP430**

Interfacing and programming GPIO ports in Embedded C using MSP430 (LED blink using push button).

WEEK-9	**USAGE OF LOW POWER MODES**

a) Measure the active mode current
b) Standby mode current using MSPEXP430FR5969 as hardware

WEEK-l0	**USING ULP ADVISOR**

Using ULP advisor in Code Composer Studio on MSP430

WEEK-l1	**LOW POWER MODES AND ENERGY TRACE++**

a) Enable Energy Trace and Energy Trace ++ modes in CC Studio
b) Compute Total Energy, and Estimated lifetime of an AAbattery.

WEEK-12	**PWM GENERATION**

PWM generation using Timer on MSP430 GPIO

Reference Books:

1. A.K.Ray & K.M. Bhurchandi "Advanced Microprocessor and Peripherals", 2nd Edition TMH, 2012.
2. MSP430 microcontroller basics. John H. Davies, Newnes Publication, 1st Edition, 2008.

Web References:

1. http://www.nptel.ac.in/downloads/106108100
2. http://www.the8051microcontroller.com/web-references

HARDWARE AND SOFTWARE REQUIRED

HADWARE: Desktop Computer Systems.

SOFTWARES: MASM/TASM and CC Studio.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate knowledge on Assembly Language Program using 8086 Microprocessor.

CO2: Analyze the Assembly Language Program to perform Arithmetic, Logical Operations, Sorting, String manipulation operations and Code conversion.

CO3: Design the GPIO Ports, PWM Generation in Embedded C programming using MSP430 microcontroller.

CO4: Conduct investigation and test the functionality of Low power modes and energy trace.

CO5: Select appropriate tools as MASM/TASM software and Trainer kit for 8086 Microprocessor and procedure to Interface external devices to the processor and controller.

CO6: Follow ethical principles in designing, simulating and implementing circuits.

CO7: Do experiments effectively as an individual and as a member in a group.

CO8: Communicate verbally and in written form, the understandings about the experiments.

CO9: Continue updating their skill related to implementation for various application during their life time.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-		3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3		-	-	-	-	-	-	-	3	-
CO5	-	-	-		3	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3		-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

CONSTITUTION OF INDIA

<table>
<tr><td colspan="11">B.Tech III Year I Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours/Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20CA52501</td><td rowspan="2">Foundation</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>TOTAL</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>0</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Contact Classes:32</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 32</td></tr>
</table>

Course Objectives:

The course should enable the students:

1. To realize the significance of constitution of India to students from all walks of life and help them to understand the basic concepts of Indian constitution.
2. To identify the importance of fundamental rights as well as fundamental duties.
3. To understand the functioning of Union, State and Local Governments in Indian federal system.
4. To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure.

UNIT I	**INTRODUCTION TO CONSTITUTION**	**Classes:06**

Meaning and importance of the Constitution, salient features of Indian Constitution. Preamble of the Constitution. Fundamental rights- meaning and limitations. Directive principles of state policy and Fundamental duties-their enforcement and their relevance.

UNIT II	**UNION GOVERNMENT**	**Classes:06**

Union Executive- President, Vice-president, Prime Minister, Council of Ministers. Union Legislature-Parliament and Parliamentary proceedings. Union Judiciary-Supreme Court of India–composition and powers and functions.

UNIT III	**STATE GOVERNMENT**	**Classes:06**

State Executive-Governor, Chief Minister, Council of Ministers. State Legislature-State Legislative Assembly and State Legislative Council. State Judiciary-High court.

UNIT IV	**LOCAL GOVERNMENT**	**Classes:07**

Local Government-Panchayat raj system with special reference to 73rd and Urban Local Self Govt. withspecialreferenceto74thAmendment.

UNIT V	**ELECTION PROVISIONS, EMERGENCY PROVISIONS, AMENDMENT OF THE CONSTITUTION**	**Classes:07**

Election Commission of India-composition, powers and functions and electoral process. Types of emergency-grounds, procedure, duration and effects. Amendment of the constitution- meaning, procedure and limitations.

Text Books:

1. M.V.Pylee,“IntroductiontotheConstitutionofIndia”,4th Edition,Vikaspublication,2005.
2. Durga Das Basu (DD Basu),“Introduction to the constitution of India”,(Student Edition),19th edition,Prentice-Hall EEE,2008.

References:

1. Merunandan,“MultipleChoiceQuestionsonConstitutionofIndia”,2nd Edition,Meagapublication,2006

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Understand and explain the significance of Indian Constitution as the fundamental law of the land.
CO2: Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building.
CO3: Analyze the Indian political system, the powers and functions of the Union and State Governments in detail.
CO4: Analyze the Indian political system, the powers and functions of the Local Governments in detail.
CO5: Understand Electoral Process, Emergency provisions and Amendment procedure.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**2.4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

DIGITAL SIGNAL PROCESSING

<table>
<tr><td colspan="10">B. Tech III Year II Semester</td></tr>
<tr><td>Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum</td></tr>
<tr><td rowspan="2">20CA04601</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 48</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

Course Objectives:
The course should enable the students:

1. To develop skills for analyzing discrete signals and systems also apply discrete fourier transformfor frequency domain analysis along with the implementation of FFT.
2. To provide concepts and skills for the design and realization of IIR and FIR filters, with givenspecifications, using different techniques.
3. To investigate the effect of finite word length in the design of digital filters.
4. To tackle the design of multirate filters using DSP and introduce a real world digital signal processing applications.

UNIT-I	**REVIEW OF DISCRETE TIME SIGNALS AND SYSTEMS**	**Classes: 10**

Discrete time signal: Definition, Classification, Elementary Signals.
Discrete time Systems: Definition, Classification, Linear time invariant (LTI) System, Properties of LTI system, Time and Frequency domain analysis of discrete time signals and systems, Methods of evaluating the convolution sum, Filtering using overlap-save and overlap-add method.

UNIT-II	**DISCRETE FOURIER TRANSFORM & FAST FOURIER TRANSFORM**	**Classes: 09**

Discrete Fourier Transforms: Introduction to Discrete Fourier transform (DFT), Direct computation of DFT, Properties of DFT, Circular Convolution using DFT, Relationship of DFT with other transforms.
Fast Fourier Transforms: Efficient Computation of DFT algorithms, Radix-2 Decimation-in-Time and Decimation-in-Frequency algorithms, Inverse FFT, Illustrative problems.

UNIT-III	**IIR FILTERS**	**Classes: 10**

IIR Digital Filters: Design of IIR filters from Analog filters - Impulse invariance, Bilinear transformation, Frequency transformation in the analog and digital domains, Illustrative problems. **Realization of IIR systems:** Structures for IIR systems – Direct form, Cascade form, Parallel form and Lattice structures.

UNIT-IV	**FIR FILTERS**	**Classes: 09**

FIR Digital Filters: Linear phase FIR filter, Characteristic response, Design of FIR filters using Windows and Frequency sampling technique, Illustrative problems.
Realization of FIR Systems: Structures for IIR systems - Directform, Cascade form, Lattice form, Comparison of IIR and FIR filters.

UNIT-V	**MULTIRATE SIGNAL PROCESSING & INTRODUCTION TO DSP PROCESSORS**	**Classes: 10**

Multirate signal processing: Decimation, Interpolation, Implementation of sampling rate conversion, Multi stage Implementation of sampling rate conversion, Polyphase structures for decimation and interpolation filters.
Introduction to programmable DSPs: Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in DSPs, Pipelining, Special addressing modes, Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit.

Text Books:

1. John G. Proakis, Dimitris G. Manolakis, “Digital signal processing, Principles, Algorithms andApplications”, Prentice Hall, 4th Edition, 2007. 2. Sanjit K Mitra, “Digital signal processing, A computer base approach”, McGraw-Hill HigherEducation, 4th Edition, 2011.
Reference Books:
1. Li tan, “Digital signal processing: fundamentals and applications” Elsevier Science &. TechnologyBooks, 2nd Edition, 2008. 2. Robert J.schilling, Sandra. L.harris, “Fundamentals of Digital signal processing using Matlab”,Thomson Engineering, 2nd Edition, 2005. 3. Salivahanan, Vallavaraj, Gnanapriya, “Digital signal processing”, McGraw-Hill Higher Education,2nd Edition, 2009.
Web References:
1. https://www.coursetalk.com/providers/coursera/courses/digital-signal-processing 2. https://www.edx.org/course/discrete-time-signal-processing-mitx-6-341x-1
E-Text Books:
1. http://www.dspguide.com/pdfbook.htm 2. http://dspguru.com/dsp/books/favorites 3. http://onlinevideolecture.com/ebooks 4. http://www.freebookcentre.net/SpecialCat/Free-Signal-Processing-Books

COURSE OUTCOMES	
CO1	Analyze the various discrete time signals and systems.
CO2	Implement DFT, FFT using Radix-2 in frequency and time domains.
CO3	Analyze and Design IIR filters using realization structures.
CO4	Analyze and Design IIR filters using Window techniques.
CO5	Exhibit the knowledge on multirate signal processing and DSP building blocks to achieve high speed in DSP processor to meet the real time applications.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	-	1	-	-	-	-	-	-	3	1
CO	**3**	**2.4**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**

SATELLITE COMMUNICATIONS

B.Tech III Year II Semester									
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20CA04602	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

Course Objectives:

The course should enable the students :

1. To introduce the basic principles of Satellite Communication systems, orbital mechanics, launchers.
2. To introduce the basic concepts and designing of Satellite links.
3. To introduce the basic concepts of earth station transceiver.
4. To know the basic concepts of various multiple access techniques and GPS systems.

UNIT-I	**INTRODUCTIONTO SATELLITE COMMUNICATIONS**	**Classes:11**

Origin of satellite communications, Historical background, Introduction to Indian satellites, basic concepts of satellite communications, frequency allocations for satellite services, applications, future trends of satellite communications. Orbital Mechanics look angle determination, orbital perturbations, orbit determination, launches and launch vehicles, orbital effects in communication systems performance.

UNIT-II	**SATELLITE SUBSYSTEMS AND LINK DESIGN**	**Classes:10**

Attitude and orbital control system, Telemetry, Tracking, command and monitoring, power systems, communication sub systems, satellite antenna equipment reliability and space qualification. Basic transmission theory, system noise temperature and G/T ratio, design of down links, uplink design, design of satellite links for specified C/N, system design example.

UNIT-III	**EARTH STATION TECHNOLOGY, LOW EARTH ORBITAND GEO-STATIONARY SATELLITE SYSTEMS**	**Classes:09**

Introduction, transmitters, receivers, Antennas, tracking systems, terrestrial interface, primary power test methods. Orbit consideration, coverage and frequency considerations, delay and throughput considerations, system considerations, operational NGSO constellation designs.

UNIT-IV	**MULTIPLEACCESSTECHNIQUES**	**Classes:09**

Introduction to Multiple Access, Frequency Division Multiple Access, Intermodulation, Time Division Multiple Access, TDMA Frame Structure, Code Division Multiple Access, Demand Assigned Multiple Access, difference between FDMA, TDMA and CDMA.

UNIT-V	**SATELLITE NAVIGATION & GLOBAL POSITIONING SYSTEM**	**Classes:09**

Radio and satellite navigation, GPS position location principles, GPS receivers and codes, satellite signal acquisition, GPS navigation message, GPS signal levels, GPS receiver operation, GPS C/A code accuracy, Differential GPS.

Text Books:

1. Timothi Pratt, Charles Bostian and Jeremy Allnutt, “Satellite communications”, WSE, Wiley publications, 2nd Edition, 2003.
2. Wilbur L. Prichard, RobertA. Nelson & Henry G. Suyderhoud, “Satellite communications engineering”, Pearson Publications, 2nd Edition, 2003.

ReferenceBooks:

1. Dennis Roddy, “Satellite communications”, McGraw Hill, 2nd Edition, 1996.
2. M.Richharia, “Satellite communications: Design principles”, BS publications, 2nd Edition, 2003.
3. D.C.Agarwal, “Satellite communications”, Khanna publications, 5th Ed.
4. K.N.Rajarao, “Fundamentals of Satellite communications”, PHI, 2004.

COURSE OUTCOMES	
CO1	Demonstrate the knowledge on basics of satellite communication.
CO2	Analyze and design satellite links.
CO3	Exhibit the knowledge on earth station transmitter, receiver, and antenna systems.
CO4	Demonstrate the knowledge on various types of multiple access techniques.
CO5	Investigate and analyze the concepts of satellite navigation and GPS.

CO-PO/PSO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**2.6**	**2**	-	-	-	-	-	-	-	-	-	**3**	**-**

MICROWAVE ENGINEERING

B. Tech III Year II Semester									
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum**		
20CA04603	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

Course Objectives:

The course should enable the students :

- To develop the knowledge on transmission lines for microwaves, cavity resonators and waveguide components and applications.
- To understand the scattering matrix parameters and its use.
- To introduce the student the microwave test bench for measure different parameters like attenuation, VSWR, etc.

UNIT-I	**MICROWAVE TRANSMISSION LINES**	**Classes: 10**

MICROWAVE TRANSMISSION LINES: Introduction, Microwave spectrum and bands, applications of Microwaves. Rectangular Waveguides-Solution of Wave Equation in Rectangular Coordinates, TE/TM mode analysis, Expressions for fields, Characteristic equation and cutoff frequencies, dominant and degenerate modes, sketches of TE and TM mode fields in the cross-section. Mode characteristics- Phase and Group velocities, wavelengths and impedance relations.

Rectangular Waveguides– Power Transmission and Power Losses, Impossibility of TEM Modes, Micro strip lines-introduction, Z_0 relations, effective dielectric constant, losses, Q-factor.

UNIT-II	**WAVEGUIDE COMPONENTS AND APPLICATIONS**	**Classes: 10**

Coupling mechanisms: Probe, loop, coupling to a cavity resonator, waveguide discontinuities, waveguide irises, tuning screws and posts, matched loads; Waveguide attenuators; Waveguide phase shifters; waveguide multiport junctions: Properties and s-matrix calculations of E plane Tee, H plane Tee, Magic Tee, Directional Coupler, Hybrid ring,

Ferrites: Faraday rotation principle, gyrator, isolator, circulator.

UNIT-III	**MICROWAVE TUBES**	**Classes: 10**

Microwave linear beam tubes: Limitations of conventional tubes at microwave frequencies; Klystron: Velocity modulation process, bunching process, output Power, Multicavity Klystron amplifiers: Beam current density, output current, Reflex Klystron: Velocity modulation, power output and efficiency.

Helix Traveling Wave tube: Slow wave structures, amplification process, conventional current; **Microwave cross field tubes (M type):** Introduction, cross-field effects; Magnetrons: Different types, 8-cavity cylindrical travelling wave Magnetron, Hull cut-off and Hartree conditions.

UNIT-IV	**MICROWAVE SOLID-STATE DEVICES**	**Classes: 10**

Microwave solid-state devices: Microwave tunnel diode; Transferred electron devices: Gunn-effect diodes, RWH theory, modes of operations; Avalanche transit time devices: IMPATT diode, TRAPATT diode, BARITT diode, Pin diodes, varactor diodes, crystal detectors.

UNIT-V	**MICROWAVE MEASUREMENTS**	**Classes: 08**

Description of microwave bench: Different blocks and their features, precautions; Microwave power measurement: Bolometers; Measurement of attenuation; Frequency standing wave measurements: measurement of low and high VSWR; Cavity Q; Impedance measurements.

Text Books:

1. Samuel Y. Liao, “Microwave Devices and Circuits”, Pearson, 3rd Edition, 2003.
2. Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, “Microwave Principles” ,CBSPublishers and Distributors, New Delhi, 1st Edition, 2004.

Reference Books:

1. R.E. Collin, "Foundations for Microwave Engineering" IEEE Press, John Wiley, 2nd Edition,2002.
2. Peter A. Rizzi, "Microwave Engineering Passive Circuits" PHI, 3rd Edition, 1999.
3. M.L. Sisodia, G.S.Raghuvanshi, "Microwave Circuits and Passive Devices" Wiley Eastern Ltd.,New Age International Publishers Ltd, 1st Edition, 1995.

Web References:

1. http://nptel.ac.in/courses/117101119/1
2. http://www-group.slac.stanford.edu/kly/Lecture_Series/slac_klystron_lecture_series.htm
3. https://books.google.co.in/books?id=ZU19Uemy83YC&printsec=frontcover&dq=microwave+ engineering & hl=en & redir_esc=y#v=onepage & q&f = false

E-Text Books:

1. https://ecedmans.files.wordpress.com/2014/10/microwave-devices-and-circuits-samuel-liao.pdf
2. http://www.faadooengineers.com/threads/11621-Microwave-engineering-ebook-pdf-Free-Download
3. http://www2.electron.frba.utn.edu.ar/~jcecconi/Bibliografia/Ocultos/Libros/Microwave_Engineerin g_David_M_Pozar_4ed_Wiley_2012.pdf.

Course Outcomes:

Upon the successful completion of the course, the student will be able to

CO1: Exhibit the knowledge on transmission lines for microwave circuits, cavity resonators and wave guide components.

CO2: Analyze and design various microwave circuits and devices using S-matrix parameters.

CO3: Investigate and analyze different microwave tubes such as klystron, Reflex Klystron and M type tubes.

CO4: Exhibit the knowledge on various transit time devices.

CO5: Demonstrate the basic knowledge on various microwave metrics.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	1	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**1.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

COMPUTER ORGANIZATION
(PROFESSIONAL ELECTIVE-II)

B. Tech III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
20CA04604	Elective	3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

Course Objectives:

The course should enable the students :

1. To Understand the Organization of Computer Systems.
2. To Study the Assembly Language Program Execution, Instruction format and Instruction Cycle.
3. To Design a simple Computer using Hardwired and Micro Programmed Control methods.
4. To Study the basic Components of Computer Systems besides the Computer Arithmetic.
5. To Understand Input-Output Organization, Memory Organization and Management and Pipelining.

UNIT-I **Introduction to Computer Organization** **Classes: 10**

Basic Computer Organization, CPU Organization, Memory Subsystem Organization and Interfacing, Input or Output Subsystem Organization and Interfacing, A simple Computer Levels of Programming Languages, Assembly Language Instructions, Instruction Set Architecture Design, A simple Instruction Set Architecture.

UNIT-II **Organization of a Computer** **Classes: 10**

Register Transfer: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro Operations.

Control unit: Control Memory, Address Sequencing, Micro Program Example, and Design ofControl Unit.

UNIT-III **CPU and Computer Arithmetic** **Classes: 09**

C**PU design:** Instruction cycle, Data representation, Memory reference instructions, Input-Output, and Interrupt, Addressing Modes, Data Transfer and Manipulation, Program Control.

Computer Arithmetic: Addition and Subtraction, Floating Point Arithmetic Operations, Decimal Arithmetic unit.

UNIT-IV **Input-Output Organization and Memory Organization** **Classes: 10**

Input or Output Organization: Input or Output Interface, Asynchronous data transfer, Modes of transfer, Priority Interrupt, Direct Memory Access.

Memory organization: Memory hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

UNIT-V **Multiprocessors** **Classes: 09**

Pipeline: Parallel processing, Pipelining-Arithmetic pipeline, Instruction Pipeline.

Multiprocessors: Characteristics of Multi Processors, Inter Connection Structures, Inter Processor Arbitration, Inter Processor Communication and Synchronization.

Text Books:

1. M. Morris Mano, “Computer Systems Architecture”, Pearson, 3rd Edition, 2007.
2. John D. Carpinelli, “Computer Systems Organization and Architecture”, Pearson, 1st Edition, 2001.
3. Patterson, Hennessy, “Computer Organization and Design: The Hardware/Software Interface”, Morgan Kaufmann, 5th Edition, 2013.

Reference Books:

1. John. P. Hayes, “Computer System Architecture”, McGraw Hill, 3rd Edition, 1998.
2. Carl Hamacher, Zvonko G Vranesic, Safwat G Zaky, “Computer Organization”, McGraw Hill, 5th Edition, 2002.
3. William Stallings, “Computer Organization and Architecture”, Pearson Edition, 8th Edition, 2010.

Web References:

1. https://www.tutorialspoint.com/computer_logical_organization/
2. https://www.courseera.org/learn/comparch
3. https://www.cssimplified.com/.../computer-organization-and-assembly-language-programming

E-Text Books:

1. https://www.groupes.polymtl.ca/inf2610/.../ComputerSystemBook.pdf
2. https://www.cse.hcmut.edu.vn/~vtphuong/KTMT/Slides/TextBookFull.pdf

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1 : Demonstrate knowledge on design of the functional units of a digital computer system

CO2 : Design of control unit and apply the instruction set, instruction formats

CO3: Use of Interrupt Handling, Performance Considerations and Memory Management requirements.

CO4: Demonstrate knowledge on representations of numbers stored in digital computers and perform Basic arithmetic Operations

CO5 : Analyze memory hierarchy and its impact on computer Cost/performance

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-

DIGITAL SYSTEM DESIGN
(PROFESSIONAL ELECTIVE-II)

B. Tech III Year II Semester

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
20CA04605	Elective	3	0	0	3	30	70	100
Contact Classes:48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

Course Objectives:
The course should enable the students :
1. To be able to use computer-aided design tools for development of complex digital logic circuits.
2. To be able to model, simulate, verify, analyze, and synthesize with hardware description languages.
3. To be able to design and prototype with standard cell technology and programmable logic.
4. To be able to design tests for digital logic circuits, and design for testability.

UNIT-I	CMOS LOGIC	Classes:11

Introductiontologicfamilies,CMOSlogic,CMOSsteadystateelectricalbehavior,CMOSdynamicelectricalbehavior,CMOSlogicfamilies.
Bipolar Logic and Interfacing; Bipolar logic, Transistor logic, TTL families, CMOS/TTL interfacing,lowvoltageCMOSlogicandinterfacing,emittercoupledlogic,comparisonoflogicfamilies,Familiaritywithstandard74-seriesandCMOS40-series-ICs-specifications.

UNIT-II	HARDWARE DESCRIPTION LANGUAGE	Classes:09

Introduction to Verilog: Verilog Fundamentals-Levels of design description,Module Representation, Timing and Delays in Modelling, Hierarchical Module Representation. Test bench Formation in Verilog- Structure of a Verilog Test bench File, Displaying TestResults.
Verilog Data Types and Operators:
Data Types, Net and VariableData Types, Data Values, naming a Net or Variable, Defining Constants and Parameters,Defining Vectors, Operators, Arithmetic Operators, Concatenation and ReplicationOperators.

UNIT-III	COMBINATIONAL CIRCUIT BLOCKS	Classes: 09

Adders-Half adder, Full adder-parallel adder, Comparators,Decoders, Encoders, Multiplexers, Parity Generators andCheckers, Applications on Combinational Circuits-Implementing the Home AlarmSystem, Implementing the Car Park Occupied SlotCounting System.

UNIT-IV	SEQUENTIAL LOGIC DESIGN	Classes: 10

Data Storage Elements: Latches in Verilog, Flip-Flops in Verilog, Registers, Memory-Read-Only Memory, Random AccessMemory.
Sequential Circuits: Timing in Sequential Circuits- Synchronous Operation, AsynchronousOperation, Shift Registers in Verilog- Multiplication andDivision Using Shift Registers, Counter- Synchronous Counter,Asynchronous Counter, Counters in Verilog, Frequency Division Using Counters.

UNIT-V	DIGITAL INTERFACING	Classes: 09

Universal Asynchronous Receiver/Transmitter(UART) in Verilog,Serial Peripheral Interface (SPI) in Verilog, Video Graphics Array (VGA) in Verilog,Universal Serial Bus (USB) Receiving Module in Verilog, Application-Digital Clock,Moving Wave via LEDs.

Text Books:

1. Cem Unsalan, BoraTar “Digital System Design with FPGA Implementation Using Verilog and VHDL” McGraw-Hill Education

2. Design through Verilog HDL – T.R. Padmanabhan and B. Bala Tripura Sundari, WSE, IEEE Press,2004.
Reference Books:
1. Advanced Digital Design with Verilog HDL – Michael D. Ciletti, PHI,2005. 2. Fundamentals of Logic Design with Verilog – Stephen. Brown andZvonkoVranesic, TMH,2005 3. A Verilog Primer – J. Bhasker, BSP,2003.
E-Text Books:
1. www.jntubook.com2.www.ebookgalaxy.in
COURSE OUTCOMES: **Upon the successful completion of the course, the student will be able to** CO1: Demonstrate knowledge on various logic families and their interfacing with CMOS circuits. CO2: Analyze the basics of Verilog HDL and its implementation strategies. CO3: Design combinational circuits and develop a Verilog HDL Programming. CO4: Analyze the data storage elements and develop a sequential circuit using verilog HDL Programming. CO5: Demonstrate knowledge on the digital circuits interfacing and applications.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	1	-	-	-	-	-	-	-	-	3	**-**
CO2	3	2	3	1	-	-	-	-	-	-	-	-	3	**-**
CO3	3	2	3	1	-	-	-	-	-	-	-	-	3	**-**
CO4	3	2	3	1	-	2	-	-	-	-	-	-	3	**-**
CO5	3	3	3	1	-	2	-	-	-	-	-	-	3	**-**
CO	**3**	**2.4**	**2.8**	**1**	-	**2**	**-**	**-**	-	**-**	-	**-**	**3**	**-**

DATA COMMUNICATIONS AND NETWORKING
(PROFESSIONAL ELECTIVE-II)

B.Tech III Year II Semester								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
20CA04606	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**TotalClasses:48**		

Course Objectives:
The course should enable the students :
1. To Study the evolution of computer networks and future directions.
2. To Study the concepts of computer networks from layered perspective.

3. To Study the issues open for research in computer network protocols suite are addressed.
4. To Discuss the nature uses and implications of internet technology

UNIT-I	INTRODUCTION	Classes: 10

Components, Data representation, Network and Network Types, Internet History, Protocols, Standards and Administration.
Network Models: Layered tasks, TCP/IP Protocol Suite, The ISO Model.
The Physical layer: Data and Signals, Transmission impairment, Data rate limits, Performance, Transmission media- Guided Media, Unguided Media, Switching: Introduction, Circuit Switched Networks, Packet switching.

UNIT-II	DATALINKLAYER	Classes: 10

Introduction, Link layer addressing, Service provided by the link layer, Framing, Error detection and Correction: Cyclic codes, Checksum, Forward error correction, Flow control protocols and error control protocols.
Data link control: DLC Services, Data link layer protocols, HDLC, Point to Point Protocol,
Media Access control: Random Access, Controlled Access, channelization, Connecting devices and virtual LANs.

UNIT-III	MULTIPLEACCESSAND DATANETWORKS	Classes: 09

Multiple access: ALOHA, CSMA, CSMA/CD, CSMA/CA, Wired LANs: IEEE standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LANs: IEEE802.11, BluetoothIEEE802.16.
The Network Layer: Network layer design issues, Addressing types-physical, Logical and port address, Routing algorithms, Congestion control algorithms, Quality of service, Internetworking,
The network layer in the Internet: IPV4 Addresses, IPV6, Internet Control protocol, OSPF, BGP, IP, ICMPv4, IGMP.

UNIT-IV	TRANSPORTLAYER	Classes: 09

Transport Services, Elements of Transport Protocols, Congestion Control.
Internet transport protocols: UDP, TCP, Performance problems in computer networks, Network performance measurement.

UNIT-V	APPLICATION LAYER	Classes: 10

Introduction, Client Server Programming, WWW and HTTP, FTP, e-mail, TELNET, Secure Shell, Domain Name System, SNMP.

Text Books:

1. Behrouz A. Forouzan, "Data communications and networking", McGraw Hill Education, 5th edition,2012.
2. Andrew S.Tanenbaum, Wetherall,"Computer Networks",Pearson,5thedition,2010.

Reference Books:

1. Data Communication and Networks, Bhushan Trivedi, Oxford
2. Internetworking with TCP/IP – Principles, protocols, and architecture- Volume 1, Douglas E. Comer,5th edition, PHI
3. Computer Networks‖, 5E, Peterson, Davie, Elsevier.
4. Introduction to Computer Networks and Cyber Security, Chawan-Hwa Wu, Irwin, CRC Publications.
5. Computer Networks and Internets with Internet Applications, Comer.

Web References:

1. http://www.ie.itcr.ac.cr/
2. http://www.neduet.edu.pk/
3. http://www.researchgate.net
4. http://www.mitpress.mit.edu

E-Text Books:

1. http://www.e-booksdirectory.com/listing.php?category=2922.link.springer.com/book/10.1007%2F978-1-4899-2215
2. www.ie.itcr.ac.cr/acotoc/Maestria_en_Computacion/Sistemas_de
3. https://www.crcpress.com/...Communications-Theoretical...Applications

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Exhibit the knowledge on the basics of data communication, networking, internet and various protocol layers and their importance.

CO2: Analyze the services and features of data link layer, protocols and media access control.

CO3: Demonstrate the knowledge on various multiple access protocols, Ethernet speed, IP addressing and design of network protocols.

CO4: Analyze TCP/IP protocols.

CO5: Exhibit the knowledge on application layer protocol and their functions for data communication.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**2.4**	**2**	-	-	-	-	-	-	-	-	-	**3**	-

ANALOG IC DESIGN
(PROFESSIONAL ELECTIVE-II)

<table>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours / Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">20CA04607</td><td rowspan="2">Elective</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 48</td><td colspan="2">Tutorial Classes: Nil</td><td colspan="3">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

Course Objectives:

The course should enable the students :

1. To Understand significance of different biasing styles and apply them for designing analog ICs.
2. To Analyze the functionality of Current Mirrors, Current Sinks, Differential amplifiers and Current amplifiers.
3. To Design basic building blocks of analog ICs like, current mirrors, current sources, current sinks, two stage CMOS Power amplifiers and comparators

UNIT - I	MOS DEVICES AND MODELING	Classes: 10

The MOS Transistor, Passive Components-Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

UNIT-II	ANALOG CMOS SUB-CIRCUITS	Classes: 10

MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage, Band gap Reference.

UNIT - III	CMOS AMPLIFIERS	Classes: 9

Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures, Mismatch-offset cancellation techniques, Reduction of Noise by offset cancellation techniques, Alternative definition of CMRR.

UNIT - IV	CMOS OPERATIONAL AMPLIFIERS	Classes: 9

Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

UNIT-V	COMPARATORS	Classes: 10

Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators

Text Books:

1. Design of Analog CMOS Integrated Circuits- BehzadRazavi, TMH Edition.
2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.

Reference Books:

1 Analog Integrated Circuit Design- David A.Johns, Ken Martin, Wiley Student Edn, 2013.
2. CMOS: Circuit Design, Layout and Simulation- Baker, Li and Boyce,
3. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition, 2010.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Analyze the small and large signal models of MOS transistors.
CO2: Analyze and Design current mirror circuits.
CO3: Demonstrate the use of Analogue circuits analysis techniques to analyze the operation and behavior of various Analogue Integrated Circuits.
CO4: Analyze and Design Analogue operational Trans conductance Amplifiers.
CO5: Design a two stage open loop comparators.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**2**	-	-	-	-	-	-	-	-	-	**3**	-

DIGITAL SIGNAL PROCESSING LABORATORY

B. Tech III Year II Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
20CA04609	Core	0	0	3	1.5	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 48				Total Classes: 48		

Course Objectives:

The course should enable the students :

1. To implement the convolution in MATLAB.
2. To implement of digital signal processing algorithms in MATLAB and C.
3. To understand the real-time operation of digital filters.
4. To analyze the multirate signal processing algorithms.

Conduct any 7 experiments from PART-A and any 3 experiments from PART-B

PART –A (The following experiments shall be conducted using MATLAB software)

1. Energy and Power of a discrete signal
2. Linear and Circular Convolution of discrete sequences.
3. DFT / IDFT of a discrete time signal
4. Implementation of FFT of a Sequence.
5. Design and implementation of IIR Butterworth filter.
6. Design and implementation of IIR Chebyshev filter.
7. Design and implementation of FIR low pass filter using windowing techniques. Plot its magnitude and phase responses.
8. Design and implementation of FIR high pass filter using windowing techniques. Plot its magnitude and phase responses.
9. Design of analog filters.

PART –B (The following experiments shall be conducted using CC Studio / DSP Processors)

10. DFT / IDFT of a discrete time signal.
11. Implementation of FFT of a sequence.
12. Linear and Circular Convolution of discrete sequences.
13. Design and implementation of IIR Butterworth / Chebyshev filter.
14. Design and implementation of FIR low pass / high pass filter using windowing techniques. Plot its magnitude and phase responses.

Reference Books:

1. John G. Proakis, Dimitris G. Manolakis, “Digital signal processing, Principles, Algorithms and Applications”, Prentice Hall, 4th Edition, 2007.
2. B. Preetham Kumar, “Digital Signal Processing Laboratory”, CRC Press, 2nd Edition, 2010
3. B.Venkata Ramani, M.Bhaskar, “ Digital Signal Processors- Architecture, Programming and applications”, TMH, 2nd Edition, 2002

Web References:

1. http://eceweb1.rutgers.edu/~orfanidi/ece348/
2. http://www.eecs.umich.edu/courses/eecs452/refs.html
3. http://www.dsp.sun.ac.za/lab-reference-guide/

SOFTWARE AND HARDWARE REQUIRED FOR A BATCH OF 30 STUDENTS

HARDWARE: 30 numbers of Desktop Computer Systems with 2 GB RAM

SOFTWARES: a) MATLAB b) C6713 DSK Code Composer Studio c) TI d) DSP Processor

LIST OF EQUIPMENT REQUIRED FOR A BATCH OF 36 STUDENTS

S.No	Name of the Equipment	Range
1	TMS320C6713 DSP Starter Kit (DSK)	225 MHz device delivering up to 1800 million instructions per second (MIPs)
2	USB Cable	--

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

CO1	Demonstrate the knowledge on CC Studio and Analyze the DSP Systems programming through CCS.
CO2	Analyze the various DSP processor kits for floating point operations.
CO3	Design and develop programming on DSP tool kits using CCS.
CO4	Conduct investigation and test the functionality on implementation of CCS through DSP programming.
CO5	Select appropriate tool kit to analyze and implement DSP Processor.
CO6	Follow **ethical** principles in designing and programming DSP processors.
CO7	Do experiments effectively as an **individual** and as a member in a **group**.
CO8	**Communicate** verbally and in written form, the understandings about the programming.
CO9	Continue updating their skill related to implementation for various applications during their **life time.**

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-	-	-	3		3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

VLSI & EMBEDDED SYSTEMS LABORATORY

<table>
<tr><td colspan="11">B.Tech III Year I Semester</td></tr>
<tr><td rowspan="1">Course Code</td><td>Category</td><td colspan="3">Hours / Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td rowspan="2">20CA04610</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 48</td><td colspan="3">Total Classes: 48</td></tr>
</table>

Course Objectives:

The course should enable the students :

1. To design and draw the internal structure of the various digital integrated circuits
2. To develop Verilog HDL / VHDL source code, perform simulation using relevant simulator and analyze the obtained simulation results using necessary synthesizer.
3. To perform programming on TM4C and TIVA processors.

<table>
<tr><td colspan="2">LIST OF EXPERIMENTS</td></tr>
<tr><td colspan="2">MINIMUM OF TEN EXPERIMENTS TO BE CONDUCTED
(FIVE EXPERIMERNTS SHOULD BE CONDUCTED FROM PART-A AND PART-B)</td></tr>
<tr><td colspan="2">Part-A (Use Verilog HDL/ VHDL)</td></tr>
<tr><td>Exp-1</td><td>Realization of Logic Gates.</td></tr>
<tr><td>Exp-2</td><td>Design of Multiplexer and De-multiplexer</td></tr>
<tr><td>Exp-3</td><td>Half adder and Half subtractor design modeling</td></tr>
<tr><td>Exp-4</td><td>HDL model for Flip Flops</td></tr>
<tr><td>Exp-5</td><td>Design of Decade Counter</td></tr>
<tr><td>Exp-6</td><td>Design of Universal Shift Registers</td></tr>
<tr><td colspan="2">Embedded C Experiments using TM4C processor (PART – B)</td></tr>
<tr><td>Exp-7</td><td>Configure EK-TM4C123GXL Launch pad digitalI/O pins. Write a C program for configuration of GPIO ports for Input and output operation (blinking LEDs, push buttons interface)</td></tr>
<tr><td colspan="2">a) Modify the code to make the red LED of EK-TM4C123GXL Launch pad blink.
b) Modify the code to make the green and red LEDs blink: I. Together II. Alternately</td></tr>
<tr><td>Exp-8</td><td>Learn and understand Timer based interrupt programming. Write a C programfor EK-TM4C123GXL Launch pad and associated Timer ISR to toggle
onboard LED using interrupt programming technique</td></tr>
<tr><td colspan="2">a) Modify the code for a different timer toggling frequency.
b) Write the code to turn on interrupt globally.</td></tr>
<tr><td>Exp-9</td><td>Configure hibernation module of the TM4C123GH6PM microcontroller to</td></tr>
<tr><td colspan="2">Write a program to configure hibernation mode and wake up</td></tr>
<tr><td>Exp-10</td><td>Configure in-build ADC of TM4C123GH6PM microcontroller and interface</td></tr>
<tr><td colspan="2">Tabulate ten different positions of the Potentiometer and note down the Digital value and calculate the equivalent analog value.</td></tr>
<tr><td>Exp-11</td><td>Learn and understand the generation of Pulse Width Module (PWM) signal by configuring and programming the in-build PWM module of TM4C123GH6PMmicrocontroller</td></tr>
<tr><td colspan="2">a) Change the software to output a set Duty Cycle, which can be user programmed.
b) Change the frequency of the PWM Output from 6.25 KHz to 10 KHz and do the tabulation again.</td></tr>
<tr><td>Exp-12</td><td>Learn and understand to connect EK-TM4C123GXL Launchpad to PC terminal andsend an echo of the data input back to the PC using UART.</td></tr>
<tr><td colspan="2">a) Change the baud rate to 19200 and repeat the experiment.
b) What is the maximum baud rate that can be set in the UART peripheral of TIVA?
c) Modify the software to display “Switch pressed” by pressing a user input switch on the Launchpad</td></tr>
</table>

COURSE OUTCOMES	
Upon the successful completion of the course, the student will be able to	
CO1	Demonstrate knowledge on VLSI and ES experiments.
CO2	Analyze the functionality of VLSI and ES experiments.
CO1	Develop the program for successful implementation of VLSI and ES experiments.
CO3	Conduct investigation to conduct VLSI and ES experiments.
CO4	Select appropriate tool/hardware to analyze and implement labs.
CO5	Select appropriate tool/hardware to analyze and implement labs.
CO6	Follow ethical principles in analyzing and implementing functionalities of various programs.
CO7	Do experiments effectively as an individual and as a member in a group.
CO8	Communicate verbally and in written form, the understandings about the experiments.
CO9	Continue to update the skills related to the program for various applications during the life time.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-	-	-	3		3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	-	**3**	**3**	**3**

MICROWAVE & OPTICAL COMMUNICATION LAB

<table>
<tr><td colspan="10">B.Tech III Year II Semester</td></tr>
<tr><th>Course Code</th><th>Category</th><th colspan="3">Hours/ Week</th><th>Credits</th><th colspan="3">Maximum Marks</th></tr>
<tr><td rowspan="2">20CA04611</td><td rowspan="2">Core</td><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: Nil</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: 48</td><td colspan="3">Total Classes: 48</td></tr>
</table>

Course Objectives:
The course should enable the students :

1. To Understand the working principle of Optical sources, detectors, fibers and microwave components.
2. To Understand the simple optical communication link.
3. To learn about the characteristics and measurements in optical fiber
4. To Practice microwave measurement procedures.

LISTOF EXPERIMENTS	
MINIMUMOFTENEXPERIMENTSTOBECONDUCTED	
Microwave Lab(PART–A)---Any Six(6) Experiments	
Exp-1	Reflex Klystron Characteristics.
Exp-2	Gunn Diode Characteristics.
Exp-3	Attenuation Measurement.
Exp-4	Directional Coupler Characteristics.
Exp-5	VSWR Measurement.
Exp-6	Impedance Measurement.
Exp-7	Frequency and Wavelength measurements using slotted section.
Exp-8	Impedance Matching and Tuning
Exp-9	Scattering parameters of Magic Tee.
Exp-10	Radiation Measurement using Horn Antenna
Optical Fiber Lab (PART– B) ---Any Four (4) Experiments	
Exp-11	Characterization of LED
Exp-12	Characterization of Laser Diode
Exp-13	Intensity modulation of Laser output through an optical fiber.
Exp-14	Measurement of Data rate for Digital Optical link.
Exp-15	Measurement of Numerical Aperture of the given fiber.
Exp-16	Measurement of losses for Analog Optical link.

LIST OF EQUIPMENT

S.No	Name of the Equipment	Quantity
1	Regulated Klystron Power Supply	6 Nos.
2	VSWR Meter	6 Nos.
3	Milli/Micro Ammeters	10 Nos.
4	Multi meters	10 Nos.
5	CROs	8 Nos.
6	Gunn Power Supply, Pin Moderator	4 Nos.
7	Relevant Microwave components	-----
8	Fiber Optic Analog Trainer based LED	3 Nos.
9	Fiber Optic Analog Trainer based laser	2 Nos.
10	Fiber Optic Digital Trainer	1 Nos.
11	Fiber cables	

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on the basics of waveguides, waveguide components, microwave & optical sources, etc.

CO2: Apply a proper waveguide component and it's ports to get required output signal

CO3: Analyze different waveguide components and microwave sources

CO4: Demonstrate different sources on different components for measuring purpose

CO5: Follow ethical principles in designing and implementing various measuring circuits.

CO6: Do experiments effectively as an individual and as a member in a group.

CO7:Communicate verbally and in written form, the understandings about the experiments.

CO8: Continue updating their skill related to microwave sources Optical fiber for various applications
during their life time.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	3	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-	3	-
CO6	-	-	-	-	-	-	-	3	-	-	-	-	-	3
CO7	-	-	-	-	-	-	-	-	3	-	-	-	-	3
CO8	-	-	-	-	-	-	-	-	-	3	-	-	-	3
CO9	-	-	-	-	-	-	-	-	-	-	-	3		3
CO*	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**	**3**	**3**

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

B.Tech III Year II Semester								
Course Code	**Category**	**Hours/week**			**Credits**	**Maximum Marks**		
20CA52502	**Mandatory Course**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		2	**0**	**0**	**2**	**-**	**-**	**-**
Contact Classes: 32		**Tutorial Classes: Nil**			**Practical Classes: Nil**			**Total Classes: 32**

COURSE OBJECTIVES:

The course should enable the students:

- Understand the concept of Traditional knowledge and its importance
- Know the need and importance of protecting traditional knowledge.
- Know the various enactments related to the protection of traditional knowledge.
- Understand the concepts of Intellectual property to protect the traditional knowledge.

UNIT-I	**INTRODUCTION TO TRADITIONAL KNOWLEDGE**	**Classes:08**

Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge.

UNIT-II	**PROTECTION OF TRADITIONAL KNOWLEDGE**	**Classes:06**

Protection of traditional knowledge: The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNIT-III	**LEGAL FRAMEWORK AND TK**	**Classes:06**

A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006,Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act);

B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.Geographical indicators act 2003.

UNIT-IV	**TRADITIONAL KNOWLEDGE AND INTELLECTUAL PROPERTY**	**Classes:06**

Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

UNIT-V	**TRADITIONAL KNOWLEDGE IN DIFFERENT SECTORS**	**Classes:06**

Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK. 139.

Text Books:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin KumaSingh, Pratibha Prakashan 2012.

Reference Books:

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Understand and elucidate the basic knowledge of traditional knowledge to develop the physical and social changes on traditional knowledge system.

CO2: Describe the significance of traditional knowledge protection to communicate traditional knowledge system.

CO3: Explain the acts related to schedule tribes, traditional forest dwellers, plants protection and farmers to inculcate the legal protection information.

CO4: Evaluate the legal mechanism of traditional knowledge protection to show the difference between IPR and non-IPR system.

CO5: Demonstrate the engineering, biotechnology, agricultural and medicine system to understand find the healthcare soundness of the traditional societies.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-	-

EMBEDDED SYSTEMS
(OPEN ELECTIVE)

B.Tech III Year I Semester

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
20CA04508	Elective	3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes:48		

Course Objectives:
The course should enable the students:

1. To understand the fundamental concepts of embedded systems.
2. To understand the architecture of ARM and TM4C Family fundamentals.
3. To understand the addressing and interfacing of ARM processor
4. To understand the concepts of RTC, PMW, Watch dog timer.

UNIT-I	INTRODUCTION TO EMBEDDED SYSTEMS	Classes: 10

Introduction of Embedded Systems, Characteristics of an Embedded Systems, Classification of Embedded Systems, Application of an Embedded Systems, Embedded System Memory Types, Embedded System Interfacing: serial Communication, Parallel vs. serial communication, Asynchronous Serial, Embedded System Design Process.

UNIT-II	EMBEDDED SYSTEMS ARCHITECTURE	Classes: 9

*Embedded system Architecture. Introduction of ARM and ARM architecture and Cortex – M series, Introduction to the TM4C family viz. TM4C applications. TM4C129CNCZAD block diagram, address space, on-chip peripherals (analog and digital) Register sets, Addressing modes and instruction set basics.

UNIT-III	OVERVIEW OF MICROCONTROLLER AND EMBEDDEDSYSTEMS	Classes: 10

Overview of Microcontroller and its architecture, Embedded hardware and various building blocks, Interfacing Processor, Memories and I/O Devices, I/O interfacing concepts, Timer and Counting Devices. Embedded System Design and Co-design Issues in System Development Process), Design metrics of embedded systems.

UNIT-IV	MICROCONTROLLER FUNDAMENTALS FOR BASIC PROGRAMMING	Classes: 10

pull up/down registers, Memory Mapped Peripherals, programming System registers, Watchdog Timer, need of low power for embedded systems, System Clocks and control, Active vs Standby current consumption. Introduction to Interrupts, Interrupt vector table, interrupt programming. Basic Timer, Real Time Clock (RTC), Motion Control Peripherals: PWM Module & Quadrature Encoder Interface (QEI).

UNIT-V	EMBEDDED COMMUNICATIONS PROTOCOLS AND INTERNET OF THINGS	Classes: 9

Embedded Networking fundamentals, Synchronous/Asynchronous interfaces (like UART, SPI, I2C,USB), serial communication basics, baud rate concepts, Interfacing digital and analog external device, Implementing and programming UART, SPI and I2C,Internet of Things: IoT overview and architecture, Overview of wireless sensor networks and design examples.

TEXT BOOKS:

1. Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers, Createspacepublications.2014.
2. Embedded Systems: IntroductiontoARMCortex-MMicrocontrollers,5thedition, Jonathan W.Valvano, Create space publications,2012.

Embedded Systems 2E Raj Kamal, Tata McGraw-Hill Education,2011.

REFERENCEBOOKS:

1. CC3100/CC3200SimpleLink™Wi-Fi®Internet-on-a-ChipUserGuideTexasInstrumentsLiterature Number: SWRU368A April2014–Revised August 2015.
2. Embedded Systems architecture, Tammy Noergaard, Newnes publications,2005.
3. Embedded Systems hand book, Richard Zurawski,
4. The Art of Designing Embedded Systems by Jack Ganssle, 2nd edition, Newnes publications,2008.

WEBREFERENCES:

1. http://processors.wiki.ti.com/index.php/HandsOn_Training_for_TI_Embedded_Processors
2. http://processors.wiki.ti.com/index.php/MCU_Day_Internet_of_Things_2013_Workshop
3. http://www.ti.com/ww/en/simplelink_embedded_wi-fi/home.html

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Demonstrate the knowledge on the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.

CO2: Analyze various examples of embedded systems based on TM4C123x & TM4C129x Processor.

CO3: Apply the knowledge of software development for the embedded hardware and bus protocols.

CO4: Apply the knowledge of programming to writing the program to configure and interface the various peripherals with the TM4C processor.

CO5: To understand the concept of IOT devices.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	2	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	-	**2**	-	-	-	-	-	-	-	-	**3**	-

OPTICAL COMMUNICATION
(OPEN ELECTIVE)

B. Tech III Year II Semester								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
20CA04608	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

Course Objectives:
The course should enable the students to:

1. Understand the basics of fiber optics.
2. Give clear understanding of various components such as Optical fibers, Photo detectors, connectors, coupling devices and optical amplifiers Knowledge of various components used in optical networks.
3. Get Knowledge about Various topologies used to construct optical networks.

UNIT-I	**INTRODUCTION TO OPTICAL FIBERS**	**Classes: 10**

Evolution of fiber optic system, Element of an Optical Fiber Transmission link, Ray Optics, Optical
Fiber Modes and Configurations, Mode theory of Circular Wave guides, Overview of Modes, KeyModal concepts, Linearly Polarized Modes, Single Mode Fibers, Graded Index fiber structure.

UNIT-II	**SIGNAL DEGRADATION OPTICAL FIBERS**	**Classes: 10**

Attenuation, Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides, Information Capacity determination, Group Delay, Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers, Polarization Mode dispersion,
Intermodal dispersion, Pulse Broadening in GI fibers, Mode Coupling, Design Optimization of SM fibers, RI profile and cut-off wavelength.

UNIT-III	**FIBER OPTICAL SOURCES AND COUPLING**	**Classes: 10**

Direct and indirect Band gap materials, LED structures, Light source materials, Quantum efficiencyand LED power, Modulation of a LED, lasers Diodes, Modes and Threshold condition, Rate equations,
External Quantum efficiency, Resonant frequencies, Temperature effects, Introduction to Quantumlaser, source-to-fiber Power Launching, Lensing schemes, Fiber–to- Fiber joints, Fiber splicing.

UNIT-IV	**FIBER OPTICAL RECEIVERS**	**Classes: 9**

PIN and APD diodes, Photo detector noise, SNR, Detector Response time, Avalanche MultiplicationNoise, Comparison of Photo detectors, Fundamental Receiver Operation, preamplifiers, Error Sources,
Receiver Configuration, Probability of Error, Quantum Limit.

UNIT-V	**SYSTEM DESIGN AND APPLICATIONS**	**Classes: 9**

Introduction to design of Analog Systems, System Specification, Power budget, Bandwidth budget,Introduction to design of Digital Systems, System specification, Rise time budget, power budget,
Receiver sensitivity.

Text Books:

1. Gerd Keiser, “Optical Fiber Communication” McGraw –Hill International, Singapore, 3rd edition,2000.
2. J.Senior, “Optical Communication, Principles and Practice”, Prentice Hall of India, 1994.

Reference Books:

1. Max Ming-Kang Liu, "Principles and Applications of Optical Communications", TMH, 2010.
2. S.C.Gupta, "Text book on optical fiber communication and its applications", PHI, 2005.
3. Satish Kumar, "Fundamentals of Optical Fiber communications", PHI, 2009.

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: Exhibit the knowledge on Optical Fiber Communication System, recognize and classify the structures of Optical fiber and types.

CO2: Analyze the channel impairments such as losses and dispersion and analyze various Coupling losses.

CO3: Demonstrate the knowledge on the characteristics of optical sources and detectors.

CO4: Analyze the properties of optical sources, detectors and receivers.

CO5: Design a basic optical fiber communication link/system and test its performance.

CO-PO/PSO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**2.6**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

WIRELESS COMMUNICATIONS
(OPEN ELECTIVE)

B.Tech IV Year I Semester

Course Code	Category	Hours/Week			Credits	Maximum Marks		
20CA04713	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

UNIT-I	WIRELESS COMMUNICATION SYSTEMS & STANDARDS	Classes-10

Evolution of Mobile Radio Communications, Examples of Wireless Communication Systems, Comparison of Common Wireless Communication Systems, Different generations (1G to 5G) of Cellular Networks, Wireless Local Loop (WLL), Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANs).

UNIT-II	CELLULAR CONCEPT	Classes-10

Frequency Reuse, Channel Assignment strategies, Handoff Strategies, Interference and System Capacity, Trunking and Grade of service, Improving coverage and capacity in Cellular systems.

UNIT-III	MOBILE RADIO PROPAGATION & FADING	Classes-10

Introduction to Radio wave propagation, free space propagation model, the three basic propagation mechanisms, Reflection, Ground reflection (Two Ray) model, practical link budget design using path loss models, Outdoor propagation models: Longley Rice- Model, Durkin's Model- A Case Study, Okumura model, Hata Model. Indoor Propagation Models: Partition Losses, Long distance path loss model. Small scale fading and Multipath fading, impulse response model of a multipath channel. Types of small scale fading.

UNIT-IV	EQUALIZATION AND DIVERSITY	Classes-10

Introduction and fundamental of equalization, Training a generic adaptive equalizer, equalizers in a communication receiver, survey of equalization techniques, Linear and Non equalizers. Adaptive equalization algorithms. Diversity Schemes (Space, frequency, field and polarization diversities) and combining techniques, Outage probability in MRC under imperfect ISI, Capacity of Wireless Channels, RAKE receiver.

UNIT –V	MIMO	Classes-08

Introduction, MIMO channel modelling-COST model; Outage probability of correlated MIMO channels under different combining schemes; Capacity of MIMO channel; Measurement of MIMO channel capacity; Space-time coding; Diversity multiplexing trade-off; MIMO transmission/detection techniques, Basic principle of multiuser MIMO and Massive MIMO, channel estimation using reciprocity principle; NOMA.

Text Books:

1. T. S. Rappaport, Wireless Communication Principles (2/e), Pearson, 2002.

Reference Books:

1. W. C. Y. Lee, Mobile Communication Engineering. (2/e), McGraw- Hill, 1998.
2. A Goldsmith, Wireless Communications, Cambridge University Press, 2005.
3. https://www.qualcomm.com/5g/what-is-5g
4. https://www.gsma.com/futurenetworks/wp-content/uploads/2018/04/Road-to-5G-Introduction-and-Migration_FINAL.pdf

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

CO1: To study the recent trends adopted in cellular systems and wireless standards.
CO2: Demonstrate the mobile communication system from 1G to 4G.
CO3: Understand the various transmission and reception techniques used in different mobile communication systems.
CO4: Demonstrate the importance of communication channel in performance of mobile

communication system.

CO5: Analyze the MIMO channel modelling and capacity through the measurement of the MIMO Channel.

CO-PO/PSO Mapping														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO	**3**	**3**	**2**	-	-	-	-	-	-	-	-	-	**3**	-

NEURAL NETWORKS AND FUZZY LOGIC
(OPEN ELECTIVE)

B.Tech IV Year I Semester

Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
20CA04714	Elective	3	0	0	3	30	70	100
Contact Classes: 48	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 48		

Course Objectives:

The course should enable the students to:

1. Meliorate the knowledge of fundamentals and types of neural networks.
2. Develop the different Algorithms for neural networks.
3. Meliorate the knowledge in Fuzzy logic principles.
4. Correlate the principles with applications of neural networks and fuzzy logic.

UNIT-I | **INTRODUCTIONTO ARTIFICIAL NEURAL NETWORKS AND LEARNING LAWS** | **Classes: 10**

Artificial neural networks and their biological motivation, terminology, models of neuron, topology, characteristics of artificial neural networks, types of activation functions, Learning methods: Error correction learning, Hebbian learning, perception, XOR problem, perceptron learning rule convergence theorem, adaline.

UNIT-II | **FEED FOR WARD AND RECURRENT NEURAL NETWORKS** | **Classes: 10**

Multi-layer perception, back propagation learning algorithm, universal function approximation, associative memory, auto association, hetero association, recall and cross talk, linear auto associator, bi-directional associative memory, Hop field neural network.

UNIT-III | **UNSUPERVISED LEARNING AND SELF ORGANISING NETWORKS** | **Classes: 10**

Competitive learning neural networks, max net, Mexican hat, hamming net.
Kohonen self-organizing feature map, counter propagation, learning vector quantization, applications of neural networks in image processing, signal processing, modeling and control.

UNIT-IV | **FUZZY SETS AND FUZZY RELATIONS** | **Classes: 09**

Introduction, classical sets and fuzzy sets, classical relations and fuzzy relations, Fuzzy set theory and operations, Properties of fuzzy sets, membership functions, fuzzy to crisp conversion, fuzzy arithmetic

UNIT-V | **FUZZY SYSTEMS** | **Classes: 09**

Fuzzy Logic - Fuzzy Membership, Rules: Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications.

TextBooks:

1. Laurene Fausett, “Fundamentals of Neural Networks-Architectures, algorithms and applications, Pearson Education Inc., 2004.
2. Timothy J.Ross, Fuzzy Logic with Engineering Applications, John Wiley and sons,2004
3. S.Haykin,"Neural Networks, A Comprehensive Foundation", Pearson Education Inc.,2004.

COURSE OUTCOMES	
CO1	Apply the Fundamental knowledge and analyze various types of neural networks.
CO2	Exhibit the knowledge on concepts of feed forward neural networks and Recurrent Neural Networks and analyze its characteristics.
CO3	Analyze different generative models through unsupervised learning and analyze the application of fuzzy logic control to real time systems.
CO4	Exhibit the knowledge on the fuzziness involved in various systems and analyze fuzzy set theory.
CO5	Demonstrate the knowledge on Fuzzy Membership, fuzzy Rules and analyze fuzzy algorithms and its applications.

CO-PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	2	-	-	-	-	-	-	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	2	-	-	-	-	-	-	3	2
CO	**3**	**2.8**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**

DATABASE MANAGEMENT SYSTEM
(OPEN ELECTIVE)

<table>
<tr><td colspan="11">B.Tech III Year I Semester</td></tr>
<tr><td rowspan="2">Course Code</td><td rowspan="2">Category</td><td colspan="3">Hours/ Week</td><td>Credits</td><td colspan="3">Maximum Marks</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>C</td><td>CIA</td><td>SEE</td><td>Total</td></tr>
<tr><td>20CA05506</td><td>Elective</td><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>70</td><td>100</td></tr>
<tr><td>Contact Classes: 48</td><td>Tutorial Classes: Nil</td><td colspan="4">Practical Classes: Nil</td><td colspan="3">Total Classes: 48</td></tr>
</table>

Course Objectives:
The course should enable the students to:

1. To understand the basic concepts of database management systems.
2. To give a good formal foundation on the relational model of data and usage of Relational Algebra.
3. To introduce the concepts of basic SQL as a universal Database language.
4. To demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization.
5. To become familiar with database storage structures and access techniques.

UNIT-I	**INTRODUCTION TO DATABASE SYSTEMS**	**Classes: 10**

Introduction-Database System, Purpose of Database Systems, History of Data base Systems, Database Advantages of Database systems Applications, View of Data - Data Abstraction, Instances and Schema, Data Models, Database Languages - DDL, DML, Database Architecture, Database Users and Administrators.

UNIT-II	**DATA MODELS**	**Classes: 10**

Introduction to Data base design , ER diagrams, Beyond ER Design, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model, Conceptual Design for Large enterprises. Relational Model: Introduction to the Relational Model - Integrity Constraints over Relations, Enforcing Integrity constraints, querying relational data, Logical data base Design, Introduction to Views Destroying/ altering Tables and Views.

UNIT-III	**RELATIONAL ALGEBRA AND CALCULUS**	**Classes: 10**

Relational Algebra and Calculus: Relational Algebra - Selection and Projection, Set operations, Renaming, Joins, Division, Examples of Algebra Queries, Relational calculus - Tuple relational Calculus - Domain relational calculus - Expressive Power of Algebra and calculus. Form of Basic SQL Query - Examples of Basic SQL Queries, Introduction to Nested Queries, Correlated Nested Queries, Set - Comparison Operators, Aggregate Operators, NULL values - Comparison using Null values - Logical connectives - AND, OR and NOT - Impact on SQL Constructs, Outer Joins, Disallowing NULL values, Complex Integrity Constraints in SQL Triggers and Active Data bases.

UNIT-IV	**NORMAL FORMS**	**Classes: 09**

Normalization: Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency (1NF, 2NF and 3 NF), Lossless join and dependency preserving decomposition, concept of surrogate key, Boyce-Codd normal form(BCNF), Multivalued Dependencies.

UNIT-V	**TRANSACTION AND CONCURRENCY CONTROL**	**Classes: 09**

Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, Concurrency Control - Lock - Based Protocols - Timestamp Based Protocols.
Text Books: 1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill, 4th Edition, 2002. 2. Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, TMH.
Reference Books: 1. Introduction to Database Systems, 8/e C J Date, PEA. 2. Database Management System, 6/e RamezElmasri, Shamkant B. Navathe, PEA 3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris,Peter Robb, Cengage Learning.

COURSE OUTCOMES	
CO1	Describe a relational database and object-oriented database
CO2	Create, maintain, and manipulate a relational database using SQL
CO3	Describe ER model and normalization for database design
CO4	Examine issues in data storage and query processing and can formulate appropriate solutions
CO5	Outline the role and issues in management of data such as efficiency, privacy, security, ethical responsibility, and strategic advantage

CO-PO/PSO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	-	-	-	2	-	-	-	-	-	-	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5	3	3	-	-	-	2	-	-	-	-	-	-	3	2
CO	**3**	**2.8**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**