

# **USHARAMA**

**COLLEGE OF ENGINEERING AND TECHNOLOGY**  
(AUTONOMOUS)

(Approved by A.I.C.T.E & Permanently Affiliated to JNTU, Kakinada)  
Accredited by NAAC with "A"Grade  
on NH 16, Telaprolu, Krishna Dist – 521109

**B.TECH**  
**ELECTRONICS AND COMMUNICATION ENGINEERING**

**Course Structure and Syllabus**

**UR19**

**(Applicable for the batches admitted from the Academic Year 2019-2020)**

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**



# USHARAMA

## COLLEGE OF ENGINEERING AND TECHNOLOGY

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**AUTONOMOUS**

*DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING*

### **VISION AND MISSION OF THE INSTITUTE**

#### **VISION OF THE INSTITUTION**

- To become pioneer institute in Education & Research.

#### **MISSION OF THE INSTITUTION**

1. Confer the best technical education to students with commitment to face the challenges in the global competition.
2. Promote industry-institute interaction for skill enhancement and meet the industry needs.
3. Focus on research and education as the twin goals of the organization.
4. Achieve excellence in application-oriented research.
5. Imbibe values and encourage in activities for over-all personality development of the students.

#### **VISION OF THE DEPARTMENT**

The vision of the department is to become pioneer in higher learning & research and to produce creative solution to societal needs.

#### **MISSION OF THE DEPARTMENT**

1. To provide quality education & to make the students entrepreneur & employable.
2. To acquire excellence in application-oriented research in selected areas of Technology by collaborating with core sectors and R & D Laboratories.
3. To provide ethical and value-based education by promoting activities addressing the societal needs.
4. To reach heights of excellence in global competitiveness through continuous up-gradation of technology.
5. To build up comprehensive personality by conducting co and extra-curricular activities.

## **PROGRAMME EDUCATIONAL OBJECTIVES(PEO'S)**

1. Graduates apply their knowledge of mathematics and science to identify, analyze and solve problems in the field of Electronics & develop sophisticated Communication systems.
2. Graduates exhibit their innovative ideas and management skills to meet the day to day technical challenges.
3. Graduates embody a commitment to professional ethics, diversity and social awareness in their professional career.
4. Graduates exhibit a desire for lifelong learning through technical training and professional activities.

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

**PROGRAM OUTCOMES (PO's)**

Po. No	PROGRAM OUTCOME
PO-1	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems..
PO-2	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO-3	<b>Design/development of solutions:</b> 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.
PO-4	<b>Conduct investigations of complex problems:</b> 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.
PO-5	<b>Modern tool usage:</b> 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.
PO-6	<b>The engineer and society:</b> 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.
PO-7	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO-8	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO-9	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO-10	<b>Communication:</b> 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.
PO-11	<b>Project management and finance:</b> 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	<b>Life-long learning:</b> 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.

## PROGRAM SPECIFIC OUTCOMES (PSO's)

### **PROGRAMME SPECIFIC OUTCOMES(PSO'S)**

**PSO 1.** Design, implement and test Electronics and Communication systems using analytical knowledge and applying modern hardware and software tools

**PSO 2.** Develop their skills to solve problems and assess social, environmental issues with ethics and manage different projects in multidisciplinary areas.

**PSO 3.** Improve personality development skills and make them to be useful to the society and industry.

**PSO 4.** Make use of acquired technical knowledge for successful career and qualifying in competitive examinations at the National and Global levels.

**UR19 CBCS REGULATIONS**

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## **1. PREAMBLE**

Usha Rama College of Engineering and Technology (URCET) aims at achieving academic excellence by implementing new initiatives in teaching-learning and evaluation processes. Based on the directions of the University Grants Commission (UGC), New Delhi, All India Council for Technical Education (AICTE), New Delhi and Jawaharlal Nehru Technological University (JNTUK) Kakinada, URCET introduced the Credit Based Semester System (CBSS) in under-graduate programmes offered from the academic year 2019 – 20. Keeping in view of the standardization of the higher education system in India, URCET is going to implement Choice Based Credit System (CBCS).

## **2. ADMISSION CRITERIA**

The eligibility criteria for admission into engineering programmes offered at URCET shall be as prescribed by the Government of Andhra Pradesh. The criteria are given below:

- The candidate shall be an Indian National / NRI.
- The candidate should have completed 18 years of age as on 31st December of the academic year for which the admissions are being conducted.
- The candidate should have passed the qualifying examination (10+2) or equivalent as on the date of admission recognized by BIE, Andhra Pradesh State.
- Seats in each programme in the Institute are classified into three categories i.e., Category – A, Category – B
- Category – Lateral Entry seats as per the GOs.

### **2.1 Category – A Seats**

These seats shall be filled through counseling by convener as per the rank secured by a candidate in the Common Entrance Test (EAMCET) conducted by the Government of Andhra Pradesh and as per other admission criteria laid down in the GOs.

### **2.2 Category – B Seats**

These seats shall be filled by the Institute as per the GOs issued by the Government of Andhra Pradesh from time to time.

### **2.3 Category – Lateral Entry seats**

Direct Admission to Second Year: (Lateral Entry Scheme)

A candidate shall be admitted into the third semester (II year I semester) based on the rank secured by the candidate in the Engineering Common Entrance Test [ECET (For Diploma Holders)] by the Government of Andhra Pradesh and as per other admission criteria laid down in the GOs.

## **3. UNDER-GRADUATE DEGREE PROGRAMMES OFFERED**

The following courses of study are offered at present as specializations for the B. Tech. Courses:

**Table 1: Under graduate degree programs offered**

S.No	Branch
1	Civil Engineering (CE)
2	Electrical and Electronics Engineering ( EEE )
3	Mechanical Engineering (ME )
4	Electronics and Communication Engineering (ECE)
5	Computer Science and Engineering (CSE)
6	Information Technology (IT)

#### 4. AWARD OF B.TECH DEGREE

A student will be declared eligible for the award of B. Tech. Degree if he/she fulfills the following academic requirements:

1. A student shall be declared eligible for the award of the B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academic years
2. The candidate shall register for 160 credits and secure all the 160 credits.

NOTE: Students, who fail to fulfill all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. programme.

3. In case of Lateral Entry students, the candidate shall register for 120 credits and secure all the 120 credits.

NOTE: Students, who fail to fulfill all the academic requirements for the award of the degree within six academic years from the year of their admission, shall forfeit their seat in B.Tech. programme.

#### 5. DURATION OF THE ACADEMIC PROGRAMMES

Under CBCS, it is possible for an outstanding student to qualify for the award of degree in a shorter time than that of the duration specified for the concerned programme. However, the B.Tech. degree shall be issued at the end of normal duration of the programme.

##### **Normal Duration:**

The duration of the B.Tech. degree programme shall be four (4) years.

The duration of the B.Tech Lateral Entry Scheme (LES) degree programme shall be three (3) years.

##### **Maximum Duration:**

The maximum period in which a student can complete a full time B.Tech. degree programme shall be twice the normal duration of the programme, i.e., eight years (16 semesters) for B.Tech. degree and six years (12 semesters) for B.Tech. lateral entry scheme degree (For Diploma Holders).

The maximum period for a programme shall also be dictated by the fact that a student has to demonstrate the prescribed minimum academic performance by registering for the prescribed minimum number of credits in every semester, for continuing in the programme. This period can be equal to or lesser than the maximum period.

## 6. B.TECH. PROGRAMME COURSE STRUCTURE

### 6.1 Medium of Instruction And Examination

The medium of instruction shall be English for all the courses including their content delivery and examinations, seminars, presentations and project evaluation as prescribed in the programme curriculum.

### 6.2 Scheme of Instruction And Examination:

The scheme of instruction and examination of all B. Tech programs are given separately.

### 6.3 Minimum Instruction Days

Each semester shall consist of 16 weeks of academic work excluding examination and evaluation. The minimum instruction days for each semester shall be 90 working days.

## 7. COURSES AND CREDIT STRUCTURE

**Table 2: Course Code and Definitions**

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HMC	Humanities and social sciences including Management Courses
PCC	Professional Core Courses
PEC	Professional Elective Courses
OEC	Open Elective Courses
LC	Laboratory Courses
MC	Mandatory Courses
PROJ	Project

**Table 3: Description of Courses**

Broad Course Classification	Course Category	Description of Courses
Foundation Courses	Basic Science courses	Includes mathematics, physics, chemistry and biology courses
	Engineering Science courses	Includes fundamental engineering courses
	Humanities and Social Science courses including Management courses	Includes courses related to humanities, social sciences and management
Core courses	Professional Core courses	Includes core courses related to the parent discipline / department / branch of Engineering
	Project Work	B.Tech. project stage-I and stage-II
	Mini- project	Internship / Industry oriented mini-project
Elective courses	Professional Elective courses	Includes elective courses related to the parent discipline / department t/ branch of Engineering
	Open Elective courses	Elective courses which include inter – disciplinary courses or courses in an area outside the parent discipline / department / branch of Engineering
Mandatory courses		Mandatory non-credit courses

**Table 4: Category of Courses, their Codes and Distribution of Credits**

Type of Courses	Course Category	Code	Range of Credits	
Compulsory Courses	Engineering Science courses	ESC	14-20	
	Foundation courses	Basic Science courses	BSC	17-25
		Humanities & Social Science Incl. Management	HM	09-16
	Core courses	Professional Core courses	PC	70-75
	Project	Project	PROJ	12-13
Elective Courses	Professional Elective	PE	15-20	
	Open Elective	OE	09-12	
Mandatory Courses	Mandatory courses MC		Non- Credit	
Total Credits			160	

### **Engineering Exploration Project**

Engineering Exploration Project is offered to the First year students of all engineering disciplines. The motivation of including this project is to make the students practice creative problem solving method - Design Thinking which fosters collaboration and solve problems in human-centered ways. It enables the students to exercise and identify design opportunities through various phases with the help of hands-on activities. Obtaining a best solution for an identified problem involves a non-linear, iterative process which seeks to understand users, challenge assumptions, redefine problems and create innovative solutions to prototype and test. The students are encouraged to explore real-world problems and expected to take charge of their own learning, work together in teams towards the problem.

The evaluation of the Engineering Exploration Project involves in writing their observations in Activity Cards at the end of each task given in syllabus and submitting a final report along with working prototype.

## **8. CHOICE BASED CREDIT SYSTEM**

Flexibility is extended to the fast learning students to take the courses of higher semesters in advance as per their convenience to concentrate on their placement activity/ project work etc., during the seventh/eighth semesters.

### **8.1 CBCS Course Registration policy**

Fast learning students can register for additional courses from higher semesters by satisfying the pre-requisite course(s) to a maximum of 6 credits in each of the semesters from 3rd semester onwards along with the regular semester courses as prescribed. There is no minimum limit on the credits for taking additional courses.

### **8.2 Eligibility for choosing CBCS flexibility**

Regular Students (4 Year duration), entering the nth semester must pass all the subjects in single attempt as on date and with CGPA  $\geq 7.75$  up to (n-2)th semester, are only eligible to opt for this flexibility.

Lateral entry students (3 year duration) with 70% Marks in their Diploma are eligible to opt for this flexibility during 3rd and 4th Semesters. Those students entering into V/ VI /VII semester with no backlog courses as on date and with CGPA  $\geq 7.75$  up to (n-2)th semester, are only eligible to opt for this flexibility

- List of additional courses offered in the even & odd semesters, registration dates will be notified by the respective departments well in advance.
- Withdrawal from the respective course by the student may be permitted within 10 days after the commencement of the course.
- Choice of opting this flexibility is purely optional to the students.
- Minimum number of students required to register for an additional course shall be twenty (20). In case the registered strength for the additional course is less than twenty (20), the course may be

offered on the recommendation of the Head of the Department and subsequent approval of the Principal.

## **9. EXAMINATIONS AND SCHEME OF EVALUATION**

### **9.1 Description of Evaluation**

#### **9.1.1 Internal Evaluation**

The performance of the student in each course is evaluated by the faculty/course coordinator all through the semester with mid-term examinations, assignments, Online quiz, project reviews, viva voce, laboratory assessment and other means covering the entire syllabus of the course.

#### **9.1.2 Semester End Evaluation (SEE)**

Semester End Examination (SEE) shall be conducted by the Controller of Examinations (COE) by inviting Question Papers from the External Examiners. Question papers may be moderated for the coverage of syllabus, pattern of questions by an examiner appointed by the COE. The appointed examiner shall prepare a detailed answer key and scheme of valuation and submit it to the COE. Laboratory SEE shall be conducted involving internal and external examiners. The controller of examinations must use the panel of examiners for question paper setting/evaluation approved by concerned BOS. At present, Question paper setting and evaluation shall be external (IIT/NIT/Central University/State University/Reputed Autonomous Colleges).

## **9.2 CONTINUOUS INTERNAL EVALUATION**

### **9.2.1 Theory Courses**

Each course is evaluated for 30 marks. For theory subjects, during a semester, there shall be two mid-term examinations. Each mid-term exam consists of one objective paper, one descriptive paper and one assignment. The midterm marks shall be awarded giving a weightage of 75% in the midterm examination in which the student scores more marks and 25% for the midterm examination in which the student scores less marks.

- (a) Two assignment tests each for 5 marks will be conducted for 60 minutes duration. Question bank with minimum six comprehensive questions from the concerned UNIT of the syllabus will be given at least a week in advance before the commencement of Assignment Test.
- (b) Two descriptive type mid-term examinations each for 15 Marks will be conducted for 90 minutes duration.
- (c) Two Online Quizzes (Objective type mid-term exam) for 10 marks will be conducted for 20 minutes duration.
- (d) For the subject having design and/or drawing (such as Engineering Graphics & Drafting, Machine Drawing) and

Estimation, there is no online quiz. The distribution of internal marks shall be as given below.

Day to day performance – 15M

Midterm exam – 15M

- (e) **Mandatory Courses (Non Credit):** Environmental Sciences, Universal Human Values, Ethics, Indian Constitution and Essence of Indian Traditional Knowledge etc are non-credit (zero credits) mandatory courses. Environmental Sciences shall be offered compulsorily as Mandatory Course for all branches. There shall be Semester End Examination for 70 marks and it shall be conducted by the college internally. Two internal examinations shall be conducted for 30 marks. Internal marks can be calculated with 75% weightage for best performance internal exam and 25% weightage for least performance internal exam. Student has to secure 35% of marks in the Semester End Examination and minimum 40% marks in the sum total of the internal marks and Semester End Examination marks putting together for passing the course. There is no online internal exam for mandatory courses. No marks or letter grade shall be printed in the transcripts for all mandatory non-credit courses, but only Completed (Y)/Not-completed (N) will be specified. A student who failed to complete the course can appear for a supplementary examination as per the schedule announced by URCET.

### **9.2.2 Lab Courses**

For Laboratory courses there shall be continuous internal evaluation during the semester for 20 marks (Day to day work 10M + Record 5M + Internal laboratory test 5M) and semester end evaluation for 30 marks.

### **9.2.3 Engineering Exploration Project / Engineering Project for Community Services /Mini Project**

For Engineering Exploration Project /Engineering Project for Community services / Mini Project, there shall be Internal evaluation during the semester for 20 marks and semester end evaluation for 30 marks.

### **9.2.4 Project: 80 Marks**

Project work shall be carried out in two stages. The Project stage 1 during the VII semester and Project stage 2 during the VIII semester. Project stage 1 shall be evaluated for 50 marks and Project stage 2 shall be evaluated for 150 marks.

For Project stage 1, there shall be an internal evaluation during the VII semester for 20 marks and semester end evaluation for 30 marks. The internal evaluation for project stage 1 shall be on the basis of project reviews conducted by the Project Review Committee (PRC). The PRC consists of HOD, Project coordinator, two senior faculty members of the department and project guide. Students have to submit a report containing introduction

to the project work, literature survey and problem definition for the project stage 1 at the end of VII semester.

For Project stage 2, there shall be an internal evaluation during the VIII semester for 60 marks and semester end evaluation for 90 marks. The internal evaluation for Project stage 2 shall be on the basis of project reviews conducted by the Project Review Committee (PRC). Students have to submit a report containing the project work carried out during Project stage 1 and Project stage 2 putting together at the end of VIII semester.

### **9.3 SEMESTER END EXAMINATIONS**

#### **9.3.1 Theory Courses (70M)**

The Semester End Examination shall be conducted for 3 hours duration at the end of the semester. The question paper shall be given in the prescribed pattern. Each course shall consist of 5 units of syllabus. The questions shall be framed in line with the Course Outcomes defined and Blooms Taxonomy levels.

#### **9.3.2 Laboratory Courses**

The semester end examination for laboratory courses shall be conducted for three hour duration at the end of semester for 30 marks. Each Semester-end Laboratory Examination shall be conducted by an External Examiner along with an Internal Examiner. The average of the marks awarded by Internal and External Examiners shall be taken into consideration in case of difference of opinion.

#### **9.3.3 Engineering Exploration Project/ Engineering Project For Community Services/Mini Project: 30 Marks**

The distribution of semester end examination marks for Engineering Exploration Project / Engineering Project for Community services and Mini Project is given below

Report – 20 Marks

Presentation and Viva Voce – 10 Marks

The semester end examination shall be conducted and evaluated by the Committee nominated by the Head of the Department.

#### **9.3.4 Project: 120 Marks**

The semester end examination for project stage 1 shall be held for 30 marks and project stage 2 shall be for 90 marks (Evaluation, Presentation and Viva Voce) by a committee consisting of an external examiner, Head of the Department and Project coordinator. The evaluation of project stage 1 shall be conducted at the end of VII semester and project stage 2 at the end of VIII semester. The average of marks awarded by the committee members shall be taken in to consideration. The semester end examination for both project stages shall be completed before the commencement of semester end theory examinations.

**9.3.5 Self-Learning Courses:**

(Prescribed from the existing open courseware)

Students who have qualified in the examination conducted by the MOOCs providers are exempted from appearing in the internal and semester end evaluations conducted by the institution in that category.

In case a student fails to complete the MOOCs course offered by MOOCs providers, he/she may be allowed to register again for the same with any of the providers from the list approved by the department.

For the courses under this category, those students who have not registered under MOOCs platform and are able to learn by themselves shall appear for internal evaluation for 20 marks and semester end examination for 30 marks in the VIII semester

The distribution of marks for internal evaluation is given below

Home assignment - 5M

Assignment test - 5M Midterm

Examination – 10M

**9.3.6 Industry Interaction / Internships: 100M**

Students have to register for an Internship in collaboration with an Industry of their specialization during summer.

The candidate shall submit the comprehensive report to the department. The report will be evaluated for 100 marks by the Review Committee consisting of Head of the department, Program Coordinator and Industry Institute Interaction Coordinator.

**9.3.7 Induction Program:**

Induction program is mandatory for all the first year B.Tech students and shall be conducted as per Semester – 0 course structure.

**9.4 MINIMUM ACADEMIC REQUIREMENTS**

In addition to the attendance requirements mentioned in these regulations for the award of B.Tech Degree, a student must satisfy the minimum academic requirements as given below:

A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each theory or practical or design or drawing course in B.Tech programme, if he secures

**9.4.1** A minimum of 35% marks for each theory course and Mandatory Course in the semester end examinations and a minimum of 40% marks for each theory course and Mandatory Course considering both IE and SEE taken together.

**9.4.2** A minimum of 50% marks for lab courses, internship, industry oriented mini-project and project.

**9.4.3** A student shall be treated as failed, if he does not submit a report on internship, industry oriented mini-project, project or does not make a presentation of the same before the evaluation committee as per the schedule, or secures less than 50% marks in evaluation.

**9.4.4** In case of a student not meeting any of the above points, student may re-appear for each of the evaluation of internship, industry oriented mini-project, project, design sensitization, design thinking courses, as scheduled by the evaluation committee until he/she meets the requirement.

**9.4.5** A student shall register for all the courses covering 160 credits as specified and listed in the course structure of the B.Tech programme, fulfills all the attendance and academic requirements for 160 credits, 'earn all 160 credits' by securing SGPA  $\geq 5.0$  (in each semester) and CGPA (at the end of each successive semester)  $\geq 5.0$  to successfully complete the under-graduate programme.

**9.4.6** If a student fails to secure a pass grade in a particular course, he shall register and reappear for the supplementary examination in that course. It is mandatory that he should continue to register and reappear for the examination till he secures a pass grade.

**9.4.7** A student eligible to appear in SEE of any course, but remains absent from it or gets failed (failing to secure 'D' grade or above) may reappear for that course in the supplementary SEE as and when conducted. In such cases, IE assessed earlier for that course shall be carried over, and added to the marks to be obtained in the supplementary SEE examination for evaluating the performance in that course.

**9.4.8** A student detained in a semester due to shortage of attendance, may be re-admitted into the same semester in the next academic year for fulfillment of the academic requirements.

**9.4.9** Academic regulations applicable to the semester in which re-admission is sought shall be applicable to the re-admitted student. However, no grade allotments or SGPA/ CGPA calculations shall be done for the entire semester in which the student has been detained.

**9.4.10** A student detained due to lack of credits, shall be promoted to the next year only after acquiring the required academic credits. Academic regulations applicable to the semester in which re-admission is sought shall be applicable to the re-admitted student.

**9.4.11** The student shall be qualified in two certificate courses not less than 40 hours duration each during his course of study. Out of the two certificate courses, atleast one certificate course shall be pursued through MOOCs platform like SWAYAM-NPTEL online courses, Coursera online courses, BEC certification courses etc.

**9.4.12** Students who fail to earn 160 credits(LEs 120 Credits) as indicated in the course structure within eight academic years(LEs 6) counting from the year of their admission shall forfeit their seat in B.Tech programme and their admission stands cancelled.

## 9.5 REVALUATION AND PERSONAL VERIFICATION

### 9.5.1 Internal Evaluation

The Internal Evaluation scripts shall be shown to the students before finalizing the marks.

### 9.5.2 Semester End Evaluation

1. As per the notification issued by the Controller of Examinations, the students can submit the application form along with the requisite fee receipt for revaluation of his/her answer script(s) of theory course(s), if he/she is not satisfied with marks obtained.
2. The Controller of Examinations shall arrange for re-evaluation of those answer script(s).
3. A new examiner, other than the first examiner, shall re-evaluate the answer script(s).
4. Best out of the two will be taken into consideration.

### 9.5.3 Personal verification

On payment of special fee, the Semester End Examination answer scripts shall be shown to the candidate in front of the Controller of Examinations.

## 9.6 PERFORMANCE AND GRADING SYSTEM

Marks Range (% of marks)	Letter Grade	Level	Grade Points
≥ 90	O	Outstanding	10.00
≥80 to <90	S	Excellent	9.00
≥70 to <80	A	Very Good	8.00
≥60 to <70	B	Good	7.00
≥50 to <60	C	Fair	6.00
≥40 to <50	D	Satisfactory	5.00
<40	F	Fail	0
	AB	Absent	0

## 9.7 COMPUTATION OF SGPA AND CGPA

### Computation of SGPA

The following procedure is to be adopted to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e

$$SGPA (S) = \frac{\sum_i (C_i \times G_i)}{\sum C_i}$$

Where  $C_i$  is the number of credits of the  $i^{\text{th}}$  course and  $G_i$  is the grade point scored by the student in the  $i^{\text{th}}$  course.

### Computation of CGPA

The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semester of a programme, i.e.

$$\text{CGPA (S)} = \frac{\sum (C_i \times S_i)}{\sum C_i}$$

Where  $S_i$  is the SGPA of the  $i^{\text{th}}$  semester and  $C_i$  is the total number of credits in that semester.

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

$$\text{Equivalent Percentage} = (\text{CGPA} - 0.75) \times 10$$

### 9.8 Award of Class

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B.Tech Degree, he shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured	
First Class with Distinction	$\geq 7.75$ with no subject failures	From the CGPA secured from 160 Credits (120 credits incase of LEs)
First Class	$\geq 6.75$ with subject failures	
Second Class	$\geq 5.75$ to $< 6.75$	
Pass Class	$\geq 4.75$ to $< 5.75$	

### 9.9 WITH HOLDING RESULTS

If the student has any dues, to the institute or if any case of indiscipline is pending against him, the result of the student will be withheld. His degree will be withheld in such cases.

### 9.10 MALPRACTICES:

Institution implements JNTUK guide lines for malpractices and improper conduct in examinations.

#### Disciplinary Action for Malpractices/Improper Conduct in Examinations

S.No	Nature of Malpractices/Improper conduct	Punishment
	<i>If the candidate:</i>	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm	Expulsion from the examination hall and cancellation of the performance in that subject only.

**UR19 CBCS Regulations**

	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)	
(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

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		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 officer-in charge 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 officer in-charge, 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	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.

**UR19 CBCS Regulations**

	which result in damage to or destruction of property in the examination hall or any part of the College campus 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.	
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 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.

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		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 Principal for further action to award suitable punishment.	

### 10. ATTENDANCE REQUIREMENTS AND DETENTION POLICY

Student has to maintain a minimum of 50% in each subject and 75% of attendance in aggregate to be eligible for appearing the Semester End Examinations. Students who do not meet this requirement shall be detained in that semester.

However, the following are the special cases where the lack of attendance can be condoned.

- (i) Shortage of attendance up to 10% on medical grounds in which case the student must submit the medical certificate from any recognized medical practitioner on the day of reporting back to the class work after recovery from ill health.
- (ii) Up to a maximum of 10% if the student represents the university/state/country in any extra /co-curricular activities.

#### **Shortage of attendance below 65 % shall in no case be condoned.**

- A stipulated fee shall be payable towards condonation of shortage of attendance.
- Students, who do not meet the minimum required attendance in a semester, shall be detained in that semester and their registration for that semester shall stand cancelled. They shall not be promoted to the next semester.
- Students detained in a semester shall seek re-admission into that semester as and when offered.
- Academic regulations applicable to the semester in which re-

admission is sought shall be applicable to the re-admitted student. In case if there are any professional electives and/or open electives, the same may also be re- registered if offered. However, if those electives are not offered in the later semesters, then alternate electives may be chosen from the same set of elective courses offered under that category.

- A student fulfilling the attendance requirement in the present semester shall not be eligible for re-admission into the same class.

### **11. ELIGIBILITY CRITERIA FOR SEMESTER END EXAMINATIONS**

- i) Minimum required attendance 75%
- ii) No dues

### **12. PROMOTION RULES**

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.8 for promotion to higher classes

- a. A student shall be promoted from first year to second year if he fulfills the minimum attendance requirement as per norms of the college.
- b. A student will be promoted from II to III year if he fulfills the minimum attendance requirements in II year II semester and also the academic requirement of 40% of credits up to II year II Semester from all the examinations, whether or not the candidate takes the examinations. Due to any reason, if II Year II Semester results are not declared/delayed, student must have secured 40% of total credits up to II Year I semester of the respective programme from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
- c. A student shall be promoted from III year to IV year if he fulfills the minimum attendance requirements in III year II semester as per the norms of the college and also the academic requirements of 40% of the credits up to III year II semester from all the examinations, whether or not the candidate takes the examinations. Due to any reason, if III Year II Semester results are not declared/delayed, student must have secured 40% of total credits up to III Year I semester of the respective programme from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.

### **13. DISCIPLINE**

Students shall conduct themselves within and outside the premises of the Institute in a manner befitting the students of our Institution.

#### **13.1 Ragging:**

As per the order of Honorable Supreme Court of India, ragging in any form is considered as criminal offence and is banned. Any form of ragging will be severely dealt with the institute implements anti ragging regulations of UGC.

#### **URCET - ANTI RAGGING REGULATIONS**

#### **According to UGC Anti Ragging Regulations 2009**

#### **UGC REGULATIONS ON CURBING THE MENACE OF RAGGING IN HIGHER EDUCATIONAL INSTITUTIONS, 2009**

In exercise of the powers conferred by clause (g) of Sub-Section (1) of Section 26 of the University Grants Commission Act, 1956, the University Grants Commission, hereby, makes the following Regulations, namely

#### **Title, commencement and applicability:-**

1. These regulations shall be called the "UGC Regulations on Curbing the Menace of Ragging in Higher Educational Institutions, 2009".
2. They shall come into force with immediate effect.
3. They shall apply to all the Universities established or incorporated by or under a Central Act, a Provincial Act or a State Act, to all Institutions deemed to be University under Section 3 of UGC Act, 1956, to all other higher Educational Institutions, Including the departments, constituent units and all the premises (academic, residential, sports, canteen, etc.) of such Universities, deemed University and other Higher Educational Institutions, whether located within the campus or outside, and to all means of transportation of students whether public or private.

#### **Objective:**

To root out raging in all its forms from Universities, Colleges and other educational institutions in the country by prohibiting it by law, preventing its occurrence by following the provision of these regulations and punishing those who indulge in ragging as provided for in these regulations and the appropriate law in force.

#### **"Ragging" means the following:**

Any conduct whether by words spoken or written or by an act which has the effect of teasing, treating or handling with rudeness any other student, indulging in rowdy or undisciplined activities which causes or is likely to cause annoyance, hardship or psychological harm or to raise fear or apprehension thereof in a fresher or a junior student or asking the students to do any act or perform something which such student will not in the ordinary course and which has the effect of causing or generating a

sense of shame or embarrassment so as to adversely affect the physique or psyche of a fresher or a junior student.

**Punishable ingredients or Ragging:**

- Abetment to ragging;
- Criminal conspiracy to ragging;
- Unlawful assembly and rioting while ragging;
- Public nuisance created during ragging;
- Violation of decency and morals through ragging;
- Injury to body, causing hurt or grievous hurt;
- Wrongful restraint;
- Wrongful confinement;
- Use of criminal force;
- Assault as well as sexual offences or unnatural offences;
- Extortion;
- Criminal trespass;
- Offences against property;
- Criminal intimidation;
- Attempts to commit any or all of the above mentioned offences against the victim(s);
- Physical or psychological humiliation;
- All other offences following from the definition of "Ragging".

**Punishments:**

**At the institution level:**

Depending upon the nature and gravity of the offence as established by the Anti-Ragging Committee of the institution, the possible punishments for those found guilty of ragging at the institution level shall be any one or any combination of the following:

- Suspension from attending classes and academic privileges.
- Withholding/Withdrawing scholarship/fellowship and other benefits.
- Debarring from appearing in any test/examination or other evaluation process.
- Withholding results.
- Debarring from representing the institution in any regional, National or International meet, tournament, Youth festival, etc.
- Suspension/ Expulsion from the hostel.
- Cancellation of Admission.
- Rustication from the Institution for period ranging from 1 to 4 semesters.
- Expulsion from the Institution and consequent debarring from admission to any other institution for specified period.
- Fine ranging between Rupees 25,000/- and Rupees 1 Lakh.

**Collective punishment:** when the persons committing or abetting the crime of ragging are not identified, the institution shall resort to collective punishment.

### **13.2 Eve Teasing**

- i) Definition: "Eve teasing" means any indecent conduct or act by a man which causes or likely to cause intimidation, fear, shame or embarrassment to a woman, including abusing or causing hurt or nuisance to or assault, use of force on a woman.
- ii) Eve teasing at any place is prohibited.
- iii) Whoever commits or participates in or abets Eve teasing in or within the precincts of the institute shall be punished.

### **14. LATERAL ENTRY SCHEME ACADEMIC REGULATIONS**

UR 19 CBCS regulations are applicable for lateral entry students admitted into 2<sup>nd</sup> year B.Tech from the Academic Year 2020-2021. All the regulations applicable to B.Tech 4-year degree course (Regular) will hold good for B.Tech Lateral Entry Scheme unless otherwise mentioned.

### **15. TRANSITORY REGULATIONS**

1. Discontinued or detained candidates are eligible for readmission as and when next offered.
2. The readmitted students will be governed by the current regulations under which the candidate has been readmitted.
3. Transfer from other universities is permitted with the approval of Academic Council/APSHEC. Equivalent subjects and credits will be calculated with the approval of Board of Studies (BOS) chairman.

### **16. GENERAL**

1. Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".
2. The academic regulation should be read as a whole for the purpose of any interpretation.
3. In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.
4. The institute may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the institute.

### **17. AMENDMENTS TO REGULATIONS**

The Academic council of Usha Rama College of Engineering and Technology (Autonomous) reserves the right to revise, amend or change the regulations, scheme of examinations and/or syllabi or any other matter pertained suitable to the needs of the students, society, industry without any notice.

**COURSE STRUCTURE**  
**ELECTRONICS AND COMMUNICATION ENGINEERING**  
**(Applicable for batches admitted from 2019-2020)**

<b>I SEMESTER</b>								
<b>S.No</b>	<b>Course Category</b>	<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Contact Hrs./Wk</b>	<b>C</b>
1	HMC	UR19HM101	Communicative English	2	0	0	2	2
2	BSC	UR19BSC101	Linear Algebra & Calculus	3	1	0	4	4
3	BSC	UR19BSC108	Applied Physics	3	0	0	3	3
4	ESC	UR19ESC104	Basic Electrical Engineering	3	0	0	3	3
5	ESC	UR19ESC108	Engineering Graphics and Drafting	1	0	3	4	2.5
6	HMC	UR19HML101	Communicative English Lab	0	0	2	2	1
7	BSC	UR19BSCL102	Applied Physics Lab	0	0	3	3	1.5
8	ESC	UR19ESCL101	Engineering Workshop & IT Workshop	0	0	3	3	1.5
<b>Mandatory Course</b>								
9	MC	UR19MC102	Applied Physics-Virtual Lab*	0	0	0	2	0
<b>Total</b>				<b>12</b>	<b>1</b>	<b>11</b>	<b>26</b>	<b>18.5</b>
<b>*Internal Evaluation</b>								

<b>II SEMESTER</b>								
<b>S.No</b>	<b>Course Category</b>	<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Contact Hrs./Wk</b>	<b>C</b>
1	HMC	UR19HM202	Professional English	2	0	0	2	2
2	BSC	UR19BSC203	Numerical Methods & Transforms	3	0	0	3	3
3	BSC	UR19BSC205	Differential Equations & Vector Calculus	3	0	0	3	3
4	BSC	UR19BSC210	Applied Chemistry	3	0	0	3	3
5	ESC	UR19ESC203	Network Analysis	3	0	0	3	3
6	ESC	UR19ESC210	Problem Solving and Programming using C	3	0	0	3	3
7	HMC	UR19HML202	Professional English Lab	0	0	3	3	1.5
8	BSC	UR19BSCL203	Engineering and Applied Chemistry Lab	0	0	3	3	1.5
9	ESC	UR19ESCL202	Problem Solving and Programming using C Lab	0	0	3	3	1.5
<b>Mandatory Courses</b>								
10	MC	UR19MC200	Engineering Exploration Project*	0	0	0	1	0
11	MC	UR19MC203	Constitution of India*	0	0	0	2	0
<b>Total</b>				<b>17</b>	<b>0</b>	<b>9</b>	<b>29</b>	<b>21.5</b>
<b>*Internal Evaluation</b>								

III SEMESTER								
S.No	Course Category	Course Code	Course Title	L	T	P	Contact Hrs./Wk	C
1	PCC	UR19PCEC301	Electronics Devices and Circuits	3	0	0	3	3
2	PCC	UR19PCEC302	Switching Theory and Logic Design	3	0	0	3	3
3	PCC	UR19PCEC303	Signals and Systems	3	0	0	3	3
4	PCC	UR19PCEC304	Random Variables and Stochastic Process	3	0	0	3	3
5	ESC	UR19ESEC301	Object Oriented Design and Programming using Java	3	0	0	3	3
6	HMC	UR19HM301	Managerial Economics & Financial Analysis	3	0	0	3	3
7	PCC	UR19PCECL301	Electronics Devices and Circuits - Lab	0	0	3	3	1.5
8	PCC	UR19PCECL302	Switching Theory and Logic Design -Lab	0	0	2	2	1
<b>Mandatory Course</b>								
9	MC	UR19MC301	Environmental studies*	0	0	0	3	0
<b>Total</b>				<b>18</b>	<b>0</b>	<b>5</b>	<b>26</b>	<b>20.5</b>
<b>*Internal Evaluation</b>								

IV SEMESTER								
S.No	Course Category	Course Code	Course Title	L	T	P	Contact Hrs./Wk	C
1	PCC	UR19PCEC401	Analog Circuits	3	0	0	3	3
2	PCC	UR19PCEC402	Analog Communications	3	0	0	3	3
3	PCC	UR19PCEC403	Control Systems	3	0	0	3	3
4	PCC	UR19PCEC404	Electromagnetic Waves and Transmission Lines	3	0	0	3	3
5	ESC	UR19ESEC401	Computer Architecture and Organization	3	0	0	3	3
6	HMC	UR19HM401	Management and Organizational Behavior	3	0	0	3	3
7	PCC	UR19PCECL401	Analog Circuits - Lab	0	0	3	3	1.5
8	PCC	UR19PCECL402	Analog Communications - Lab	0	0	3	3	1.5
<b>Mandatory Courses</b>								
9	MC	UR19MC401	MOOCS-1*	0	0	0	0	0
10	PROJ	UR19PROJEC401	Mini Project-I*	0	0	0	2	0
<b>Total</b>				<b>18</b>	<b>0</b>	<b>6</b>	<b>26</b>	<b>21</b>
<b>*Internal Evaluation</b>								

V SEMESTER								
S.No	Course Category	Course Code	Course Title	L	T	P	Contact Hrs./Wk	C
1	PCC	UR19PCEC501	Integrated Circuits and applications	3	0	0	3	3
2	PCC	UR19PCEC502	Microprocessor and Microcontrollers	3	0	0	3	3
3	PCC	UR19PCEC503	Digital Communications	3	0	0	3	3
4	PCC	UR19PCEC504	Antennas and Wave Propagation	3	0	0	3	3
Professional Elective (PE1)								
5	PEC	UR19PEEC501	Information Theory & Coding	3	0	0	3	3
		UR19PEEC502	Data structures and Algorithms					
		UR19PEEC503	Nano-Materials					
		UR19PEEC504	Intelligent Instrumentation					
6	PCC	UR19PCECL501	Integrated Circuits and applications - Lab	0	0	3	3	1.5
7	PCC	UR19PCECL502	Microprocessor and Microcontrollers Lab	0	0	3	3	1.5
8	PCC	UR19PCECL503	Digital Communications Lab	0	0	3	3	1.5
Mandatory Course								
9	MC	UR19MC501	MOOCS-2*	0	0	0	0	0
<b>Total</b>				<b>15</b>	<b>0</b>	<b>9</b>	<b>24</b>	<b>19.5</b>
Employability Skills- I*							2	0
*Internal Evaluation								

VI SEMESTER								
S.No	Course Category	Course Code	Course Title	L	T	P	Contact Hrs./Wk	C
1	PCC	UR19PCEC601	Internet of Things	3	0	0	3	3
2	PCC	UR19PCEC602	VLSI Design	3	0	0	3	3
3	PCC	UR19PCEC603	Digital Signal Processing	3	0	0	3	3
Professional Elective (PE2)								
4	PEC	UR19PEEC601	Cellular & Mobile Communications	3	0	0	3	3
		UR19PEEC602	Global Position System (GPS)					
		UR19PEEC603	Electromagnetic Interference & Compatibility (EMI/EMC)					
		UR19PEEC604	Biomedical Signal processing					
5	OEC	---	<b>Open Elective -I (OE1)</b>	3	0	0	3	3
6	PCC	UR19PCECL601	Internet of Things Lab	0	0	3	3	1.5
7	PCC	UR19PCECL602	VLSI Lab	0	0	3	3	1.5
8	PCC	UR19PCECL603	Digital Signal Processing Lab	0	0	3	3	1.5
Mandatory Courses								
9	MC	UR19MCEC601	IPR and Patents*	0	0	0	3	0
10	PROJ	UR19PROJEC601	Mini Project-II*	0	0	0	2	0
<b>Total</b>				<b>15</b>	<b>0</b>	<b>9</b>	<b>29</b>	<b>19.5</b>
Employability Skills- II*							2	0
*Internal Evaluation								

VII SEMESTER								
S.No	Course Category	Course Code	Course Title	L	T	P	Contact Hrs./Wk	C
1	PCC	UR19PCEC701	Microwave and Optical communications	3	0	0	3	3
2	PCC	UR19PCEC702	Data Communications & Computer networks	3	0	0	3	3
<b>Professional Elective (PE3)</b>								
3	PEC	UR19PEEC701	Telecommunication Switching Systems	3	0	0	3	3
		UR19PEEC702	Digital IC Design					
		UR19PEEC703	Embedded Systems					
		UR19PEEC704	Digital Imaging and Video Processing					
<b>Professional Elective (PE4)</b>								
4	PEC	UR19PEEC705	Radar Engineering	3	0	0	3	3
		UR19PEEC706	Low power VLSI Design					
		UR19PEEC707	DSP processors and Architectures					
		UR19PEEC708	Simulation & Mathematical Modeling					
5	OEC	---	<b>Open Elective-II (OE2)</b>	3	0	0	3	3
6	PCC	UR19PCECL701	Microwave and Optical communications Lab	0	0	3	3	1.5
7	PCC	UR19PCECL702	Data Communications & Computer networks Lab	0	0	3	3	1.5
8	PROJ	UR19PROJEC701	Project Phase-I	0	0	3	3	1.5
9	PROJ	UR19PROJEC702	Summer internship	0	0	0	0	2
<b>Total</b>				<b>15</b>	<b>0</b>	<b>9</b>	<b>24</b>	<b>21.5</b>

VIII SEMESTER								
S.No	Course Category	Course Code	Course Title	L	T	P	Contact Hrs./Wk	C
1	PCC	UR19PCEC801	Wireless Networks	3	0	0	3	3
<b>Professional Elective (PE5)</b>								
2	PEC	UR19PEEC801	Satellite Communications	3	0	0	3	3
		UR19PEEC802	VLSI Testing & Testability					
		UR19PEEC803	Machine Learning & Artificial Intelligence					
		UR19PEEC804	SOC Architecture					
3	OEC	---	<b>Open Elective-III (OE3)</b>	3	0	0	3	3
4	PROJ	UR19PROJEC801	Project Phase-II	0	0	18	18	9
<b>Total</b>				<b>9</b>	<b>0</b>	<b>18</b>	<b>27</b>	<b>18</b>

**Total Credits = 18.5+21.5+20.5+21+19.5+19.5+21.5+18 = 160**

## List of Open Electives

### Open Electives offered by the Dept. of CE

S.No.	Course Code	Open Elective-I
1.	UR19OECE 601	Introduction To GIS
2.	UR19OECE 602	Environmental Pollution Control
	<b>Course Code</b>	<b>Open Elective-II</b>
3.	UR19OECE701	Metro Systems and Engineering
4.	UR19OECE702	Natural Disaster Mitigation and Management
	<b>Course Code</b>	<b>Open Elective-III</b>
5.	UR19OECE801	Sanitary and Public Health Engineering
6.	UR19OECE802	Environmental and Industrial Hygiene

### Open Electives offered by the Dept. of EEE

S.No.	Course Code	Open Elective-I
1.	UR19OEEE601	Neural Networks and Fuzzy Logic
2.	UR19OEEE602	Linear Control Systems
3.	UR19OEEE603	Electrical Safety Management
	<b>Course Code</b>	<b>Open Elective - II</b>
4.	UR19OEEE701	Programmable Logic Controllers
5.	UR19OEEE702	Energy Audit and Conservation Management
6.	UR19OEEE703	Electrical Technology
	<b>Course Code</b>	<b>Open Elective - III</b>
7.	UR19OEEE801	Non Conventional Energy Sources
8.	UR19OEEE802	Industrial Electrical Operation
9.	UR19OEEE803	Hybrid Electric Vehicles

### Open Electives offered by the Dept. of ME

S.No.	Course Code	Open Elective-I
1.	UR19OEME601	Nano Technology
2.	UR19OEME602	Robotics
3.	UR19OEME603	Power Plant Engineering
	<b>Course Code</b>	<b>Open Elective-II</b>
4.	UR19OEME701	Operations Research
5.	UR19OEME702	Industrial Engineering & Quality control
6.	UR19OEME703	Advanced materials
	<b>Course Code</b>	<b>Open Elective-III</b>
7.	UR19OEME801	Optimization Techniques
8.	UR19OEME802	Green Engineering systems
9.	UR19OEME803	Mechatronics

### Open Electives offered by the Dept. of ECE

S.No.	Course Code	Open Elective-I
1	UR19OEEC601	Consumer Electronics
2	UR19OEEC602	Digital Electronics
	<b>Course Code</b>	<b>Open Elective-II</b>
3	UR19OEEC701	Embedded Systems
4	UR19OEEC702	Internet of Things (IoT)
	<b>Course Code</b>	<b>Open Elective-III</b>
5	UR19OEEC801	Microcontrollers
6	UR19OEEC802	Principles of Electronic Communications

### Open Electives offered by the Dept. of CSE

S.No.	Course Code	Open Elective-I
1.	UR19OECS601	Java Programming
2.	UR19OECS602	Data Base Management Systems
3.	UR19OECS603	C++ Programming
	<b>Course Code</b>	<b>Open Elective-II</b>
4.	UR19OECS701	Distributed Computing
5.	UR19OECS702	Deep Learning
6.	UR19OECS703	AI and ML for Robotics
	<b>Course Code</b>	<b>Open Elective-III</b>
7.	UR19OECS801	AI Tools & Techniques
8.	UR19OECS802	Information Security
9.	UR19OECS803	Big Data

### Open Electives offered by the Dept. of IT

S.No.	Course Code	Open Elective-I
1.	UR19OEIT101	Data Structures
2.	UR19OEIT102	Computer Graphics
3.	UR19OEIT103	Data Science
	<b>Course Code</b>	<b>Open Elective - II</b>
4.	UR19OEIT201	Operating Systems
5.	UR19OEIT202	Python Programming
6.	UR19OEIT203	Web Technologies
	<b>Course Code</b>	<b>Open Elective - III</b>
7.	UR19OEIT301	Information Security
8.	UR19OEIT302	Mobile Application Development
9.	UR19OEIT303	Block Chain Technologies

**COMMUNICATIVE ENGLISH**

(Common to all branches)

**Course Objectives:**

- Recall and improve the language proficiency of the students in English
- Paraphrase and interpret the ideas and thoughts in a dynamic way
- Prioritize the importance of practical learning of English
- Distinguish the various levels of Listening, Speaking, Reading and writingskills
- Construct statements in writing and speaking in professional manner

**UNIT – I****Poem:** "Life" by Sarojini Naidu**Grammar:** Articles**Vocabulary:** Prefixes and Suffixes**Writing:** Paragraph Writing**Life-Skills:** Attitude**UNIT – II****Essay:** A Drawer full of Happiness**Grammar:** Prepositions**Vocabulary:** Homonyms, Homophones, Homographs**Writing:** Letter of Request and Apology**Life-Skills:** Self- Management**UNIT – III****Short Story:** "Half a Rupee Worth" by R.K. Narayan**Grammar:** Tenses**Vocabulary:** Idiomatic Expressions; Phrasal Verbs**Writing:** Letter of Complaint and Appreciation**Life-Skills:** Body Language**UNIT – IV****Text:** Stephen Hawking – Positivity 'Benchmark'**Grammar:** Question Tags, Conjunctions**Vocabulary:** One - Word Substitutes, Collocations**Writing:** Dialogue and Speech Writing**Life-Skills:** Being Assertive**UNIT – V****Poem:** Once Upon a Time by Gabriel Okara**Grammar:** Degrees of Comparison**Vocabulary:** Technical Abbreviations**Writing:** E-mail Writing, Preparation of Resume and Letter of application**Life-Skills:** Goal Setting, Working in a Team**TEXT BOOKS:**

'InfoTech English' – Maruti Publications

**REFERENCE BOOKS:**

Raymond Murphy, "Murphy's Essential English Grammar" with CD, Cambridge University Press  
Practical English Usage, Michael Swan, OUP, 1995

**NPTEL ONLINE COURSE:**

'Enhancing Soft skills & Personality Development

**Course Outcomes:**

- CO1:** Apply critical-thinking to develop writing skills
- CO2:** Understand and evaluate different kinds of prose texts.
- CO3:** Describe distinct literary characteristics of poems.
- CO4:** Analyze the major and minor details of a biography.
- CO5:** Develop grammar and vocabulary skills
- CO6:** Evaluate the effectiveness in improving life-skills.

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**LINEAR ALGEBRA & CALCULUS**

(Common to all branches)

**Course Objectives:**

- This course will illuminate the students in the concepts of calculus and linear algebra.
- 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:** Solving system of homogeneous and non-homogeneous linear equations by Gauss elimination method. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem.

**UNIT – II**

**Sequences and Series:** Convergence and divergence, Ratio test - Comparison test -Cauchy's root test-. Fourier series, Euler's formulae, conditions for Fourier expansion, Even and Odd functions.

**UNIT – III**

**Mean Value Theorems:** Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (single variable & without proofs).

**UNIT – IV**

**Multivariable calculus:** 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:** Double integrals, change of order of integration, double integration in polar coordinates. Evaluation of triple integrals, change of variables.

**TEXT BOOKS:**

1. Higher Engineering Mathematics, B.S.Grewal, Khanna Publishers

**Course Outcomes:**

- CO1:** Develop the use of matrix algebra techniques that is needed by engineers for practical Applications
- CO2:** Find or compute the Fourier series of Fourier series periodic signals.
- CO3:** Utilize mean value theorems to real life problems.
- CO4:** Translate the given function as series of Taylor's and Maclaurin's with remainders.
- CO5:** Familiarize with functions of several variables which are useful in optimization.
- CO6:** Apply Double integration in evaluating areas bounded by regions.

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**APPLIED PHYSICS**

(EEE &amp; ECE)

**Course Objectives:**

- Impart Knowledge of Physical Optics phenomena like Interference and Diffraction required to design instruments with higher resolution.
- Understand the physics of Semiconductors and their working mechanism for their utility in sensors.
- Impart the knowledge of materials with characteristic utility in appliances.

**UNIT – I**

**INTERFERENCE:** Principle of Superposition – Coherent Sources – Interference in thin films (reflection geometry) – Newton's rings.

**DIFFRACTION:** Diffraction - Fraunhofer Diffraction - Diffraction due to Single slit (quantitative), Double slit, N -slits and circular aperture (qualitative) – Intensity distribution curves - Diffraction Grating – Grating spectrum – missing order – resolving power – Rayleigh's criterion – Resolving powers of Microscope, Telescope and grating (qualitative).

**UNIT – II**

**QUANTUM MECHANICS:** Introduction – Matter waves – de Broglie's hypothesis – Davisson-Germer experiment – G.P.Thomson experiment – Heisenberg's Uncertainty Principle – interpretation of wave function – Schrödinger Time Independent and Time Dependent wave equations – Particle in a potential box.

**UNIT – III**

**FREE ELECTRON THEORY & BAND THEORY OF SOLIDS :** Introduction – Classical free electron theory (merits and demerits only) - Quantum Free electron theory – electrical conductivity based on quantum free electron theory – Fermi Dirac distribution function – Temperature dependence of Fermi-Dirac distribution function - expression for Fermi energy -Density of states.

Bloch's theorem (qualitative) – Kronig-Penney model(qualitative) – energy bands in crystalline solids – E Vs K diagram – classification of crystalline solids – effective mass of electron –  $m^*$  Vs K diagram - concept of hole.

**UNIT – IV**

**SEMICONDUCTOR PHYSICS:** Introduction – Intrinsic semi conductors - density of charge carriers - Electrical conductivity – Fermi level – extrinsic semiconductors - p-type & n-type - Density of charge carriers - Dependence of Fermi energy on carrier concentration and temperature – Hall effect- Hall coefficient - Applications of Hall effect - Drift and Diffusion currents – Einstein's equation.

**TEXT BOOKS:**

1. "A Text book of Engineering Physics" by M.N.Avadhanulu,P.G.Kshirsagar - S.Chand Publications, 2017.
2. "Engineering Physics" by D.K.Bhattacharya and Poonam Tandon, Oxford press (2015).
3. "Engineering Physics" by R.K Gaur. and S.L Gupta., - Dhanpat Rai publishers, 2012.

**REFERENCE BOOKS:**

1. Applied Physics by P.K. Palanisamy, Scitech publications (2014).
2. Lasers and Non-Linear optics by B.B. Laud, New Age International Publishers (2008).
3. Engineering Physics by M. Arumugam, Anuradha Publication (2014).

4. Physics for Engineers by M.R. Srinasan, New Age international publishers (2009).

**Course Outcomes:**

- CO1:** Explain the need of coherent sources and the conditions for sustained interference and illustrate the resolving power of various optical instruments.
- CO2:** Explain the fundamental concepts of quantum mechanics and analyze the physical significance Of wave function.
- CO3:** Explain the various electron theories and interpret the effects of temperature on Fermi Dirac distribution function
- CO4:** Explain the various energy bands
- CO5:** Classify the energy bands of semiconductors and outline the properties of n-type and p-type Semiconductors.
- CO6:** Explain the applications of dielectric and magnetic materials.

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### **BASIC ELECTRICAL ENGINEERING (ECE)**

**Course Objectives:**

- To learn the basic principles of electrical law's and analysis of networks.
- To understand the principle of operation and construction details of DC machines.
- To understand the principle of operation and construction details of transformer.
- To understand the principle of operation and construction details of alternator and 3-Phase induction motor.
- To understand the principles and construction of various measuring instruments.

**UNIT – I****ELECTRICAL CIRCUITS:**

Basic definitions, Types of elements, Classification of different sources, Ohm's Law, Kirchhoff's Laws, Resistive networks, Inductive networks, capacitive networks, Series, Parallel circuits.(simple problems)

**UNIT – II GENERATION OF ELECTRIC POWER**

**Conventional sources:** Hydroelectric plant, Thermal Power Plant, Nuclear Power Plant and function of each component.

**Non conventional sources : Solar energy-** Operating principle , Photovoltaic cell concepts, Cell, module, array , Series and parallel connections , Applications – layout of solar thermal power plant

**UNIT – III DC AND AC MACHINES****DC MACHINES**

Principle of operation of DC generator – emf equation – types of DC machine.

DC Motor-principle of operation-torque equation of DC motor –applications – three point starters, speed control methods.

**AC MACHINES**

Principle of operation of a 3 phase induction motor, Types of Rotors-Torque equation- Slip Torque Characteristics, simple problems (descriptive treatment Only) Alternators- principle of operation – synchronous motor.

**UNIT – IV TRANSFORMERS**

Classification of transformers based on construction, Principle of operation of single phase transformers – emf equation – losses – efficiency and regulation, OC and SC tests on transformers

**TEXT BOOKS:**

1. Theory and Problems of Basic Electrical Engineering by D.P.Kothari & I.J. Nagrath PHI.
2. Basic Electrical Engineering –By T.K.Nagasarkar and M.S. Sukhija Oxford University Press.
3. Electric Circuits- A. Sudhakar & Shyammmohan S. Palli, Tata Mc-Graw- Hill,2005.

4. S.Rao, Prof. H.L. Saluja "Electrical safety and fire safety Engineering and safety management", Khanna publishers, New Delhi, 1998.

**REFERENCE BOOKS:**

1. Electrical Technology by Surinder Pal Bali, Pearson Publications.
2. Electrical Circuit Theory and Technology by John Bird, Routledge Taylor & Francis Group
3. Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications, 2nd edition
4. Electrical Engineering – Prasad, Sivanagaraju, Cengage Learning

**Course Outcomes:**

- CO1:** Able to analyze the various electrical networks.
- CO2:** Able to understand the various conventional and Non conventional sources of energy.
- CO3:** Able to understand the operation of DC generator, DC Motor, 3-point starter and Speed Control methods.
- CO4:** Able to analyze the performance of transformer.
- CO5:** Able to explain the operation of 3-phase alternator and 3-phase induction motors.
- CO6:** Able to explain the working principle of various measuring instruments and safety measures to Avoid electric hazards.

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I Year - I Semester

Course Code : UR19ESC108

L	T	P	C
1	0	3	2.5

Internal: 30 Marks          External: 70 Marks

**ENGINEERING GRAPHICS & DRAFTING  
(CIVIL/EEE/ECE)**

**PRE-REQUISITES:** Mathematics, Physics

**COURSE EDUCATIONAL OBJECTIVE**

- Engineering drawing being the principle method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

**UNIT – I INTRODUCTION TO ENGINEERING DRAWING:**

Introduction: Principles of Engineering Graphics and their significance - Drawing Instruments - Geometrical Constructions.

**Polygons:** Constructing regular polygons by general methods, inscribing and describing polygons on circles.

**Curves:** Ellipse, Parabola and Hyperbola by general methods,

**Scales:** Diagonal scales and Vernier scales

**UNIT – II**

**ORTHOGRAPHIC PROJECTIONS:** Principle of orthographic projection-Method of Projections – First and third angle projection methods Projections of Points – Projections of straight lines of different orientations - True lengths and traces.

**UNIT – III**

**PROJECTIONS OF PLANES & SOLIDS:** Regular planes perpendicular/parallel to one plane and inclined to the other reference plane; inclined to both the reference planes. Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the planes.

**UNIT – IV**

**ISOMETRIC VIEWS:** Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

**UNIT – V**

**COMPUTER AIDED DRAFTING:** Introduction – Computer Aided drafting system –Advantages, Applications of AUTOCAD, Drafting software-AUTOCAD-Advantages, Initial setup commands, utility commands, Drawing Aids, Entity Draw commands, Display commands, Edit commands, Lettering & Dimensioning

**TEXT BOOKS:**

1. N. D. Bhatt, Engineering Drawing, Revised and Enlarged Edition, Charotar publishers,
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers
3. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age

**REFERENCE BOOKS:**

1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers
3. Engineering Graphics by PI Varghese, McGrawHill Publishers

**Course Outcomes:**

- CO1:** Represent the geometrical objects considering BIS standards.
- CO2:** Comprehend the basics of orthographic projections and deduce orthographic projections of a point and a line at different orientations.
- CO3:** Visualize geometrical planes of different positions in real life environment
- CO4:** Draw the projection of various of types of solids.
- CO5:** Imagine orthographic views of various solid objects at different orientations
- CO6:** Recognize the significance of isometric drawing to relate 2D environment with 3D environment. Learn basics of CAD.

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**COMMUNICATIVE ENGLISH LAB**

(Common to all branches)

**Course Objectives:**

To enable the students to learn through practice the communication skills of listening, speaking, reading and writing.

**List of Activities**

- 1) Introducing yourself
- 2) Greeting
- 3) Thanking and Responding to thanks
- 4) Requesting and Responding to requests
- 5) Making and Responding to complaints
- 6) Apologising and accepting apologies
- 7) Consonants : Plosives, Affricates and Nasals
- 8) Consonants: Fricatives, Liquids and Glides
- 9) Vowels: Pure vowels
- 10) Vowels :Diphthongs
- 11) Consonant clusters
- 12) Word Accent
- 13) Word Stress
- 14) Intonation

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Reference Manuals:**

'INTERACT: English Lab Manual for Undergraduate Students' Published by Orient Blackswan Pvt Ltd 'Strengthen Your Communication Skills' published by Maruthi Publications

**Course Outcomes:**

Upon completion of the course, the student will be able to:

CO1 Apply expressions in day to day life

- CO2 Build language proficiency by using patterns
- CO3 Develop communication skills through various language activities
- CO4 Outline of Letters and Sounds
- CO5 Identify consonants and vowel sounds in phonetic script
- CO6 Understand pronunciation, stress and intonation

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**APPLIED PHYSICS LAB****Course objectives:**

- To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
- To learn the usage of electrical and optical systems for various measurements.
- Apply the analytical techniques and graphical analysis to the experimental data.
- To develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.

**List of Experiments**

1. Determination of wavelength of a source-Diffraction Grating-Normal incidence.
2. Newton's rings – Radius of Curvature of Plano - Convex Lens.
3. Determination of thickness of a spacer using wedge film and parallel interference fringes.
4. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
5. Energy Band gap of a Semiconductor p - n junction.
6. Characteristics of Thermistor – Temperature Coefficients
7. Determination of dielectric constant by charging and discharging method
8. Determination of resistivity of semiconductor by Four probe method.
9. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
10. Measurement of magnetic susceptibility by Quincke's method.
11. Dispersive power of diffraction grating.
12. Verification of laws of stretched string – Sonometer.
13. Resolving power of grating.
14. Determination of Hall voltage and Hall coefficients of a given semiconductor using Hall effect.
15. Variation of dielectric constant with temperature.

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Text book:**

1. A Text book of Practical Physics, Balasubramanian S, Srinivasan M.N, S Chand Publishers, 2017

**Course outcomes:**

- CO1: Handle optical instruments like microscope and spectrometer  
CO2: Determine thickness of a hair/paper with the concept of interference  
CO3: Estimate the wavelength and resolving power of different colors using diffraction grating  
CO4: Demonstrate the elastic response of loaded beams; estimate the frequency of a vibrating system using standing wave pattern.  
CO5: Estimate the strength of the magnetic field due to a current carrying coil.  
CO6: Estimate the mechanical properties of materials.

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## ENGINEERING WORK SHOP AND IT WORK SHOP

### ENGINEERING WORK SHOP:

#### Course Objectives:

- To familiarize with the basics of tools and equipments used in fitting, carpentry, Sheet metal and smithy.
- To familiarize with the production of simple modes in the above trades.

**NOTE: At least one exercise to be done from each trade.**

#### Trade: Carpentry:

1. Cross –Lap joint
2. Mortise and Tenon joint
3. T-Lap joint

#### FITTING:

1. V-fit
2. Square fit
3. Dovetail fit

#### Black Smithy:

1. S-Hook
2. Round rod to square
3. Round rod to Hexagonal headed bolt
4. Making simple parts like chisel.

#### House Wiring:

1. Parallel/Series connection of three bulbs
2. Stair Case wiring
3. Florescent lamp fitting
4. Measurement of earth resistance

#### Tin Smithy:

1. Making rectangular tray
2. Making scoop
3. Making hopper
4. Making funnel

### IT WORK SHOP:

#### Course Objectives:

- IT Workshop is to impart basic computer usage and maintenance skills and to introduce you to a suite of productivity tools that will aid in your day to day activities.
- IT workshop works in a learning-by-doing mode. It concentrates more on hands-on experience for the participants rather theoretical classes.
- It enables the participant to make the best use of Microsoft Office Suite in their day-to-day requirements and make use of it to improve the standards in the educational environment.
- The IT Workshop prepares the participant to have a hands-on experience in maintaining and troubleshooting a PC by themselves.

Task1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor

- Task2: Every student should individually install MS windows on the personal computer.
- Task3: Hardware Troubleshooting: Students have to be given a PC which does not boot due to improper assembly or defective peripherals.
- Task 4: Word Orientation: an overview of Microsoft (MS) office 2007/ 10: Importance of MS office 2007/10, overview of toolbars, saving files, Using help and resources, rulers, format painter.
- Task 5: Excel Orientation: The importance of MS office 2007/10 tool Excel as a Spreadsheet tool, Accessing, overview of toolbars, saving excel files, Using help and resources. Creating a Scheduler - Features to be covered:- Gridlines, Format Cells, Summation, auto fill, Formatting Text.
- Task 6: Basic power point utilities and tools which helpful to create basic power point presentation. Topic covered during this includes PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in both Latex and Power point.
- Task 7: Introduction to HTML &Basic syntax of html Attributes, elements, lists, and basic programs, Homepage using HTML Consisting of photo, name, address and education details as a table.

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Course Outcomes:**

Upon completion of the course, the student will be able to

CO1: Identify the peripherals, components of CPU along with the functions of CPU.

CO2: Implement the installation of Windows OS and explain about Hardware Troubleshooting.

CO3: Create HTML Homepage and use MS Office like Word, Excel and Power Point Presentation.

CO4: Apply basic Electrical Engineering knowledge for House-wiring Practice.

CO5: Make different components using Fitting and Carpentry.

CO6: Prepare simple jobs as per specifications using Tinsmithy tools and Blacksmithy Tools.

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Internal: 20 Marks

External: 0 Marks

Semester-end: 30 Marks

**APPLIED PHYSICS - VIRTUAL LAB****(Any 3 of the following listed 12 experiments)****Course objectives:**

- To gain practical knowledge by applying the experimental methods to correlate with the Physics theory.
- To learn the usage of electrical and optical systems for various measurements.

**LIST OF EXPERIMENTS**

1. Hall Effect
2. Crystal Structure
3. Brewster's angle
4. Numerical Aperture of Optical fiber
5. Photoelectric Effect
6. LASER – Beam Divergence and Spot size
7. Michelson's interferometer
8. Black body radiation
9. Flywheel –moment of inertia
10. AC Sonometer
11. Resistivity by four probe method
12. Newton's rings –Refractive index of liquid

**URL: [www.vlab.co.in](http://www.vlab.co.in)****Course outcomes:**

CO1: Handle optical instruments like microscope and spectrometer

CO2: Determine thickness of a hair/paper with the concept of interference

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I Year - II Semester

Course Code : UR19HM202

L	T	P	C
2	0	0	2

Internal: 30 Marks

External: 70 Marks

### **PROFESSIONAL ENGLISH**

(Common to all branches)

#### **Course Objectives:**

- Recall and improve the language proficiency of the students in English
- Paraphrase and interpret the ideas and thoughts in a dynamic way
- Prioritize the importance of practical learning of English
- Distinguish the various levels of Listening, Speaking, Reading and writing skills
- Construct statements in writing and speaking in professional manner

#### **UNIT – I**

**Poem:** “Enterprise” by

Nissim Ezekiel **Grammar:**

Types of Sentences

**Vocabulary:** Synonyms

**Writing:** Essay Writing

**Life-Skills:** Values and Ethics

#### **UNIT – II**

**Text:** Like a tree, unbowed:

Wangari Maathai **Grammar:** Active Voice

& Passive Voice **Vocabulary:** Antonyms

**Writing:** Technical Report Writing **Life-Skills:** Time Management

#### **UNIT – III**

**Text:** Stay Hungry – Stay Foolish

**Grammar:** Common Errors in Articles and Prepositions

**Vocabulary:** Words Often Confused

**Writing:** Describing People, Places, Objects, Events

**Life-Skills:** Motivation

#### **UNIT – IV**

**Story:** The Cop and the Anthem by O. Henry

**Grammar:** Common Errors in Subject – Verb agreement

**Vocabulary:** Technical Vocabulary

**Writing:** Note-Making **Life-Skills:** Rapid Reading

## **UNIT – V**

**Short Story:** “A Village School Master” by Oliver Gold Smith

**Grammar:** Common Errors

**Vocabulary:** GRE Word List

**Writing:** Precise Writing / Information Article

**Life-Skills:** Career Planning

### **TEXT BOOK:**

1. ‘InfoTech English’ – Maruti Publications

### **REFERENCE BOOKS:**

1. Raymond Murphy, “Murphy’s Essential English Grammar” with CD, Cambridge University Press.
2. Practical English Usage, Michael Swan, OUP, 1995
3. Remedial English Grammar, F.T. Wood, Macmillan, 2007

### **Course Outcomes:**

Upon completion of the course, the students will be able to

**CO1:** Apply critical thinking to develop writing skills

**CO2:** Evaluate common errors in grammar

**CO3:** Describe distinct literary characteristics of poems

**CO4:** Analyze the characteristics of one-act-plays

**CO5:** Develop correspondence skills and promotional writing skills

**CO6:** Evaluate the importance of values and ethics for career planning.

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**NUMERICAL METHODS&TRANSFORMS**

(ECE/EEE)

**Course Objectives:**

- To elucidate the different numerical methods to solve nonlinear algebraic equations.
- To familiarize the students with numerical methods of solving the non-linear equations.
- 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**

**Solution to algebraic equations:** Solution of polynomial and transcendental equations: Bisection method, Regula-Falsi method, Iteration method, Newton-Raphson method.

**UNIT – II**

**Interpolation:** Finite differences, interpolation using Newton's forward and backward difference formulae, Gauss forward and backward interpolation formulae, Interpolation with unequal intervals, Newton's divided difference and Lagrange's formulae.

**UNIT – III**

**Numerical integration and Solution of ODE:** Numerical integration- trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Ordinary differential equations, Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first order ODE .

**UNIT – IV**

**Laplace Transforms :** Laplace transforms of elementary functions, Properties of Laplace Transforms of derivatives and integrals, Multiplication by t, Division by t, Inverse transforms, Method of Partial fractions, Applications of Ordinary differential equations.

**UNIT – V**

**Fourier Transforms:** Fourier integral theorem (without proof), Fourier sine and cosine integral, Fourier transforms, Fourier sine and cosine transforms, Properties of Fourier transforms.

**TEXT BOOK:**

Higher Engineering Mathematics, B.S. Grewal.

**REFERENCE BOOKS:**

1. Advanced Engineering Mathematics, Erwin kreyszig,
2. Introductory methods of Numerical Analysis by S.S.Sastri

**Course Outcomes:**

Upon completion of the course, the students will be able to

**CO1:** Evaluate approximating the roots of polynomial and transcendental equations by different Algorithms.

**CO2:** Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal Intervals.

**CO3:** Apply definite integral of a function by using different numerical methods.

**CO4:**Solve different algorithms for approximating the solutions of ordinary differential equations to its analytical computations.

**CO5:**Explain the Laplace and Inverse Laplace Transform for different types of functions and Evaluate ordinary differential equations using Laplace transform technique.

**CO6:**Apply integral expressions for the forwards and inverse Fourier transform to a range of non – periodic waveforms .

\*\*\*\*\*

Internal: 30 Marks      External: 70 Marks

**DIFFERENTIAL EQUATIONS & VECTOR CALCULUS**  
(Common to all branches)

**Course Objectives:**

- To enlighten the learners in the concept of differential equations.
- 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:** Definitions, complete solution, operator  $D$ , rules for finding complimentary function, inverse operator, rules for finding particular integral with RHS of the forms  $e^{ax}$ ,  $\sin ax$ ,  $\cos ax$ ,  $x^n$ ,  $e^{ax} \cdot V$  and  $xV$ . L-C-R Circuit problems.

**UNIT – II**

**First order Partial Differential Equations:** Formation of PDE, solutions of Lagrange's linear equation Method of grouping – Method of multipliers, Solution of non-linear PDEs of the forms  $f(p,q)=0$ ,  $f(z,p,q)=0$ ,  $f(x,p)=g(y,q)$ ,  $Z=px+qy+f(p,q)$ .

**UNIT – III**

**Applications of Partial Differential Equations:** Method of Separation of variables-One dimensional Wave equation-Two dimensional Heat equation, Laplace equation.

**UNIT – IV**

**Vector Differential Calculus:** Scalar and vector point functions, Gradient, Directional derivative. Divergence, Curl, Physical interpretation of operators.

**UNIT – V**

**Vector Integral Calculus:** Line integral-work done, surface and volume integrals, Green's theorem in the plane (without proof), Stoke's theorem (without proof), Divergence theorem (without proof).

**TEXT BOOK:**

1. Higher Engineering Mathematics, B. S. Grewal.

**REFERENCE BOOKS:**

1. Advance Engineering in Mathematics, Erwin Kreyszig.
2. Vector calculus, Schaum's series.

**Course Outcomes:**

Upon completion of the course, the students will be able to

**CO1:** Solve the differential equations related to various engineering fields.

**CO2:** Identify solution methods for partial differential equations that model physical processes.

**CO3:** Apply a range of techniques to find solutions of standard PDEs .

**CO4:** Classify the nature of the partial differential equations.

**CO5:** Interpret the physical meaning of different operators such as gradient, curl and divergence.

**CO6:** Estimate the work done against a field and circulation using vector calculus.

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### APPLIED CHEMISTRY (EEE & ECE)

#### Course Objectives:

- Importance of usage of Plastics in household appliances and composites (FRP) in aerospace automotive industries.
- Select the fuels as a source of energy are a basic need of any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence they are introduced.
- Constructions of galvanic cells as well as some batteries used in instruments are introduced. Understand the mechanism of corrosion which itself is explained by electrochemical theory
- With the increase in demand, a wide variety of materials are coming up; some of them have excellent engineering properties and a few of these materials are introduced.
- Explain the computational chemistry and different applications of analytical instruments.

#### UNIT – I

##### HIGH POLYMERS AND PLASTICS

**Polymerisation** : Introduction- Mechanism of polymerization - Stereo regular polymers – methods of polymerization (emulsion and suspension) -Physical and mechanical properties – Plastics as engineering materials : advantages and limitations – Thermoplastics and Thermosetting plastics – Compounding and fabrication (4 techniques)- Preparation, properties and applications of Polyethene, PVC, Bakelite and Teflon Elastomers – Natural rubber- compounding and vulcanization – Synthetic rubbers : Buna S, Buna N, Thiokol and polyurethanes – Applications of elastomers. Composite materials & Fiber reinforced plastics – Biodegradable polymers – Conducting polymers.

#### UNIT – II

##### FUEL TECHNOLOGY

**Fuels**:- Introduction – Classification – Calorific value - HCV and LCV – Dulong’s formula – Bomb calorimeter – Numerical problems – Coal — Proximate and ultimate analysis – Significance of the analyses – Liquid fuels – Petroleum- Refining – Cracking – Synthetic petrol –Petrol knocking – Diesel knocking - Octane and Cetane ratings – Anti-knocking agents – Power alcohol – Gaseous fuels – Natural gas. LPG and CNG – Combustion – Calculation of air for the combustion of a fuel – Flue gas analysis – Orsat apparatus – Numerical problems on combustion.

#### UNIT – III

##### ELECTROCHEMICAL CELLS AND CORROSION

###### Part-A:

##### ELECTROCHEMISTRY

Introduction- Galvanic cells - Reversible and irreversible cells – Single electrode potential – Electro chemical series and uses of this series- Standard electrodes (Hydrogen and Calomel electrodes) - Concentration Cells – Batteries: Dry Cell –Lead-Acid storage cells-Li cells. Fuel cells: - Hydrogen Oxygen fuel cells – Methanol Oxygen fuel cells.

###### Part-B

##### CORROSION

Corrosion:- Definition – Theories of Corrosion (electrochemical and chemical)-Galvanic corrosion,Differential aeration corrosion –Factors which influence the rate of corrosion - Protection

from corrosion– Cathodic protection - Protective coatings: – Surface preparation – Metallic (cathodic and anodic) coatings - Methods of application on metals (Galvanizing, Tinning, Electroplating, Electroless plating).

#### **UNIT – IV**

##### **CHEMISTRY OF ADVANCED ENGINEERING MATERIALS**

**Nano materials**:- Introduction–Sol-gel method & chemical reduction method of preparation - Carbon nano tubes-Preparation and Applications;**Solar Energy**:- Introduction, application of solar energy, photovoltaic cell: design, working and its importance **Liquid Crystals** :- Types and applications **Non-Elemental Semiconducting Materials**:-Stoichiometric, Controlled valency&Chalcogen photo/semiconductors, Preparation of Semiconductors(Distillation,Zonerefining,Czochralski crystal pulling,epitaxy,diffusion,ion implantation) **Superconductors** :- Type-I & Type-2, properties &applications.

#### **UNIT – V**

##### **COMPUTATIONAL CHEMISTRY AND SPECTROSCOPIC STUDIES**

**COMPUTATIONAL CHEMISTRY**: Introduction,Ab Initio studies.

**SPECTROSCOPIC STUDIES**: Electromagnetic spectrum-UV(laws of absorption,instrumentation,theory of electronic spectroscopy, Frank-condon principle,chromophores and auxochromes,intensity shifts,applications),X-Ray diffraction method , FT-IR(Instrumentation and IR of some organic compounds,applications)-MRI and CT scan(Procedure & Applications).

##### **TEXT BOOKS:**

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publishing Co.
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015 edition.

##### **REFERENCE BOOKS:**

1. Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others, 2014 edition (second).
2. Engineering Chemistry by Prasanth Rath, Cengage Learning, 2015 edition.
3. A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition
4. Applied Chemistry by H.D. Gesser, Springer Publishers
5. Text book of Nano-science and nanotechnology by B.S. Murthy, P. Shankar and others, University Press, IIM.

##### **Course Outcomes:**

Upon completion of this course, the students will be able to

**CO1:** Understand the advantages and limitations of plastic materials.

**CO2:** Describe the need of fuels as a source of energy.

**CO3:** Explain the theory of construction of batteries.

**CO4:** Study some methods of corrosion control and Categorize the reasons for corrosion.

**CO5:** Generalize the importance of advanced engineering materials like Nanomaterials, Liquid Crystals, Principles of Green chemistry, Refractories and Cementing materials.

**CO6:** Obtain the knowledge of computational chemistry and understand the principles of different analytical instruments.

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**NETWORK ANALYSIS**  
(ECE)**Course Objectives:**

- To study the concepts of passive elements, types of sources and various Network reduction techniques.
- To understand the applications of network topology to electrical circuits.
- To study the concept of magnetic coupled circuit.
- To understand the behavior of RLC networks for sinusoidal excitations.
- To study the performance of R-L, R-C and R-L-C circuits with variation of one of the parameters and to understand the concept of resonance.
- To understand the applications of network theorems for analysis of electrical networks.

**UNIT – I**

**Introduction to Electrical Circuits:** Passive components and their V-I relations. Sources (dependent and independent) -Kirchoff's laws, Network reduction techniques. source transformation technique, nodal analysis and mesh analysis.

**UNIT – II**

**Network topology:** Definitions of Graph and Tree, Basic cutset and tieset matrices for planar networks, Loop and nodal methods of analysis of networks with independent voltage and current sources, Duality and Dual networks.

**UNIT – III**

**Magnetic Circuit:** Basic definition of MMF, flux and reluctance. Analogy between electrical and magnetic circuits. Faraday's laws of electromagnetic induction Concept of self and mutual inductance. Dot convention-coefficient of coupling .

**Single Phase A.C Systems:** Periodic waveforms -Concept of phase angle and phase difference – Waveforms and phasor diagrams for lagging, leading networks. Complex and polar forms of representations, steady state analysis of R, L and C circuits. Power Factor and its significance real, reactive power and apparent power, waveform of instantaneous power triangle and complex power.

**UNIT – IV**

**Analysis of AC Networks:** Extension of node and mesh analysis to AC networks, Numerical problems on sinusoidal steady state analysis, Series and parallel resonance, selectively band width and Quasi factor.

**UNIT – V**

**Network theorems (DC & AC Excitations):** Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem .

**TEXT BOOKS:**

1. Engineering Circuit Analysis by William Hayt and Jack E. Kemmerley, McGraw Hill Company, 6th edition
2. Network Analysis: Van Valkenburg; Prentice-Hall of India Private Ltd

**REFERENCE BOOKS:**

1. Fundamentals of Electrical Circuits by Charles K.Alexander and Mathew N.O.Sadiku, McGraw Hill Education (India)
2. Electric Circuits by David A. Bell, Oxford publications
3. Introductory Circuit Analysis by Robert L Boylestad, Pearson Publications
4. Circuit Theory (Analysis and Synthesis) by A.Chakrabarthy,DhanpatRai&Co.

**Course Outcomes:**

Upon completion of the course, the students will be able to

**CO1:** Identify various electrical networks in presence of active and passive elements.

**CO2:** Classify electrical networks with network topology concepts.

**CO3:** Judge any magnetic circuit with various dot conventions.

**CO4:** Point out any R, L, C network with sinusoidal excitation.

**CO5:** Identify any R, L, network with variation of any one of the parameters i.e R, L, C. and f.

**CO6:** Explain electrical networks by using principles of network theorems.

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I Year - II Semester

Course Code : UR19ESC210

L	T	P	C
3	0	0	3

Internal: 30 Marks      External: 70 Marks

**Problem Solving and Programming Using C  
(CE/EEE/ECE/CSE/IT)**

**Course Objectives:**

- The objectives of this course are to make the student familiar with 'problem solving using computers, development of algorithms, usage of basic flowchart symbols and designing flowcharts.
- The students can also understand programming language basic concepts, reading and displaying the data, earn the programming skills using selection, iterative control structures, functions, arrays, pointers and files. After completion of this course the student is expected to analyze the real life problem and write programs in C language to solve the problems.

**UNIT – I INTRODUCTION**

Problem Solving: Problem solving aspects, Problem solving techniques, Computer as a Problem solving tool, Algorithms-definition, features, criteria. Flowchart-definition, basic symbols, sample flowcharts. Top down design, Implementation of program verification, The efficiency of algorithms, Analysis of algorithms, computational complexity of algorithm, order(O) notation, Worst case & Average case Analysis.

**UNIT – II**

Basics of C programming language: Introduction to C, structure of a C program, basic data types and sizes, constants, variables, unary, binary and ternary operators, expressions, type conversions, conditional expressions, precedence and order of evaluation, Input and Output statements, Sample Programs.

SELECTION-DECISION MAKING CONDITIONAL CONTROL STRUCTURES: simple-if, if- else, nested if-else, if- else ladder and switch-case.

ITERATIVE: while-loop, do-while loop and for loop control structures, goto, break and continue statements. Sample Programs.

**UNIT – III**

FUNCTIONS-basics, parameter passing, storage classes extern, auto, register, static, scope rules, block structure, user defined functions, standard library functions, recursive functions, Recursive solutions for Fibonacci series, towers of Hanoi, header files, C Preprocessor, example c programs :

ARRAYS-concepts, declaration, definition, accessing elements, storing 'elements, 1-D arrays, 2-D arrays and character arrays, Multidimensional arrays, array applications: Matrix operations, checking the symmetricity of a Matrix, Passing 1-D arrays, 2-D arrays to functions, Strings and String Manipulations

**UNIT – IV**

POINTERS-pointers concepts, initialization of pointer variables, pointers and function arguments, passing by address-dangling memory, address arithmetic, character pointers and

functions, pointers to pointers, pointers and -multi-dimensional arrays, dynamic memory management functions, command line arguments

#### **UNIT – V**

ENUMERATED, STRUCTURE AND UNION TYPES: Derived types- structures- declaration, definition and initialization of structures, accessing 'structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bit-fields, program applications

FILEHANDLING: Concept of a file, text files and binary files, Formatted I/O, File I/O operations

#### **TEXT BOOKS:**

1. How to Solve it by Computer, R. G. Dromey, Pearson Education, 2019
2. Programming in C, Ashok N Kamthane, Amit Ashok Kamthane, 3rd Edition, Pearson Education, 2019

#### **Reference Books:**

1. The C programming Language by Dennis Richie and Brian Kernighan
2. Programming in C, Reema Thareja, OXFORD
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, Cengage

#### **Course Outcomes:**

Upon completion of the course, the students will be able to

**CO1:** Design efficient algorithm for solving a problem.

**CO2:** Identify various constructs of C programming language efficiently.

**CO3:** Apply programs using modular approach such as functions.

**CO4:** Create programs to perform matrix and mathematical applications.

**CO5:** Understand dynamic memory management and problems using pointers and solving the problems.

**CO6:** Develop real life applications using structures and also learn about handling the files for storing the data permanently.

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Internal: 20 Marks

External: 30 Marks

**PROFESSIONAL ENGLISH LAB**

(Common to all branches)

**Course Objectives:**

To enable the students to learn through practice the communication skills of listening, speaking, reading and writing.

**List of activities:**

- 1) Body Language: facial expressions, body posture, gestures
- 2) Body Language: eye movement, touch and the use of space
- 3) JAM
- 4) Extempore
- 5) Debate: Lincoln-Douglas debate and dos and don'ts
- 6) Debate: Formal and Informal debate
- 7) Interview Skills: Formal and Informal Interview
- 8) Interview Skills: Telephonic interview
- 9) Group Discussion: Dos and don'ts, general topics
- 10) Group Discussion: Science and technical topics
- 11) Presentation: Elimination of stage fear and preparation
- 12) Presentation on general topics
- 13) Presentation: using ppt or visual aids.

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Reference Manuals:**

'INTERACT: English Lab Manual for Undergraduate Students' Published by Orient Blackswan Pvt Ltd 'Strengthen Your Communication Skills' published by Maruthi Publications

**Course Outcomes:**

Upon Completion of the course, the student will be able to:

- CO1 Understand different types of body language
- CO2 Develop communication skills through various language activities
- CO3 Apply critical thinking to get main ideas for debate
- CO4 Develop audacity to face an interview
- CO5 Build knowledge for discussing topics effectively
- CO6 Analyze a topic by making a presentation

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Internal: 20 Marks

External: 30 Marks

**Engineering and Applied Chemistry Lab****Course objectives:**

- To gain practical knowledge by applying the experimental methods to correlate with the chemistry theory.
- To learn the usage of electrical systems for various measurements.
- Apply the analytical techniques and graphical analysis to the experimental data.

**List of Experiments**

1. Introduction to Chemistry laboratory-Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations, Qualitative analysis, Quantitative analysis etc.
2. Trial experiment-Estimation of HCl by using standard  $\text{Na}_2\text{CO}_3$  solution.
3. Estimation of Total hardness of water by using standard EDTA solution.
4. Estimation of Zinc using standard EDTA solution.
5. Estimation of Copper using standard EDTA solution.
6. Estimation of  $\text{P}^{\text{H}}$  of the given sample solution using  $\text{P}^{\text{H}}$  meter.
7. Conductometric titration between Strong acid and Strong base.
8. Conductometric titration between Strong acid and Weak base.
9. Potentiometric titration between Strong acid and Strong base.
10. Potentiometric titration between Strong acid and Weak base.
11. Estimation of  $\text{KMnO}_4$  using standard Oxalic acid.
12. Determination of Alkalinity of water.
13. Determination of Viscosity of given sample by Ostwald viscometer.
14. Estimation of Ferric iron using standard  $\text{K}_2\text{Cr}_2\text{O}_7$  solution.
15. Estimation of Copper using standard  $\text{K}_2\text{Cr}_2\text{O}_7$  solution.
16. Preparation of Bakelite (Demo).

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Reference Books**

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.
2. Dr. Jyotsna Cherukuri (2012) Laboratory Manual of engineering chemistry-II, VGS Techno Series
3. Chemistry Practical Manual, Lorven Publications
4. K. Mukkanti (2009) Practical Engineering Chemistry, B.S. Publication.

**Course Outcomes:**

Upon Completion of the course, the student will be able to

CO1: Utilize different Analytical tools and execute experiments involving estimation of raw materials, finished products and environmental samples etc.

CO2: Utilize modern instruments like Conductometer, pH meter and Potentiometer for the analysis of samples.

CO3: Determine the total hardness present in water for its quality in drinking purpose.

CO4: Estimate the Viscosity of oil and assess its suitability as a lubricant.

CO5: Determine the alkalinity present in water for its quality in drinking purpose.

CO6: Identify the adulteration of lemon juice for Vitamin-C.

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### Problem Solving and Programming using C Lab

#### Course Objectives:

- Understand the basic concept of C Programming, and its different modules that include conditional and looping expressions, Arrays, Strings, Functions, Pointers, Structures and File programming.
- Acquire knowledge about the basic concept of writing a program.
- Role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language.
- Use of conditional expressions and looping statements to solve problems associated with conditions and repetitions.
- Role of Functions involving the idea of modularity.

#### Exercise 1

- Write a C Program to calculate the area of a triangle.
- Write a C program to find the largest of three numbers using ternary operator.
- Write a C Program to swap two numbers without using a temporary variable.

#### Exercise 2

- Write a C program to find the 2's complement of a binary number.
- Write a C program to find the roots of a quadratic equation.
- Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, \*, /, % and use Switch Statement)

#### Exercise 3

- Write a C program to find the sum of individual digits of a positive integer and, also, find 'the reverse of the given number.
- Write a C program to generate the first n terms of the Fibonacci sequence.
- Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

#### Exercise 4

- Write a C Program to print the multiplication table of a given number.
- Write a C Program to read a decimal number and find its equivalent binary number.
- Write a C Program to check whether the given number is Armstrong number or not.

#### Exercise 5

- Write a C program to interchange the largest and smallest numbers in the given array.
- Write a C program to implement a linear search on a given set of values.
- Write a C program to implement binary search on a given set of values.

#### Exercise 6

- Write a C program to implement sorting of an array of elements.
- Write a C program to input two m x n matrices, check the compatibility and perform 'addition and multiplication of them.

**Exercise 7**

Write a C program that uses functions to perform the following operations:

- i. To insert a sub-string into given main string at a given position.
- ii. To delete n characters from a given position in a given string.
- iii. To replace a character of string either from beginning or ending or at a specified location.

**Exercise 8**

Write a C program that uses functions to perform the following operations using Structure:

- i) Reading a complex number
- ii) Writing a complex number
- iii) Addition of two complex numbers
- iv) Multiplication of two complex numbers

**Exercise 9**

Write C Programs for the following string operations without using the built in functions

- to concatenate two strings to append a string to another string
- to compare two strings

**Exercise 10**

- a) Write C Program to find the number of characters in a given string including and excluding spaces.
- b) Write C Program to copy the contents of one string to another string without using string handling functions.
- c) Write C Program to find whether a given string is palindrome or not.
- d) Write a C program to find both the largest and smallest number of an array of integers using call by value and call by reference.

**Exercise 11**

Write a C program using recursion for the following:

- a) To display sum of digits of given number
- b) To find the factorial of a given integer
- c) To find the GCD (greatest common divisor) of two given integers.
- d) To find Fibonacci sequence

**Exercise 12**

- a) Write C Program to reverse a string using pointers
- b) Write a C Program to compare two 2D arrays using pointers
- c) Write a C program consisting of Pointer based function to exchange value of two integers using passing by address.

**Exercise 13**

Examples which explores the use of structures, union and other user defined variables.

**Exercise 14**

- a) Write a C program. which copies one file to another.
- b) Write a C program to count the number of characters and number of lines in a file.
- c) Write a C Program to merge two files into a third file. The names of the files must be entered using command line arguments.

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Course Outcomes:**

Upon the completion of the course, the student will be able to:

CO1: Apply and practice logical ability to solve the problems.

CO2: Identify C programming development environment, compiling, debugging, and linking and executing a program using the development environment.

CO3: Analyze the complexity of problems, modularize the problems into small modules and then convert them into programs.

CO4: Apply the in-built functions and customized functions for solving the problems.

CO5: Create C programs using pointers, memory allocation techniques.

CO6: Use files for dealing with variety of problems.

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## ENGINEERING EXPLORATION PROJECT

### COURSE OBJECTIVES:

- Build mindsets & foundations essential for designers
- Learn about the Human-Centered Design methodology and understand their real-world applications
- Use Design Thinking for problem solving methodology for investigating illdefined problems.
- Undergo several design challenges and work towards the final design challenge.

### Apply Design thinking on the following Streams to

- Project Stream 1: Electronics, Robotics, IOT and Sensors
- Project Stream 2: Computer Science and IT Applications
- Project Stream 3: Mechanical and Electrical tools
- Project Stream4: Eco-friendly solutions for waste management, infrastructure, safety, alternative energy sources, Agriculture, Environmental science and other fields of engineering.

### HOW TO PURSUE THE PROJECT WORK?

- The first part will be learning-based-making students to embrace the methodology by exploring all the phases of design thinking through the wallet/ bag challenge and podcasts.
- The second part will be more discussion-based and will focus on building some necessary skills as designers and learning about complementary material for human-centered design.
- The class will then divide into teams and they will be working with one another for about 2 – 3 weeks. These teams and design challenges will be the basis for the final project and final presentation to be presented.
- The teams start with **Design Challenge** and go through all the phases more in depth from coming up with the right question to empathizing to ideating to prototyping and to testing.
- Outside of class, students will also be gathering the requirements, identifying the challenges, usability, importance etc
- At the end, Students are required to submit the final reports, and will be evaluated by the faculty.

### TASKS TO BE DONE:

Task 1: Everyone is a Designer

- Understand class objectives & harness the designer mindset

### Task 2: The Wallet/Bag Challenge and Podcast

- Gain a quick introduction to the design thinking methodology
- Go through all stages of the methodology through a simple design challenge
- Podcast: Observe, Listen and Engage with the surrounding environment and identify a design challenge.

**Task 3: Teams & Problems**

- Start Design Challenge and learn about teams & problems through this
- Foster team collaboration, find inspiration from the environment and learn how to identify problems.

**Task 4: Empathizing**

- Continue Design Challenge and learn empathy
- Learn techniques on how to empathize with users
- Go to the field and interview people in their environments
- Submit Activity Card

**Task 5: Ideating**

- Continue Design Challenge and learn how to brainstorm effectively
- Encourage exploration and foster spaces for brainstorming
- Submit Activity Card

**Task 6: Prototyping**

- Continue Design Challenge and learn how to create effective prototypes
- Build tangible models and use them as communication tools
- Start giving constructive feedback to classmates and teammates
- Submit Activity Card

**Task 7: Testing**

- Finish Design Challenge and iterate prototypes and ideas through user feedback
- Evolve ideas and prototypes through user feedback and constructive criticism
- Get peer feedback on individual and group performance
- Submit Activity Card

**Task 8:**

- Final Report Submission and Presentation

**Note:** The colleges may arrange for Guest Speakers from Various Design Fields: Graphic Design, Industrial Design, Architecture, Product Design, Organizational Design, etc to enrich the students with Design Thinking Concept.

**REFERENCES:**

1. Tom Kelly, *The Art of Innovation: Lessons in Creativity From IDEO, America's Leading Design Firm* (Profile Books, 2002)
2. Tim Brown, *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation* (HarperBusiness, 2009)
3. Jeanne Liedtka, Randy Salzman, and Daisy Azer, *Design Thinking for the Greater Good: Innovation in the Social Sector* (Columbia Business School Publishing, 2017)

**OTHER USEFUL DESIGN THINKING FRAMEWORKS AND METHODOLOGIES:**

- Human-Centered Design Toolkit (IDEO); <https://www.ideo.com/post/design-kit>
- Design Thinking Boot Camp Bootleg (Stanford D-School); <https://dschool.stanford.edu/resources/the-bootcamp-bootleg>
- Collective Action Toolkit (frogdesign); [https://www.frogdesign.com/wpcontent/uploads/2016/03/CAT\\_2.0\\_English.pdf](https://www.frogdesign.com/wpcontent/uploads/2016/03/CAT_2.0_English.pdf)
- Design Thinking for Educators (IDEO); <https://designthinkingforeducators.com/>

**CONSTITUTION OF INDIA**

(CE,EEE, ME &amp; ECE)

**Course Objectives:**

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of india and election commission of india.
- To understand the central and state relation financial and administrative.

**UNIT – I**

**Introduction to Indian Constitution:** Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

**UNIT – II**

**Union Government and its Administration Structure of the Indian Union:** Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;

**UNIT – III**

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

**UNIT – IV**

A. Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation Panchayati Raj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy.

**UNIT – V**

**Election Commission:** Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women.

**TEXT BOOKS:**

1. Subash Kashyap, Indian Constitution, National Book Trust
2. J.A. Siwach, Dynamics of Indian Government & Politics

**REFERENCE BOOKS:**

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd., New Delhi
2. D.C. Gupta, Indian Government and Politics
3. H.M. Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
4. J.C. Johari, Indian Government and Politics Hans

5. J. Raj Indian Government and Politics

6. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi

7. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012.

**Course Outcomes:**

Upon completion of the course, the students will be able to

CO1: Explain the concept of Indian constitution and Evaluate Preamble Fundamental Rights and Duties

CO2: Judge the structure of Indian government, Differentiate between the state and central government.

CO3: Explain the role of President and Prime Minister and Know the Structure of Supreme Court and High court.

CO4: Analyze the role Governor and Chief Minister and explain the role of state Secretariat

CO5: Explain the role of Myer and elected representatives of Municipalities, Evaluate Zilla panchayat block level organization

CO6: Identify the roles of Election Commission apply knowledge and Evaluate various commissions of viz SC/ST/OBC and women.

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**ELECTRONIC DEVICES AND CIRCUITS****Internal Marks: 30****External Marks: 70****Course Objectives:**

1. To introduce components such as diodes, BJTs and FETs.
2. To know the applications of components.
3. To know the switching characteristics of components.
4. To give understanding of various types of amplifier circuits.

**UNIT I**

**Diode and Applications: Diode** - Static and Dynamic resistances, Equivalent circuit, Load line analysis, Diffusion and Transition Capacitances, Diode Applications: Switch-Switching times. Rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifiers With Capacitive Filter, Clippers-Clipping at two independent levels, Clampers-Clamping Operation, types, Clamping Circuit Theorem, Comparators.

**UNIT II**

**Bipolar Junction Transistor (BJT):** Principle of Operation and characteristics -Common Emitter, Common Base, Common Collector Configurations, Operating point, DC & AC load lines, Transistor Hybrid parameter model, Determination of h-parameters from transistor characteristics, Conversion of h-parameters.

**UNIT III**

**Transistor Biasing and Stabilization:** Bias Stability, Fixed Bias, Collector to Base bias, Self Bias, Bias Compensation using Diodes and Transistors.

**Analysis and Design of Small Signal Low Frequency BJT Amplifiers:** Analysis of CE, CC, CB Amplifiers and CE Amplifier with emitter resistance, low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors on CE Amplifier.

**UNIT IV**

**Junction Field Effect Transistor:** Construction, Principle of Operation, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and FET, Biasing of FET, FET as Voltage Variable Resistor, MOSFET Construction and its Characteristics in Enhancement and Depletion modes.

**UNIT V**

**FET Amplifiers:** Small Signal Model, Analysis of CS, CD, CG JFET Amplifiers, Basic Concepts of MOSFET Amplifiers.

**Special Purpose Devices:** Zener Diode-Characteristics, Voltage Regulator; LED, PNP Diodes, Principle of Operation - SCR, Tunnel diode, UJT, Varactor Diode.

### **TEXT BOOKS**

1. Electronic Devices and Circuits - Jacob Millman, McGraw Hill Education.
2. Electronic Devices and Circuits theory- Robert L. Boylestead, Louis Nashelsky, 11thEdition, Pearson, 2009.

### **REFERENCE BOOKS**

1. The Art of Electronics, Horowitz, 3rdEdition Cambridge University Press, 2018
2. Electronic Devices and Circuits, David A. Bell – 5th Edition, Oxford.
3. Pulse, Digital and Switching Waveforms –J. Millman, H. Taub and Mothiki S. Prakash Rao, 2 Ed., McGraw Hill, 2008.
4. Electronic Devices and Circuits, S. Salivahanan, N. Suresh Kumar, A Vallvaraj, 2<sup>nd</sup>Edition, TMH.

### **Course Outcomes:**

Upon completion of the Course, the students will be able to:

1. Know the characteristics of various components.
2. Understand the utilization of components for the design of circuits.
3. Understand the biasing techniques.
4. Design and analyze small signal amplifier circuits.
5. Understand the JFET and design the FET Amplifiers.
6. Know the working of special purpose devices.

## SWITCHING THEORY AND LOGIC DESIGN

**Internal Marks: 30**  
**External Marks: 70**

### Course Objectives:

1. To understand common forms of number representation in logic circuits.
2. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
3. To understand the concepts of combinational logic circuits and sequential circuits.
4. To understand the Realization of Logic Gates Using Diodes & Transistors.

### UNIT I

**Number Systems:** Number systems, Complements of Numbers, Codes-Weighted and Non-Weighted codes and its Properties, Parity check code and Hamming code.

**Boolean Algebra:** Basic Theorems and Properties, Switching Functions-Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations.

### UNIT II

**Minimization of Boolean Functions:** Karnaugh Map Method - Up to five Variables, Don't Care Map Entries, Tabular Method,

**Combinational Logic Circuits:** Adders, Subtractors, comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free Relations.

### UNIT III

**Sequential Circuits Fundamentals:** Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another.

**Registers and Counters:** Shift Registers- Left, Right and Bidirectional Shift Registers, Applications of Shift Registers - Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters.

### UNIT IV

**Sequential Machines:** Finite State Machines, Synthesis of Synchronous Sequential Circuits- Serial Binary Adder, Sequence Detector, Parity-bit Generator, Synchronous Modulo N – Counters, Finite state machine- capabilities and limitations, Mealy and Moore models.

## **UNIT V**

**Realization of Logic Gates Using Diodes & Transistors:** AND, OR and NOT Gates using Diodes and Transistors, DCTL, RTL, DTL, TTL and CML Logic Families and its Comparison, Classification of Integrated Circuits.

### **TEXT BOOKS**

1. Switching and Finite Automata Theory – Zvi Kohavi & Niraj K. Jha, 3<sup>rd</sup> Edition, Cambridge, 2010.
2. Modern Digital Electronics – R. P. Jain, 3<sup>rd</sup> edition, Tata McGraw-Hill, 2007.

### **REFERENCE BOOKS**

1. Digital Design- Morris Mano, PHI, 4th Edition, 2006
2. Introduction to Switching Theory and Logic Design – Fredriac J. Hill, Gerald R. Peterson, 3<sup>rd</sup> Ed, John Wiley & Sons Inc.
3. Fundamentals of Logic Design- Charles H. Roth, Cengage Learning, 5<sup>th</sup>, Edition, 2004.
4. Switching Theory and Logic Design – A Anand Kumar, PHI, 2013

### **Course Outcomes:**

Upon completing this course, the student will be able to

1. Understand the numerical information in different forms and Boolean Algebra theorems.
2. Postulates of Boolean algebra and to minimize combinational functions.
3. Design and analyze combinational and sequential circuits.
4. Understand and design Registers and Counters.
5. Know the realization logic gates based on diode and transistor.
6. Know the logic families and about Integrated circuits

**SIGNALS AND SYSTEMS****Internal Marks: 30****External Marks: 70****Course Objectives:**

This subject gives the basics of Signals and Systems required for all Electrical Engineering related courses. The objectives of this subject are to:

1. Classify signals and systems and their analysis in time and frequency domains.
2. Study the concepts of distortion less transmission through LTI systems, convolution and correlation properties.
3. Understand Laplace and Z-transforms their properties for analysis of signals and systems.
4. Identify the need for sampling of CT signals, types and merits and demerits of each type.

**UNIT I**

**Signal Analysis:** Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

**UNIT II**

**Fourier Series:** Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

**Fourier Transforms:** Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.

**UNIT III**

**Signal Transmission through Linear Systems:** Linear System, Impulse response, Response of a Linear System, Linear Time Invariant(LTI)System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and rise time, Convolution and Correlation of Signals, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution.

## UNIT IV

### Laplace Transforms and Z-Transforms:

**Laplace Transforms:** Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis.

**Z-Transforms:** Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z- Transform, Constraints on ROC for various classes of signals, Inverse Z- transform, Properties of Z-transforms.

## UNIT V

**Sampling Theorem:** Graphical and analytical proof for Band Limited Signals, Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass Sampling.

**Correlation:** Cross Correlation and Auto Correlation of Functions, Properties of Correlation Functions, Energy Density Spectrum, Parsevals Theorem, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Relation between Convolution and Correlation, Detection of Periodic Signals in the presence of Noise by Correlation, Extraction of Signal from Noise by Filtering

## TEXT BOOKS

1. Signals, Systems & Communications - B.P. Lathi, BSP, 2013.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawabi, 2 Ed.

## REFERENCE BOOKS

1. Signals and Systems – Simon Haykin and Van Veen, Wiley 2 Ed.,
2. Signals and Systems – A. Rama Krishna Rao, 2008, TMH
3. Fundamentals of Signals and Systems - Michel J. Robert, 2008, MGH International Edition.
4. Signals, Systems and Transforms - C. L. Philips, J. M. Parr and Eve A. Riskin, 3 Ed., 2004, PE.
5. Signals and Systems – K. Deergha Rao, Birkhauser, 2018.

## Course Outcomes:

Upon completing this course, the student will be able to:

1. Understand the basic elementary signals and systems and its properties.
2. Understand the Fourier Series and Fourier Transform.
3. Know and the design of linear systems and its response.
4. Identify the significance of LT, ZT and their relationships.
5. Understand the significance of sampling types and its applications.
6. Know the properties of correlation.

**RANDOM VARIABLES & STOCHASTIC PROCESSES****Internal Marks: 30****External Marks: 70****Course Objectives:**

1. This gives basic understanding of random signals and processing.
2. Utilization of Random signals and systems in Communications and Signal Processing areas.
3. To know the Spectral and temporal characteristics of Random Process.
4. To Learn the Basic concepts of Noise sources.

**UNIT I**

**Probability & Random Variables:** Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bay's Theorem, Independent Events.

**Random Variables:** Definition, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Methods of defining Conditioning Event, Conditional Distribution, Conditional Density and their Properties.

**UNIT II**

**Operations on Single & Multiple Random Variables – Expectations:** Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable - Monotonic and Non-monotonic Transformations of Continuous and Discrete Random Variable, Vector Random Variables, Joint Distribution Function and its Properties, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density – Interval conditioning, Statistical Independence, Sum of Two and more Random Variables, Central Limit Theorem, Equal and Unequal Distribution. Expected Value of a Function of Random Variables- Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

### **UNIT III**

**Random Processes – Temporal Characteristics:** The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity 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. Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output.

### **UNIT IV**

**Random Processes – Spectral Characteristics:** The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation 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 Spectrums of Input and Output.

### **UNIT V**

**Noise Sources & Information Theory:** Resistive/Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties. Entropy, Information rate, Source coding: Huffman coding, Shannon Fano coding, Mutual information, Channel capacity of discrete channel, Shannon-Hartley law; Trade - off between bandwidth and SNR.

### **TEXT BOOKS**

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4<sup>th</sup> Edition, 2001.
2. Principles of Communication systems by Taub and Schilling (TMH), 2008

### **REFERENCE BOOKS**

1. Random Processes for Engineers-Bruce Hajck, Cambridge unipress, 2015
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.
3. Probability, Statistics & Random Processes-K .Murugesan, P. Guruswamy, Anuradha Agencies, 3rd Edition, 2003.
4. Signals, Systems & Communications - B.P. Lathi, B.S. Publications, 2003.

**Course Outcomes:**

Upon completing this course, the student will be able to

1. Understand the concepts of Probability and Random Variables.
2. Know the Operations on single & multiple random variables – expectations.
3. Know the concepts of cross correlation and covariance.
4. Understand the concepts of Random Processes and its temporal and spectral Characteristics.
5. Know the concepts of Noise sources in communication theory.
6. Learn the concepts in Information theory.

## OBJECT ORIENTED DESIGN AND PROGRAMMING USING JAVA

**Internal Marks: 30**

**External Marks: 70**

### Course Objectives:

1. To familiarize with the concepts of object oriented programming.
2. To impart the knowledge of AWT components in creation of GUI.

### UNIT I

**Fundamentals of OOP and JAVA:** Need of OOP, principles of OOP languages, procedural languages vs. OOP, Java virtual machine, java features. Java Programming constructs: variables, primitive data types, identifiers, keywords, Literals, operators, arrays, type conversion and casting.

### UNIT II

**Class Fundamentals and Inheritance:** Class fundamentals, declaring objects, methods, constructors, this keyword, overloading methods and constructors, access control. Inheritance- Basics, types, using super keyword, method overriding, dynamic method dispatch, abstract classes, using final with inheritance, Object class.

**Interfaces and Packages:** Interfaces: Defining an interface, implementing interfaces, nested interfaces, variables in interfaces and extending interfaces. Packages: Defining, creating and accessing a package.

### UNIT III

**Exception Handling and Multithreading:** Exception Handling- exception-handling fundamentals, uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws, finally, user-defined exceptions. Multithreading - Introduction to multitasking, thread life cycle, creating threads, synchronizing threads, thread groups.

### UNIT IV

**Applets and Event Handling:** Applets- Concepts of Applets, differences between applets and applications, life cycle of an applet, creating applets. Event Handling- Events, event sources, event classes, event listeners, Delegation event model, handling mouse and keyboard events, adapter classes.

### UNIT V

**AWT:** The AWT class hierarchy, user interface components- label, button, checkbox, checkbox group, choice, list, text field, scrollbar, layout managers – flow, border, grid, card, grid bag.

**TEXT BOOKS**

1. Herbert Schildt, "Java The Complete Reference", 7th edition, TMH.
2. Sachin Malhotra, Saurabh Choudhary, "Programming in Java", 2nd edition, Oxford.

**REFERENCE BOOKS**

1. Joyce Farrel, Ankit R. Bhavsar, "Java for Beginners", 4th edition, Cengage Learning.
2. Y. Daniel Liang, "Introduction to Java Programming", 7th edition, Pearson.
3. P.Radha Krishna, "Object Oriented Programming through Java", Universities Press.

**Course Outcomes:**

Upon successful completion of the course, the students will be able to

1. Apply Object Oriented approach to design software.
2. Know the class fundamentals and Inheritance.
3. Create user defined interfaces and packages for a given problem.
4. Develop code to handle exceptions.
5. Know the Implementation of multi tasking with multi threading.
6. Design and develop applets for web applications and GUI programs using AWT components.

## MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

**Internal Marks: 30**

**External Marks: 70**

### Course Objectives:

1. The Learning objectives of this paper is to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting, Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis.
2. To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles.
3. To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation. Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

### UNIT I

**Introduction to Managerial Economics and Demand Analysis:** Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects – Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting.

### UNIT II

**Production and Cost Analysis:** Concept of Production function- Cobb-Douglas Production function- Leontief production function - Law of Variable proportions- Isoquants and Isocosts and choice of least cost factor combination- Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs- Fixed costs, Variable Costs and Total costs –Cost – Volume-Profit analysis-Determination of Breakeven point(simple problems)- Managerial significance and limitations of Breakeven point.

### UNIT III

**Introduction to Markets, Theories of the Firm & Pricing Policies:** Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average

cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: Flat Rate Pricing, Usage sensitive pricing and Priority Pricing.

#### **UNIT IV**

**Types of Business Organization and Business Cycles:** Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms – Business Cycles : Meaning and Features – Phases of Business Cycle.

#### **UNIT V**

**Introduction to Accounting & Financing Analysis:** Introduction to Double Entry Systems – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow statements (Simple Problems)

**Capital and Capital Budgeting:** Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(payback period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

#### **TEXT BOOKS**

1. Dr. N. Appa Rao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi – 2011
2. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011
3. Prof. J.V. Prabhakararao, Prof. P. Venkatarao. 'Managerial Economics and Financial Analysis', Ravindra Publication.

#### **REFERENCE BOOKS**

1. Dr. B. Kuberudu and Dr. T. V. Ramana: Managerial Economics & Financial Analysis, Himalaya Publishing House, 2014.
2. V. Maheswari: Managerial Economics, Sultan Chand.2014
3. Suma Damodaran: Managerial Economics, Oxford 2011.
4. Vanitha Agarwal: Managerial Economics, Pearson Publications 2011.
5. Sanjay Dhameja: Financial Accounting for Managers, Pearson.
6. Maheswari: Financial Accounting, Vikas Publications.
7. S. A. Siddiqui & A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2012
8. Ramesh Singh, Indian Economy, 7th Edn., TMH2015
9. Pankaj Tandon A Text Book of Microeconomic Theory, Sage Publishers, 2015
10. Shailaja Gajjala and Usha Munipalle, Universities press, 2015

**Course Outcomes:**

Upon successful completion of the course, the students will be able to

1. Get the knowledge of managerial economics and demand analysis.
2. Knowing the production and cost analysis.
3. Understand the Input-Output-Cost relationships and estimation of the least cost combination of inputs and nature of different markets its pricing policies.
4. Understand Price Output determination under various market conditions.
5. Know different business organisations and its business cycles.
6. Prepare Financial Statements and the usage of various Accounting tools for Analysis and to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

## **ELECTRONIC DEVICES AND CIRCUITS LAB**

**Internal Marks: 20**  
**External Marks: 30**

### **Course Objectives:**

1. Know the functionality of electronic components.
2. Observe the characteristics of Electronic Devices

### **List of Experiments :( Minimum of 12 Experiments has to be performed)**

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Zener diode characteristics and Zener as voltage Regulator
3. Half Wave Rectifier with & without filters
4. Full Wave Rectifier with & without filters
5. Measurement of h-parameters of transistor in CB, CE, CC configurations
6. Input and Output characteristics of FET in CD configuration
7. SCR Characteristics.
8. Common Emitter Amplifier Characteristics
9. Common Base Amplifier Characteristics
10. Common Source Amplifier Characteristics
11. Types of Clippers and at different reference voltage
12. Types of Clampers and at different reference voltage
13. The steady state output waveform of clampers for a square wave input
14. Comparison Operation of different types of Comparators

### **Equipment Required:**

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. Analog/Digital Function Generators
4. Digital Multimeters
5. Decade Resistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital)
8. Voltmeters (Analog or Digital)

## 9. Active & Passive Electronic Components

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

### **Course Outcomes:**

Upon completion of the course, the student will be able to

1. Measure voltage, frequency and phase of any waveform using CRO and resistor colour coding.
2. Generation of sine, square and triangular waveforms with required frequency and amplitude using function generator.
3. Design and analysis of circuits like PN junction diode, Zener diode and rectifiers, clippers and clampers, comparators.
4. Design and analysis of various amplifier configurations in multisim and bread board
5. To compare Operation of different types of Comparators
6. Measurement of h-parameters of transistor in CB, CE, CC configurations

**SWITCHING THEORY AND LOGIC DESIGN -LAB****Internal Marks: 20****External Marks: 30****Course Objectives:**

Student able to know the

1. Design of digital circuits based on logic gates on trainer kit and corresponding software.

**List of Experiments:**

1. Realization of Boolean Expressions using Gates
2. Design and realization logic gates using universal gates
3. Generation of clock using NAND / NOR gates
4. Design a 4 – bit Adder / Subtractor
5. Design and realization a 4 – bit gray to Binary and Binary to Gray Converter
6. Design and realization of a 4 bit pseudo random sequence generator using logic gates.
7. Design and realization of an 8 bit parallel load and serial out shift register using flip-flops.
8. Design and realization a Synchronous and Asynchronous counters using flip-flops
9. Design and realization of Asynchronous counters using flip-flops
10. Design and realization 8x1 using 2x1 MUX
11. Design and realization 2 bit comparator
12. Verification of truth tables and excitation tables
13. Realization of logic gates using DTL, TTL, ECL, etc.
14. State reduction techniques for State machines

**Equipment required for Laboratory:**

1. RPS - 0 – 30 V
2. CRO - 0 – 20 M Hz.
3. Function Generators - 0 – 1 M Hz
4. Components
5. Multi Meters

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Course Outcomes:**

After the completion of the lab course the student will be able to:

1. Design and realization of logic gates on trainer kit and software.
2. Design of digital circuits based on logic gates adder/subtractor.
3. Design of registers and counters, flip-flops.
4. Design and realization of DTL, TTL, ECL techniques
5. To Verification of truth tables and excitation tables
6. Design and realization 2 bit comparator.

**ENVIRONMENTAL STUDIES****Internal Marks: 100****External Marks: 0****Course Objectives:**

The objectives of the course is to impart

1. Overall understanding of the natural resources
2. Basic understanding of the ecosystem and its diversity
3. Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities
4. An understanding of the environmental impact of developmental activities
5. Awareness on the social issues, environmental legislation and global treaties

**UNIT I**

**Multidisciplinary nature of Environmental Studies:** Definition, Scope and Importance –Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, Carbon Credits, acid rains, ozone layer depletion, population growth and explosion, effects. Role of Information Technology in Environment and Human Health.

**Ecosystems:** 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 Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

**UNIT II**

**Natural Resources:** Natural resources and associated problems Forest resources – Use and over – exploitation, deforestation – 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, Sustainable mining of Granite, Lignite, Coal, Sea and River sands. Food resources: World food problems, changes caused by non-agriculture activities- effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources Vs Oil and Natural Gas Extraction. Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

### UNIT III

**Biodiversity and its conservation:** Definition: genetic, species and ecosystem diversity- classification - Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, man- wildlife conflicts - Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.

### UNIT IV

**Environmental Pollution:** Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Studies.

**Solid Waste Management:** Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.

### UNIT V

**Social Issues and the Environment:** Urban problems related to energy -Water conservation, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental 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.

**Environmental Management:** Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism, Green Campus – Green business and Green politics. The student should Visit an Industry/Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

### TEXT BOOKS

1. Environmental Studies, K.V. S. G. Murali Krishna, VGS Publishers, Vijayawada
2. Environmental Studies, R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.
3. Environmental Studies, P.N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

### REFERENCE BOOKS

1. Text Book of Environmental Studies, Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi
3. Environmental Studies, Benny Joseph, Tata McGraw Hill Co, New Delhi

4. "Perspectives in Environment Studies" Anubha Kaushik, C P Kaushik, New Age International Publishers, 2014

**Course Outcomes:**

Upon completing this course, the student should have knowledge on

1. The natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources
2. The concepts of the ecosystem and its function in the environment. The need for protecting the producers and consumers in various ecosystems and their role in the food web
3. The biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity
4. Various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices
5. Social issues both rural and urban environment and the possible means to combat the challenges
6. The environmental legislations of India and the first global initiatives towards sustainable development.

**ANALOG CIRCUITS****Internal Marks: 30****External Marks: 70****Course Objectives:**

1. Learn the concepts of high frequency analysis of transistors.
2. To give understanding of various types of amplifier circuits such as small signal, cascaded, large signal and tuned amplifiers.
3. To familiarize the Concept of feedback in amplifiers so as to differentiate between negative and positive feedback.
4. To construct various multi-vibrators using transistors and sweep circuits.

**UNIT I**

**Multistage Amplifiers:** Classification of Amplifiers, Distortion in amplifiers, Different coupling schemes used in amplifiers, Frequency response and Analysis of multistage amplifiers, Cascade amplifier, Darlington pair.

**Transistor at High Frequency:** Hybrid - model of Common Emitter transistor model,  $\alpha$ ,  $\beta$  and unity gain bandwidth, Gain bandwidth product.

**UNIT II**

**Feedback Amplifiers:** Concepts of feedback – Classification of feedback amplifiers – General characteristics of negative feedback amplifiers – Effect of Feedback on Amplifier characteristics – Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations.

**UNIT III**

**Oscillators:** Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge Oscillators, LC type Oscillators –Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators, Frequency and amplitude stability of Oscillators, Crystal Oscillator.

**UNIT IV**

**Large Signal Amplifiers:** Class A Power Amplifier- Series fed and Transformer coupled, Conversion Efficiency, Class B Power Amplifier- Push Pull and Complimentary Symmetry configurations, Conversion Efficiency, Principle of operation of Class AB and Class C Amplifiers.

**Tuned Amplifiers:** Single Tuned Amplifiers – Q-factor, frequency response of tuned amplifiers, Concept of stagger tuning and synchronous tuning

## **UNIT V**

**Multivibrators:** Types of Triggering, Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors.

### **TEXT BOOKS**

1. Integrated Electronics, Jacob Millman, Christos C Halkias, McGraw Hill Education, 2<sup>nd</sup> Ed., 2010
2. Electronic Devices Conventional and current version -Thomas L. Floyd, Pearson, 2015.

### **REFERENCE BOOKS**

1. Electronic Devices and Circuits, David A. Bell – 5th Ed., Oxford, 1986.
2. Electronic Devices and Circuits theory– Robert L. Boylestead, Louis Nashelsky, 11th Ed., Pearson, 2009.
3. Millman's Pulse, Digital and Switching Waveforms –J. Millman, H. Taub and Mothiki S. Prakash Rao, 2 Ed., TMH, 2008.
4. Pulse, Switching and Digital Circuits –David A. Bell, 5th Ed, Oxford, 2015.

### **Course Outcomes:**

Upon completing this course, the student will be able to

1. Design the multistage amplifiers
2. Understand the concepts of High Frequency Analysis of transistors.
3. Utilize the Concepts of negative feedback to improve the stability of amplifiers and positive feedback to generate sustained oscillations.
4. Design and realize different types of Oscillators and understand the frequency and amplitude stability of Oscillators.
5. Design and realize different classes of Power amplifiers and tuned amplifiers useable for audio and Radio applications.
6. Design of multi-vibrators, time base generators for various applications.

## ANALOG COMMUNICATIONS

**Internal Marks: 30**

**External Marks: 70**

### Course Objectives:

Students undergoing this course, are expected to

1. Familiarize with the fundamentals of analog communication systems
2. Familiarize with various techniques for analog modulation and demodulation of signals
3. Distinguish the figure of merits of various analog modulation methods
4. Develop the ability to classify and understand various functional blocks of radio transmitters and receivers
5. Familiarize with basic techniques for generating and demodulating various pulse modulated signals

### UNIT I

**Amplitude Modulation:** 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 AM waves, Generation of AM waves, square law Modulator, Switching modulator, Detection of AM Waves; Square law detector, Envelope detector.

### UNIT II

**DSB & SSB Modulation:** Double side band suppressed carrier modulators, time domain and frequency domain description, Generation of DSBSC Waves, Balanced Modulators, Ring Modulator, Coherent detection of DSB-SC Modulated waves, COSTAS Loop. Frequency domain description, Frequency discrimination method for generation of AM SSB Modulated Wave, Time domain description, Phase discrimination method for generating AM SSB Modulated waves. Demodulation of SSB Waves, Vestigial side band modulation: Frequency description, Generation of VSB Modulated wave, Time domain description, Envelope detection of a VSB Wave pulse Carrier, Comparison of AM Techniques, Applications of different AM Systems.

### UNIT III

**Angle Modulation:** Basic concepts, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Waves, Direct FM, Detection of FM Waves: Balanced Frequency discriminator, Zero crossing detector, Phase locked loop, Comparison of FM & AM.

## **UNIT IV**

**Transmitters & Receivers:** Radio Transmitter - Classification of Transmitter, AM Transmitter, Effect of feedback on performance of AM Transmitter, FM Transmitter – Variable reactance type and phase modulated FM Transmitter, frequency stability in FM Transmitter. Radio Receiver - Receiver Types - Tuned radio frequency receiver, Superhetrodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, AGC, FM Receiver, Comparison with AM Receiver, Amplitude limiting. Communication Receivers, extensions of super heterodyne principle and additional circuits.

## **UNIT V**

**Noise:** Review of noise and noise sources, noise figure, Noise in Analog communication Systems, Noise in DSB& SSB System, Noise in AM System, Noise in Angle Modulation Systems, Threshold effect in Angle Modulation System, Pre-emphasis & De-emphasis

**Pulse Modulation:** Time Division Multiplexing,, Types of Pulse modulation, PAM (Single polarity, double polarity) PWM: Generation & demodulation of PWM, PPM, Generation and demodulation of PPM, TDM Vs FDM

## **TEXT BOOKS**

1. Principles of Communication Systems – H Taub & D. Schilling, Gautam Sahe, TMH, 2007 3rd Edition.
2. Communication Systems – B.P. Lathi, BS Publication, 2006.

## **REFERENCE BOOKS**

1. Principles of Communication Systems - Simon Haykin, John Wiley, 2nd Ed.,
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH 2004.
3. Communication Systems– R.P. Singh, SP Sapre, Second Edition TMH, 2007.
4. Fundamentals of Communication Systems - John G. Proakis, Masond, Salehi PEA, 2006.
5. Electronic Communication systems – Tomasi, Pearson.

## **Course Outcomes:**

After undergoing the course, students will be able to

1. Understand the concepts of modulation and demodulation schemes
2. Know the comparison and applications of modulation techniques.
3. Design of radio transmitter for amplitude and frequency modulation.
4. Design of various types of radio receivers for communication systems.
5. Understand the concepts of noise and various types of noise sources in analog communication systems.
6. Know the pulse modulation techniques and multiplexing techniques.

## CONTROL SYSTEMS

**Internal Marks: 30**

**External Marks: 70**

### Course Objectives:

The Objectives of this course are

1. To introduce the principles and applications of control systems in everyday life.
2. To introduce the basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems.
3. To understand different aspects of stability analysis of systems in frequency domain and time domain.

### UNIT I

**Introduction:** Concepts of Control Systems- Open Loop and closed loop control systems and their differences examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions - Translational and Rotational mechanical systems.

**Transfer Function Representation:** Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples –Block diagram algebra – Representation by Signal flow graph - Reduction using mason's gain formula.

### UNIT II

**Time Response Analysis:** Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

### UNIT III

**Stability Analysis:** The concept of stability, Routh stability criterion, qualitative stability and conditional stability.

**Root Locus Technique:** The root locus concept, construction of root loci, effects of adding poles and zeros to  $G(s)$   $H(s)$  on the root loci.

**Frequency Response Analysis:** Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots.

#### **UNIT IV**

**Stability Analysis In Frequency Domain:** Polar Plots, Nyquist Plots and applications of Nyquist criterion for stability –Effects of adding poles and zeros.  
**Classical Control Design Techniques:** Compensation techniques – Lag, Lead, and Lead-Lag Controllers design in frequency Domain, PID Controllers.

#### **UNIT V**

**State Space Analysis of Continuous Systems:** Concepts 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 its Properties.

#### **TEXT BOOKS**

1. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers, 2nd edition.
2. Modern Control Engineering – by Katsuhiko Ogata – Prentice Hall of India Pvt. Ltd., 3<sup>rd</sup> edition, 1998.

#### **REFERENCE BOOKS**

1. Control Systems by N. K. Sinha, New Age International (P) Limited Publishers, 3rd Edition, 1998.
2. Automatic Control Systems 8th edition– by B. C. Kuo 2003– John wiley and son's.
3. Control Systems Engg. by NISE 3rd Edition – John wiley
4. Control Systems by S. Kesavan, Hitech Publications.
5. “Modeling & Control Of Dynamic Systems” by Narciso F. Macia George J. Thaler, Thomson Publishers.

#### **Course Outcomes:**

After completing this course, the student will be able to

1. Know the open and closed loop control systems
2. Modeling of transfer function derivations for translational and rotational systems.
3. Understand the Time response analysis and frequency response analysis.
4. Get the knowledge on Stability Analysis, Root Locus Technique
5. Understand the time response analysis, stability analysis, frequency response analysis of different ordered systems through their characteristic equation and time-domain specifications.
6. Get the knowledge on state space analysis of Continuous Systems.

## ELECTROMAGNETIC WAVES AND TRANSMISSION LINES

**Internal Marks: 30**

**External Marks: 70**

### Course Objectives:

The main objectives of this course are to understand:

1. Fundamentals of steady electric and magnetic fields using various laws.
2. The concept of static and time varying Maxwell equations and power flow using pointing theorem.
3. Wave characteristics in different media for normal and oblique incidence.
4. Various concepts of transmission lines and impedance measurements.

### UNIT I

**Review of Co-ordinate Systems, Electrostatics:** Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Illustrative Problems. Convection and Conduction Currents, Dielectric Constant, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations; Capacitance – Parallel Plate, Coaxial Capacitors, Illustrative Problems.

### UNIT II

**Magneto Statics:** 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, Ampere's Force Law, Inductances and Magnetic Energy. Illustrative Problems

**Maxwell's Equations (Time Varying Fields):** Faraday's Law and Transformer emf, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. Conditions at a Boundary Surface: Dielectric-Dielectric and Dielectric-Conductor Interfaces. Illustrative Problems.

### UNIT III

**EM Wave Characteristics – I:** Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H, Sinusoidal Variations, Wave Propagation in Lossy dielectrics, lossless dielectrics, free space, wave propagation in good conductors, skin depth, Polarization & Types. Illustrative Problems

**EM Wave Characteristics – II:** 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 IV**

**Transmission Lines – I:** Types, Parameters, T&Π Equivalent Circuits, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line, Lossless lines, distortion less lines, Loading - Types of Loading. Illustrative Problems.

#### **UNIT V**

**Transmission Lines – II:** Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. Low loss radio frequency lines and UHF Transmission lines, UHF Lines as Circuit Elements; Impedance Transformations  $\lambda/4$ ,  $\lambda/2$ ,  $\lambda/8$  Lines – Smith Chart – Construction and Applications, Quarter wave transformer, Stub Matching-single & double, Illustrative Problems.

#### **TEXT BOOKS**

1. Elements of Electromagnetic – Matthew N.O. Sadiku, Oxford Univ. Press, 3rd ed., 2001.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2<sup>nd</sup> Edition, 2000.

#### **REFERENCE BOOKS**

1. Electromagnetic Fields and Wave Theory –GSN Raju, Pearson Education 2006
2. Engineering Electromagnetics: Nathan Ida, Springer (India) Pvt .Ltd., New Delhi, 2nd ed., 2005.
3. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, TMH, 7th ed., 2006.
4. Electromagnetic Field Theory and Transmission Lines: G Sasi Bhushana Rao, Wiley India 2013
5. Transmission Lines and Networks–Umesh Sinha, Satya Prakashan (Tech. India Publications), New Delhi, 2001.
6. Electromagnetic waves and transmission lines – R S Rao, PHI, EEE edition

#### **Course Outcomes:**

At the end of this course the student will be able to:

1. Understand various fundamental laws in electrostatics and magnetostatics.
2. Get knowledge on Maxwell equations in both static and time varying fields.
3. Understand the electromagnetic wave characteristics for various media and pointing theorem.
4. Understand the concepts of transmission lines for electromagnetic wave propagation.

5. Know the development and measurements using smith chart of various parameters.
6. Design of single stub, double stub by using smith chart.

## COMPUTER ARCHITECTURE AND ORGANIZATION

**Internal Marks: 30**

**External Marks: 70**

### Course Objectives:

1. Understand the architecture of a modern computer with its various processing units and also the Performance measurement of the computer system.
2. In addition to this the memory management system of computer.

### UNIT I

**Basic Structure of Computers:** Functional unit, Basic Operational concepts, Bus structures, System Software, Performance, The history of computer development.

### UNIT II

**Machine Instruction and Programs:** Instruction and Instruction Sequencing: Register Transfer Notation, Assembly Language Notation, Basic Instruction Types, Addressing Modes, Basic Input/output Operations, The role of Stacks and Queues in computer programming equation. Component of Instructions: Logic Instructions, shift and Rotate Instructions

### UNIT III

**Type of Instructions:** Arithmetic and Logic Instructions, Branch Instructions, Addressing Modes, Input/output Operations

**Input/Output Organization:** Accessing I/O Devices, Interrupts: Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access, Buses: Synchronous Bus, Asynchronous Bus, Interface Circuits, Standard I/O Interface: Peripheral Component Interconnect (PCI) Bus, Universal Serial Bus (USB)

### UNIT IV:

**The Memory Systems:** Basic memory circuits, Memory System Consideration, Read-Only Memory: ROM, PROM, EPROM, EEPROM, Flash Memory, Cache Memories: Mapping Functions, INTERLEAVING

**Secondary Storage:** Magnetic Hard Disks, Optical Disks,

### UNIT V

**Processing Unit:** Fundamental Concepts: Register Transfers, Performing an Arithmetic OR Logic Operation, Fetching a Word from Memory, Execution of Complete Instruction, Hardwired Control

**Micro programmed Control:** Microinstructions, Micro program Sequencing, Wide Branch Addressing Microinstructions with next –Address Field

### **TEXT BOOKS**

1. Computer Organization, Carl Hamacher, Zvonks Vranesic, Safea Zaky, 5th Edition, McGraw Hill.
2. Computer Architecture and Organization, John P. Hayes, 3rd Edition, McGraw Hill.

### **REFERENCE BOOKS**

1. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI
2. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition PHI/Pearson
3. Fundamentals or Computer Organization and Design, - Sivaraama Dandamudi Springer Int. Edition.
4. “Computer Organization and Design: The Hardware/Software Interface” by David A. Patterson and John L. Hennessy.
5. J .P. Hayes, "Computer Architecture and Organization", McGraw-Hill, 1998.

### **Course Outcomes:**

After undergoing the course, students will be able to

1. Understand the basic structure of computers
2. Know the various types of machine instructions
3. Understand input and output organisation of devices and buses
4. Get the knowledge on memory management systems
5. Get the knowledge on secondary storage devices.
6. Understand the concepts of processing unit and micro programmed control unit.

**MANAGEMENT AND ORGANIZATIONAL BEHAVIOR****Internal Marks: 30****External Marks: 70****Course Objectives:**

1. To familiarize with the process of management and to provide basic insight into select contemporary management practices
2. To provide conceptual knowledge on functional management and strategic management.

**UNIT I**

**Introduction to Management:** 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 behaviour Effectiveness(GLOBE) structure

**UNIT II**

**Operations Management:** Principles and Types of Management – Work study- Statistical Quality Control- Control charts (P-chart, R-chart, and C-chart) Simple problems- Material Management: Need for Inventory control- EOQ, ABC analysis (simple problems) and Types of ABC analysis (HML, SDE, VED, and FSN analysis).

**UNIT III**

**Functional Management:** Concept of HRM, HRD and PMIR- Functions of HR Manager- Wage payment plans (Simple Problems) – Job Evaluation and Merit Rating - Marketing Management- Functions of Marketing – Marketing strategies based on product Life Cycle, Channels of distributions. Operationlizing change through performance management.

**UNIT IV**

**Project Management: (PERT/CPM):** Development of Network – Difference between PERT and CPM Identifying Critical Path- Probability- Project Crashing (Simple Problems)

**Strategic Management:** 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 Practice:** Basic concepts of MIS, MRP, Justin-Time(JIT) system, Total Quality Management(TQM), Six sigma and Capability Maturity Model(CMM) Levies, Supply Chain Management , Enterprise Resource Planning (ERP), Business Process outsourcing (BPO), Business process Re-engineering and Bench Marking, Balanced Score Card.

### **TEXT BOOKS**

1. Dr. P. Vijaya Kumar &Dr. N. AppaRao, 'Management Science' Cengage, Delhi, 2012.
2. Dr. A. R. Aryasri, Management Science' TMH 2011.

### **REFERENCE BOOKS**

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. Kanishka Bedi: 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: Strategic 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:**

After completion of the Course, the student will

1. Acquire the knowledge on management functions.
2. Get the knowledge on global leadership and organizational behaviour.
3. Familiarize with the concepts of Operational Management
4. Understand the concepts of Functional management
5. Understand the concepts of Marketing and its Functions
6. Understand the concepts of project management and strategic management and Familiarize with the concepts of Contemporary Management Practice.

### **ANALOG CIRCUITS LAB**

**Internal Marks: 20**

**External Marks: 30**

#### **Course Objectives:**

1. To illustrate the students different analog electronic circuit and their application in practice.
2. To impart knowledge on assessing performance of analog electronic circuit through monitoring of sensitive parameters.
3. To evaluate the use of computer-based analysis tools to review performance of semiconductor device circuit.

#### **List of Experiments:**

1. Current Shunt Feedback amplifier
2. Voltage Series Feedback amplifier
3. Cascade amplifier
4. Darlington Pair
5. RC Phase shift Oscillator
6. Hartley and Colpitt's Oscillators
7. Class A power amplifier
8. Class B Complementary symmetry amplifier
9. Two Stage RC Coupled Amplifier
10. Wien Bridge Oscillator using Transistors
11. Design a Bistable Multivibrator and draw its waveforms
12. Design an Astable Multivibrator and draw its waveforms
13. Design a Monostable Multivibrator and draw its waveforms
14. Response of Schmitt Trigger circuit for loop gain less than and greater than one
15. The output- voltage waveform of Boot strap sweep circuit
16. The output- voltage waveform of Miller sweep circuit
17. Pulse Synchronization of An Astable circuit
18. Response of a transistor Current sweep circuit

**Equipment required:****Software:**

- i.** Multisim/ Equivalent Industrial Standard 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

**Note:** The students are required to design the circuit and perform the simulation using Multisim/ Equivalent Industrial Standard Licensed simulation software tool. Further they are required to verify the result using necessary hardware equipment.

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Course Outcomes:**

At the end of the course, a student will be able to:

1. Identify relevant information to supplement to the Analog Electronic Circuit.
2. Set up testing strategies and select proper instruments to evaluate performance characteristics of analog electronic circuit.
3. Choose testing and experimental procedures on different types of analog electronic circuit and analyse their operation different operating conditions.
4. Evaluate possible causes of discrepancy in practical experimental observations in comparison to theory.
5. Prepare professional quality textual and graphical presentations of laboratory data and Computational results, incorporating accepted data analysis and synthesis methods, Mathematical software tools.
6. Find Response of a transistor Current sweep circuit

### **ANALOG COMMUNICATIONS LAB**

**Internal Marks: 20**  
**External Marks: 30**

#### **Course Objectives:**

1. To analyze various modulation techniques in communications.
2. To analyze various spectrums using spectrum analyzer.
3. To analyze receiver characteristics.

#### **List of Experiments:**

**The students have to calculate the relevant parameters**

(a. Hardware, b. MATLAB Simulink, c. MATLAB Communication tool box)

1. Amplitude Modulation - Mod. & Demod.
2. AM - SSB SC – Modulation.
3. Spectrum Analysis of Modulated signal using Spectrum Analyser
4. Diode Detector
5. Pre-emphasis & De-emphasis
6. Frequency Modulation and Demodulation
7. Balanced Modulator.
8. Frequency Synthesizer
9. Synchronous detector
10. AGC Circuits
11. Sampling Theorem
12. Pulse Amplitude Modulation - Mod. & Demod.
13. PWM, PPM - Mod. & Demod.
14. PLL
15. Radio receiver characteristics

#### **Equipments & Software required:**

##### **Software:**

- i.) Computer Systems with latest specifications
- ii) Connected in Lan (Optional)
- iii) Operating system (Windows XP)
- iv) Simulations software (Simulink & MATLAB)

**Equipment:**

1. RPS - 0 – 30 V
2. CRO - 0 – 20 M Hz.
3. Function Generators - 0 – 1 M Hz
4. Components
5. Multimeters
6. Spectrum Analyser

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Course Outcomes:**

At the end of the course, a student will be able to:

1. Getting knowledge on matlab to write matlab code for modulation techniques in analog communications and its related circuits.
2. Comprehend the fundamentals in explain the functionality of modulation and demodulation environment.
3. Analyze the concepts, write and simulate the concepts of AM and AM Demodulation process in Communication.
4. Know the origin and simulation of FM and FM-Demodulation process in communication.
5. Acquaint with AM and FM basic functionalities.
6. Design of AGC circuits and sampling theorem concepts.

**B.Tech. IV Semester**

**COURSE CODE: UR19MC401**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

**MOOCS-I**

**Internal Marks: 100**

**External Marks: 0**

**Guidelines:**

1. The student shall be qualified in two certificate courses not less than 40 hours duration each during his course of study. The two certificate courses, shall be pursued through MOOCs platform like SWAYAM-NPTEL online courses, Coursera online courses, BEC certification courses etc.
2. Students who have qualified in the examination conducted by the MOOC providers are exempted from appearing in the internal and semester end evaluations conducted by the institution in that category.
3. In case a student fails to complete the MOOCs course offered by MOOCs providers, he/she may be allowed to register again for the same with any of the providers from the list approved by the department.
4. For the courses under this category, those students who have not registered under MOOCs platform and are able to learn by themselves shall appear for internal evaluation for 30 marks and semester end examination for 70 marks in the VIII semester

**SOCIALLY RELEVANT MINI PROJECT-I**

**Internal Marks: 20**

**Semester-end Marks: 30**

**External Marks: 0**

**Guidelines:**

1. Students should select a problem which addresses some basic home, office or other real life applications.
2. The electronic circuit for the selected problem should have at least 20 to 25 components.
3. Students should understand testing of various components.
4. Soldering of components should be carried out by students.
5. Students should develop a necessary PCB for the circuit.
6. Students should see that final circuit submitted by them is in working condition.
7. 5-10 pages report to be submitted by students.
8. Group of maximum three students can be permitted to work on a single mini project.
9. The mini project must have hardware part. The software part is optional.
10. Department may arrange demonstration with poster presentation of all mini projects developed by the students at the end of semester.
11. It is desirable that the electronic circuit/systems developed by the students have some novel features.

## INTEGRATED CIRCUITS AND APPLICATIONS

**Internal Marks: 30**

**External Marks: 70**

### Course Objectives:

The main objectives of the course are:

1. To introduce the basic building blocks of linear integrated circuits.
2. To introduce the theory and applications of analog multipliers and PLL.
3. To introduce the concepts of waveform generation and introduce some special function ICs.
4. To understand and implement the working of basic digital circuits.

### UNIT I

**Operational Amplifier:** Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Modes of Operation - Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

### UNIT II

**Op-Amp, IC-555 & IC 565 Applications:** Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer - Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL - Block Schematic, principle and Applications.

### UNIT III

**Data Converters:** Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

### UNIT IV

**Combinational Logic ICs:** Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

## **UNIT V**

**Sequential Logic IC's:** Familiarity with commonly available 74XX & CMOS 40XX Series ICs – All Types of Flipflops, Synchronous Counters, Decade Counters, Shift Registers.

### **TEXT BOOKS**

1. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 2003.
2. Digital Fundamentals – Floyd and Jain, Pearson Education, 8th Ed., 2005.

### **REFERENCE BOOKS**

1. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2nd Ed., 2003.
2. Digital Design Principles and Practices – John. F. Wakerly, Pearson 3rd Ed., 2009.
3. Linear Integrated Circuits and Applications – Salivahana, TMH, 2008.
4. Operational Amplifiers with Linear Integrated Circuits, 4th Ed., William D. Stanley, Pearson Education India, 2009.

### **Course Outcomes:**

Upon completing this course, the student will be able to

1. Understand of operational amplifiers with linear integrated circuits.
2. Attain the knowledge of functional diagrams and applications of IC 555 and IC 565.
3. Acquire the knowledge about the Data converters.
4. Obtain the knowledge about the types of ADC and DAC converters.
5. Identify the different Combinational Logic ICs and their characteristics.
6. Understand of the different Sequential Logic ICs and their characteristics.

## MICROPROCESSOR AND MICROCONTROLLERS

**Internal Marks: 30**

**External Marks: 70**

### Course Objectives:

1. To acquire knowledge on microprocessors and microcontrollers.
2. To select processors based on requirements.
3. To acquire the knowledge on interfacing various peripherals, configure and develop programs to interface peripherals/sensors.
4. To develop programs efficiently on ARM Cortex processors and debug

### UNIT I

**Introduction:** Basic Microprocessor architecture, Harvard and Von Neumann architectures with examples, Microprocessor Unit versus Microcontroller Unit, CISC and RISC architectures.

**8086 Architecture:** Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration

### UNIT II

**8086 Programming:** Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools

### UNIT III

**8086 Interfacing:** Semiconductor memories interfacing (RAM,ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDs, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

### UNIT IV

**Intel 8051 Microcontroller:** Architecture, Hardware concepts, Input/output ports and circuits, external memory, counters/timers, serial data input/output, interrupts. Assembly language programming: Instructions, addressing modes, simple programs. Interfacing to 8051: A/D and D/A Convertors, Stepper motor interface, keyboard, LCD Interfacing, Traffic light control..

## **Unit V**

**ARM Architectures and Processors:** ARM Architecture, ARM Processors Families, ARM Cortex-M Series Family, ARM Cortex-M3 Processor Functional Description, functions and interfaces. Programmers Model – Modes of operation and execution, Instruction set summary, System address map, write buffer, bit-banding, processor core register summary, exceptions. ARM Cortex-M3 programming – Software delay, Programming techniques, Loops, Stack and Stack pointer, subroutines and parameter passing, parallel I/O, Nested Vectored Interrupt Controller – functional description and NVIC programmers' model..

### **TEXT BOOKS**

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3<sup>rd</sup> Edition.
2. The 8051 Microcontrollers and Embedded systems Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; Pearson 2011 2-Edition.
3. The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors by Joseph You

### **REFERENCE BOOKS**

1. Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English, by Dr. Alexander G. Dean, Published by Arm Education Media.
2. Cortex -M3 Technical Reference Manual

### **Course Outcomes:**

Upon completing this course, the student will be able to

1. Understand the internal architecture, organization and assembly language programming of 8086 processors.
2. Design the internal architecture, organization and assembly language programming of 8051 controllers.
3. Know the I/O and Memory Interface of 8051 based systems.
4. Understand the Serial Communication and Bus Interface of 8086/8051 based systems.
5. Familiarize the internal architecture of ARM processors.
6. Realize the basic concepts of advanced ARM processors.

**DIGITAL COMMUNICATIONS****Internal Marks: 30****External Marks: 70****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. Understand the concept of entropy and different source coding techniques
4. Familiarize with block codes, cyclic codes and convolutional codes

**UNIT I**

**Pulse Digital Modulation:** Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization & Coding, 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**

**Digital Modulation Techniques:** Introduction, ASK, FSK, PSK, DPSK, DEPSK, QPSK, M-array PSK, ASK, FSK, similarity of BFSK and BPSK.

**UNIT III**

**Data Transmission:** Base band signal receiver, probability of error, the optimum filter, matched filter, probability of error using matched filter, coherent reception, non-coherent detection of FSK, calculation of error probability of ASK, BPSK, BFSK, QPSK.

**Information Theory:** Discrete messages, concept of amount of information and its properties, Average information, Entropy and its properties, Information rate, Mutual information and its properties.

**UNIT IV**

**Source Coding:** Introductions, Advantages, Shannon's theorem, Shannon-Fano coding, Huffman coding, efficiency calculations, channel capacity of discrete and analog Channels, capacity of a Gaussian channel, bandwidth -S/N trade off.

## **UNIT V**

**Linear Block Codes:** Introduction, Matrix description of Linear Block codes, Error detection and error correction capabilities of Linear block codes, Hamming codes, Binary cyclic codes, Algebraic structure, encoding, syndrome calculation, BCH Codes.

**Convolution Codes:** Introduction, encoding of convolution codes, time domain approach, transform domain approach. Graphical approach: state, tree and trellis diagram decoding using Viterbi algorithm.

## **TEXT BOOKS**

1. Digital communications - Simon Haykin, John Wiley, 2005
2. Principles of Communication Systems – H. Taub and D. Schilling, TMH, 2003

## **REFERENCE BOOKS**

1. Digital and Analog Communication Systems - Sam Shanmugam, John Wiley, 2005.
2. Digital Communications – John Proakis, TMH, 1983. Communication Systems Analog & Digital – Singh & Sapre, TMH, 2004.
3. Modern Analog and Digital Communication – B. P. Lathi, Oxford reprint, 3rd edition, 2004.

## **Course Outcomes:**

After undergoing the course students will be able to:

1. Discuss the concept of Pulse Digital Modulation, performance of different waveform coding techniques for the generation and digital representation of the signals.
2. Familiarize the concepts of different Digital Modulation Techniques; determine the probability of error for various digital modulation schemes
3. Understand the concept of Data Transmission Techniques.
4. Explain the concept of Information Theory.
5. Describe different source coding techniques.
6. Compute and analyze different error control coding schemes for the reliable transmission of digital information over the channel.

## ANTENNAS AND WAVE PROPAGATION

**Internal Marks: 30**

**External Marks: 70**

### Course Objectives:

The course objectives are:

1. To understand the concept of radiation, antenna definitions and significance of antenna parameters, to derive and analyze the radiation characteristics of thin wire dipole antennas and solve numerical problems.
2. To analyze the characteristics and design relations of UHF, VHF and Microwave Antennas.
3. To identify the antenna array requirements, to determine the characteristics of ULAs and estimate the patterns of BSA, EFA, and Binomial Arrays.
4. To understand the concepts and set-up requirements for microwave measurements, and familiarize with the procedure to enable antenna measurements.
5. To define and distinguish between different phenomenon of wave propagation (ground wave, space wave and sky wave), their frequency dependence, and estimate their characteristics, identifying their profiles and parameters involved.

### UNIT I

**Antenna Basics:** Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height. Fields from Oscillating Dipole, Field Zones, Front - to-back Ratio, Antenna Theorems, Radiation, Retarded Potentials – Helmholtz Theorem.  
**Thin Linear Wire Antennas:** Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area and Effective Height, Natural Current Distributions, Far Fields and Patterns of Thin Linear Centre-fed Antennas of Different Lengths. Loop Antennas - Small Loop, Comparison of Far Fields of Small Loop and Short Dipole, Radiation Resistances and Directivities of Small Loops (Qualitative Treatment).

### UNIT II

**Antenna Arrays:** Point Sources – Definition, Patterns, arrays of 2 Isotropic Sources - Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, Endfire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-uniform Amplitude Distributions – General Considerations and Binomial Arrays.

**Antenna Measurements:** Introduction, Concepts - Reciprocity, Near and Far Fields, Coordinate System, Sources of Errors, Patterns to be Measured, Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3- Antenna Methods).

### **UNIT III**

**VHF, UHF and Microwave Antennas – I:** Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics, Helical Antennas – Helical Geometry, Helix Modes, Practical Design Considerations for Monofilar Helical Antenna in Axial and Normal Modes, Horn Antennas – Types, Fermat’s Principle, Optimum Horns, Design Considerations of Pyramidal Horns.

### **UNIT IV**

**VHF, UHF and Microwave Antennas – II:** Microstrip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Characteristics of Microstrip Antennas. Reflector Antennas – Introduction, Flat Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern Characteristics, Feed Methods, Reflector Types – Related Features.

### **UNIT V**

**Wave Propagation:** Definitions, Categorizations and General Classifications, Different Modes of Wave Propagation, Ray/Mode Concepts,

**Ground Wave Propagation:** Plane Earth Reflections, Space and Surface Waves, Wave Tilt, Curved Earth Reflections.

**Space Wave Propagation:** Field Strength Variation with Distance and Height, Effect of Earth’s Curvature, Absorption, Super Refraction, M-Curves and Duct Propagation, Scattering Phenomena, Troposphere Propagation.

**Sky Wave Propagation:** 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. Antennas and Wave Propagation – J.D. Kraus, R.J. Marhefka and Ahmad S. Khan, TMH, New Delhi, 4th ed., (Special Indian Edition), 2010.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2<sup>nd</sup> ed., 2000.

### **REFERENCE BOOKS**

1. Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd Ed., 2005.
2. Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.
3. Radio Engineering Handbook- Keith henney, 3rd edition TMH.
4. Antenna Engineering Handbook –John Leonidas Volakis, 3rd edition, 2007

**Course Outcomes:**

Upon completing this course, the student will be able to

1. Explain the mechanism of radiation, definitions of different antennas.
2. Identify the characteristic parameters of different antennas and establish their mathematical relations.
3. Characterize the antennas based on frequency, configure the geometry and establish the radiation patterns of VHF, & UHF.
4. Establish the radiation patterns Microwave antennas and also antenna arrays.
5. Specify the requirements for microwave measurements and arrange a setup to carry out the antenna far zone pattern and gain measurements in the laboratory.
6. Classify the different wave propagation mechanisms, determine the characteristic features of different wave propagations, and estimate the parameters involved.

**INFORMATION THEORY AND CODING  
(PE-I)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

1. To acquire the knowledge in measurement of information and errors.
2. Understand the importance of various codes for communication systems.
3. To design encoder and decoder of various codes.
4. To know the applicability of source and channel codes.

**UNIT I**

**Coding for Reliable Digital Transmission and storage:** 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:** 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:** 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:** 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:** 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.

### **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, Wiley India, 2006.
4. Information Theory, Coding and Cryptography – Ranjan Bose, 2nd Ed., TMH, 2009

### **Course Outcomes:**

Upon completing this course, the student will be able to

1. Understand the concepts of Coding for Reliable Digital Transmission and storage and learn measurement of information and errors.
2. Familiarize the concept of Linear Block Codes.
3. Obtain knowledge in Error Detection and design various source codes and channel codes.
4. Design encoders and decoders for block and cyclic codes.
5. Verify the Encoding and Decoding of convolutional codes.
6. Explain the procedure for BCH Coding and Error Detection.

**DATA STRUCTURES AND ALGORITHMS  
(PE-I)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

1. To understand the basic concepts such as Abstract Data Types, Linear, and Non-Linear Data structures.
2. To understand the notations used to analyze the Performance of algorithms.
3. To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graphs and their representations.
4. To choose the appropriate data structure for a specified application.
5. To understand and analyze various searching and sorting algorithms.
6. To write programs in C to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables, search trees.

**UNIT I**

Basic concepts- Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction Performance analysis- time complexity and space complexity, Asymptotic Notation-Big O, Omega and Theta notations, Introduction to Linear and Non Linear data structures.

Singly Linked Lists-Operations-Insertion, Deletion, Concatenating singly linked lists, Circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations- Insertion, Deletion. Representation of single, two dimensional arrays, sparse matrices-array and linked representations.

**UNIT II**

Stack ADT, definition, operations, array and linked implementations in C, applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation, Queue ADT, definition and operations ,array and linked Implementations in C, Circular queues-Insertion and deletion operations, Deque (Double ended queue)ADT, array and linked implementations in C.

**UNIT III**

Trees – Terminology, Representation of Trees, Binary tree ADT, Properties of Binary Trees, Binary Tree Representations-array and linked representations, Binary Tree traversals, Threaded binary trees, Max Priority Queue ADT-implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap.

Graphs – Introduction, Definition, Terminology, Graph ADT, Graph Representations- Adjacency matrix, Adjacency lists, Graph traversals- DFS and BFS.

#### **UNIT IV**

Searching- Linear Search, Binary Search, Static Hashing-Introduction, hash tables, hash functions, Overflow Handling, Sorting-Insertion Sort, Selection Sort, Radix Sort, Quick sort, Heap Sort, Comparison of Sorting methods.

#### **UNIT V**

Search Trees-Binary Search Trees, Definition, Operations- Searching, Insertion and Deletion, AVL Trees-Definition and Examples, Insertion into an AVL Tree, B-Trees, Definition, B-Tree of order m, operations-Insertion and Searching, Introduction to Red-Black and Splay Trees (Elementary treatment-only Definitions and Examples), Comparison of Search Trees. Pattern matching algorithm- The Knuth-Morris-Pratt algorithm, Tries (examples only).

#### **TEXT BOOKS**

1. Fundamentals of Data structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson-Freed, Universities Press.
2. Data structures A Programming Approach with C, D. S. Kushwaha and A. K. Misra, PHI.

#### **REFERENCE BOOKS**

1. Data structures: A Pseudocode Approach with C, 2nd edition, R. F. Gilberg and B.A. Forouzan, Cengage Learning.
2. Data structures and Algorithm Analysis in C, 2nd edition, M. A. Weiss, Pearson.
3. Data Structures using C, A. M. Tanenbaum, Y. Langsam, M. J. Augenstein, Pearson.
4. Data structures and Program Design in C, 2nd edition, R. Kruse, C. L. Tondo and B. Leung, Pearson.
5. Data Structures and Algorithms made easy in JAVA, 2nd Edition, Narsimha Karumanchi, and Career Monk Publications.
6. Data Structures using C, R. Thareja, Oxford University Press.
7. Data Structures, S. Lipschutz, Schaum's Outlines, TMH.
8. Data structures using C, A. K. Sharma, 2nd edition, Pearson.
9. Data Structures using C & C++, R. Shukla, Wiley India.
10. Classic Data Structures, D. Samanta, 2nd edition, PHI.
11. Advanced Data structures, Peter Brass, Cambridge.

#### **Course Outcomes:**

Upon completing this course, the student will be able to

1. Identify the basic concepts of Algorithms and Data Structures and ability to design appropriate data structure for solving computing problems in respective language.

2. Understand the concept of Stacks, Queues and Linked Lists as well as their implementation in C Language.
3. Familiarize the concept of Trees, Binary Trees and their implementation.
4. Explain the concept of Graphs, their Terminology and Representations.
5. Discuss Searching and Sorting Methods.
6. Classify the concept of Search Trees and their algorithms.

**EMBEDDED SYSTEMS  
(PE-I)**

**Internal Marks: 30  
External Marks: 70**

**Course Objectives:**

The main objectives of this course are given below:

1. The basic concepts of an embedded system are introduced.
2. The various elements of embedded hardware and their design principles are explained.
3. Different steps involved in the design and development of firmware for embedded systems is elaborated.
4. Internals of Real-Time operating system and the fundamentals of RTOS based embedded firmware design is discussed.
5. Fundamental issues in hardware software co-design were presented and explained.
6. Familiarize with the different IDEs for firmware development for different family of processors/controllers and embedded operating systems.
7. Embedded system implementation and testing tools are introduced and discussed.

**UNIT I**

**Introduction:** Embedded system-Definition, history of embedded systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems, the typical embedded system-core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware, Characteristics of an embedded system, Quality attributes of embedded systems, Application-specific and Domain-Specific examples of an embedded system.

**UNIT II**

**Embedded Hardware Design:** Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.

**UNIT III**

**Embedded Firmware Design:** Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross- compiler.

#### **UNIT IV**

**Real Time Operating System:** Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling, Task communication, Task synchronization, Device Drivers.

**Hardware Software Co-Design:** Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade-offs, Integration of Hardware and Firmware, ICE.

#### **UNIT V**

**Embedded System Development:** The integrated development environment, Types of files generated on cross-compilation, Deassembler/Decompiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan, Embedded Software development process and tools.

**Embedded System Implementation And Testing:** The main software utility tool, CAD and the hardware, Translation tools-Pre-processors, Interpreters, Compilers and Linkers, Debugging tools, Quality assurance and testing of the design, Testing on host machine, Simulators, Laboratory Tools.

#### **TEXT BOOKS**

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu. K.V - Tata McGraw Hill Education Private Limited, 2013.

#### **REFERENCE BOOKS**

1. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
2. Embedded Systems-Lyla B. Das-Pearson Publications, 2013.

#### **Course Outcomes:**

At the end of this course, the student will be able to:

1. Understand the basic concepts of an embedded system
2. Know the hardware components required for an embedded system.
3. Know an embedded system design approach to perform a specific function.
4. Compare the concepts related to C and Embedded C.
5. Integrate hardware and firmware of an embedded system using real time operating system.
6. Familiarize with concepts of Embedded System Implementation and Testing.

**NEURAL NETWORKS AND FUZZY LOGIC CONTROL  
(PE-I)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

1. To cater the knowledge of Neural Networks and Fuzzy Logic Control and use these for controlling real time systems..

**UNIT I**

**Architectures:** Introduction –Biological neuron-Artificial neuron-Neuron modeling-Learning rules-Single layer-Multi layer feed forward network-Back propagation-Learning factors.

**UNIT II**

**Neural Networks for Control:** Feedback networks-Discrete time hop field networks-Schemes of neuro-control, identification and control of dynamical systems-case studies (Inverted Pendulum, Articulation Control).

**UNIT III**

**Fuzzy Systems:** Classical sets-Fuzzy sets - Fuzzy relations- Fuzzification – Defuzzification- Fuzzy rules.

**UNIT IV**

**Fuzzy Logic Control:** Membership function – Knowledge base-Decision – making logic – Optimizations of membership function using neural networks- Adaptive fuzzy systems-Introduction to genetic algorithm.

**UNIT V**

**Application of FLC:** Fuzzy logic control-Inverted pendulum-Image processing-Home Heating system-Blood pressure during anesthesia-Introduction to neuro fuzzy controller.

**TEXT BOOKS**

1. Kosko, B, “Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine Intelligence”, Prentice Hall, New Delhi, 2004.
2. Timothy J Ross, “Fuzzy Logic with Engineering Applications”, John Willey and Sons, West Sussex, England, 2005.

**REFERENCE BOOKS**

1. Jack M. Zurada, “Introduction to Artificial Neural Systems”, PWS Publishing Co., Boston, 2002.

2. Klir G.J. & Folger T.A., "Fuzzy sets, Uncertainty and Information", Prentice – Hall of India Pvt. Ltd., New Delhi, 2008.
3. Zimmerman H.J., "Fuzzy set theory and its Applications", Kluwer Academic Publishers Dordrecht, 2001.
4. Driankov, Hellendroonb, "Introduction to fuzzy control", Narosa Publishers, 2001.
5. Laurance Fausett, Englewood cliffs, N.J., "Fundamentals of Neural Networks", Pearson Education, New Delhi, 2008.

**Course Outcomes:**

After completing this course, the student should be able to:

1. Expose the students to the concepts of feed forward neural networks
2. Provide adequate knowledge about feedback networks.
3. Teach about the concept of fuzziness involved in various systems.
4. Provide adequate knowledge about fuzzy set theory.
5. Provide comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.
6. Provide adequate knowledge of application of fuzzy logic control to real time systems.

**Electronic Measurements and Instrumentation  
(PE-I)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

1. Explain basic concepts and definitions in measurement.
2. Describe the bridge configurations and their applications.
3. Elaborate discussion about the importance of signal generators and analyzers in Measurement

**UNIT I**

Performance characteristics of instruments, Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity. Errors in Measurement, Dynamic Characteristics-speed of response, Fidelity, Lag and Dynamic error. DC Voltmeters- Multi-range, Range extension/Solid state and differential voltmeters, AC voltmeters- multi range, range extension, shunt. Thermocouple type RF ammeter, Ohmmeters series type, shunt type, Multi- meter for Voltage, Current and resistance measurements.

**UNIT II**

Signal Generator- fixed and variable, AF oscillators, Standard and AF sine and square wave signal generators, Function Generators, Square pulse, Random noise, sweep, Arbitrary waveform. Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzers, Digital Fourier Analyzers

**UNIT III**

Oscilloscopes CRT features, vertical amplifiers, horizontal deflection system, sweep, trigger pulse, delay line, sync selector circuits, simple CRO, triggered sweep CRO, Dual beam CRO, . Dual trace oscilloscope, sampling oscilloscope, storage oscilloscope, digital readout oscilloscope, digital storage oscilloscope, Lissajous method of frequency measurement, standard specifications of CRO, probes for CRO- Active & Passive, attenuator type.

**UNIT IV**

AC Bridges Measurement of inductance- Maxwell's bridge, Anderson bridge. Measurement of capacitance- Schearing Bridge. Wheat stone bridge. Wien Bridge, Errors and precautions in using bridges. Q-meter.

**UNIT V**

Transducers- active & passive transducers : Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors, Sensistors. Measurement of physical parameters force, pressure, velocity, humidity, moisture, speed, proximity and displacement. Data acquisition systems

**TEXT BOOK**

1. Electronic instrumentation, second edition - H.S.Kalsi, Tata McGraw Hill, 2004.
2. Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrick and W.D. Cooper, PHI, 5<sup>th</sup> Edition, 2002.

**REFERENCE BOOKS:**

1. Electronic Instrumentation & Measurements - David A. Bell, PHI, 2nd Edition, 2003.
2. Electronic Test Instruments, Analog and Digital Measurements - Robert A.Witte, Pearson Education, 2nd Ed., 2004.
3. Electronic Measurements & Instrumentations by K. Lal Kishore, Pearson Education - 2005.

**Course Outcomes**

After completing this course, the student should be able to:

1. Select the instrument to be used based on the requirements.
2. Understand and analyze different signal generators and analyzers.
3. Understand the design of oscilloscopes for different applications.
4. Design different transducers for measurement of different parameters.
5. Employ appropriate instruments to measure given sets of parameters.
6. Identify the various parameters that are measurable in electronic instrumentation

**INTEGRATED CIRCUITS AND APPLICATIONS LAB**

**Internal Marks: 20**  
**External Marks: 30**

**Course Objectives:**

1. To Gain the practical hands-on experience on 741 Op-Amp applications.
2. To Gain the practical hands-on experience on 555 Timer applications.
3. To Gain the practical hands-on experience on 723 Voltage Regulator and Three terminal voltage regulators.
4. To Gain the practical hands-on experience on IC 565 – PLL Applications.

**List of Experiments:**

Verify the functionality of the IC in the given application.  
Design and Implementation of:

1. Inverting and Non-inverting Amplifiers using Op Amps.
2. Adder and Subtractor using Op Amp.
3. Comparators using Op Amp.
4. Integrator Circuit using IC 741.
5. Differentiator circuit using Op Amp.
6. Active Filter Applications – LPF, HPF (first order)
7. IC 741 Waveform Generators – Sine, Square wave and Triangular waves.
8. Mono-stable Multivibrator using IC 555.
9. Astable Multivibrator using IC 555.
10. Schmitt Trigger Circuits – using IC 741.
11. IC 565 – PLL Applications.
12. Voltage Regulator using IC 723.
13. Three Terminal Voltage Regulators –7805, 7809, 7912
14. 8X1 Multiplexer– 74151 and 2X4 De-multiplexer- 74155

**Equipment Required:**

1. RPS
2. CRO
3. Function Generator

4. Multi Meters
5. IC Trainer Kits (Optional)
6. Bread Boards
7. Components: - IC741, IC555, IC565, IC1496, IC723, 7805, 7809, 7912 and other essential components.
8. Analog IC Tester

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Course Outcomes:**

After Completion of the course the student is able to

1. Understand the basics of Op-Amp and to Design, Analyze Amplifiers, Active filters and Hysteresis voltage of Schmitt trigger using 741 IC.
2. Design the Multivibrator circuits using IC555 and determine the frequency of oscillation and time delay.
3. Explain the functionality of IC723 and determine the load and line regulations.
4. Discuss the characteristics of PLL & design the various applications of PLL.
5. Solve higher order linear differential equation using appropriate techniques for modeling and analyzing electrical circuits.
6. Demonstrate basic knowledge of Laplace Transform., Vector differentiation and differentiation Integration.

**MICROPROCESSOR AND MICROCONTROLLERS LAB**

**Internal Marks: 20**  
**External Marks: 30**

**Course Objectives:**

1. To study programming based on 8086 microprocessor and 8051 microcontroller.
2. To study 8086 microprocessor based ALP using arithmetic, logical and shift operations.
3. To study modular and Dos/Bios programming using 8086 microprocessor.
4. To study to interface 8086 with I/O and other devices.
5. To study parallel and serial communication using 8051 micro controller.

**List of Experiments:**

**PART- A:** (Minimum of 5 Experiments has to be performed)

**8086 Assembly Language Programming and Interfacing:**

1. Programs for 16 -bit arithmetic operations (using Various Addressing Modes).
  - a. Addition of n-BCD numbers.
  - b. Multiplication and Division operations.
2. Program for sorting an array.
3. Program for Factorial of given n-numbers.
4. Interfacing ADC to 8086
5. Interfacing DAC to 8086.
6. Interfacing stepper motor to 8086.

**PART-B:** (Minimum of 5 Experiments has to be performed)

**8051 Assembly Language Programming and Interfacing**

7. Finding number of 1's and number of 0's in a given 8-bit number
8. Average of n-numbers.
9. Program and verify Timer/ Counter in 8051.
10. Interfacing Traffic Light Controller to 8051
11. UART operation in 8051
12. Interfacing LCD to 8051.

**PART-C:** (Minimum of 2 Experiments has to be performed)

Conduct the following experiments using ARM CORTEX M3 PROCESSOR USING KEIL, MDK, ARM

13. Write an assembly program to multiply of 2 16-bit binary numbers.
14. Write an assembly program to find the sum of first 10 integers numbers.
15. Write a program to toggle LED every second using timer interrupt

**Equipment Required:**

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. 8086 Microprocessor kits
4. 8051 microcontroller kits
5. ADC module
6. DAC module
7. Stepper motor module
8. Keyboard module
9. LED, 7-Segment Units
10. Digital Multimeters
11. ROM/RAM Interface module
12. Bread Board etc.

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Course Outcomes:**

After Completion of the course the student is able to

1. Explain the fundamentals of assembly level programming of microprocessors and microcontroller.
2. Understand the concepts related to I/O and memory interfacing.
3. Troubleshoot interactions between software and hardware.
4. Analyze abstract problems and apply a combination of hardware and software to address the problem.
5. Use standard test and measurement equipment to evaluate digital interfaces.
6. Develop the programs for sorting.

**DIGITAL COMMUNICATIONS LAB**

**Internal Marks: 20**  
**External Marks: 30**

**Course Objectives:**

1. To understand the building blocks of digital communication system.
2. To prepare mathematical background for communication signal analysis.
3. To understand and analyze the signal flow in a digital communication system.
4. To analyze error performance of a digital communication system in presence of noise and other interferences.
5. To understand concept of spread spectrum communication system.

**List of Experiments:**

Note:

1. Minimum Eight hardware experiments should be conducted.
2. Any Four experiments are to be simulated first either using MATLAB, Comsim or any other simulation package and then to be realized in hardware

1. Time division multiplexing.
2. Pulse code modulation.
3. Differential pulse code modulation.
4. Delta modulation.
5. Frequency shift keying.
6. Phase shift keying.
7. Differential phase shift keying.
8. Companding
9. Source Encoder and Decoder
10. Linear Block Code-Encoder and Decoder
11. Binary Cyclic Code – Encoder and Decoder
12. Convolution Code – Encoder and Decoder

**Equipment Required:**

1. RPS – 0 – 30 V
2. CRO – 0 – 20 M Hz.
3. Function Generators – 0 – 1 M Hz
4. RF Generators – 0 – 1000 M Hz./0 – 100 M Hz.
5. Multimeters
6. Lab Experimental kits for Digital Communication
7. Components

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Course Outcomes:**

After Completion of the course the student is able to

1. Understand the performance of a baseband and pass band digital communication system in terms of error rate and spectral efficiency.
2. Perform the time and frequency domain analysis of the signals in a digital communication system.
3. Analyze Performance of spread spectrum communication system.
4. Verify the error detection and error correction in linear convolution codes.
5. Design and implement analogue to digital converters like PCM, DM.
6. Demonstrate pass band digital demodulation techniques.

## PROFESSIONAL ETHICS AND HUMAN VALUES

**Internal Marks: 30**

**Semester-end Marks: 70**

**External Marks: 0**

### Course Objectives:

1. To give basic insights and inputs to the student to inculcate Human values to grow as a responsible human beings with proper personality.
2. Professional Ethics instills the student to maintain ethical conduct and discharge their professional duties.

### UNIT I

**Human Values:** Morals, Values and Ethics – Integrity –Trustworthiness - Work Ethics – Service Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value Time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character.

### UNIT II

**Principles for Harmony:** Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties - Aspirations and Harmony (I, We & Nature) – Gender Bias - Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness.

### UNIT III

**Engineering Ethics and Social Experimentation:** History of Ethics - Need of Engineering Ethics - Senses of Engineering Ethics- Profession and Professionalism – Self Interest - Moral Autonomy – Utilitarianism – Virtue Theory - Uses of Ethical Theories - Deontology- Types of Inquiry –Kohlberg’s Theory - Gilligan’s Argument – Heinz’s Dilemma - Comparison with Standard Experiments – Learning from the Past –Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law - Role of Codes – Codes and Experimental Nature of Engineering.

### UNIT IV

**Engineers’ Responsibilities towards Safety and Risk:** Concept of Safety - Safety and Risk – Types of Risks – Voluntary v/s Involuntary Risk – Consequences – Risk Assessment – Accountability – Liability - Reversible Effects - Threshold Levels of Risk - Delayed v/s Immediate Risk - Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.

## **UNIT V**

**Engineers' Duties and Rights:** Concept of Duty - Professional Duties – Collegiality - Techniques for Achieving Collegiality – Senses of Loyalty - Consensus and Controversy - Professional and Individual Rights –Confidential and Proprietary Information - Conflict of Interest-Ethical egoism - Collective Bargaining – Confidentiality - Gifts and Bribes - Problem solving- Occupational Crimes- Industrial Espionage- Price Fixing-Whistle Blowing.

**Global Issues:** Globalization and MNCs –Cross Culture Issues - Business Ethics – Media Ethics - Environmental Ethics – Endangering Lives - Bio Ethics - Computer Ethics - War Ethics – Research Ethics -Intellectual Property Rights.

### **TEXT BOOKS**

1. Professional Ethics by R. Subramaniam – Oxford Publications, New Delhi.
2. Ethics in Engineering by Mike W. Martin and Roland Schinzinger - Tata McGraw-Hill – 2003.
3. Professional Ethics and Morals by Prof. A. R .Aryasri, Dharanikota Suyodhana - Maruthi Publications.

### **REFERENCE BOOKS**

1. Engineering Ethics by Harris, Pritchard and Rabins, Cengage Learning, New Delhi.
2. Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd., Noida.
3. Engineering Ethics & Human Values by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd – 2009.
4. Professional Ethics and Human Values by A. Alavudeen, R.Kalil Rahman and M. Jayakumaran – University Science Press.
5. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill - 2013
6. Human Values And Professional Ethics by Jayshree Suresh and B. S. Raghavan, S.Chand Publications

### **Course Outcomes:**

After completion of the Course, the student will be able to

1. Gain a comprehensive understanding of a variety issues that are encountered by every professional in discharging professional duties.
2. Acquire the sensitivity and global outlook in the contemporary world to fulfill the professional obligations effectively.
3. Understand Principles for Harmony
4. Familiarize with the topics of Engineering Ethics and Social Experimentation
5. Learn about Engineers' Responsibilities towards Safety and Risk
6. Study Global Issues

## INTERNET OF THINGS

**Internal Marks: 30**

**External Marks: 70**

### Course Objectives:

1. To learn and understand elements of IoT system.
2. Acquire knowledge about various protocols of IoT.
3. To learn and understand design principles and capabilities of IoT.

### UNIT I: Introduction to IoT

Introduction to IoT, Architectural Overview, Design principles and needed capabilities, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT.

### UNIT II: Elements of IoT

Hardware Components- Computing- Arduino, Raspberry Pi, ARM Cortex-A class processor, Embedded Devices – ARM Cortex-M class processor, ARM Cortex-M0 Processor Architecture, Block Diagram, Cortex-M0 Processor Instruction Set, ARM and Thumb Instruction Set.

### UNIT III: IoT Application Development

Communication, IoT Applications, Sensing, Actuation, I/O interfaces.

Software Components- Programming API's (using Python/Node.js/Arduino) for Communication Protocols- MQTT, ZigBee, CoAP, UDP, TCP, Bluetooth.

#### Bluetooth Smart Connectivity

Bluetooth overview, Bluetooth Key Versions, Bluetooth Low Energy (BLE) Protocol, Bluetooth, Low Energy Architecture, PSoC4 BLE architecture and Component Overview.

### UNIT IV: Solution framework for IoT applications

Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

### UNIT V: IoT Case Studies

IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation.

**TEXT BOOKS:**

1. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017.
2. The Definitive Guide to the ARM Cortex-M0 by Joseph Yiu, 2011
3. Vijay Madisetti, Arshdeep Bahga, Internet of Things, "A Hands on Approach", University Press, 2015.

**REFERENCE BOOKS**

1. Olivier Hersent, David Boswarthick, Omar Elloumi, –The Internet of Things – Key applications and Protocols, Wiley, 2012
2. The Internet of Things: Applications to the Smart Grid and Building Automation by – Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley - 2012
3. Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press – 2010

**Course Outcomes:**

After Completion of the course the student is able to

1. Understand internet of Things and its hardware and software components
2. Interface I/O devices, sensors & communication modules.
3. Remotely monitor data and control devices.
4. Design real time IoT based applications
5. Understand the IoT Case Studies
6. Identify Elements of IoT.

## VLSI DESIGN

**Internal Marks: 30**

**External Marks: 70**

### Course Objectives:

The objectives of the course are to:

1. Give exposure to different steps involved in the fabrication of ICs.
2. Explain electrical properties of MOS and BiCMOS devices to analyze the behavior of inverters with various loads.
3. Give exposure to the design rules to be followed to draw the layout of any logic circuit.
4. Provide design concepts to design building blocks of data path of any system using gates.
5. Understand basic programmable logic devices and testing of CMOS circuits.

### UNIT I

**Introduction:** Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS

**Basic Electrical Properties:** Basic Electrical Properties of MOS and BiCMOS Circuits:  $I_{ds}$ - $V_{ds}$  relationships, MOS transistor threshold Voltage,  $g_m$ ,  $g_{ds}$ , Figure of merit; Pass transistor, NMOS Inverter, Various pull ups CMOS Inverter analysis and design, Bi-CMOS Inverters.

### UNIT II

**VLSI Circuit Design Processes:** VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

### UNIT III

**Gate Level Design:** Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays, Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out.

### UNIT IV

**Data Path Subsystems:** Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters.

**Array Subsystems:** SRAM, DRAM, ROM, Serial Access Memories.

### UNIT V

**Programmable Logic Devices:** Design Approach – PLD, PAL, Standard Cells FPGAs, CPLDs.

**CMOS Testing:** CMOS Testing, Test Principles, Design Strategies for test, Chip level Test Techniques.

### **TEXT BOOKS**

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Douglas and A. Pucknell, PHI, 2005.
2. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E Weste, David Harris, Ayan Banerjee, 3rd Ed., Pearson, 2009.

### **REFERENCE BOOKS**

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011.
2. CMOS logic circuit Design - John .P. Uyemura, Springer, 2007.
3. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Ed., 1997.

### **Course Outcomes:**

Upon completing this course, the student will be able to

1. Acquire qualitative knowledge about the fabrication process MOS ICs.
2. Understand the process of designing VLSI Circuits and draw the layout of any logic circuit to understand and estimate parasitic effect of any logic circuit.
3. Explain the concepts of Gate Level Design.
4. Familiarize with alternate Gate Circuits.
5. Design building blocks of data path systems, memories and simple logic circuits using PLA, PAL, FPGA and CPLD.
6. Verify different types of faults that can occur in a system and learn the concept of testing.

**DIGITAL SIGNAL PROCESSING****Internal Marks: 30****External Marks: 70****Course Objectives:**

The course objectives are:

1. To provide background and fundamental concepts for the analysis and processing of digital signals.
2. To understand the fast computation of DFS and DFT.
3. To design digital filters and their realization structures.
4. To acquaint in Multi-rate signal processing techniques and finite word length effects.

**UNIT I**

**Introduction:** Introduction to Digital Signal Processing: Discrete Time Signals & Sequences, conversion of continuous to discrete signal, Normalized Frequency, Linear Shift Invariant Systems, Stability, and Causality, linear differential equation to difference equation, Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems.

**Realization of Digital Filters:** Applications of Z – Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters – Direct, Canonic, Cascade and Parallel Forms.

**UNIT II**

**Discrete Fourier series:** Fourier Series, Fourier Transform, Laplace Transform and Z-Transform relation, DFS Representation of Periodic Sequences, Properties of Discrete Fourier Series, Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of FT: Over-Lap Add Method, Over-Lap Save Method, Relation between DTFT, DFS, DFT and Z-Transform.

**Fast Fourier Transforms:** Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT.

**UNIT III**

**IIR Digital Filters:** Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformations.

#### **UNIT IV**

**FIR Digital Filters:** Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Filters: Fourier Method, Digital Filters using Window Techniques, Frequency Sampling Technique, Comparison of IIR & FIR filters.

#### **UNIT V**

**Multirate Digital Signal Processing:** Introduction, Down Sampling, Decimation, Up sampling, Interpolation, Sampling Rate Conversion.

**Finite Word Length Effects:** Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round Off Noise, Methods to Prevent Overflow, Trade Off Between Round Off and Overflow Noise, Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects.

#### **TEXT BOOKS**

1. Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009
2. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.

#### **REFERENCE BOOKS**

1. Digital Signal Processing – Fundamentals and Applications – Li Tan, Elsevier, 2008
2. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling, Sandra L. Harris, Thomson, 2007
3. Digital Signal Processing – K. Deergha Rao and M. N. S. Swamy, Springer, 2018.
4. Digital Signal Processing - A Practical approach, Emmanuel C. Ifeakor and Barrie W. Jervis, 2nd Edition, Pearson Education, 2009

#### **Course Outcomes:**

Upon completing this course, the student will be able to:

1. Understand the LTI-DT systems, their frequency domain representation and realization.
2. Distinguish DFTS, DFS, DFT and FFT.
3. Explain the concept of IIR Digital Filters.
4. Design IIR digital filters from prototype approximations.
5. Identify FIR digital filters from prototype approximations.
6. Demonstrate the importance of Multirate signal processing and finite word length effects in DSP applications.

**CELLULAR AND MOBILE COMMUNICATIONS  
(PE-II)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

The course objectives are:

1. To provide the student with an understanding of the Cellular concept, Frequency reuse, Hand-off strategies.
2. To provide the student with an understanding of Co-channel and Non-Co-channel interferences.
3. To give the student an understanding of cell coverage for signal and traffic, diversity techniques and mobile antennas.
4. To give the student an understanding of frequency management, Channel assignment and types of handoff.

**UNIT I**

**Introduction to Cellular Mobile Radio Systems:** Limitations of Conventional Mobile Telephone Systems, Basic Cellular Mobile System, First, Second, Third and Fourth Generation Cellular Wireless Systems, Uniqueness of Mobile Radio Environment- Fading -Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time.

**Fundamentals of Cellular Radio System Design:** Concept of Frequency Reuse, Co-Channel Interference, Co-Channel Interference Reduction Factor, Desired C/I From a Normal Case in a Omni Directional Antenna System, System Capacity Improving Coverage and Capacity in Cellular Systems- Cell Splitting, Sectoring, Microcell Zone Concept.

**UNIT II**

**Co-Channel Interference:** Measurement Of Real Time Co-Channel Interference, Design of Antenna System, Antenna Parameters and Their Effects, Diversity Techniques-Space Diversity, Polarization Diversity, Frequency Diversity, Time Diversity.

**Non-Co-Channel Interference:** Adjacent Channel Interference, Near End Far End Interference, Cross Talk, Effects on Coverage and Interference by Power Decrease, Antenna Height Decrease, Effects of Cell Site Components.

**UNIT III**

**Cell Coverage for Signal and Traffic:** 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, Path Loss From a Point to Point Prediction Model in Different Conditions, Merits of Lee Model.

**Cell Site and Mobile Antennas:** Space Diversity Antennas, Umbrella Pattern Antennas, Minimum Separation of Cell Site Antennas, Mobile Antennas.

#### **UNIT IV**

**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**

**Handoffs and Dropped Calls:** Handoff Initiation, Types of Handoff, Delaying Handoff, Advantages of Handoff, Power Difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoff, Intersystem Handoff, Introduction to Dropped Call Rates and their Evaluation.

#### **TEXT BOOKS**

1. Mobile Cellular Telecommunications – W.C.Y. Lee, McGraw Hill, 2nd Ed., 1989.
2. Wireless Communications - Theodore. S. Rapport, Pearson Education, 2nd Ed., 2002.

#### **REFERENCE BOOKS**

1. Principles of Mobile Communications – Gordon L. Stuber, Springer International, 2<sup>nd</sup> Ed., 2001.
2. Modern Wireless Communications-Simon Haykin, Michael Moher, Pearson Education, 2005.
3. Wireless Communications and Networking, Vijay Garg, Elsevier Publications, 2007.
4. Wireless Communications – Andrea Goldsmith, Cambridge University Press, 2005.

#### **Course Outcomes:**

Upon completing this course, the student will be able to

1. Design the evolution of cellular and mobile communication systems.
2. Demonstrate Co-channel and Non Co-channel interferences.
3. Familiarize with cell coverage for signal and traffic.
4. Verify diversity techniques and Mobile Antennas.
5. Understand the concepts of frequency management and Channel assignment.
6. Explain the concepts of and types of handoff, impairments due to multipath fading channel and how to overcome the different fading effects.

**GLOBAL POSITION SYSTEM (GPS)  
(PE-II)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

The course objectives are:

1. To provide the student with an understanding of the GPS concept, GPS Architecture.
2. To provide the student with an understanding of Signal Characteristics
3. To give the student an understanding of GPS Receivers, Data Errors, Differential GPS and GPS Applications.

**UNIT I**

**Introduction:** Basic concept, system architecture, GPS and GLONASS Overview, Satellite Navigation, Time and GPS, User position and velocity calculations, GPS, Satellite Constellation, Operation Segment, User receiving Equipment, Space Segment Phased development, GPS aided Geoaugmented navigation (GAGAN) architecture.

**UNIT II**

**Signal Characteristics:** GPS signal components, purpose, properties and power level, signal acquisition and tracking, Navigation information extraction, pseudo range estimation, frequency estimation, GPS satellite position calculation, Signal structure, anti-spoofing (AS), selective availability, Difference between GPS and GALILEO satellite construction.

**UNIT III**

**GPS Receivers & Data Errors:** Receiver Architecture, receiver design options, Antenna design, GPS error sources, SA errors, propagation errors, ionospheric error, tropospheric error, multipath, ionospheric error, estimation using dual frequency GPS receiver, Methods of multipath mitigation, Ephemeris data errors, clock errors.

**UNIT IV**

**Differential GPS:** Introduction, LADGPS, WADGPS, Wide Area Augmentation systems , GEO Uplink subsystem , GEO downlink systems , Geo Orbit determination , Geometric analysis , covariance analysis , GPS /INS Integration Architectures

## **UNIT V**

**GPS Applications:** GPS in surveying, Mapping and Geographical Information System, Precision approach Aircraft landing system, Military and Space application, intelligent transportation system. GPS orbital parameters, description of receiver independent exchange format (RINEX) , Observation data and navigation message data parameters, GPS position determination, least squares method

### **TEXT BOOK**

1. Mohinder S. Grewal, Lawrence R. Weill, Angus P. Andrews, "Global positioning systems, Inertial Navigation and Integration", Wiley 2007.

### **REFERENCE BOOK**

1. E. D. Kaplan, Christopher J. Hegarty, "Understanding GPS Principles and Applications", Artech House Boston 2005.

### **Course Outcomes:**

At the end of this course, the student will be able to

1. Discuss the basic concepts of GPS and its Architecture.
2. Acquire knowledge regarding Signal Characteristics.
3. Familiarize with the concepts of GPS Receivers.
4. Explain the concepts of Data Errors.
5. Understand the concepts of Differential GPS.
6. Obtain ability to work independently and in a team towards relevant research in Global positioning systems.

**ELECTROMAGNETIC INTERFERENCE & COMPATIBILITY (EMI/EMC)  
(PE-II)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

1. To introduce important system concepts such as Electromagnetic interference and Electromagnetic compatibility (EMI & EMC).
2. To familiarize with unavoidable and naturally happening sources of EMI and problems to ensure EMC.
3. To study various techniques to reduce EMI from systems and to improve EMC of electronic systems.

**UNIT I**

**Sources of EMI:** Definition of EMI and EMC, Classification, Natural and Man-Made EMI Sources, Switching Transients, Electrostatic Discharge, Nuclear Electromagnetic Pulse and High Power Electromagnetics.

**EMI/EMC Standards:** Introduction, Standards for EMI/EMC – MIL –STD 461/462 – IEEE/ANSI Standards – CISPR/IEC, Standards – FCC Regulations.

**UNIT II**

**EMI Coupling Modes:** Penetration: Introduction, Shielding Theory – Shielding Effectiveness, The Circuit Approach, The Wave Approach, Aperture Theory, Calculation of Effectiveness of a Conducting Box with an Aperture, Introduction to Propagation and Cross Talk – Introduction, Basic Principles, Determination of EM Field from Transmission Lines.

**UNIT III**

**EMI Controlling Techniques – I:** Grounding, Principles and Practice of Earthing, Precautions in Earthing, Measurements of Ground Resistance, System Grounding for EMC, Cable Shielding Grounding. Shielding, Theory and Effectiveness, Materials, Integrity at Discontinuities, Conductive Coatings, Cable Shielding, Effectiveness Measurements, Electrical Bonding.

**UNIT IV**

**EMI Controlling Techniques – II:** Characteristics and Types of Filters – Impedance Mismatch, Lumped Element Low-Pass, High-Pass, Band-Pass and Band-Reject Filters, Power Line Filter Design - Common Mode, Differential Mode, Combined CM and DM Filters, Design Example. EMC Gaskets – Knitted Wire-Mesh Gaskets, Wire-Screen Gaskets, Oriented Wire Mesh, Conductive Elastomer, Transparent Conductive Windows, Conductive Adhesive,

Conductive Grease, Conductive Coatings, Isolation Transformers, Opto- Isolators.

## **UNIT V**

**EMI Measurements:** Introduction to Open Area Test Site Measurements – Measurement Precautions – Open Area Test Site – Terrain Roughness – NSA – Measurement of Test Site Imperfections – Antenna Factor Measurement – Measurement Errors Radiated Interference Measurements – Anechoic Chamber – TEM Cell – Reverberating Chamber – GHz TEM Cell – Comparison of Test Facilities – Measurement Uncertainties Conducted Interference Measurements – Characterization – Conducted EM Noise on Power Supply Lines – Conducted EMI from Equipment – Immunity – Detectors and Measurement – Pulsed EMI Immunity – Electrostatic Discharge.

## **TEXT BOOK**

1. Engineering Electromagnetic Compatibility – V. Prasad Kodali – 2/e – IEEE Press –Wiley India Pvt. Ltd – 2001.

## **REFERENCE BOOKS:**

1. Introduction to Electromagnetic Compatibility – Clayton R. Paul – John Wiley & Sons, 1992.
2. Electromagnetic Compatibility of Integrated Circuits – Techniques for Low Emission and Susceptibility – Edited by Sonia Ben Dhia, Mohamed Ramdani and Etienne Sicard – Springer, 2006.
3. EMI reduction in Electronic Systems – Mills – J.P – Prentice Hall Inc.
4. Noise Reduction in Electronic Systems – Henry W. Ott, 2nd Edition, Wiley Interscience, 1988.

## **Course Outcomes:**

Upon completion of this course, the student will be able to

1. Obtain basic knowledge of problems associated with EMI and EMC from electronic circuits and systems, and analyzing various sources of EMI and various possibilities to provide EMC.
2. Familiarize with the concepts of EMI Coupling Mode and use of proper coupling mechanisms to improve compatibility of electronic circuits and systems in a given electromagnetic environment.
3. Explain the basic concepts of EMI Controlling techniques.
4. Demonstrate and Analyze Possible EMI Preventing Techniques such as grounding and shielding.
5. Understand and Analyze EMI Controlling using Filtering and Windowing Techniques.
6. Acquire knowledge regarding the concepts of various EMI Measurement Techniques.

**BIOMEDICAL SIGNAL PROCESSING  
(PE-II)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

1. To introduce important concepts of Biomedical Signal Processing.
2. To familiarize with the concepts of Z-Transform, Fourier Transform, IIR & FIR Filters.
3. To study various types of Bio-signals.

**UNIT I**

Z transform introduction, definition, convergence. Inverse Z transforms, Analysis of discrete time systems using Z transforms. Solutions of differential equations. Transfer functions and stability.

**UNIT II**

Fourier transform for continuous signals. Energy spectrum, Properties (without proof), Gibbs phenomena, Auto and cross correlation. Discrete Fourier transforms. Properties (without proof), Inverse DFT, introduction to FFT

**UNIT III**

IIR & FIR Filters, Low pass, High Pass, Band Pass Filters using windows – Kaiser Windows, Sampling Theorem, aliasing Nyquist criteria, ADC's and DAC's.

**UNIT IV**

Digital signals and systems: Classification of systems causal, time varying, time invariant, lumped. Introduction to digital signals systems. Convolution, Auto-correlation and cross correlation, Use of Matlab signal processing toolbox on various real bio – medical signals.

**UNIT V**

Introduction, Characteristics of Bio-Signals, Types of Signals, Measurement, Transformation and reduction, computation of signal parameters that are diagnostically significant, stationary and non – stationary bio – signals, Application areas of Bio -Signals analysis – EEG, ECG, Phonocardiogram, Spiro Gram, Evoked Signals.

**TEXT BOOKS**

1. Digital signal processing, Proakis (PHI)
2. Signal Analysis By R. P. Singh, Second edition Tata McGraw – Hill

3. Engineering Electronics by Mauro R Prentice – Hall
4. Malmivuo, J. and Plonsey, R. Bioelectromagnetism: Principles and Applications of Bioelectric and Biomagnetic Fields, Oxford University Press, New York, 1995.
5. D C Reddy, McGraw Hill, Biomedical Signal Processing.

### **REFERENCE BOOKS**

1. Biomedical signal processing: Metin Akay (academic press)
2. Biomedical signal processing: Tompkins (academic press)
3. Theory and application of digital signal processing: Rabiner and Gold (EEE pub)

### **Course Outcomes:**

Upon completion of this course, the student will be able to

1. Understand the concepts of Z-Transform, Solutions of differential equations, Transfer functions and stability.
2. Explain the concepts of Fourier Transform, DFT, Inv-DFT & FFT.
3. Design and analyze different IIR & FIR Filters and Windowing Techniques.
4. Acquire Knowledge related to Sampling Theorem, Aliasing, Nyquist criteria, ADC's and DAC's.
5. Demonstrate the concepts of Digital signals and systems.
6. Verify the various Bio-signals and their Classification.

**MIMO SYSTEMS  
(PE-II)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

1. To make students familiar with fundamentals of wireless communication systems.
2. To understand the diversity and spatial multiplexing phenomenon in MIMO system.
3. To understand the receiver system design for MIMO.
4. To become familiar with OFDM and MIMO-OFDM systems.

**UNIT I**

Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems, MIMO vs. multi-antenna systems, Diversity, Exploiting multipath diversity, Transmit diversity, Space-time codes, The Alamouti scheme, Delay diversity, Cyclic delay diversity, Space-frequency codes, Receive diversity, The rake receiver, Combining techniques, Spatial Multiplexing, Spectral efficiency and capacity, Transmitting independent streams in parallel, Mathematical notation

**UNIT II**

The generic MIMO problem, Singular Value Decomposition, Eigenvalues and eigenvectors, Equalising MIMO systems, Disadvantages of equalising MIMO systems, Predistortion in MIMO systems, Disadvantages of pre-distortion in MIMO systems, Pre-coding and combining in MIMO systems, Advantages of pre-coding and combining, Disadvantages of precoding and combining, Channel state information.

**UNIT III**

Codebooks for MIMO, Beamforming, Beamforming principles, Increased spectrum efficiency, Interference cancellation, Switched beamformer, Adaptive beamformer, Narrowband beamformer, Wideband beamformer

**UNIT IV**

Case study: MIMO in LTE, Codewords to layers mapping, Pre-coding for spatial multiplexing, Pre-coding for transmit diversity, Beamforming in LTE, Cyclic delay diversity based pre-coding, Pre-coding codebooks, Propagation Channels, Time & frequency channel dispersion, AWGN and multipath propagation channels, Delay spread values and time variations, Fast and slow fading

environments, Complex baseband multipath channels, Narrowband and wideband channels, MIMO channel models.

#### **UNIT V**

Channel Estimation, Channel estimation techniques, Estimation and tracking, Training based channel estimation, Blind channel estimation, Channel estimation architectures, Iterative channel estimation, MMSE channel estimation, Correlative channel sounding, Channel estimation in single carrier systems, Channel estimation for CDMA, Channel estimation for OFDM.

#### **TEXT BOOKS**

1. Claude Oestges, Bruno Clerckx, "MIMO Wireless Communications : From Real-world Propagation to Space-time Code Design", Academic Press, 1st edition, 2010.
2. Mohinder Janakiraman, "Space - Time Codes and MIMO Systems", Artech House Publishers, 2004..

#### **REFERENCE BOOKS**

1. Goldsmith, Andrea, "Wireless Communications", Cambridge University press (2005).
2. Rakesh. S. Kshetrimayum: "Fundamentals of MIMO Wireless Communications", Cambridge University press, 2017

#### **Course Outcomes:**

Upon completing this course, the student will be able to

1. Understand channel modelling and propagation, MIMO Capacity, space-time coding, MIMO receivers, MIMO for multi-carrier systems (e.g. MIMO-OFDM), multi-user communications, multi-user MIMO.
2. Study about Diversity Receiver
3. Acquire knowledge related to cooperative and coordinated multi-cell MIMO
4. Familiarize with MIMO in 4G (LTE, LTE-Advanced, WiMAX).
5. Perform Mathematical modelling and analysis of MIMO systems.
6. Distinguish different Channel Estimation Techniques.

**B.Tech. VI Semester**

**COURSE CODE: ---**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OPEN ELECTIVE-I**

**Internal Marks: 30**

**External Marks: 70**

The student can choose any one OE-I subject offered by other Branches. The list of OEs are available in Course Structure.

**INTERNET OF THINGS LAB****Internal Marks: 20****External Marks: 30****Course Objectives:**

1. To create innovative applications and domain capability across verticals for country's needs such as Smart City, Smart Health, Smart Manufacturing, Smart Agriculture, Smart Buildings, etc.
2. To build industry capable talent, start-up community and entrepreneurial ecosystem for IoT.
3. To energize research mind-set and reduce costs in research and development by providing neutral and interoperable, multi-technology stack laboratory facilities.
4. To provide environment for product creation, testing and also for validation & incubation.

**List of Experiments:**

1. Introduction to Raspberry Pi Board/ Arduino/NodeMCU.
2. Familiarization with ARM keil MDK for programming and debugging an application on the PSoC 4 BLE chip and perform necessary software installation.
3. To interface Push button/Digital sensor (IR/LDR) with ARM keil MDK on PSoC 4 BLE chip and write a program to turn ON LED when push button is pressed or at sensor detection.
4. Set up a Bluetooth Low Energy (namely Bluetooth Smart) connection between the PSoC BLE kit and a smart phone and use an app to send and receive data to and from the BLE Pioneer kit.
5. To interface capacitor sensor (touch sensor) with smart phone and write a program to turn RGB LED ON/OFF when '1'/'0' is received from smart phone using Bluetooth.
6. Automatic street light control to control the street light (Turn on and off based on the light) using Arduino/ Node MCU/Raspberry Pi
7. Smoke Detection using MQ-2 Gas Sensor
8. Detecting obstacle with IR Sensor and Arduino/ Node MCU/Raspberry Pi
9. Arduino board interfacing with the temperature and humidity sensor and prints the output on LCD / serial monitor
10. Write an Arduino program for interfacing Arduino board with the Ultrasonic sound sensor and print the output on Serial monitor.

11. To Control LED using any of the development board (Ex. Arduino or Raspberry Pi) and control LED using the board.
12. To interface DC motor using Arduino PWM
13. Create a mobile app to control an actuator.
14. To control Raspberry Pi Music Player.

**Hardware Required:**

Arduino/Node MCU/Raspberry Pi + PSoC 4 BLE Bluetooth Low Energy Pioneer Kit + Hardware, MQ-2 Gas Sensor, Ultrasonic sound sensor.

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Course Outcomes:**

Upon completion of this course, the student will be able to

1. Understand the concepts of IOT.
2. Analyze and evaluate the data received through sensors in IOT.
3. Explain IoT applications in different domain and be able to analyze their performance.
4. Implement basic IoT applications on embedded platform.  
And Design and develop smart city in IOT.
5. Apply IOT to different applications and Evaluate protocols used in IOT.
6. Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.

**VLSI LAB****Internal Marks: 20****External Marks: 30****Course Objectives:**

1. To make the students familiarize with the design of analog and digital circuits.
2. To draw schematic and layout, analyze, and test of analog and digital circuits and simulation by using EDA tool.

**List of Experiments:**

Any **SIX** of the following experiments from each part are to be conducted **(Total-12)**

**Part-I**

The following experiments have to be implemented in HDL.

1. Realization of all the logic gates.
2. Design of 8-to-3 encoder (without and with priority) and 2-to-4 decoder.
3. Design of 8-to-1 multiplexer and 1-to-8 demultiplexer.
4. Design of 4 bit binary to gray code converter.
5. Design of 4 bit comparator.
6. Design of Full adder using 3 modeling styles.
7. Design of flip flops: SR, D, JK, T.
8. Design of 4-bit binary, BCD counters (synchronous/ asynchronous reset) or any sequence counter.
9. Design of Finite State Machines.

**Part-II**

1. Basic logic gates.
2. CMOS inverter.
3. CMOS NOR/ NAND gates.
4. CMOS XOR and MUX gates.
5. Static / Dynamic logic circuit (register cell).

6. Latch.
7. Pass transistor.
8. Layout of any combinational circuit (complex CMOS logic gate).

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Software Required:**

- i. Mentor Graphics Software / Equivalent Industry Standard Software.
- ii. Personal computer system with necessary software to run the programs and to implement.

**Course Outcomes:**

Upon successful completion of the course, the students will be able to

1. Design analog and digital circuits.
2. Handle EDA tools to perform simulation, draw schematic and layout, analysis, testing, and interpret results.
3. Write VHDL/Verilog code.
4. Give oral presentations and prepare written reports.
5. Design combinational and sequential circuits.
6. Analyze and layout design of CMOS circuits in micron and submicron level using any platform Learn techniques and engineering tools (such as HDL, Xilinx) to design and implement.

**DIGITAL SIGNAL PROCESSING LAB****Internal Marks: 20****External Marks: 30****Course Objectives:**

1. To analyze and manipulate digital signals for the representation of systems using MATAB.
2. To practical implementation of the convolution, correlation, DFT, IDFT, Block convolution, Signal smoothing, filtering of long duration signals, and Spectral analysis of signals.

**List of Experiments:**

Any 12 Programs shall be implemented in Software (Using MATLAB / Lab View / C Programming/Equivalent) and any Four Hardware (Using TI / Analog Devices / Motorola / Equivalent DSP processors).

1. Generation of Sinusoidal Waveform/Signal based on Recursive Difference Equations.
2. Circular Convolution
3. Discrete Fourier Transform / Inverse Discrete Fourier Transform
4. To find DFT/IDFT of given DT Signal.
5. To find Frequency Response of a System given in Transfer Function/ Differential equation form.
6. Implementation of FFT of given Sequence.
7. Determination of Power Spectrum of a given Signal(s).
8. Implementation of LP FIR Filter for a given Sequence/Signal.
9. Implementation of HP IIR Filter for a given Sequence/Signal.
10. Generation of Narrow Band Signal through Filtering.
11. Generation of DTMF Signals.
12. Implementation of Decimation Process.
13. Implementation of Interpolation Process.
14. Implementation of I/D Sampling Rate Converters.
15. Impulse Response of First order and Second Order Systems.

**Software Required:**

MATLAB / Lab View / C Programming/Equivalent

**Hardware Required:**

TI / Analog Devices / Motorola / Equivalent DSP processors

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Course Outcomes:**

Upon successful completion of the course, the students will be able to

1. Analyze and implement digital signal processing systems in time domain.
2. Calculate and Plot DFT / IDFT of given DT signal and prove it theoretical.
3. Compute linear and circular convolution and the discrete Fourier transform (DFT) of discrete-time signals.
4. Design IIR, and FIR filters for band pass, band stop, low pass and high pass filters.
5. Generate DTMF signals.
6. Plot Impulse response of first order and second order systems.

## INTELLECTUAL PROPERTY RIGHTS

**Internal Marks: 30**  
**Semester-end Marks: 70**  
**External Marks: 0**

### Course Objectives

- To understand the basic concepts of Ethics and Human values.
- To enable the students understand the role and importance of ethics in Engineering.
- To familiarize the rights and responsibilities of Engineers.
- To know the laws and protect author's rights.
- To understand the legal aspects present in intellectual property law.

### UNIT – I

#### Human Values

Morals, Values and Ethics – Integrity – Work Ethics – Service Learning – Civic Virtue -Value time – Co-operation – Commitment – Empathy – Self-confidence – Character.

Ethics- Types of Inquiry – Kohlberg's Theory – Gilligan's Argument – Heinz's Dilemma.

### UNIT – II

#### Engineers' Responsibilities and Rights

Safety and Risk – Types of Risks – Voluntary vs. Involuntary Risk- Short Term vs Long Term Consequences - Expected Probability - Reversible Effects – Threshold Levels for Risk - Delayed vs Immediate. Risk Collegiality – Techniques for achieving Collegiality – Group / Team – Two Senses of Loyalty, Rights – Professional Responsibilities – Confidential and Proprietary information – Conflict of Interest – Conflict resolution – Self-interest.

### UNIT – III

#### Patent Laws

Introduction – Rights and Limitations – Application process – Patent requirements – Ownership – Transfer – Infringement – Litigation – International Patent Law – Double Patenting – New development in Patent Law.

### UNIT – IV

#### Trade Marks and Copyrights

Trade Mark and Copyrights: Introduction – Registration Process – Transfer – Infringement – Dilution of Ownership – Imitation – Litigations.

### UNIT – V

#### Cyber Law

Introduction to Cyber Law – Cyber Crime and E-Commerce – Online Crime – Innovations and Inventions in Trade Related Intellectual Property Rights.

**Text Books**

1. "Principia Ethica" by Goerge Edward Moore, Cambridge University Press, 11-Nov-1993, Cambridge.
2. "Engineering Ethics includes Human Values" by M.Govindarajan, S.Natarajan and .S.SenthilKumar-PHI Learning Pvt. Ltd-2009.
3. Deborah E.Bouchoux: "Intellectual Property", Cengage Learning, New Delhi

**Reference Books**

1. "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran- Laxmi Publications.
2. R.Radha Krishnan, S.Balasubramanian: "Intellectual Property Rights",Excel Books, New Delhi.
3. Prabhuddha Ganguli: "Intellectual Property Rights" Tata Mc-Graw- Hill, New Delhi.

**Course Outcomes**

Students will be able to

- 1.Understand different Moral Perspectives and enabling him to frame one's own Ethical standards.
- 2.Find solutions for issues related to growth with reference to absolute ethical tenets.
- 3.Resolve Professional/Moral Dilemmas and be able to guide productivity.
- 4.Analyze the likelihood of confusion in Trademark Claims.
- 5.Understand different forms of infringement of Intellectual Property Rights.
- 6.Recognize the relevant criteria for protecting Creativity

**SOCIALLY RELEVANT MINI PROJECT-II**

**Internal Marks: 20**  
**Semester-end Marks: 30**  
**External Marks: 0**

**Guidelines:**

1. Students should select a problem which addresses some basic home, office or other real life applications.
2. The electronic circuit for the selected problem should have at least 20 to 25 components.
3. Students should understand testing of various components.
4. Soldering of components should be carried out by students.
5. Students should develop a necessary PCB for the circuit.
6. Students should see that final circuit submitted by them is in working condition.
7. 5-10 pages report to be submitted by students.
8. Group of maximum three students can be permitted to work on a single mini project.
9. The mini project must have hardware part. The software part is optional.
10. Department may arrange demonstration with poster presentation of all mini projects developed by the students at the end of semester.
11. It is desirable that the electronic circuit/systems developed by the students have some novel features.

## MICROWAVE AND OPTICAL COMMUNICATIONS

**Internal Marks: 30**

**External Marks: 70**

### Course Objectives:

1. To introduce the microwave passive components, solid state devices and procedures to measure different parameters in microwave frequency range.
2. To familiarize with different types of optical fibers, light sources and detectors.

### UNIT I

**Introduction to Microwave Components:** Microwave frequencies and applications, waveguide attenuators – resistive card and rotary vane types; calculation of scattering matrix for E plane, H plane, Magic Tee and directional coupler; ferrite components – Gyrator, Isolator, Circulator.

### UNIT II

**Microwave Tubes:** Classification of microwave tubes, two cavity Klystron – structure, velocity modulation, output power; reflex Klystron – structure, power output and efficiency; Travelling Wave Tube – structure, amplification process; 8-cavity cylindrical travelling wave magnetron operation.

### UNIT III

**Microwave Solid State Devices and Measurements:** Gunn diode – Principle, RWH theory; IMPATT diode, description of microwave bench, measurement of attenuation, frequency, VSWR and power using microwave bench.

### UNIT IV

**Overview of Optical Fibers:** The evolution of fiber optic systems, elements of an optical fiber transmission link, optical fiber structures, nature of light, basic optical laws and definitions, optical fiber modes and configurations.

### UNIT V

**Optical Sources and Photo Detectors:** LEDs - structures, quantum efficiency, modulation capability; Laser diodes - principle, threshold conditions, external quantum efficiency, resonant frequencies. Photodiodes – Principle, PIN and avalanche photo diodes; comparison of photo detectors, noise in photo detectors.

**TEXT BOOKS**

1. Samuel Y. Liao, "Microwave Devices and Circuits", Pearson Education, 3<sup>rd</sup> Edition, 2003
2. Gerd Keiser, "Optical Fiber Communications", 3<sup>rd</sup> edition, McGrawHill

**REFERENCE BOOKS**

1. M. Kulkarni "Microwave and Radar engineering", Umesh publications, New Delhi. 3<sup>rd</sup> Edition, 2008.
2. R.E. Collin, "Foundations for Microwave Engineering", IEEE Press, John Wiley, 2<sup>nd</sup> Edition, 2002.
3. Herbert J. Reich, J. G. Skalnik, P. F. Ordnung and H. L. Krauss, "Microwave Principles", CBS Publishers and Distributors, New Delhi, 2004.
4. Djafar K. Mynbaev and Lowell L. Scheiner, "Fiber Optic Communication Technology", Pearson Education Asia.
5. R. S. Rao, "Microwave Engineering", PHI New Delhi, 2<sup>nd</sup> Edition, 2016.

**Course Outcomes:**

Upon successful completion of the course, the students will be able to

1. Design the microwave bench setup with different wave guide components.
2. Distinguish microwave sources based on constructional, operational and performance aspects.
3. Demonstrate the use of microwave bench for calculating power, attenuation, frequency and VSWR.
4. Understand the basic concepts of fiber optics.
5. Design a fiber optic communication network with suitable light sources for a given application.
6. Design a fiber optic communication network with suitable optical detectors for a given application.

**DATA COMMUNICATIONS AND COMPUTER NETWORKS****Internal Marks: 30****External Marks: 70****Course Objectives:**

1. Analyze the terminology and concepts of the OSI and TCP-IP reference model.
2. Examine various error correction and error detection methods.
3. Learn addressing mechanisms efficiently to build a network.
4. Understand and predict the Pros and cons of existing protocols and its working procedures.

**UNIT I**

**Data Communications:** Components – Direction of Data flow – Networks – Components and Categories – Types of Connections – Topologies – Protocols and Standards – ISO / OSI model, Example Networks such as ATM, Frame Relay, ISDN

**Physical Layer:** Transmission modes, Multiplexing, Transmission Media, Switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks.

**UNIT II**

**Data Link Layer:** Introduction, Framing, and Error – Detection and Correction – Parity – LRC – CRC Hamming code, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC, Point to Point Protocols.

**Medium Access Sub Layer:** ALOHA, CSMA/CD, LAN - Ethernet IEEE 802.5 - IEEE 802.11, Random access, Controlled access, Channelization.

**UNIT III**

**Network Layer:** Logical Addressing, Internetworking, Tunneling, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multicast Routing Protocols.

**UNIT IV**

**Transport Layer:** Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Control, QoS, Integrated Services, Differentiated Services, QoS in Switched Networks.

**UNIT V**

**Application Layer:** Domain name space, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP.

### **TEXT BOOKS**

1. Data Communications and Networking – Behrouz A. Forouzan, Fourth Edition TMH, 2006.
2. Computer Networks — Andrew S Tanenbaum, 4th Edition. Pearson Education/PHI.

### **REFERENCE BOOKS**

1. Data communications and computer Networks, P.C .Gupta, PHI.
2. An Engineering Approach to Computer Networks-S. Keshav, 2nd Edition, Pearson Education.
3. Understanding communications and Networks, 3rd Edition, W.A. Shay, Cengage Learning.
4. Computer Networking: A Top-Down Approach Featuring the Internet. James F. Kurose & Keith W. Ross, 3rd Edition, Pearson Education.
5. Larry L. Peterson and Peter S. Davie, Computer Networks, Harcourt Asia Pvt. Ltd., Second Edition.
6. William Stallings, –Data and Computer Communication, Sixth Edition, Pearson Education, 2000.

### **Course Outcomes:**

After completion of the course the student is able to

1. Demonstrate the Layered Architecture (OSI and TCP-IP reference models) of Computer Networks.
2. Understand the concepts of Data link layer, Medium Access sub layer and apply all the error correction and detection mechanisms.
3. Understand the concepts of Network Layer.
4. Familiarize with the protocols related to Network Layer.
5. Implement the Addressing mechanisms to assign IP addresses to network efficiently.
6. Design applications using internet protocols.

**TELECOMMUNICATION SWITCHING SYSTEMS  
(PE-III)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

1. To study about the basic concepts of telephony switching.
2. To learn about the telecommunication networks.
3. To learn about the telecommunication signaling.
4. To learn about the packet switching and high speed networks.

**UNIT I**

**Switching Systems:** Evolution of Telecommunications: Basics, functions, types and design parameters of switching system. 100/1000/10,000 Line exchange. Principles of Crossbar switching; A General Trunking; Electronic and digital switching systems.

**UNIT II**

**Telecommunications Traffic:** Introduction; Unit of traffic; congestion; Traffic measurement; Mathematical model; Lost call systems-Theory; Traffic performance; Loss systems in Tandem; Use of traffic tables; Queuing systems- the second Erlang distribution; Probability of delay; Finite queue capacity; some other useful results; Systems with a single server; queues in tandem; Delay tables; Applications of delay formulae.

**Switching Networks:** Introduction, Single stage networks; Grading Principles; Design of progressive grading; other forms of gradings; Traffic capacity of Grading; Applications of grading; Link systems-grading; Two, Three and four stage networks; Grades of service of link systems.

**UNIT III**

**Time Division Switching:** Basics of time division space switching; basics of time division time switching; Time multiplexed space switch; Time multiplexed time switch; Combination switching; Three stage combination switching. Control of switching systems; call processing functions; sequence of operations; signal exchanges; State transition diagrams; common control; reliability; availability and security ; Stored program control.

**UNIT IV**

**Signaling:** Introduction; Customer Line signaling; Audio frequency Junction and trunk circuits; FDM carrier systems-Outband signaling; Inband (VF) signaling; PCM signaling; Inter Register signaling; Common channel signaling principles-General signaling networks; CCITT signaling system number 6;

CCITT signaling system number 7; High level data link control; Signal units; The signaling information field.

## **UNIT V**

**Packet Switching:** Introduction; Statistical multiplexing; Local and wide Area networks- network topologies and their comparison; Optical fiber Networks; Large scale networks-General; Datagrams and virtual circuits; Routing; Flow control; Standards; Frame relay; Broadband networks-general; Asynchronous Transfer mode; ATM switches, IP switches; ISDN; Cellular radio networks; private networks; charging; Routing-general, automatic, Alternative routing.

## **TEXT BOOKS**

1. Telecommunication Switching and Traffic Networks, J.E Flood, Pearson Education, 2006.
2. Telecommunication Switching system and Networks, Tyagarajan Viswanathan Prentice hall of India Pvt. Ltd., 2006.

## **REFERENCE BOOKS**

1. Digital Telephony, John C Bellamy, John Wiley International Student Edition, 3rd Edition, 2000.
2. Data Communications and Networking, Behrouz A. Ferouzan, TMH, 2nd Edition, 2000.
3. Introduction to Data Communications and Networking, Tomasi, Pearson Education, 1st Edition, 2007.

## **Course Outcomes:**

After Completion of the course the student is able to

1. Understand the basic concepts of Switching Systems
2. Analyze the performance of telecommunication switching system and network.
3. Gain knowledge related to Time Division Switching.
4. Understand the concepts related to Control of switching systems.
5. Implement the switching and signaling techniques in communication networks
6. Familiarize the concepts of Packet Switching and analyze the different routing protocols and high speed networks.

**DIGITAL IC DESIGN  
(PE-III)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

1. The student will be able to understand the MOS Design.
2. In this course, students can study Combinational MOS Logic Circuits and Sequential MOS Logic Circuits.
3. Another main object of this course is to motivate the graduate students to design and to develop the Digital Integrated Circuits for different Applications.
4. The concepts of Semiconductor Memories, Flash Memory, RAM array organization.

**UNIT I**

**MOS Design:** Pseudo NMOS Logic – 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:** 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:** Behaviour of bistable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latch and edge triggered flip-flop.

**Dynamic Logic Circuits:** Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits.

**UNIT IV:**

**Interconnect:** Capacitive Parasitics, Resistive Parasitics, Inductive Parasitics, Advanced Interconnect Techniques.

**UNIT V**

**Semiconductor Memories:** Memory 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 Circuits – A Design Perspective, Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, 2nd Ed., PHI.
2. Digital Integrated Circuit Design – Ken Martin, Oxford University Press, 2011.

### **REFERENCE BOOKS**

1. CMOS Digital Integrated Circuits Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 3rd Ed., 2011.
2. CMOS VLSI Design – Neil H.E Weste, David harris, Ayan Banerjee 3rd Edition, Pearson

### **Course Outcomes:**

After going through this course the student will be able to

1. Understand the concepts of MOS Design.
2. Design and analysis of Combinational MOS Circuits.
3. Design and analyze Sequential MOS Circuits.
4. Understand the concept of Dynamic Logic Circuits and extend the Digital IC Design to Different Applications.
5. Familiarize with Interconnect Techniques.
6. Describe the Semiconductor Memories.

**ASIC AND FPGA DESIGN  
(PE-III)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

1. To prepare the student to be an entry-level industrial standard ASIC or FPGA designer.
2. To give the student an understanding of issues and tools related to ASIC/FPGA design and implementation.
3. To give the student an understanding of basics of System on Chip and Platform based design

**UNIT I**

**Overview of ASIC and PLD 9:** Types of ASICs - Design flow – CAD tools used in ASIC Design – Programming Technologies: Antifuse – static RAM – EPROM and EEPROM technology, Programmable Logic Devices: ROMs and EPROMs – PLA –PAL. Gate Arrays – CPLDs and FPGAs.

**UNIT II**

**ASIC Physical Design 9:** System partition -partitioning - partitioning methods – interconnect delay models and measurement of delay - floor planning - placement – Routing: global routing - detailed routing - special routing - circuit extraction - DRC

**UNIT III**

**Logic Synthesis, Simulation and Testing 9:** Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language - PLA tools - EDIF-CFI design representation. Verilog and logic synthesis - VHDL and logic synthesis - types of simulation - boundary scan test - fault simulation - automatic test pattern generation.

**UNIT IV**

**FPGA:** Field Programmable gate arrays- Logic blocks, routing architecture, Design flow technology - mapping for FPGAs, Xilinx XC4000 - ALTERA's FLEX 8000/10000, ACTEL's ACT-1,2,3 and their speed performance Case studies: Altera MAX 5000 and 7000 - Altera MAX 9000 – Spartan II and Virtex II FPGAs - Apex and Cyclone FPGAs

**UNIT V**

**SOC Design:** Design Methodologies – Processes and Flows - Embedded software development for SOC – Techniques for SOC Testing – Configurable

SOC – Hardware / Software codesign Case studies: Digital camera, Bluetooth radio / modem, SDRAM and USB.

### **TEXT BOOKS**

1. M.J.S .Smith, "Application Specific Integrated Circuits, Addison -Wesley Longman Inc.,1997
2. S. Trimberger, Field Programmable Gate Array Technology, Edr, Kluwer Academic Publications, 1994.
3. John V.Oldfield, Richard C Dore, Field Programmable Gate Arrays, Wiley Publications1995

### **REFERENCE BOOKS**

1. P. K. Chan & S. Mourad, Digital Design Using Field Programmable Gate Array, Prentice Hall, 1994.
2. Parag. K. Lala, Digital System Design using Programmable Logic Devices, BSP, 2003.
3. S. Brown, R. Francis, J. Rose, Z. Vransic, Field Programmable Gate Array, Kluwer Pubin, 1992.
4. J. Old Field, R. Dorf, Field Programmable Gate Arrays, John Wiley & Sons, Newyork,1995.
5. Farzad Nekoogar and Faranak Nekoogar, From ASICs to SOCs: A Practical Approach, Prentice Hall PTR, 2003.
6. Wayne Wolf, FPGA-Based System Design, Prentice Hall PTR, 2004.
7. R. Rajsuman, System-on-a-Chip Design and Test. Santa Clara, CA: Artech House Publishers, 2000.

### **Course Outcomes:**

At the end of this course the student can able to:

1. Study the design flow of different types of ASIC.
2. Familiarize the different types of programming technologies and logic devices.
3. Learn the architecture of different types of FPGA.
4. Gain knowledge about partitioning, floor planning, placement and routing including circuit extraction of ASIC
5. Analyse the synthesis, Simulation and testing of systems.
6. Understand the design issues of SOC and know about different high performance algorithms and its applications in ASICs.

**DIGITAL IMAGING AND VIDEO PROCESSING  
(PE-III)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

The main objectives of this course are given below:

1. The basic concepts of an Image Processing.
2. The various concepts of Image Enhancement, Restoration, Segmentation and Compression.
3. Different steps involved in Video Processing and 2D Motion Estimation.

**UNIT I**

**Fundamentals of Image Processing and Image Transforms:** Introduction, Image sampling, Quantization, Resolution, Image file formats, Elements of image processing system, Applications of Digital image processing Introduction, Need for transform, image transforms, Fourier transform, 2 D Discrete Fourier transform and its transforms, Importance of phase, Walsh transform, Hadamard transform, Haar transform, slant transform Discrete cosine transform, KL transform, singular value decomposition, Radon transform, comparison of different image transforms.

**UNIT II**

**Image Enhancement:** Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering.

**Image Restoration:** Introduction to Image restoration, Image degradation, Types of image blur, Classification of image restoration techniques, Image restoration model, Linear and Nonlinear image restoration techniques, Blind deconvolution

**UNIT III**

**Image Segmentation:** Introduction to image segmentation, Point, Line and Edge Detection, Region based segmentation., Classification of segmentation techniques, Region approach to image segmentation, clustering techniques, Image segmentation based on thresholding, Edge based segmentation, Edge detection and linking, Hough transform, Active contour

**Image Compression:** Introduction, Need for image compression, Redundancy in images, Classification of redundancy in images, image compression scheme, Classification of image compression schemes, Fundamentals of information theory, Run length coding, Shannon – Fano coding, Huffman coding,

Arithmetic coding, Predictive coding, Transformed based compression, Image compression standard, Wavelet-based image compression, JPEG Standards.

#### **UNIT IV**

**Basic Steps of Video Processing:** Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

#### **UNIT V**

**2-D Motion Estimation:** Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

#### **TEXT BOOKS**

1. Digital Image Processing – Gonzalez and Woods, 3rd Ed., Pearson.
2. Video Processing and Communication – Yao Wang, Joem Ostermann and Ya-quin Zhang. 1st Ed., PH Int.
3. S. Jayaraman, S. Esakkirajan and T. VeeraKumar, “Digital Image processing, Tata McGraw Hill publishers, 2009

#### **REFERENCE BOOKS**

1. Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools – Scotte Umbaugh, 2nd Ed, CRC Press, 2011.
2. Digital Video Processing – M. Tekalp, Prentice Hall International.
3. Digital Image Processing – S. Jayaraman, S. Esakkirajan, T. Veera Kumar – TMH, 2009.
4. Multidimensional Signal, Image and Video Processing and Coding – John Woods, 2nd Ed, Elsevier.
5. Digital Image Processing with MATLAB and Labview – Vipula Singh, Elsevier.
6. Video Demystified – A Hand Book for the Digital Engineer – Keith Jack, 5th Ed., and Elsevier.

#### **Course Outcomes:**

At the end of this course, the student will be able to:

1. Understand the fundamentals of Image Processing and Image Transforms.
2. Familiarize with the concepts of Image Enhancement and Restoration Techniques.
3. Classify Image Segmentation Techniques.
4. Describe the concept of Image Compression Techniques.
5. Gain knowledge related to steps involved in Video Processing
6. Familiarize with the concepts of 2D Motion Estimation.

**EMBEDDED REAL TIME OPERATING SYSTEMS  
(PE-III)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

1. To Learn the UNIX, Commands, and basic concepts of Inter-process communication.
2. To be exposed to the basic concepts of real time Operating system, skills necessary to design and develop embedded applications by means of real-time operating systems.

**UNIT I**

**Introduction:** Introduction to UNIX, Overview of Commands, File I/O, (open, create, close, lseek, read, write), Process Control (fork, vfork, exit, wait, waitpid, exec), Signals, Interprocess communication,( pipes, fifos, message queues, semaphores, shared memory)

**UNIT II**

**Real Time Systems:** Typical real time applications, Hard Vs Soft real-time systems, a reference model of Real Time Systems: Processors and Resources, Temporal Parameters of real Time Work load, Periodic task model precedence constraints and data dependency, functional parameters, Resource Parameters of jobs and parameters of resources.

**UNIT III**

**Scheduling and Inter-process Communication:** Commonly used Approaches to Real Time Scheduling Clock Driven, Weighted Round Robin, Priority Driven, Dynamic Vs State Systems, Effective release time and Deadlines, Offline Vs Online Scheduling. Inter-process Communication and Synchronization of Processes, Tasks and Threads- Multiple Process in an Application, Problem of Sharing data by multiple tasks & routines, Inter-process communication

**UNIT IV**

**Real Time Operating Systems & Programming Tools**

Operating Systems Services, I/O Subsystems, RT & Embedded Systems OS, Interrupt Routine in RTOS Environment. Micro C/OS-II- Need of a well Tested & Debugged RTOS, Use of mCOS-II

## **UNIT V**

### **VX Works**

Memory managements task state transition diagram, pre-emptive priority, Scheduling context switches- semaphore- Binary mutex, counting watch dogs, I/O system

**Case Study:** Data compressor -Alarm Clock- Audio player- Software modem-Digital still camera - Telephone answering machine-Engine control unit -Video accelerator. Case study of sending application Layer byte Streams on a TCP/IP network

### **TEXT BOOKS**

1. Rajkamal, "Embedded Systems- Architecture, Programming and Design", 2<sup>nd</sup> edition., 2008, TMH.
2. Wayne Wolf, "Computers as Components - Principles of Embedded Computing System Design", Third Edition "Morgan Kaufmann Publisher (An imprint from Elsevier), 2008.

### **REFERENCE BOOKS**

1. David. E. Simon, "An Embedded Software Primer", 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007.
2. Raymond J.A. Buhr, Donald L.Bailey, "An Introduction to Real-Time Systems-From Design to Networking with C/C++", Prentice Hall, 1999.
3. C.M. Krishna, Kang G. Shin, "Real-Time Systems", International Editions, Mc Graw Hill 1997.
4. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dream Tech Press, 2005.

### **Course Outcomes:**

Upon completing this course, the student will be able to

1. Describe the concepts of embedded systems.
2. Explain the basic concepts of real time Operating system design.
3. Use the system design techniques to develop software for embedded systems, differentiate between the general purpose operating system and the real time operating system.
4. Model real-time applications using embedded-system concepts.
5. Understand the topics of VX Works.
6. Perform case studies related to Data Compressor and TCP/IP Network.

## RADAR ENGINEERING (PE-IV)

**Internal Marks: 30**  
**External Marks: 70**

### Course Objectives:

1. To explore the concepts of radar and its frequency bands.
2. To understand Doppler Effect and get acquainted with the working principles of CW radar, FM-CW radar.
3. To impart the knowledge of functioning of MTI and Tracking Radars.
4. To explain the deigning of a Matched Filter in radar receivers.

### UNIT I

**Basics of Radar:** Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation.

**Radar Equation:** SNR, Envelope Detector – False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets , Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment).

### UNIT II

**CW and Frequency Modulated Radar:** Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar.

**FM-CW Radar:** Range and Doppler Measurement, Block Diagram and Characteristics, FM-CW altimeter.

### UNIT III

**MTI and Pulse Doppler Radar:** Principle, MTI Radar - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.

### UNIT IV

**Tracking Radar:** Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

## **UNIT V**

**Detection of Radar Signals in Noise:** Matched Filter Receiver – Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise.

**Radar Receivers:** Noise Figure and Noise Temperature, Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Applications, Advantages and Limitations.

## **TEXT BOOK**

1. Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2<sup>nd</sup> Ed., 2007.

## **REFERENCE BOOKS**

1. Radar: Principles, Technology, Applications – Byron Edde, Pearson Education, 2004.
2. Radar Principles – Peebles, Jr., P.Z., Wiley, New York, 1998.
3. Principles of Modern Radar: Basic Principles – Mark A. Richards, James A. Scheer, William A. Holm, Yesdee, 2013.
4. Radar Handbook - Merrill I. Skolnik, 3rd Ed., McGrawHill Education, 2008

## **Course Outcomes:**

Upon completing this course, the student will be able to

1. Gain the basic knowledge related to Radar and derive the complete radar range equation.
2. Understand the need and functioning of CW, FM-CW Radars.
3. Understand the concepts of MTI radars its principle and limitations.
4. Familiarize with the concepts of Pulse Doppler Radar.
5. Know various Tracking methods.
6. Derive the matched filter response characteristics for radar receivers.

**LOW POWER VLSI DESIGN  
(PE-IV)**

**Internal Marks: 30  
External Marks: 70**

**Course Objectives:**

1. To make the students familiarize with the sources of power dissipation and power minimization techniques.

**UNIT I**

**Low Power Requirements:** Historical background, requirements for low power, sources of power dissipation, low power design methodologies.

**UNIT II**

**Sources of Power Dissipation:** Short circuit power dissipation, switching power dissipation, glitching power dissipation, leakage power dissipation.

**UNIT III**

**Supply Voltage Scaling Approaches:** Device feature size scaling, architectural level approaches, voltage scaling using high-level transformations, multilevel voltage scaling.

**Switched Capacitance Minimization Approaches:** Hardware software trade-off, bus encoding, clock gating, glitching power minimization, logic styles for low power.

**UNIT IV**

**Leakage Power Minimization Approaches:** Variable-Threshold voltage CMOS (VTCMOS) approach, transistor stacking, Multi- Threshold-voltage CMOS (MTCMOS) approach, power gating.

**UNIT V**

**Adiabatic Logic Circuits:** Adiabatic charging, adiabatic amplification, adiabatic logic gates, pulsed power supply, partially adiabatic circuits.

**TEXT BOOKS**

1. Jan M. Rabaey and Massoud Pedram, "Low Power Design Methodologies", Kluwer Academic Publishers, 1996 (Unit-I).
2. Ajit Pal, Low Power VLSI Circuits and Systems, Springer India, 2015 Edition (Units - II to V)

## **REFERENCE BOOKS**

1. Sung Mo Kang and Yusuf Leblebici, "CMOS Digital Integrated Circuits", Tata Mcgraw Hill, Third Edition.
2. Neil H. E. Weste and K. Eshraghian, "Principles of CMOS VLSI Design", Addison Wesley (Indian reprint), Second Edition.
3. A. Bellamour and M. I. Elmasri, "Low Power VLSI CMOS Circuit Design", Kluwer Academic Press, 1995.
4. Anantha P. Chandrakasan and Robert W. Brodersen, "Low Power Digital CMOS Design", Kluwer Academic Publishers, 1995.
5. Kaushik Roy and Sharat C. Prasad, "Low-Power CMOS VLSI Design", Wiley-Interscience, 2000.
6. Prof. Ajit Pal, Department of Computer Science and Engineering, IIT Kharagpur, Low Power VLSI Circuits & Systems, NPTEL video course.

## **Course Outcomes:**

Upon successful completion of the course, the students will be able to

1. Identify the requirements for low power.
2. Distinguish static and dynamic power dissipations.
3. Apply voltage scaling approaches to reduce dynamic power.
4. Apply various methods to minimize switched capacitance.
5. Identify suitable leakage power minimization technique.
6. Describe low power design methodologies such as adiabatic circuits.

**DSP PROCESSORS AND ARCHITECTURES  
(PE-IV)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

1. To familiarize with the Architecture and interfacing of TMS320C54XX processors.
2. Conversant with applications of DSP processors.

**UNIT I**

**Computational Accuracy in DSP Implementations:** Number formats for signals and coefficients in DSP systems, dynamic range and precision, sources of error in DSP implementations, A/D Conversion errors, DSP computational errors, D/A conversion errors, compensating filter.

**UNIT II**

**Architectures for Programmable DSP Devices:** Basic architectural features, DSP computational building blocks, bus architecture and memory, data addressing capabilities, address generation unit, programmability and program execution, speed issues, features for external interfacing.

**UNIT III**

**Programmable Digital Signal Processors – TMS320C54XX:** Data addressing modes, memory space, program control, instructions and programming, on-chip peripherals, interrupts pipeline operation.

**Analog Devices Family of DSP Devices:** Analog devices family of DSP devices- ALU and MAC block diagram, shifter instruction, base architecture of ADSP 2100, ADSP-2181 high performance processor.

**UNIT IV**

**Blackfin Processor:** Introduction to Blackfin processor-The Blackfin Processor, introduction to micro signal architecture, overview of hardware processing units and register files, address arithmetic unit, control unit, bus architecture and memory, basic peripherals.

**UNIT V**

**Applications of Programmable DSP Devices:** Introduction, DSP- based biotelemetry receiver: Pulse Position Modulation, decoding scheme for the PPM Receiver, biotelemetry receiver implementation, ECG signal processing for heart rate determination, brain tumor detection using DSP processor.

### **TEXT BOOKS**

1. Avtar Singh and S. Srinivasan –,"Digital Signal Processing", Thomson Publications, 2004.
2. K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, "A practical Approach to Digital Signal Processing", New Age International, 2006/2009

### **REFERENCE BOOKS**

1. Woon-Seng Gan, Sen M. Kuo, "Embedded Signal Processing with the Micro signal Architecture", Wiley - IEEE Press, 2007.
2. B. Venkataramani and M. Bhaskar, "Digital Signal Processors, Architecture, Programming and Applications", 2004, TMH.
3. Jonatham Stein, "Digital Signal Processing", John Wiley, 2005.

### **Course Outcomes:**

Upon successful completion of the course, the students will be able to

1. Understand the concepts of Computational Accuracy, calculate DSP computational Errors and apply the concepts of Sampling, DFT and Filters.
2. Identify the Architectural features of Programmable DSP Devices.
3. Understand the concepts of Programmable DSP TMS320C54XX
4. Acquire the knowledge regarding Analog Devices Family of DSP Devices and interface I/O and memory devices with DSP Processors.
5. Familiarize with the concepts of Blackfin Processor.
6. Learn the different applications of Programmable DSP Devices.

**SIMULATION AND MATHEMATICAL MODELING  
(PE-IV)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

1. To familiarize with the concepts of Mathematical Modeling.
2. To familiarize with Mathematical Models in different fields.
2. To learn different Simulation Techniques.

**UNIT I**

**Mathematical Modelling Concepts:** Concepts of mathematical modelling; open and closed systems; limitations of mathematical modelling; properties of mathematical modelling; needs and techniques used; areas of applications; discussion on non-uniqueness of models.

**UNIT II**

**Classification of Mathematical Modelling:** Classification of mathematical models in terms of areas of application; Classification in terms of the types of mathematics used: Graphical models, models using algebra, models using differential equations (ordinary and partial both); models using difference equations; models using calculus of variations and dynamic programming, etc.

**UNIT III**

**Procedure and Techniques of Mathematical Modelling:** Real problems, identification of parameters, significant parameters, parameters of importance, reduction of an open problem to a closed form, conversion of a real problem into a mathematical problem; identification of problem to be modelled; quest for a mathematical technique for solution; importance of numerical techniques; computer simulation; physical interpretation; illustrations.

**UNIT IV**

**Mathematical Models in Different Fields:** Classical and continuous models, Deterministic, probabilistic and stochastic models; Case studies in problems of physics, chemistry, engineering, biological sciences, genetics, economics, defence, meteorology, music, languages and literature, chaos, synchronization, sports etc.

**UNIT V**

**Simulation:** Barterning model, Basic optimization, Basic probability, Monte-Carlo simulation, Approaches to differential equation: Heun method, Local stability theory: Bernoulli Trials, General techniques for simulating continuous

random variables, simulation from Normal and Gamma distributions, simulation from discrete probability distributions, simulating a non – homogeneous Poisson Process and queuing system.

### **TEXT BOOKS**

1. J. N. Kapoor, Mathematical Modelling, Wiley Eastern Limited.
2. J. N. Kapoor, Mathematical Modelling in biology and medicine, Affiliated East-West Press Pvt. Ltd.
3. Edward A. Bender., An Introduction to Mathematical Modelling.
4. S.M. Ross, Simulation, India Elsevier Publication.

### **REFERENCE BOOKS**

1. C. Fowler Mathematical Models in Applied Sciences, Cambridge University Press
2. A. M .Law and W. D. Kelton. Simulation Modelling and Analysis, T.M.H. Edition.

### **Course Outcomes:**

At the end of this course, the student will be able to

1. Understand the Mathematical modelling concepts.
2. Familiarize with Classification of Mathematical modelling.
3. Learn Procedure and techniques of Mathematical modelling.
4. Acquire knowledge related to Identification of Problems to be modelled.
5. Learn Mathematical models in different fields.
6. Understand various Simulation Techniques.

**SOFTWARE DEFINED RADIO  
(PE-IV)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

1. To understand an in-depth knowledge of wireless RF hardware design issues
2. To evaluate the performances by implementing a test-bed using Software defined radio.

**UNIT I**

**Introduction:** The Need for Software Radios, What is Software Radio, Characteristics and benefits of software radio- Design Principles of Software Radio, RF Implementation issues- The Purpose of RF Front – End, Dynamic Range- The Principal Challenge of Receiver Design – RF Receiver Front- End Topologies- Enhanced Flexibility of the RF Chain with Software Radios- Importance of the Components to Overall Performance- Transmitter Architectures and Their Issues- Noise and Distortion in the RF Chain, ADC and DAC Distortion.

**UNIT II**

**Profile and Radio Resource Management:** Communication Profiles- Introduction, Communication Profiles, Terminal Profile, Service Profile , Network Profile, User Profile, Communication Profile Architecture, Profile Data Structure, XML Structure, Distribution of Profile Data, Access to Profile Data, Management of Communication Profiles, Communication Classmarks, Dynamic Classmarks for Reconfigurable Terminals, Compression and Coding, Meta Profile Data.

**UNIT III**

**Radio Resource Management in Heterogeneous Networks:** Introduction, Definition of Radio Resource Management, Radio Resource Units over RRM Phases, RRM Challenges and Approaches, RRM Modelling and Investigation Approaches, Investigations of JRRM in Heterogeneous Networks, Measuring Gain in the Upper Bound Due to JRRM, Circuit-Switched System, Packet-Switched System, Functions and Principles of JRRM, General Architecture of JRRM, Detailed RRM Functions in Sub-Networks and Overall Systems.

**UNIT IV**

**Reconfiguration of the Network Elements:** Introduction, Reconfiguration of Base Stations and Mobile Terminals, Abstract Modelling of Reconfigurable Devices, the Role of Local Intelligence in Reconfiguration, Performance Issues,

Classification and Rating of Reconfigurable Hardware, Processing Elements, Connection Elements, Global Interconnect Networks, Hierarchical Interconnect Networks, Installing a New Configuration, Applying Reconfiguration Strategies, Reconfiguration Based on Comparison, Resource Recycling, Flexible Workload Management at the Physical Layer, Optimised Reconfiguration, Optimisation Parameters and Algorithms, Optimization Algorithms, Specific Reconfiguration Requirements, Reconfiguring Base Stations, Reconfiguring Mobile Terminals.

## **UNIT V**

**Object – Oriented Representation of Radios and Network Resources:** Networks- Object Oriented Programming- Object Brokers- Mobile Application Environments- Joint Tactical Radio System. Case Studies in Software Radio Design: Introduction and Historical Perspective, SPEAK easyJTRS, Wireless Information Transfer System, SDR-3000 Digital Transceiver Subsystem, Spectrum Ware, CHARIOT.

## **TEXT BOOKS**

1. Markus Dillinger, Kambiz Madani, “Software Defined Radio Architecture System and Functions”, WILEY 2003
2. Walter Tuttle Bee, “Software Defined Radio: Enabling Technologies”, 2002, Wiley Publications.

## **REFERENCE BOOKS**

1. Jeffrey H. Reed, “Software Radio: A Modern Approach to Radio Engineering”, 2002, PEA Publication.
2. Paul Burns, “Software Defined Radio for 3G”, 2002, Artech House.
3. Markus Dillinger, Kambiz Madani, Nancy Alonistioti, “Software Defined Radio: Architectures, Systems and Functions”, 2003, Wiley.
4. Joseph Mitola, “Software Radio Architecture: Object Oriented Approaches to wireless System Engineering”, 2000, John Wiley & Sons.

## **Course Outcomes:**

Upon completing this course, the student will be able to:

1. Understand basic design issues of physical RF hardware blocks
2. Apply the knowledge of wireless communication systems and signal processing filters, designs using Software defined radio.
3. Classify communication profiles.
4. Study the RRM Architecture.
5. Acquire the knowledge of Reconfiguration of the Network.
6. Gain the knowledge of Object – Oriented Programming.

**B.Tech. VII Semester**

**COURSE CODE: ---**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OPEN ELECTIVE-II**

**Internal Marks: 30**

**External Marks: 70**

The student can choose any one OE-II subject offered by other Branches. The list of OEs are available in Course Structure.

**MICROWAVE AND OPTICAL COMMUNICATIONS LAB****Internal Marks: 20****External Marks: 30****Course Objectives:**

1. To expose to characterization of microwave components and measurements at microwave frequencies.
2. To familiarize with the fiber optic communication system.

**List of Experiments:****Part – A:** (Minimum 7)

1. Reflex Klystron characteristics.
2. Gunn diode characteristics.
3. Attenuation measurement.
4. Directional coupler characteristics.
5. VSWR Measurement.
6. Impedance measurement.
7. Waveguide parameters measurement.
8. S matrix of Circulator.
9. S matrix of Magic Tee.

**Part – B:** (Minimum 5)

1. Characterization of LED.
2. Characterization of Laser diode.
3. Intensity modulation of laser output through an optical fiber
4. Measurement of data rate for digital optical link.
5. Measurement of numerical aperture.
6. Measurement of losses in plastic fiber.

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Equipment Required for Laboratories:**

- |  |  |
|--|--|
| 1. Regulated Klystron Power Supply, Klystron mount | 13. SS Tuner                               |
| 2. VSWR Meter                                      | 14. Directional Coupler                    |
| 3. Micro Ammeter                                   | 15. E, H, Magic Tees                       |
| 4. Multi meter                                     | 16. Circulators, Isolator                  |
| 5. CRO   | 17. Matched Loads                          |
| 6. GUNN Power Supply, Pin Modulator                | 18. Pyramidal Horn and Parabolic Antennas  |
| 7. Crystal Diode detector                          | 19. Turntable for Antenna Measurements     |
| 8. Micro wave components (Attenuation)             | 20. HFSS Software                          |
| 9. Frequency Meter                                 | 21. Fiber Optic Analog Trainer based LED   |
| 10. Slotted line carriage                          | 22. Fiber Optic Analog Trainer based laser |
| 11. Probe detector                                 | 23. Fiber Optic Digital Trainer            |
| 12. Wave guide shorts                              | 24. Fiber cables - (Plastic, Glass)        |

**Course Outcomes:**

Upon the completion of this course, students will be able to

1. Obtain the characteristics of microwave components.
2. Predict the scattering matrix of microwave components.
3. Measure signal parameters at microwave frequencies.
4. Find numerical aperture of an optical fiber.
5. Demonstrate the characteristics of LED and LASER
6. Obtain the characteristics of analog and digital optical links.

**DATA COMMUNICATIONS AND COMPUTER NETWORKS LAB****Internal Marks: 20****External Marks: 30****Course Objectives:**

This course will enable students to:

1. Choose suitable tools to model a network and understand the protocols at various OSI reference levels.
2. Design a suitable network and simulate using a Network simulator tool.
3. Simulate the networking concepts and protocols using C/C++ programming.
4. Model the networks for different configurations and analyze the results.

**List of Experiments:**

**Note:** Any **SIX** of the following experiments from each part are to be conducted **(Total-12)**

**PART-A:** Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/QualNet or any other equivalent tool

1. Implement a point to point network with four nodes and duplex links between them. Analyze the network performance by setting the queue size and varying the bandwidth.
2. Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3.
3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.
4. Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data rate.
5. Implement Ethernet LAN using n nodes and assign multiple traffic to the nodes and obtain congestion window for different sources/ destinations.
6. Implement ESS with transmission nodes in Wireless LAN and obtain the performance parameters.
7. Implementation of Link state routing algorithm.

**PART-B:** Implement the following in C/C++/Java or any other equivalent tool

1. Write a program for a HDLC frame to perform the following.
  - i) Bit stuffing
  - ii) Character stuffing.
2. Write a program for distance vector algorithm to find suitable path for transmission.
3. Implement Dijkstra's algorithm to compute the shortest routing path.

4. For the given data, use CRC-CCITT polynomial to obtain CRC code. Verify the program for the cases without error
5. For the given data, use CRC-CCITT polynomial to obtain CRC code. Verify the program for the cases with error
6. Implementation of Stop and Wait Protocol and Sliding Window Protocol
7. Write a program for congestion control using leaky bucket algorithm

**Software Required:**

Simulation of the above experiments to be conducted using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/QualNet and C/C++/Java or any other equivalent tool.

**Note:** Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

**Course Outcomes:**

Upon the completion of this course, students will be able to

1. Analyze the terminology and concepts of the OSI and TCP-IP reference model.
2. Use the network simulator for learning and practice of networking algorithms.
3. Illustrate the operations of network protocols and algorithms using C programming.
4. Simulate the network with different configurations to measure the performance parameters.
5. Implement the data link and routing protocols using C programming.
6. Learn addressing mechanisms efficiently to build a network.

**PROJECT STAGE-I****Internal Marks: 20****External Marks: 30****Syllabus Contents:**

The project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The project should have the following

1. Relevance to social needs of society
2. Relevance to value addition to existing facilities in the institute
3. Relevance to industry need
4. Problems of national importance
5. Research and development in various domain

The student should complete the following in project Stage I:

1. Literature survey Problem Definition
2. Motivation for study and Objectives
3. Preliminary design / feasibility / modular approaches
4. Implementation and Verification
5. Report and presentation

**Guidelines for Project Stage – I :**

1. As per the AICTE directives, the project is a yearlong activity, to be carried out and evaluated in two stages i.e. Stage – I: VII Semester and Stage – II: VIII Semester.
2. The project may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.
3. After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define project objectives. The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, white papers, product catalogues should be referred and reported.
4. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and stage wise work distribution, and submit the proposal within a month from the date of registration.

5. Stage – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, a record of continuous progress.

6. Stage – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Stage-I work.

**Course Outcomes:**

At the end of the course, the student will be able to

1. Synthesize knowledge and skills previously gained.
2. Apply an in-depth study and execution of new technical problem.
3. Select from different methodologies, methods.
4. Form analysis to produce a suitable research design, and justify their design.
5. Present the findings of their technical solution in a written report.
6. Present the work in International/ National conference or reputed journals.

**B.Tech. VII Semester**

**COURSE CODE: UR19PROJEC702**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>

**SUMMER INTERNSHIP**

**Internal Marks: 100**

**External Marks: 0**

The candidate shall submit the comprehensive report to the department. The report will be evaluated for 100 marks by the Review Committee consisting of Head of the department, Program Coordinator and Industry Institute Interaction Coordinator.

## WIRELESS NETWORKS

**Internal Marks: 30**

**External Marks: 70**

### Course Objectives:

1. To learn about fundamentals of Ad-hoc wireless networks.
2. To learn about different types of MAC and ad-hoc routing protocols.
3. Be expose to the TCP issues in Ad-hoc networks.
4. Learn the architecture and protocols of wireless sensor networks.
5. To learn about Qos and different power management schemes.

### UNIT I

**Introduction:** Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs): concepts and architectures. Applications of Ad Hoc and Sensor networks, Design Challenges in Ad hoc and Sensor Networks.

### UNIT II

**Mac Protocols for Ad Hoc Wireless Networks:** Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols- Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11

### UNIT III

**Routing Protocols and Transport Layer In Ad Hoc Wireless Networks:** Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

### UNIT IV

**Wireless Sensor Networks (WSNS) and Mac Protocols:** Single node architecture: hardware and software components of a sensor node - WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

### UNIT V

**WSN Routing, localization & QOS:** Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative

localization, triangulation-QoS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.

### **TEXT BOOK**

1. C. Siva Ram Murthy and B. S. Manoj, –Ad Hoc Wireless Networks Architectures and Protocols||, Prentice Hall, PTR, 2004.

### **REFERENCE BOOKS**

1. Carlos De Moraes Cordeiro, Dharma Prakash Agrawal –Ad Hoc & Sensor Networks: Theory and Applications||, World Scientific Publishing Company, 2006.

2. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication - 2002.

3. Holger Karl and Andreas Willig –Protocols and Architectures for Wireless Sensor Networks||, Wiley, 2005

4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, –Wireless Sensor Networks-Technology, Protocols, and Applications||, John Wiley, 2007.

5. Anna Hac, –Wireless Sensor Network Designs||, John Wiley, 2003.

### **Course Outcomes:**

After Completion of the course, the student is able to

1. Understand the basic concepts of Wireless Communication Technology.
2. Learn and analyze the Mac Protocols for Ad Hoc Wireless Networks.
3. Analyze the protocol design issues of Routing Protocols
4. Learn the concepts of Transport Layer in Ad Hoc Wireless Networks
5. Familiar with network architectures and applications of ad hoc wireless sensor networks.
6. Evaluate the QoS related performance measurements of ad hoc and sensor networks

**SATELLITE COMMUNICATIONS  
(PE-V)**

**Internal Marks: 30  
External Marks: 70**

**Course Objectives:**

The student will be introduced to:

1. Understand the basic concepts, applications, frequencies used and types of satellite communications.
2. Understand the concept of look angles, launches and launch vehicles and orbital effects in satellite communications.
3. Understand the various satellite subsystems and its functionality.
4. Understand the concepts of satellite link design and calculation of C/N ratio.
5. Understand the concepts of multiple access and various types of multiple access techniques in satellite systems.
6. Understand the concepts of satellite navigation, architecture and applications of GPS.

**UNIT I**

**Introduction:** Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

**Orbital Mechanics and Launchers:** Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance.

**UNIT II**

**Satellite Subsystems:** Attitude and orbit control system, telemetry, tracking, Command and monitoring, power systems, communication subsystems, Satellite antenna, Equipment reliability and Space qualification.

**Satellite Link Design:** Basic transmission theory, system noise temperature and G/T ratio, Design of down links, up link design, Design of satellite links for specified C/N, System design example.

**UNIT III**

**Multiple Access:** Frequency division multiple access (FDMA) Intermodulation, Calculation of C/N. Time division Multiple Access (TDMA) Frame structure, Examples. Satellite Switched TDMA Onboard processing, DAMA, Code Division Multiple access (CDMA), Spread spectrum transmission and reception.

#### **UNIT IV**

**Earth Station Technology:** Introduction, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial interface, Primary power test methods.

**Low Earth Orbit and Geo-Stationary Satellite Systems:** Orbit consideration, coverage and frequency considerations, Delay & Throughput considerations, System considerations, Operational NGSO constellation Designs

#### **UNIT V**

**SATELLITE NAVIGATION & THE GLOBAL POSITIONING SYSTEM:** 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. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2<sup>nd</sup> Edition, 2003.
2. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, 2<sup>nd</sup> Edition, Pearson Publications, 2003.

#### **REFERENCE BOOKS**

1. Satellite Communications: Design Principles – M. Richharia, BS Publications, 2<sup>nd</sup> Edition, 2003.
2. Satellite Communication - D.C Agarwal, Khanna Publications, 5<sup>th</sup> Ed

#### **Course Outcomes:**

At the end of this course the student can able to:

1. Understand the History, basic concepts and applications of Satellite Communications.
2. Learn about the subsystems of Satellite communications and derive the expression for G/T ratio and to solve some analytical problems on satellite link design.
3. Understand the various types of multiple access techniques
4. Learn about Spread spectrum transmission and reception
5. Familiar with architecture of earth station design.
6. Understand the concepts of GPS and its architecture.

**VLSI TESTING & TESTABILITY  
(PE-V)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

The student will be introduced to:

1. Basic concepts of VLSI Testing and Logic and Fault Simulation.
2. Understand the concepts of Testability Measures, Built-in Self Test and Boundary Scan Standard.

**UNIT I**

**Introduction to Testing:** Testing Philosophy, Role of Testing, Digital and Analog VLSI Testing, VLSI Technology Trends affecting Testing, Types of Testing, Fault Modeling: Defects, Errors and Faults, Functional Versus Structural Testing, Levels of Fault Models, Single Stuck-at Fault.

**UNIT II**

**Logic and Fault Simulation:** Simulation for Design Verification and Test Evaluation, Modeling Circuits for Simulation, Algorithms for True-value Simulation, Algorithms for Fault Simulation.

**UNIT III**

**Testability Measures:** SCOAP Controllability and Observability, High Level Testability Measures, Digital DFT and Scan Design: Ad-Hoc DFT Methods, Scan Design, Partial-Scan Design, Variations of Scan.

**UNIT IV**

**Built-In Self-Test:** The Economic Case for BIST, Random Logic BIST: Definitions, BIST Process, Pattern Generation, Response Compaction, Built-In Logic Block Observers, Test-Per-Clock, Test-Per-Scan BIST Systems, Circular Self Test Path System, Memory BIST, Delay Fault BIST.

**UNIT V**

**Boundary Scan Standard:** Motivation, System Configuration with Boundary Scan: TAP Controller and Port, Boundary Scan Test Instructions, Pin Constraints of the Standard, Boundary Scan Description Language: BSDL Description Components, Pin Descriptions.

**TEXT BOOK**

1. Essentials of Electronic Testing for Digital, Memory and Mixed Signal VLSI Circuits -M.L. Bushnell, V. D. Agrawal, Kluwer Academic Publishers.

## **REFERENCE BOOKS**

1. Digital Systems and Testable Design - M. Abramovici, M. A. Breuer and A.D Friedman, Jaico Publishing House.
2. Digital Circuits Testing and Testability - P. K. Lala, Academic Press.

## **Course Outcomes:**

At the end of this course, the student will be able to:

1. Understand the basic concepts of VLSI Testing, Types of Testing and Levels of Fault Models.
2. Understand the concept of Logic and Fault Simulation and Algorithms for Fault Simulation.
3. Understand the concepts of Testability Measures.
4. Get familiarize with the concept of Digital DFT and Scan Design Methods.
5. Acquire the knowledge of Built-in Self Test Concept.
6. Learn the concepts of Boundary Scan Standard.

**MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE  
(PE-V)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

1. To learn the distinction between optimal reasoning vs. human like reasoning
2. To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
3. To learn different knowledge representation techniques.
4. To understand the applications of AI, namely game playing, theorem proving, and machine learning.

**UNIT I**

**Problem Solving by Search-I:** Introduction to AI, Intelligent Agents

**Problem Solving by Search -II:** Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform cost search, Depth-first search, Iterative deepening Depth-first search, Bidirectional search, Informed (Heuristic) Search Strategies: Greedy best-first search, A\* search, Heuristic Functions, Beyond Classical Search: Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces, Searching with Non-Deterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environment.

**UNIT II**

**Problem Solving by Search-II and Propositional Logic:** Adversarial Search: Games, Optimal Decisions in Games, Alpha-Beta Pruning, Imperfect Real-Time Decisions.

**Constraint Satisfaction Problems:** Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

**Propositional Logic:** Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses, Forward and backward chaining, Effective Propositional Model Checking, Agents Based on Propositional Logic.

**UNIT III**

**Logic and Knowledge Representation First-Order Logic:** Representation, Syntax and Semantics of First-Order Logic, Using 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.

**Knowledge Representation:** Ontological Engineering, Categories and Objects, Events. Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information.

#### **UNIT IV**

##### **Planning:**

**Classical Planning:** Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches.

**Planning and Acting in the Real World:** Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

#### **UNIT V**

##### **Uncertain knowledge and Learning:**

**Uncertainty:** Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use

**Probabilistic Reasoning:** Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First-Order Probability, Other Approaches to Uncertain Reasoning; Dempster-Shafer theory.

**Learning:** Forms of Learning, Supervised Learning, Learning Decision Trees. Knowledge in Learning: Logical Formulation of Learning, Knowledge in Learning, Explanation-Based Learning, Learning Using Relevance Information, Inductive Logic Programming.

#### **TEXT BOOK**

1. Machine Learning and Artificial Intelligence, Ameet V Joshi, Springer International Publishing, 1st ed. 2020.
2. Artificial Intelligence A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

#### **REFERENCE BOOKS**

1. Artificial Intelligence, 3rd Edn., E. Rich and K. Knight (TMH)
2. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, Pearson Education.
3. Artificial Intelligence, Shivani Goel, Pearson Education.
4. Artificial Intelligence and Expert systems – Patterson, Pearson Education

#### **Course Outcomes:**

At the end of this course, the student will be able to

1. Learn the basic Concepts of Artificial Intelligence and formulate an efficient problem space for a problem expressed in natural Language.

2. Select a search algorithm for a problem and estimate its time and space complexities.
3. Understand the concept of First Order Logic and Inference in First Order Logic.
4. Possess the skill for representing knowledge using the appropriate technique for a given problem.
5. Get familiarize with concepts of Planning, Classical Planning and Acting in the Real World.
6. Possess the ability to apply AI techniques to solve problems of game playing, and machine learning.

**COMPUTER VISION  
(PE-V)**

**Internal Marks: 30  
External Marks: 70**

**Course Objectives:**

1. Be familiar with both the theoretical and practical aspects of computing with images.
2. Have described the foundation of image formation, measurement, and analysis.
3. Have implemented common methods for robust image matching and alignment.
4. Understand the geometric relationships between 2D images and the 3D world.
5. Have gained exposure to object and scene recognition and categorization from images.
6. Able to develop the practical skills necessary to build computer vision applications.

**UNIT I**

**Image Formation Models:** Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems, Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration. Apparel, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration. Apparel, Stereo vision

**UNIT II**

**Feature Extraction:** Image representations (continuous and discrete), Edge detection, Edge linking, corner detection, texture, binary shape analysis, boundary pattern analysis, circle and ellipse detection, Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.

**UNIT III**

**Shape Representation and Segmentation:** Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multi-resolution analysis, Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation

## **UNIT IV**

**Motion Detection and Estimation:** Regularization theory, Optical computation, Stereo Vision, Motion estimation, Background Subtraction and Modelling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation • Structure from motion, Motion Tracking in Video

**Object recognition:** Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition.

## **UNIT V**

**Applications of Computer Vision:** Automated Visual Inspection, Inspection of Cereal Grains, Surveillance, In-Vehicle Vision Systems, CBIR, CBVR, Activity Recognition, computational photography, Biometrics, stitching and document processing

## **TEXT BOOKS**

1. D. Forsyth and J. Ponce, "Computer Vision - A modern approach", 2nd Edition, Pearson Prentice Hall, 2012
2. Szeliski, Richard, "Computer Vision: Algorithms and Applications", 1st Edition, Springer-Verlag London Limited, 2011.
3. Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", 2nd Edition, Cambridge University Press, 2004.

## **REFERENCE BOOKS**

1. K. Fukunaga, "Introduction to Statistical Pattern Recognition", 2<sup>nd</sup> Edition, Morgan Kaufmann, 1990.
2. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 3rd Edition, Prentice Hall, 2008.
3. B. K. P. Horn, "Robot Vision", 1st Edition, McGraw-Hill, 1986.
4. E. R. Davies "Computer and Machine Vision: Theory, Algorithms, Practicalities", 4<sup>th</sup> Edition, Elsevier Inc, 2012

## **Course Outcomes:**

At the end of the course, the student will be able to

1. Demonstrate knowledge and understanding of Human and computer vision systems.
2. Study the image formation models and feature extraction for computer vision.
3. Identify the segmentation and motion detection and estimation techniques.
4. Analyze and design a range of algorithms for image processing and computer vision
5. Develop and evaluate solutions to problems in computer vision
6. Develop small applications and detect the objects in various applications.

**NETWORK SECURITY AND CRYPTOGRAPHY  
(PE-V)**

**Internal Marks: 30**

**External Marks: 70**

**Course Objectives:**

1. To understand Security concepts.
2. To understand the Cryptography Techniques.
3. To understand the Authentication.

**UNIT I**

**Security:** Need, security services, Attacks, OSI Security Architecture, one time passwords, Model for Network security, Classical Encryption Techniques like substitution ciphers, Transposition ciphers, Cryptanalysis of Classical Encryption Techniques.

**UNIT II**

**Number Theory:** Introduction, Fermat's and Euler's Theorem, The Chinese Remainder Theorem, Euclidean Algorithm, Extended Euclidean Algorithm, and Modular Arithmetic.

**UNIT III**

**Private-Key (Symmetric) Cryptography:** Block Ciphers, Stream Ciphers, RC4 Stream cipher, Data Encryption Standard (DES), Advanced Encryption Standard (AES), Triple DES, RC5, IDEA, Linear and Differential Cryptanalysis.

**UNIT IV**

**Public-Key (Asymmetric) Cryptography:** RSA, Key Distribution and Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography, Message Authentication Code, hash functions, message digest algorithms: MD4 MD5, Secure Hash algorithm, RIPEMD-160, HMAC.

**UNIT V**

**Authentication:** IP and Web Security Digital Signatures, Digital Signature Standards, Authentication Protocols, Kerberos, IP security Architecture, Encapsulating Security Payload, Key Management, Web Security Considerations, Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction. System Security- Intruders, Intrusion Detection, Password Management, Worms, viruses, Trojans, Virus Counter measures, Firewalls, Firewall Design Principles, Trusted Systems.

## **TEXT BOOKS**

1. William Stallings, "Cryptography and Network Security, Principles and Practices", Pearson Education, 3rd Edition.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security, Private Communication in a Public World", Prentice Hall, 2nd Edition.

## **REFERENCE BOOKS**

1. Christopher M. King, Ertem Osmanoglu, Curtis Dalton, "Security Architecture, Design Deployment and Operations", RSA Press.
2. Stephen Northcutt, Leny Zeltser, Scott Winters, Karen Kent, and Ronald W. Ritchey, "Inside Network Perimeter Security", Pearson Education, 2nd Edition.
3. Richard Bejtlich, "The Practice of Network Security Monitoring: Understanding Incident.

## **Course Outcomes:**

At the end of the course, the student will be able to

1. Identify and utilize different forms of cryptography techniques.
2. Incorporate authentication and security in the network applications.
3. Distinguish among different types of threats to the system and handle the same.
4. Provide security of the data over the network.
5. Do research in the emerging areas of cryptography and network security.
6. Implement various networking protocols.

**B.Tech. VIII Semester**

**COURSE CODE: ---**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OPEN ELECTIVE-III**

**Internal Marks: 30**

**External Marks: 70**

The student can choose any one OE-III subject offered by other Branches. The list of OEs are available in Course Structure.

## PROJECT STAGE-II

**Internal Marks: 60**

**External Marks: 90**

### **Syllabus Contents:**

The project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The project should have the following

1. Relevance to social needs of society
2. Relevance to value addition to existing facilities in the institute
3. Relevance to industry need
4. Problems of national importance
5. Research and development in various domain

The student should complete the following:

The project stage II is based on a report prepared by the students on project topic allotted to them. It may be based on:

1. Experimental verification / Proof of concept.
2. Design, fabrication, testing of Communication System.
3. The viva-voce examination will be based on the above report and work.

### **Guidelines for Project Stage - II**

1. As per the AICTE directives, the project is a yearlong activity, to be carried out and evaluated in two stages i.e. Stage - I: VII Semester and Stage - II: VIII Semester.
2. The project may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.
3. After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define project objectives. The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.
4. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and stage wise

work distribution, and submit the proposal within a month from the date of registration.

7. During Stage – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

8. Stage – II deliverables: A project report as per the specified format, developed system in the form of hardware and/or software, a record of continuous progress.

9. Stage – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q &A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work.

### **Course Outcomes:**

At the end of the course, the student will be able to

1. Synthesize knowledge and skills previously gained.
2. Apply an in-depth study and execution of new technical problem.
3. Select from different methodologies, methods.
4. Form analysis to produce a suitable research design, and justify their design.
5. Present the findings of their technical solution in a written report.
6. Present the work in International/ National conference or reputed journals.

**Open Electives syllabus offered by the Dept. of ECE**

B.Tech. VI Semester

COURSE CODE: UR19OEEC601

L	T	P	C
3	0	0	3

**CONSUMER ELECTRONICS**  
**(not for ECE)**  
**(OE-I)**

**Internal Marks: 30**  
**External Marks: 70**

**Course Objectives:**

The objective of this course is to make students acquire required knowledge to

1. Troubleshoot different types of microphones.
2. Troubleshoot audio systems
3. Test working of various colour TV
4. Troubleshoot colour TV receivers.
5. Maintain various electronic home appliances

**UNIT I**

**Audio Fundamentals and Devices:** Basic characteristics of sound signal: level and loudness, pitch, frequency response, fidelity and linearity, Reverberation, Audio level metering, decibel level in acoustic measurement, Microphone: working principle, sensitivity, nature of response, directional characteristics, Types: carbon, condenser, crystal, electrets, tie- clip, wireless, Loud speaker: working principle, characteristic impedance, watt capacity, Types: electrostatic, dynamic, permanent magnet etc , woofers and tweeters, Sound recording: Optical recording, stereophony and multichannel sound, MP3 standard

**UNIT II**

**Audio Systems:** Audio system: CD player, home theatre sound system, surround sound, Digital console: block diagram, working principle, applications, FM tuner: concepts of digital tuning, ICs used in FM tuner TDA 7021T 2.4 PA address system: planning, speaker impedance matching, Characteristics, power amplifier, Specification

**UNIT III**

**Television Systems:** Monochrome TV standards, scanning process, aspect ratio, persistence of vision and flicker, interlace scanning, picture resolution, Composite video signal: horizontal and vertical sync details, scanning sequence, Colour TV standards, colour theory, hue, brightness, saturation, luminance and chrominance, Different types of TV camera, Transmission standards: PAL system, channel bandwidth

## **UNIT IV**

**Television Receivers and Video Systems:** PAL-D colour TV receiver, block diagram, Precision IN Line colour picture tube, Digital TVs:- LCD, LED, PLASMA, HDTV, 3-D TV, projection TV, DTH receiver, Video interface: Composite, Component, Separate Video, Digital Video, SDI, HDMI Multimedia Interface) , Digital Video Interface, CD and DVD player: working principles, interfaces

## **UNIT V**

**Home/Office Appliances:** FAX and Photocopier, Microwave Oven: types, single chip controllers, wiring and safety instructions, technical specifications, Washing Machine: wiring diagram, electronic controller for washing machine, technical specifications and types of washing machine, fuzzy logic, Air conditioner and Refrigerators: Components features, applications, and technical specification, Digital camera and cam coder: - pick up devices - picture processing - picture storage

## **TEXT BOOKS**

1. Consumer Electronics by Bali S.P., Pearson Education India,2010, latest edition
2. Audio video systems: principle practices & troubleshooting, Khanna Book Publishing Co. (P) Ltd., 2010Delhi , India, latest edition

## **REFERENCE BOOKS**

1. Modern Television practices by Gulati R.R., New Age International Publication (P) Ltd. New Delhi Year 2011, latest edition
2. Audio video systems by Gupta R.G., Tata Mcgraw Hill, New Delhi, India 2010, , latest edition
3. Mastering Digital Television by Whitaker Jerry & Benson Blair, McGraw-Hill Professional, 2010, latest edition
4. Standard handbook of Audio engineering by Whitaker Jerry & Benson Blair, McGraw-Hill Professional, 2010 , latest edition

## **Course Outcomes:**

At the end of this course, the student will be able to

1. Acquire knowledge of Audio Fundamentals and Devices.
2. Learn about different types of Audio Systems.
3. Understand the basic concepts of TV.
4. Get familiar with the concepts of Colour TV and its standards.
5. Understand the concepts of Television Receivers and Video Systems
6. Learn the basic concepts related to Home/Office Appliances that are used in our day-to-day life.

**DIGITAL ELECTRONICS**  
**(not for ECE)**  
**(OE-I)**

**Internal Marks: 30**  
**External Marks: 70**

**Course Objectives:**

1. To understand common forms of number representation in logic circuits.
2. To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
3. To understand the concepts of combinational logic circuits and sequential circuits.
4. To understand the Realization of Logic Gates Using Diodes & Transistors.

**UNIT I**

**Number Systems:** Number systems, Complements of Numbers, Codes-Weighted and Non-Weighted codes and its Properties, Parity check code and Hamming code.

**Boolean Algebra:** Basic Theorems and Properties, Switching Functions-Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations.

**UNIT II**

**Minimization of Boolean functions:** Karnaugh Map Method - Up to five Variables, Don't Care Map Entries, Tabular Method,

**Combinational Logic Circuits:** Adders, Subtractors, comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free Relations.

**UNIT III**

**Sequential Circuits Fundamentals:** Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another.

**Registers and Counters:** Shift Registers- Left, Right and Bidirectional Shift Registers, Applications of Shift Registers - Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters.

**UNIT IV**

**Sequential Machines:** Finite State Machines, Synthesis of Synchronous Sequential Circuits - Serial Binary Adder, Sequence Detector, Parity-bit Generator, Synchronous Modulo N - Counters, Finite state machine- capabilities and limitations, Mealy and Moore models.

## **UNIT V**

**Realization of Logic Gates Using Diodes & Transistors:** AND, OR and NOT Gates using Diodes and Transistors, DCTL, RTL, DTL, TTL and CML Logic Families and its Comparison, Classification of Integrated Circuits.

### **TEXT BOOKS**

1. Switching and Finite Automata Theory – Zvi Kohavi & Niraj K. Jha, 3<sup>rd</sup> Edition, Cambridge, 2010.
2. Modern Digital Electronics – R. P. Jain, 3rd edition, Tata McGraw-Hill, 2007.

### **REFERENCE BOOKS**

1. Digital Design- Morris Mano, PHI, 4th Edition, 2006
2. Introduction to Switching Theory and Logic Design – Fredriac J. Hill, Gerald R. Peterson, 3rd Ed, John Wiley & Sons Inc.
3. Fundamentals of Logic Design- Charles H. Roth, Cengage Learning, 5th, Edition, 2004.
4. Switching Theory and Logic Design – A Anand Kumar, PHI, 2013

### **Course Outcomes:**

At the end of this course the student can able to:

1. Understand the numerical information in different forms and Boolean Algebra theorems.
2. Postulates of Boolean algebra and to minimize combinational functions.
3. Design and analyze combinational and sequential circuits.
4. Design and understand Registers and Counters.
5. Design and understand Sequential Machines.
6. Known about the logic families and realization of logic gates.

**ANALOG AND DIGITAL I.C. APPLICATIONS**  
**(not for ECE)**  
**(OE-I)**

**Internal Marks: 30**  
**External Marks: 70**

**Course Objectives:**

The main objectives of the course are:

1. To introduce the basic building blocks of linear integrated circuits.
2. To introduce the theory and applications of analog multipliers and PLL.
3. To introduce the concepts of waveform generation and introduce some special function ICs.

**UNIT - I**

**Integrated Circuits :** Classification, chip size and circuit complexity, basic information of Op amp, ideal and practical Op-amp, internal circuits, Op-amp characteristics, DC and AC characteristics, 741 op-amp and its features, modes of operation-inverting, non-inverting,differential.

**OP-AMP Applications:** Basic application of Op-amp, instrumentation amplifier, ac amplifier, V to I and I to V converters, sample & hold circuits, multipliers and dividers, Differentiators and Integrators, Comparators.

**UNIT - II**

Schmitt trigger, Multivibrators, introduction to voltage regulators, features of 723.

**Active Filters & Oscillators:** Introduction, 1st order LPF, HPF filters. Band pass, Band reject, and all pass filters. Oscillator types and principle of operation – RC, Wien, and quadrature type, waveform generators – triangular, saw tooth, square wave and VCO.

**UNIT - III**

**Timers & Phase Locked Loops:** Introduction to 555 timer, functional diagram, monostable and astable operations, and applications, Schmitt Trigger. PLL - introduction, block schematic, principles, and description of individual blocks of 565.

**D-A and A- D Converters :** Introduction, basic DAC techniques, weighted resistor DAC, R- 2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs – parallel comparator type ADC, counter type ADC,

successive approximation ADC and dual slope ADC. DAC and ADC specifications.

#### **UNIT - IV**

Classification of Integrated circuits, comparison of various logic families, standard TTL NAND Gate- Analysis & characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tristate outputs, CMOS transmission gate, IC interfacing- TTL driving CMOS & CMOS driving TTL.

Design using TTL-74XX & CMOS 40XX series, code converters, decoders, Demultiplexers, decoders, & drives for LED & LCD display. Encoder, priority Encoder, multiplexers, & their applications, priority generators/checker circuits. Digital arithmetic circuits-parallel binary adder/subtractor circuits using 2's, Complement system. Digital comparator circuits.

#### **UNIT - V**

**Sequential Circuits:** Flip-flops & their conversions. Design of synchronous counters. Decade counter, shift registers, & applications, familiarities with commonly available 74XX & CMOS 40XX series of IC counters.

**Memories:** ROM architecture, types, & applications, RAM architecture, Static & Dynamic RAMs, synchronous DRAMs.

#### **TEXT BOOKS:**

1. Linear Integrated Circuits –D. Roy Choudhury, New Age International (p) Ltd, 2<sup>nd</sup> Ed., 2003.
2. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 1987.

#### **REFERENCES:**

1. Operational Amplifiers & Linear Integrated Circuits – R.F. Coughlin & Fredrick F. Driscoll, PHI, 1977.
2. Operational Amplifiers & Linear Integrated Circuits: Theory & Applications – Denton J. Daibey, TMH.
3. Design with Operational Amplifiers & Analog Integrated Circuits-Sergio Franco, McGraw Hill, 3rd Ed., 2002.
4. Digital Fundamentals – Floyd and Jain, Pearson Education, 8th Edition, 2005.

#### **Course Outcomes:**

Upon completing this course, the student will be able to

1. Understand of operational amplifiers with linear integrated circuits.

2. Attain the knowledge of functional diagrams and applications of IC 555 and IC 565.
3. Acquire the knowledge about the Data converters.
4. Obtain the knowledge about the types of ADC and DAC converters.
5. Identify the different Combinational Logic ICs and their characteristics.
6. Understand of the different Sequential Logic ICs and their characteristics.

**EMBEDDED SYSTEMS**  
**(not for ECE)**  
**(OE-II)**

**Internal Marks: 30**  
**External Marks: 70**

**Course Objectives:**

The main objectives of this course are given below:

1. The basic concepts of an embedded system are introduced.
2. The various elements of embedded hardware and their design principles are explained.
3. Different steps involved in the design and development of firmware for embedded systems is elaborated.
4. Internals of Real-Time operating system and the fundamentals of RTOS based embedded firmware design is discussed.

**UNIT I**

**Introduction:** Embedded system-Definition, history of embedded systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems, the typical embedded system-core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware, Characteristics of an embedded system, Quality attributes of embedded systems, Application-specific and Domain-Specific examples of an embedded system.

**UNIT II**

**Embedded Hardware Design:** Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.

**UNIT III**

**Embedded Firmware Design:** Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross- compiler.

**UNIT IV**

**Real Time Operating System:** Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling, Task communication, Task synchronization, Device Drivers.

**Hardware Software Co-Design:** Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade-offs, Integration of Hardware and Firmware, ICE.

## **UNIT V**

**Embedded System Development:** The integrated development environment, Types of files generated on cross-compilation, Deassembler/Decompiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan, Embedded Software development process and tools.

**Embedded System Implementation and Testing:** The main software utility tool, CAD and the hardware, Translation tools-Pre-processors, Interpreters, Compilers and Linkers, Debugging tools, Quality assurance and testing of the design, Testing on host machine, Simulators, Laboratory Tools.

## **TEXT BOOKS**

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu. K.V - Tata McGraw Hill Education Private Limited, 2013.

## **REFERENCE BOOKS**

1. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
2. Embedded Systems-Lyla B. Das-Pearson Publications, 2013.

## **Course Outcomes:**

At the end of this course the student can able to:

1. Understand the basic concepts of an embedded system and able to know an embedded system design approach to perform a specific function.
2. The hardware components required for an embedded system and the design approach of an embedded hardware.
3. The various embedded firmware design approaches on embedded environment.
4. Understand the concepts of C versus Embedded C and Compiler versus Cross-compiler.
5. Learn fundamentals of RTOS based embedded firmware design.
6. Acquire knowledge of Embedded System Development, Implementation and Testing.

**INTERNET OF THINGS  
(not for ECE)  
(OE-II)**

**Internal Marks: 30  
External Marks: 70**

**Course Objectives:**

1. To learn and understand elements of IoT system.
2. Acquire knowledge about various protocols of IoT.
3. To learn and understand design principles and capabilities of IoT.

**UNIT I: Introduction to IoT**

Introduction to IoT, Architectural Overview, Design principles and needed capabilities, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT.

**UNIT II: Elements of IoT**

Hardware Components- Computing- Arduino, Raspberry Pi, ARM Cortex-A class processor, Embedded Devices – ARM Cortex-M class processor, Arm Cortex-M0 Processor Architecture, Block Diagram, Cortex-M0 Processor Instruction Set, ARM and Thumb Instruction Set.

**UNIT III: IoT Application Development**

Communication, IoT Applications, Sensing, Actuation, I/O interfaces.

Software Components- Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, CoAP, UDP, TCP, Bluetooth.

**Bluetooth Smart Connectivity**

Bluetooth overview, Bluetooth Key Versions, Bluetooth Low Energy (BLE) Protocol, Bluetooth, Low Energy Architecture, PSoC4 BLE architecture and Component Overview.

**UNIT IV: Solution framework for IoT applications**

Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

**UNIT V: IoT Case Studies**

IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation.

**TEXT BOOKS:**

1. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017.
2. The Definitive Guide to the ARM Cortex-M0 by Joseph Yiu, 2011
3. Vijay Madiseti, Arshdeep Bahga, Internet of Things, "A Hands on Approach", University Press, 2015.

**REFERENCE BOOKS**

1. Olivier Hersent, David Boswarthick, Omar Elloumi, –The Internet of Things – Key applications and Protocols, Wiley, 2012
2. The Internet of Things: Applications to the Smart Grid and Building Automation by – Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley - 2012
3. Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press – 2010

**Course Outcomes:**

After Completion of the course the student is able to

1. Understand internet of Things and its hardware and software components
2. Interface I/O devices, sensors & communication modules.
3. Remotely monitor data and control devices.
4. Design real time IoT based applications
5. Understand the IoT Case Studies
6. Identify Elements of IoT.

**PRINCIPLES OF COMPUTER COMMUNICATIONS AND NETWORKS**  
**(not for ECE)**  
**(OE-II)**

**Internal Marks: 30**  
**External Marks: 70**

**Course Objectives:**

1. To understand the concept of computer communication.
2. To learn about the networking concept, layered protocols.
3. To understand various communications concepts.
4. To get the knowledge of various networking equipment.

**UNIT - I**

**Overview of Computer Communications and Networking:** Introduction to Computer Communications and Networking, Introduction to Computer Network, Types of Computer Networks, Network Addressing, Routing, Reliability, Interoperability and Security, Network Standards, The Telephone System and Data Communications.

**UNIT - II**

**Essential Terms and Concepts:** Computer Applications and application protocols, Computer Communications and Networking models, Communication Service Methods and data transmission modes, analog and Digital Communications, Speed and capacity of a Communication Channel, Multiplexing and switching, Network architecture and the OSI reference model. **UNIT - III**

**Analog and Digital Communication Concepts:** Representing data as analog signals, representing data as digital signals, data rate and bandwidth reduction, Digital Carrier Systems.

**UNIT - IV**

**Physical and data link layer Concepts:** The Physical and Electrical Characteristics of wire, Copper media, fiber optic media, wireless Communications. Introduction to data link Layer, the logical link control and medium access control sub-layers.

**UNIT - V**

**Network Hardware Components:** Introduction to Connectors, Transreceivers and media convertors, repeaters, network interference cards and PC cards, bridges, switches, switches Vs Routers.

**TEXT BOOKS:**

1. Computer Communications and Networking Technologies, Michel A. Gallo and William H. Hancock, Thomson Brooks / Cole.
2. Data Communications and Networking – Behrouz A. Forouzan, Fourth Edition MC GRAW HILL EDUCATION, 2006.

**REFERENCE BOOKS:**

1. Principles of Computer Networks and Communications, M. Barry Dumas, Morris Schwartz, Pearson.
2. Computer Networking: A Top-Down Approach Featuring the Internet, James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education.

**Course Outcomes:**

After completion of the course the student is able to

1. Get the knowledge of networking of computers, data transmission between computers.
2. Exposure about the various communication concepts.
3. Get awareness about the structure and equipment of computer network structures.
4. Understand the concepts of Analog and Digital Communications.
5. Familiarize with the the logical link control and MAC layers.
6. Learn different Network Hardware Components

**MICROCONTROLLERS**  
**(not for ECE)**  
**(OE-III)**

**Internal Marks: 30**  
**External Marks: 70**

**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 microcontrollers.
3. To provide strong foundation for designing real world applications using microcontrollers.

**UNIT I**

**Microprocessors and microcontroller::** Introduction, Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von- Neumann CPU architecture, Computer software. The 8051 Architecture: Introduction, Architecture of 8051, Pin diagram of 8051, Memory organization, External Memory interfacing, Stacks.

**UNIT II**

**Addressing Modes:** Introduction, Instruction syntax, Data types, Subroutines, Addressing modes: Immediate addressing , Register addressing, Direct addressing, Indirect addressing, relative addressing, Absolute addressing, Long addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. Instruction set: Instruction timings, 8051 instructions: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction.

**UNIT III**

**8051 programming:** Assembler directives, Assembly language programs and Time delay calculations.

**8051 Interfacing and Applications:** Basics of I/O concepts, I/O Port Operation, Interfacing 8051 to LCD, Keyboard, parallel and serial ADC, DAC, Stepper motor interfacing and DC motor interfacing and programming.

**UNIT IV**

**8051 Interrupts and Timers/counters:** Basics of interrupts, 8051 interrupt structure, Timers and Counters, 8051 timers/counters, programming 8051 timers in assembly and C

#### **UNIT V**

**8051 Serial Communication:** Data communication, Basics of Serial Data Communication, 8051 Serial Communication, connections to RS-232, Serial communication Programming in assembly and C. 8255A Programmable Peripheral Interface:, Architecture of 8255A, I/O addressing,, I/O devices interfacing with 8051 using 8255A.

#### **TEXT BOOKS:**

1. The 8051Microcontrollers, Architecture and Programming and Applications – K.Uma Rao, Andhe Pallavi, Pearson, 2009.
2. Advanced Microprocessors and Peripherals – A. K. Ray and K.M. Bhurchandani, TMH, 2nd Ed., 2006.

#### **REFERENCES:**

1. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed, 2004.
2. Microprocessors and Interfacing, D. V. Hall, TMGH, 2nd Edition 2006.
3. ARM System Developers guide, Andrew N Sloss, Dominic Symes, Chris Wright, Elsevier, 2012

#### **Course Outcomes:**

At the end of this course, Learner will be able to

1. Distinguish between Microprocessor and Microcontroller.
2. Learn Addressing Modes of Microcontroller.
3. Understand the concepts of 8051 programming.
4. Acquire knowledge of 8051 Interfacing and Applications.
5. Familiarize with the concept of 8051 Interrupts and Timers/counters.
6. Understand the concept of 8051 Serial Communication.

**PRINCIPLES OF ELECTRONIC COMMUNICATIONS**  
**(not for ECE)**  
**(OE-III)**

**Internal Marks: 30**  
**External Marks: 70**

**Course Objectives:**

1. To make students understand different types of communication.
2. To make students understand different modulation technique.
3. To make students understand basics of wireless communications.
4. To make students understand basics of cellular communications.

**UNIT I**

**Introduction:** Block diagram of Electrical communication system, Radio communication, Types of communications: Analog, pulse and digital.

**Analog Modulation:** Need for modulation, Types of Analog modulation, Amplitude Modulation, Angle Modulation: Frequency & Phase modulations. Generation and Demodulation techniques. Advantages of FM over AM, Bandwidth consideration, Narrow band and Wide band FM, Comparison of FM & PM.

**UNIT II**

**Pulse Modulations:** Sampling, Nyquist rate of sampling, Sampling theorem for Band limited signals, PAM, regeneration of base band signal, PWM and PPM, Time Division Multiplexing, Frequency Division Multiplexing, Asynchronous Multiplexing.

**UNIT III**

**Digital Communication:** Advantages, Block diagram of PCM, Quantization, effect of quantization, quantization error, Base band digital signal, DM, ADM, ADPCM and comparison. Digital Modulation: ASK, FSK, PSK, DPSK, QPSK demodulation, offset and non-offset QPSK, coherent and incoherent reception, Modems.

**Introduction to Wireless Networking:** Introduction, Difference between wireless and fixed telephone networks, Development of wireless networks, Traffic routing in wireless networks.

**UNIT IV**

**Cellular Mobile Radio Systems:** Introduction to Cellular Mobile System, concept of frequency reuse, Performance criteria, uniqueness of mobile radio environment, operation of cellular systems, Hexagonal shaped cells, Analog and Digital Cellular systems. Cell splitting.

**UNIT V**

**Handoffs and Dropped Calls:** Handoff, dropped calls and cell splitting, types of handoff, handoff initiation, delaying handoff, forced handoff, mobile assisted handoff, Intersystem handoff, micro cells, vehicle locating methods, dropped call rates and their evaluation.

### **TEXT BOOKS**

1. Communication Systems Analog and Digital – R.P. Singh and SD Sapre, TMH, 20th reprint, 2004.
2. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, 2nd Ed., 2002, PHI.

### **REFERENCE BOOKS**

1. Wireless Communication and Networking – William Stallings, 2003, PHI.
2. Electronic Communication Systems – Kennedy and Davis, TMH, 4th edition, 2004.
3. Communication Systems Engineering – John. G. Proakis and Masoud Salehi, PHI, 2ndEd. 2004.

### **Course Outcomes:**

After Completion of the course the student is able to

1. Learn the basic concepts of Communication Systems.
2. Understand the concept of Pulse Modulation.
3. Acquire the knowledge of Digital Communications.
4. Learn the basic concept of Wireless Networking.
5. Understand the fundamental concept of Cellular Mobile Radio Systems.
6. Learn the concepts of Handoffs and Dropped Calls.

**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**  
**(not for ECE)**  
**(OE-III)**

**Internal Marks: 30**  
**External Marks: 70**

**Course Objectives:**

1. It provides an understanding of various measuring systems functioning and metrics for performance analysis.
2. Provides understanding of principle of operation, working of different electronic instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
3. Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.

**UNIT - I**

**Block Schematics of Measuring Systems:** Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Gaussian Error, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag; Measuring Instruments: DC Voltmeters, D'Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

**UNIT - II**

**Signal Analyzers:** AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Capacitance-Voltage Meters, Oscillators.

Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, Video Signal Generators, and Specifications

**UNIT - III**

**Oscilloscopes:** CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measurement of Time, Period and Frequency Specifications.

**Special Purpose Oscilloscopes:** Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs.

**UNIT - IV**

**Transducers:** Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magneto Strictive Transducers.

## **UNIT - V**

**Bridges:** Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge.

**Measurement of Physical Parameters:** Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Force, Pressure – High Pressure, Vacuum level, Temperature - Measurements, Data Acquisition Systems.

### **TEXT BOOKS:**

1. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.
2. Electronic Instrumentation: H.S.Kalsi – TMH, 2nd Edition 2004.

### **REFERENCE BOOKS:**

1. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbins, W.D. Cooper: PHI 5th Edition 2003.
3. Electronic Measurements and Instrumentation: B.M. Oliver, J.M. Cage TMH Reprint 2009.
4. Industrial Instrumentation: T.R. Padmanabham Springer 2009.

### **Course Outcomes:**

After completing this course, the student should be able to:

1. Identify the various electronic instruments based on their specifications for carrying out a particular task of measurement.
2. Measure various physical parameters by appropriately selecting the transducers.
3. Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.
4. Understand the design of oscilloscopes for different applications
5. Employ appropriate instruments to measure given sets of parameters.
6. Identify the various parameters that are measurable in electronic instrumentation