

**ACADEMIC REGULATIONS,  
COURSE STRUCTURE  
and  
DETAILED SYLLABUS  
R22**

**B.Tech – Electronics & Communication  
Engineering**

**B.Tech - Regular Four Year Degree Programme  
(For batches admitted from the academic year 2022 - 2023)**



**Holy Mary Institute of Technology & Science**  
**Bogaram (V), Keesara (M), Medchal (Dist) - 501 301**

## **FOREWORD**

The autonomy is conferred on Holy Mary Institute of Technology & Science by UGC, based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like UGC and AICTE. It reflects the confidence of the UGC in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own **curriculum, examination system and monitoring mechanism**, independent of the affiliating University but under its observance.

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

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

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

**PRINCIPAL**

# **ACADEMIC REGULATIONS**

**B. Tech. - Regular Four Year Degree Programme  
(For batches admitted from the academic year 2022-23)  
&  
B. Tech. - Lateral Entry Scheme  
(For batches admitted from the academic year 2023-24)**

For pursuing four year Under Graduate Degree Programme of study in Engineering & Technology (UGP in E&T) offered by Holy Mary Institute of Technology & Science under Autonomous status is herein referred to as HITS (Autonomous):

All the rules specified herein approved by the Academic Council will be in force and applicable to students admitted from the Academic Year 2022-23 onwards. Any reference to “Institute” or “College” in these rules and regulations shall stand for Holy Mary Institute of Technology & Science (Autonomous).

All the rules and regulations, specified hereafter shall be read as a whole for the purpose of interpretation as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, Holy Mary Institute of Technology & Science shall be the chairman Academic Council.

## **1. ADMISSION**

### **1.1. Admission into first year of four year B. Tech. degree programmes of study in Engineering**

#### **1.1.1. Eligibility:**

A candidate seeking admission into the first year of four year B. Tech. degree Programmes should have:

- (i) Passed either Intermediate Public Examination (I.P.E) conducted by the Board of Intermediate Education, Telangana, with Mathematics, Physics and Chemistry as optional subjects or any equivalent examination recognized by Board of Intermediate Education, Telangana or a Diploma in Engineering in the relevant branch conducted by the Board of Technical Education, Telangana or equivalent Diploma recognized by Board of Technical Education for admission as per guidelines defined by the Regulatory bodies of Telangana State Council for Higher Education (TSCHE) and AICTE.
- (ii) Secured a rank in the EAMCET examination conducted by TSCHE for allotment of a seat by the Convener, EAMCET, for admission.

#### **1.1.2. Admission Procedure:**

Admissions are made into the first year of four year B. Tech. Degree Programmes as per the stipulations of the TSCHE.

- (a) Category ‘A’ seats are filled by the Convener, TSEAMCET.
- (b) Category ‘B’ seats are filled by the Management.

### **1.2 Admission into the second year of four year B. Tech. degree Program in Engineering**

#### **1.2.1 Eligibility:**

A candidate seeking admission under lateral entry into the II year I Semester B. Tech. degree Programmes should have passed the qualifying exam (B.Sc. Mathematics or Diploma in concerned course) and based on the rank secured by the candidate at Engineering Common Entrance Test ECET (FDH) in accordance with the instructions received from the Convener, ECET and Government of Telangana.

**1.2.2 Admission Procedure:**

Admissions are made into the II year of four year B. Tech. degree Programmes through Convener, ECET (FDH) against the sanctioned strength in each Programmes of study as lateral entry students.

**2. PROGRAMMES OFFERED**

**Holy Mary Institute of Technology & Science**, an autonomous college affiliated to JNTUH, offers the following B.Tech Programmes of study leading to the award of B. Tech degree under the autonomous scheme.

- 1) B.Tech – Civil Engineering
- 2) B.Tech – Computer Science and Engineering
- 3) B.Tech – Computer Science and Engineering (Artificial Intelligence & Machine Learning)
- 4) B.Tech – Computer Science and Engineering (Data Science)
- 5) B.Tech – Computer Science and Engineering (IoT)
- 6) B.Tech – Electronics and Communication Engineering
- 7) B.Tech – Electrical & Electronics Engineering
- 8) B.Tech – Mechanical Engineering
- 9) B.Tech – Artificial Intelligence (AI) and Data Science

The medium of instructions for the entire under graduate programme in Engineering & Technology will be **English** only.

**3. DURATION OF THE PROGRAMMES****3.1 Normal Duration**

**3.1.1** B. Tech. degree programme extends over a period of four academic years leading to the Degree of Bachelor of Technology (B.Tech.) of the Jawaharlal Nehru Technological University Hyderabad.

**3.1.2** For students admitted under lateral entry scheme, B. Tech. degree programme extends over a period of three academic years leading to the Degree of Bachelor of Technology (B. Tech.) of the Jawaharlal Nehru Technological University Hyderabad.

**3.2 Maximum Duration**

**3.2.1** The maximum period within which a student must complete a full-time academic programme is 8 years for B. Tech. If a student fails to complete the academic programme within the maximum duration as specified above, he shall forfeit the seat in B.Tech and his admission shall stand cancelled.

**3.2.2** For students admitted under lateral entry scheme in B. Tech. degree programme, the maximum period within which a student must complete a full-time academic programme is 6 years. If a student fails to complete the academic programme within the maximum duration as specified above, he shall forfeit the seat in B.Tech and his admission shall stand cancelled.

**3.2.3** The period is reckoned from the academic year in which the student is admitted first time into the degree Programme.

**4. AWARD OF B.Tech DEGREE**

A student will be declared eligible for the award of the B.Tech degree if he/she fulfils the following academic regulations:

**4.1** The candidate shall pursue a course of study as specified in section 3.1 and 3.2.

**4.2** The candidate shall register for **160** credits and secure **160** credits (Excluding Mandatory Courses).

**5. PROGRAMME STRUCTURE**

**5.1** UGC/AICTE specified Definitions/ Descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations/ Norms, which are listed below.

**Semester Scheme:**

Each UGP is of 4 Academic Years (8 Semesters), each year divided into two Semesters of 22 weeks (≥90 working days), each Semester having - ‘Continuous Internal Evaluation (CIE)’ and ‘Semester End Examination (SEE)’ under Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as denoted by UGC, and Curriculum/Course Structure as suggested by AICTE are followed.

**5.1.1** The B.Tech. Programme of Holy Mary Institute of Technology & Science is Semester pattern, with 8 Semesters constituting 4 Academic Years, each Academic Year having TWO Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 16-18 Weeks duration with a minimum of 90 Instructional Days per Semester.

**5.1.2** Credit Courses:

a) All Courses are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Subject/ Course in a L: T: P: C (Lecture Periods: Tutorial Periods: Practical Periods: Credits) Structure, based on the following general pattern.

- One Credit - for One hour / Week / Semester for Theory / Lecture(L) / Tutorial(T) Courses; and
- One Credit - for Two hours/Week/Semester for Laboratory/Practical (P) Courses, Mini Project...
- Mandatory Courses Credits shall not be counted for credit requirements for award of degree. However all the mandatory courses have to be passed by the student.

**5.1.3 Course Classification:**

All Courses offered for the UGP are broadly classified as:

- **Basic Science Courses (BSC):** Includes Mathematics, Physics, Chemistry, Biology etc.
- **Engineering Science Courses (ESC):** Courses include Materials, Workshop, Basics of Electrical/Electronics/ Mechanical/Computer Science & Engineering, Engineering Graphics, Instrumentation, Engineering Mechanics, Instrumentation etc.
- **Humanities and Social Science including Management Courses (HSMC):** Courses include English, Communication skills, Management etc.
- **Professional Core Courses (PCC):** Relevant to the chosen specialization/branch.
- **Professional Elective Courses (PEC):** Relevant to the chosen specialization/ branch offered as electives.
- **Open Elective Courses (OEC):** Other technical and/or emerging subject areas offered in the College by the Departments of Engineering, Science and Humanities.
- **Mandatory Course:** Course work on peripheral subjects in a programme, wherein familiarity considered mandatory. To be included as non-Credit, Mandatory Courses, with only a pass in each required to qualify for the award of degree from the concerned institution.
- **Project Work:** and/or internship in industry or elsewhere, seminar.
- **MOOCS – Massive Open Online Courses** in a variety of disciplines available at both introductory and advanced levels, accessible from e-resources in India and abroad.

**5.1.4 Course Nomenclature:**

The Curriculum Nomenclature or Course-Structure Grouping for the each of the UGP E&T (B.Tech Degree Programme) is as listed below.

S. No	Broad Course Classification	Course Group/ Category	Course Description	Credits
1)	Foundation Courses (FnC)	BSC – Basic Sciences Courses	Includes - Mathematics, Physics and Chemistry Subjects	25
2)		ESC - Engineering Sciences Courses	Includes fundamental engineering subjects.	24
3)		HSMC – Humanities and Social Sciences including Management	Includes subjects related to Humanities, Social Sciences and Management.	12



4)	Core Courses (CoC)	PCC – Professional Core Courses	Includes core subjects related to the Parent Discipline/ Department/ Branch of Engg.	57
5)	Elective Courses (EIC)	PEC– Professional Elective Courses	Includes Elective subjects related to the Parent Discipline / Department / Branch of Engg.	18
6)		OEC – Open Elective Courses	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the Parent Discipline/ Department / Branch of Engg.	09
7)	Core Courses	Project Work	Major Project.	15
8)		Industrial Training/ Mini- Project	Industrial Training/ Internship/ Mini-Project.	
9)		Seminar	Seminar / Colloquium based on core contents related to Parent Discipline/ Department/ Branch of Engg.	
10)	Mandatory Courses (MC)	-	Mandatory Courses (non-credit)	--
<b>Total Credits for UGP (B. Tech)Programme</b>				<b>160</b>

- Minor variations as per AICTE / UGC guidelines

## 6. COURSE REGISTRATION

- 6.1** A 'Faculty Advisor or Counselor' shall be assigned to each student, who advises him/her about the UGP, its Course Structure and Curriculum, Choice/Option for Subjects/Courses, based on his/her competence, progress, pre-requisites and interest.
- 6.2** Academic Section of the College invites 'Registration Forms' from students prior (before the beginning of the Semester), ensuring 'DATE and TIME Stamping'. The Registration Requests for any 'CURRENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'PRECEDING SEMESTER'.
- 6.3** A Student can apply for Registration, which includes approval from his faculty advisor, and then should be submitted to the College Academic Section through the Head of Department (a copy of the same being retained with Head of Department, Faculty Advisor and the Student).
- 6.4** A student may be permitted to register for his/her course of CHOICE with a Total of prescribed credits per Semester (permitted deviation being  $\pm 12\%$ ), based on his PROGRESS and SGPA/CGPA, and completion of the 'PRE-REQUISITES' as indicated for various courses in the Department Course Structure and Syllabus contents.
- 6.5** Choice for 'additional Courses' must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/Counselor.
- 6.6** If the Student submits ambiguous choices or multiple options or erroneous (incorrect) entries during Registration for the Course(s) under a given/specified Course Group/ Category as listed in the Course Structure, only the first mentioned Course in that Category will be taken into consideration.
- 6.7** Dropping of Courses or changing of options may be permitted, ONLY AFTER obtaining prior approval from the Faculty Advisor, 'within 15 Days of Time' from the commencement of that Semester. Course Options exercised through Registration are final and CAN NOT be changed, and CAN NOT be inter-changed; further, alternate choices will also not be considered. However, if the Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the Student shall be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or for another existing Subject (subject to availability

of seats), which may be considered. Such alternate arrangements will be made by Head of the Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

## **7. COURSES TO BE OFFERED**

- 7.1 A typical section (or class) strength for each semester shall be 60.
- 7.2 Courses may be offered to the Students, only if minimum of 20 students ( $1/3^{\text{rd}}$  of the section strength) opt for it.
- 7.3 More than ONE TEACHER may offer the SAME SUBJECT (Lab/Practical's may be included with the corresponding Theory Subject in the same Semester) in any Semester. However, selection choice for students will be based on - 'CGPA Basis Criterion' (i.e., the first focus shall be on early Registration in that Semester, and the second focus, if needed, will be on CGPA of the student).
- 7.4 If more entries for Registration of a Subject come into picture, then the concerned Head of the Department shall take necessary decision, whether to offer such a Subject/Course for TWO (or multiple) SECTIONS or NOT.
- 7.5 OPEN ELECTIVES will be offered by a department to the students of other departments.

## **8. ATTENDANCE REQUIREMENTS**

- a. A student will be eligible to appear for the End Semester Examinations, if he acquires a minimum of 75% of attendance in aggregate of all the Subjects/Courses (excluding Mandatory or Non-Credit Courses) for that Semester.
- b. Condoning of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each Semester may be granted by the College Academic Committee on genuine and valid grounds, based on the student's representation with supporting evidence by following the govt. rules in vogue.
- c. A stipulated fee shall be payable towards condoning of shortage of attendance.
- d. Shortage of Attendance below 65% in aggregate shall in No case be condoned.
- e. A student shall not be promoted to the next Semester unless he/she satisfies the attendance requirements of the current Semester. The student may seek readmission for the Semester when offered next. He / She shall not be allowed to register for the subjects of the Semester while he/she is in detention. A student detained due to shortage of attendance, will have to repeat that Semester when offered next. The academic regulations under which the student has been readmitted shall be applicable.
- f. Students whose attendance is less than 75% are not entitled to get the scholarship / fee reimbursement in any case as per the TS Govt. Rules in force.

## **9. ACADEMIC REQUIREMENTS FOR PROMOTION / COMPLETION OF REGULAR B.TECH PROGRAMME COURSE STUDY.**

- 9.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course, if student secures not less than 35% (14 marks out of 40 marks) in the internal examinations, not less than 35% (21 marks out of 60 marks) in the semester end examination, and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of letter grades, this implies securing 'C' grade or above in that subject/ course.
- 9.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Real-time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship (or) Seminar, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if he (i) does not submit a report on Industry Oriented Mini Project/Internship, or (ii) not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in Real-time Research Project (or) Field Based Research Project (or) Industry Oriented Mini Project (or) Internship evaluations.



- 9.3 A Student will not be promoted from I Year to II Year, unless he/she fulfills the Attendance and Academic Requirements and secure a Total 50% of Credits up to I Year II Semester from all the relevant regular and supplementary examinations.
- 9.4 A Student will not be promoted from II Year to III Year, unless he/she fulfills the Attendance and Academic Requirements and secure a Total 60% of Credits up to II Year II Semester from all the relevant regular and supplementary examinations.
- 9.5 A Student will not be promoted from III Year to IV Year, unless he/she fulfills the attendance and Academic Requirements and secure a Total 60% of Credits up to III Year II Semester, from all the regular and supplementary examinations.
- 9.6 After securing the necessary 160 Credits as specified for the successful completion of the entire UGP, resulting in 160 Credits for UGP performance evaluation, i.e., the performance of the Student in these 160 Credits shall alone be taken into account for the calculation of the final CGPA.
- If a Student registers for some more 'extra courses' (in the parent Department or other Departments/Branches of Engg.) other than those listed courses Totaling to 160 Credits as specified in the Course Structure of his/her Department, the performances in those 'extra courses' (although evaluated and graded using the same procedure as that of the required 160 Credits) will not be taken into account while calculating the SGPA and CGPA. For such 'extra courses' registered, % marks and Letter Grade alone will be indicated in the Grade Card, as a performance measure, subject to completion of the Attendance and Academic Requirements as stated in items 8 and 9.1-9.5.
- 9.7 Students who fail to earn minimum of 160 Credits as per the Course Structure, and as indicated above, within 8 Academic Years from the Date of Commencement of their I Year shall forfeit their seats in B.Tech Programme and their admissions shall stand cancelled.
- There is NO exemption of credits in any case.**
- When a Student is detained due to shortage of attendance/lack of credits in any Semester, he may be re-admitted into that Semester, as and when offered. However the regulations at the time of admissions hold good.**

## 10. EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

- 10.1 The performance of a student in each Semester shall be evaluated Course-wise (irrespective of Credits assigned) with a maximum of 100 marks for Theory. The B.Tech Project Work (Major Project) will be evaluated for 100 marks in Phase-I and 100 Marks in Phase-II.
- 10.2 For all Theory Courses as mentioned above, the distribution shall be 40 marks for CIE, and 60 marks for the SEE.
- 10.3 **Continuous Internal Evaluation:**
- In CIE, for theory subjects, during a semester, there shall be two mid-term examinations. Mid-Term examination for 30 marks, consist of two parts.**
- i) Part – A for 10 marks,
    - ✓ Part - A: Objective/quiz paper for 10 marks. (The objective/ quiz paper is set with multiple choice, fill-in the blanks and match the following type of questions for a total of 10 marks.)
  - ii) Part – B for 20 marks with a total duration of 2 hours as follows:
    - ✓ Part - B : Descriptive paper for 20 marks (The descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks.)
  - iii) **The remaining 10 marks of Continuous Internal Evaluation are distributed as**
    - a) Assignment for 5 marks (Average of 2 Assignments each for 5 marks)
    - b) Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject for 5 marks.
- 10.4 The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus.

- 10.4.1** Five (5) marks are allocated for assignments (as specified by the subject teacher concerned). The first assignment should be submitted before the conduct of the first mid-term examination, and the second assignment should be submitted before the conduct of the second mid-term examination. The average of the two assignments shall be taken as the final marks for assignment (for 5 marks).

Subject Viva-Voce/PPT/Poster Presentation/ Case Study on a topic in the concerned subject for 5 marks before II Mid-Term examination.

- 10.4.2** The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Overall 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores  $\geq 35\%$  (14 marks) of 40 Continuous Internal Examination (CIE) marks.

In case, the student appears for Semester End Examination (SEE) of the concerned Subject but not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE.

**There is NO Computer Based Test (CBT) for R22 regulations.**

### **10.5 Practical Examination Evaluation:**

- 10.5.1** For practical subjects there shall be a Continuous Internal Evaluation (CIE) during the semester for 40 marks and 60 marks for semester end examination. Out of the 40 marks for internal evaluation:

1. A write-up on day-to-day experiment in the laboratory (in terms of aim, components/procedure, expected outcome) which shall be evaluated for 10 marks.
2. **10 marks for viva-voce** (or) tutorial (or) case study (or) application (or) poster Presentation of the course concerned.
3. Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 10 marks.
4. The remaining 10 marks are for Laboratory Project, which consists of the Design (or) Software / Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before semester end practical examination.

The Semester End Examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the cluster / other colleges which will be decided by the examination branch of the institution.

In the Semester End Examination held for 3 hours, total 60 marks are divided and allocated as shown below:

1. 10 marks for write-up
2. 15 for experiment/program
3. 15 for evaluation of results
4. 10 marks for presentation on another experiment/program in the same laboratory course
5. 10 marks for viva-voce on concerned laboratory course.

- 10.5.2** The Student, in each subject, shall have to earn **35% of marks** (i.e. 14 marks out of 40 marks) in CIE, **35% of marks** (i.e. 21 marks out of 60) in SEE and Overall 40% of marks (i.e. **40 marks out of 100 marks**) both CIE and SEE marks put together.

The student is eligible to write Semester End Examination of the concerned subject, if the student scores  $\geq 35\%$  (14 marks) of **40 Continuous Internal Examination (CIE) marks**.

In case, the student appears for Semester End Examination (SEE) of the concerned Subject but not scored minimum **35% of CIE marks** (14 marks out of 40 internal marks), his performance in that subject in SEE shall stand cancelled inspite of appearing the SEE.

- 10.6** The evaluation of courses having ONLY internal marks in I-Year I Semester and II Year II Semester is as follows:
- 10.6.1** I Year I Semester course (ex., Elements of CE/ME/EEE/ECE/CSE): The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations are the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if he (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.
- 10.6.2** II Year II Semester Real-Time (or) Field-based Research Project course: The internal evaluation is for 50 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations are the final for 50 marks. Student shall have to earn 40%, i.e 20 marks out of 50 marks from average of the two examinations. There shall be NO external evaluation. The student is deemed to have failed, if he (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the internal committee as per schedule, or (ii) secures less than 40% marks in this course.
- 10.7** **Open Elective Course:** The students have to choose three Open Electives (OE-I, II & III) from the list of Open Electives given by other departments. However, the student can opt for an Open Elective subject offered by his own (parent) department, if the student has not registered and not studied that subject under any category (Professional Core, Professional Electives, Mandatory Courses etc.) offered by parent department in any semester. Open Elective subjects already studied should not repeat/should not match with any category (Professional Core, Professional Electives, Mandatory Courses etc.) of subjects even in the forthcoming semesters.
- 10.8** **Professional Electives:** The students have to choose Five Professional Electives (PE-I to V/VI) from the list of professional electives given.
- 10.9** There shall be Industry training (or) Internship (or) Industry oriented Mini-project (or) Skill Development Courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project in collaboration with an industry of their specialization. Students shall register for this immediately after II-Year II Semester Examinations and pursue it during summer vacation/semester break & during III Year without effecting regular course work. Internship at reputed organization (or) Skill development courses (or) Paper presentation in reputed journal (or) Industry Oriented Mini Project shall be submitted in a report form and presented before the committee in III-year II semester before end semester examination. It shall be evaluated for 100 external marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Industry Oriented Mini Project (or) Internship etc, Internal Supervisor and a Senior Faculty Member of the Department. There shall be NO internal marks for Industry Training (or) Internship (or) Mini-Project (or) Skill Development Courses (or) Paper Presentation in reputed journal (or) Industry Oriented Mini Project.
- 10.10**
- a) UG project work shall be carried out in two stages: Project Stage – I during IV Year I Semester, Project Stage – II during IV Year II Semester. Each stage will be evaluated for 100 marks. Student has to submit project work report at the end of each semester. First report includes project work carried out in IV Year I semester and second report includes project work carried out in IV Year I & II Semesters. SEE for both project stages shall be completed before the commencement of SEE Theory examinations.
- b) For Project Stage – I, the departmental committee consisting of Head of the Department, project supervisor and a senior faculty member shall evaluate the project work and project supervisor shall evaluate for 100 marks. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) secures less than 40% marks in the total of the CIE.
- A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he fails in such ‘one reappearance’ evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

- c) For Project Stage – II, the external examiner shall evaluate the project work for 60 marks and the project supervisor shall evaluate it for 40 marks. The topics for industrial oriented mini project and Project Stage – I shall be different from one another. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - II, or does not make a presentation of the same before the external examiner as per schedule, or (ii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

For conducting viva-voce of project stage – II, Chief Controller of Examinations selects an external examiner from the list of experts in the relevant branch submitted by the department HODs of the College.

A student who has failed may reappear once for the above evaluation, when it is scheduled again; if student fails in such ‘one reappearance’ evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

#### 10.11 Semester End Examination:

- a) Question paper contains 2 Parts (Part-A and Part-B) having the questions distributed equally among all units.
- b) The distribution of marks for i) PART-A for 10 marks ii) PART-B for 50 marks. Pattern of the question paper is as follows:

##### **PART–A**

Consists of one question which is compulsory. The question consists of ten sub-questions two from each unit and carries 1 mark each.

##### **PART-B**

Consists of 5 questions carrying 10 marks each. Each of these questions is from one unit and may contain sub questions. Each question there will be an “either” “or” choice (that means there will be two questions from each unit and the student should answer any one question).

- 10.12 For Mandatory Non-Credit Courses offered in a Semester, The internal evaluation is for 100 marks and it shall take place during I Mid-Term examination and II Mid-Term examination. The average marks of two Mid-Term examinations are the final for 100 marks and has secured not less than 40% marks in the CIE, then the student is **PASS** and will be qualified for the award of the degree. No marks or Letter Grade shall be allotted for these courses/activities. However, for non-credit courses ‘**Satisfactory**’ or ‘**Unsatisfactory**’ shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

- 10.13 A student shall be given only one time chance to re-register for a maximum of two Subjects in a semester:

- If the internal marks secured by a student in the Continuous Internal Evaluation marks for 40 (Sum of average of two mid-term examinations consisting of Objective & descriptive parts, Average of two Assignments & Subject Vivavoce/PPT/ Poster presentation/ Case Study on a topic in the concerned subject) are less than 35% and failed in those subjects.
- A student must re-register for the failed subject(s) for 40 marks within four weeks of commencement of the classwork in next academic year. Also, the student has to earn 35% of total internal marks (14 out of 40 marks including Mid-Term examinations, Assignment & Subject Viva-voce/PPT/ Poster presentation/ Case Study on a topic in the concerned subject).
- In the event of the student taking this chance, his Continuous Internal Evaluation marks for 40 and Semester End Examination marks for 60 obtained in the previous attempt stand cancelled.

- 10.14 SWAYAM: College intends to encourage the students to do a minimum of one MOOC in discipline and open elective during third year. The respective departments shall give a list of standard MOOCs providers including SWAYAM whose credentials are endorsed by the BoS. In general, MOOCs providers provide the result in percentage. In such case, specified by the college shall follow the grade table mentioned in 12.2. The Credits for MOOC(s) shall be transferred same as given for the respective discipline or open electives. In case a student fails to complete the MOOCs he/she shall re-register for the same with any of

the providers from the list provided by the department. The equivalence of the courses shall be established by the department committee. Still if a student fails to clear the course/s, or in case a provider fails to offer a MOOC in any semester, then in all such cases the college shall conduct the end semester examinations for the same as per the college end semester examination pattern. The syllabi for the supplementary examinations shall be same as that of MOOCs. There shall be no internal assessment however the marks obtained out of 70 shall be scaled up to 100 marks and the respective letter grade shall be allotted. The details of MOOC(s) shall be displayed in Memorandum of Grades of a student, provided he/she submits the proof of completion of it or them to the examination branch through the Coordinator/Mentor, before the end semester examination of the particular semester.

## 11 AWARD OF DEGREE

- 11.1** A student who registers for all the specified subjects/ courses as listed in the course structure and secures the required number of 160 credits (with CGPA  $\geq 5.0$ ), within 8 academic years from the date of commencement of the first academic year, shall be declared to have **'qualified'** for the award of B.Tech. degree in the branch of Engineering selected at the time of admission.
- 11.2** A student who qualifies for the award of the degree as listed in item 12.1 shall be placed in the following classes.
- 11.3** A student with final CGPA (at the end of the undergraduate programme)  $> 8.00$ , and fulfilling the following conditions - shall be placed in **'First Class with Distinction'**. However, he
- (i) Should have passed all the subjects/courses in **'First Appearance'** within the first 4 academic years (or 8 sequential semesters) from the date of commencement of first year first semester.
  - (ii) Should not have been detained or prevented from writing the semester end examinations in any semester due to shortage of attendance or any other reason. A student not fulfilling any of the above conditions with final CGPA  $> 8$  shall be placed in **'First Class'**.
- 11.4** Students with final CGPA (at the end of the undergraduate programme)  $\geq 7.0$  but  $< 8.00$  shall be placed in **'First Class'**.
- 11.5** Students with final CGPA (at the end of the undergraduate programme)  $\geq 6.00$  but  $< 7.00$ , shall be placed in **'Second Class'**.
- 11.6** All other students who qualify for the award of the degree (as per item 12.1), with final CGPA (at the end of the undergraduate programme)  $\geq 5.00$  but  $< 6$ , shall be placed in **'pass class'**.
- 11.7** A student with final CGPA (at the end of the undergraduate programme)  $< 5.00$  will not be eligible for the award of the degree.

## 12 LETTER GRADE AND GRADE POINT

- 12.1** Marks will be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practical's, or Seminar, or Project, or Internship\*/Mini-Project, Minor Course etc., based on the %marks obtained in CIE+SEE (Continuous Internal Evaluation + Semester End Examination, both taken together), and a corresponding Letter Grade shall be given.
- 12.2** As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed...

% of Marks Secured (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
90% and above ( $\geq 90\%$ , $\leq 100\%$ )	O (Outstanding)	10
Below 90% but not less than 80% ( $\geq 80\%$ , $< 90\%$ )	A <sup>+</sup> (Excellent)	9



Below 80% but not less than 70% ( $\geq 70\%$ , $< 80\%$ )	A (Very Good)	8
Below 70% but not less than 60% ( $\geq 60\%$ , $< 70\%$ )	B <sup>+</sup> (Good)	7
Below 60% but not less than 50% ( $\geq 50\%$ , $< 60\%$ )	B (Average)	6
Below 50% but not less than 40% ( $\geq 40\%$ , $< 50\%$ )	C (Pass)	5
Below 40% ( $< 40\%$ )	F (FAIL)	0
Absent	AB	0

- 12.3** A student obtaining F Grade in any Subject shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' in the End Semester Examination (SEE), as and when offered. In such cases, his Internal Marks (CIE Marks) in those Subject(s) will remain same as those he obtained earlier.
- 12.4** A Letter Grade does not imply any specific % of Marks.
- 12.5** In general, a student shall not be permitted to repeat any Subject/Course (s) only for the sake of 'Grade Improvement' or 'SGPA/CGPA Improvement'. However, he has to repeat all the Subjects/Courses pertaining to that Semester, when he is detained.
- 12.6** A student earns Grade Point (GP) in each Subject/Course, on the basis of the Letter Grade obtained by him in that Subject/Course (excluding Mandatory non-credit Courses). Then the corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Subject/Course.

Credit Points (CP) = Grade Point (GP) x Credits .... For a Course

- 12.7** The Student passes the Subject/Course only when he gets  $GP \geq 4$  (P Grade or above).
- 12.8** The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points ( $\Sigma CP$ ) secured from ALL Subjects/Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as

$$SGPA = \{ \sum_{i=1}^N C_i G_i \} / \{ \sum_{i=1}^N C_i \} \dots \text{For each Semester,}$$

where 'i' is the Subject indicator index (takes into account all Subjects in a Semester), 'N' is the no. of Subjects 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department),  $C_i$  is the no. of Credits allotted to that ix Subject, and  $G_i$  represents the Grade Points (GP) corresponding to the Letter Grade awarded for that i Subject.

#### Illustration of Computation of SGPA Computation

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course1	3	A	8	3 x 8 = 24
Course2	4	B+	7	4 x 7 = 28
Course3	3	B	6	3 x 6 = 18
Course4	3	O	10	3 x 10 = 30
Course5	3	C	5	3 x 5 = 15
Course6	4	B	6	4 x 6 = 24

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

- 12.9** The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is



rounded off to TWO Decimal Places. CGPA is thus computed from the I Year Second Semester onwards, at the end of each Semester, as per the formula

$$\text{CGPA} = \{ \sum_{j=1}^M C_j G_j \} / \{ \sum_{j=1}^M C_j \} \dots \text{for all } S \text{ Semesters registered}$$

(i.e., up to and inclusive of S Semesters,  $S \geq 2$ ),

where 'M' is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' from the 1<sup>st</sup> Semester onwards up to and inclusive of the Semester S (obviously  $M > N$ ), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S Semesters),  $C_j$  is the no. of Credits allotted to the jth Subject, and  $G_j$  represents the Grade Points (GP) corresponding to the Letter Grade awarded for that jth Subject. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

#### For CGPA Computation

Semester 1	Semester 2	Semester 3	Semester 4	Semester 5	Semester 6	Semester 7	Semester 8
Credits : 19.5	Credits : 20.5	Credits : 18.0	Credits : 19.0	Credits : 21.5	Credits : 21.5	Credits : 23	Credits : 17
SGPA : 6.9	SGPA : 7.8	SGPA : 5.6	SGPA : 6.0	SGPA : 6.3	SGPA : 8.0	SGPA : 8.0	SGPA : 8.0

$$\text{Thus, CGPA} = \frac{19.5 \times 6.9 + 20.5 \times 7.8 + 18.0 \times 5.6 + 19.0 \times 6.0 + 21.5 \times 6.3 + 21.5 \times 8.0 + 23 \times 8.0 + 17 \times 8.0}{160} = 7.10$$

- 12.10** For Merit Ranking or Comparison Purposes or any other listing, ONLY the 'ROUNDED OFF' values of the CGPAs will be used.
- 12.11** For Calculations listed in Item 12.5–12.10, performance in failed Subjects/Courses (securing F Grade) will also be taken into account, and the Credits of such Subjects/Courses will also be included in the multiplications and summations. However, Mandatory Courses will not be taken into consideration.
- 12.12** Conversion formula for the conversion of GPA into indicative percentage is  
 $\% \text{ of marks scored} = (\text{final CGPA} - 0.50) \times 10$

### 13 AWARD OF 2-YEAR B.TECH. DIPLOMA CERTIFICATE

- 13.1** A student is awarded 2-Year UG Diploma Certificate in the concerned engineering Branch on completion of all the academic requirements and earned all the 80 credits (within 4 years from the date of admission) up to B.Tech. II Year II Semester, if the student wants to exit the 4-Year B.Tech. Program and requests for the 2 -Year B.Tech. (UG) Diploma Certificate.
- 13.2** The student **once opted and awarded 2-Year UG Diploma Certificate, the Student will be permitted to join** in B. Tech. III Year I Semester and continue for completion of remaining years of study for 4-Year B. Tech. Degree ONLY in the next academic year along with next batch students. However, if any student wishes to continue the study after opting for exit, he/she should register for the subjects/courses in III Year I Semester before commencement of class work for that semester.
- 13.3** The students, who exit the 4-Year B. Tech. program after II Year of study and wish to re-join the B.Tech. Program, must submit the 2 -Year B. Tech. (UG) Diploma Certificate awarded to him, subject to the eligibility for completion of Course/Degree.
- 13.4** A student may be permitted to take one year break after completion of II Year II Semester or B. Tech. III Year II Semester (with university permission through the principal of the college well in advance) and can re-enter the course in **next Academic Year in the same college** and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year program).

**14. DECLARATION OF RESULTS**

Computation of SGPA and CGPA are done using the procedure listed in 12.5 – 12.10. No SGPA/CGPA is declared, if a candidate is failed in any one of the courses of a given Semester.

**15. WITH HOLDING OF RESULTS**

If the student has not paid fees to College at any stage, or has pending dues against his name due to any reason what so ever, or if any case of indiscipline is pending against him, the result of such student may be withheld, and he will not be allowed to go into the next higher Semester. The Award or issue of the Degree may also be withheld in such cases.

**16. REVALUATION**

Students shall be permitted for revaluation after the declaration of end Semester examination results within due dates by paying prescribed fee. After revaluation if there is any betterment in the grade, then improved grade will be considered. Otherwise old grade shall be retained.

**17. SUPPLEMENTARY EXAMINATIONS**

Supplementary examinations for the odd Semester shall be conducted with the regular examinations of even Semester and vice versa, for those who appeared and failed or absent in regular examinations. Such candidates writing supplementary examinations may have to write sometimes one or two examinations per day.

**ADVANCED SUPPLEMENTARY EXAMINATION**

Advanced supplementary examinations will be conducted for IV year II Semester after announcement of regular results.

**18. TRANSCRIPTS**

After successful completion of prerequisite credits for the award of degree a Transcript containing performance of all academic years will be issued as a final record. Duplicate PC, CMM & Transcripts will also be issued if required after the payment of requisite fee and also as per norms in vogue.

**19. RULES OF DISCIPLINE**

- 19.1 Any attempt by any student to influence the teachers, Examiners, faculty and staff of controller of Examination for undue favors in the exams, and bribing them either for marks or attendance will be treated as malpractice cases and the student can be debarred from the college.
- 19.2 When the student absents himself, he is treated as to have appeared and obtained zero marks in that course(s) and grading is done accordingly.
- 19.3 When the performance of the student in any subject(s) is cancelled as a punishment for indiscipline, he is awarded zero marks in that subject(s).
- 19.4 When the student's answer book is confiscated for any kind of attempted or suspected malpractice the decision of the Examiner is final.

**20. MALPRACTICE PREVENTION COMMITTEE**

A malpractice prevention committee shall be constituted to examine and punish the students who involve in malpractice / indiscipline in examinations. The committee shall consist of:

- a) Controller of examinations - Chairman
- b) Addl. Controller of examinations.- Member Convener
- c) Subject expert - member
- d) Head of the department of which the student belongs to. - Member
- e) The invigilator concerned - member

The committee shall conduct the meeting after taking explanation of the student and punishment will be awarded by following the malpractice rules meticulously.

Any action on the part of candidate at the examination like trying to get undue advantage in the performance at examinations or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff who are in charge of conducting examinations, valuing examination papers and preparing / keeping records of documents relating to the examinations, in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and will be recommended for appropriate punishment after thorough enquiry.

## 21. TRANSITORY REGULATIONS

### A. For students detained due to shortage of attendance:

1. A Student who has been detained in I year of R18/R21 Regulations due to lack of attendance, shall be permitted to join I year I Semester of R22 Regulations and he is required to complete the study of B.Tech. programme within the stipulated period of eight academic years from the date of first admission in I Year.
2. A student who has been detained in any semester of II, III and IV years of R18/R21 regulations for want of attendance, shall be permitted to join the corresponding semester of R22 Regulations and is required to complete the study of B.Tech. within the stipulated period of eight academic years from the date of first admission in I Year. The R22 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

### B. For students detained due to shortage of credits:

3. A student of R18/R21 Regulations who has been detained due to lack of credits, shall be promoted to the next semester of R22 Regulations only after acquiring the required number of credits as per the corresponding regulations of his/her first admission. The total credits required are 160 including both R18/R21 & R22 regulations. The student is required to complete the study of B.Tech within the stipulated period of eight academic years from the year of first admission. The R22 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

### C. For readmitted students in R22 Regulations:

4. A student who has failed in any subject under any regulation has to pass those subjects in the same regulations.
5. The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including R22 Regulations. **There is NO exemption of credits in any case.**
6. If a student is readmitted to R22 Regulations and has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R22 Regulations will be substituted by another subject to be suggested by the University.

**Note:** If a student readmitted to R22 Regulations and has not studied any subjects/topics in his/her earlier regulations of study which is prerequisite for further subjects in R22 Regulations, the College Principals concerned shall conduct remedial classes to cover those subjects/topics for the benefit of the students.

## 22. STUDENT TRANSFERS

- 22.1 There shall be no branch transfers after the completion of admission process.
- 22.2 There shall be no transfers from one college/stream to another within the constituent colleges and units of Jawaharlal Nehru Technological University Hyderabad.
- 22.3 The students seeking transfer to colleges affiliated to JNTUH from various other Universities/institutions have to pass the failed subjects which are equivalent to the subjects of HITS, and also pass the subjects of HITS which the students have not

studied at the earlier institution. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of HITS, the students have to study those subjects in HITS in spite of the fact that those subjects are repeated.

- 22.4 The transferred students from other Universities/Institutions to JNTUH affiliated colleges who are on rolls are to be provided one chance to write the CBT (for internal marks) in the **equivalent subject(s)** as per the clearance letter issued by the University.
- 22.5 The college has to provide one chance to write the internal examinations in the **equivalent subject(s)** to the students transferred from other universities/institutions to HITS who are on rolls, as per the clearance (equivalence) letter issued by the University.

### **23. AMENDMENTS TO REGULATIONS**

The Academic Council of Holy Mary Institute of Technology & Science reserves the right to revise, amend, or change the regulations, scheme of examinations, and / or syllabi or any other policy relevant to the needs of the society or industrial requirements etc., without prior notice.

There shall be no Branch transfers after the completion of Admission Process. Transfer of student is permitted subjected to the rules and regulations of TSCHE (TE Department) and JNTUH in vogue.

The College shall have its own Annual Graduation Day for the award of Degrees issued by the College/University.

Institute will award Medals to the outstanding students who complete the entire course in the first attempt within the stipulated time.

- i) Where the words “he”, “him”, “his”, occur in the write-up of regulations, they include “she”, “her”.
- ii) Where the words “Subject” or “Subjects”, occur in these regulations, they also imply “Course” or “Courses”.
- iii) The Academic Regulations should be read as a whole, for the purpose of any interpretation.
- iv) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman of the Academic Council is final.

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**Academic Regulations for B. Tech. (Lateral Entry Scheme)  
(Effective for the students getting admitted into II year  
from the Academic Year 2023-2024 onwards)**

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**1. ELIGIBILITY FOR THE AWARD OF B.TECH DEGREE (LES)**

- i. The LES students after securing admission shall pursue a course of study for not less than three academic years and not more than six academic years.
- ii. The Students have to acquire 120 credits from II to IV year of B.Tech Programme (Regular) for the award of the degree.
- iii. Students, who fail to fulfill the requirement for the award of the degree in 6 consecutive academic years from the year of admission, shall forfeit their seat.
- iv. The same attendance regulations are to be adopted as that of B. Tech. (Regular)

**2. PROMOTION RULE:**

A Student will not be promoted from II Year to III Year, unless he/she fulfills the Attendance and Academic Requirements and (i) secure a Total of 60% Credits up to III Year II Semester, from all the regular and supplementary examinations.

A Student will not be promoted from III Year to IV Year, unless he/she fulfills the Attendance and Academic Requirements and (i) secure a Total of 60% Credits up to III Year II Semester, from all the regular and supplementary examinations.

**3. AWARD OF DEGREE:**

After the student has satisfied the requirements prescribed for the completion of the programme and is eligible for the award of B. Tech. Degree, he/she shall be placed in one of the following four classes: The marks obtained for 120 credits will be considered for the calculation of CGPA.

**All other regulations as applicable for B. Tech. Four-year degree programme (Regular) will hold good for B.Tech (Lateral Entry Scheme).**

### Malpractices Rules - Disciplinary Action For /Improper Conduct in Examinations

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



4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year. The candidate is also debarred for two consecutive Semesters from class work and all 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 Addl. 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 addl. Controller of examinations 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 addl. Controller of examinations, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the 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.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year. The candidate is also debarred for two consecutive Semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

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

# **COURSE STRUCTURE**

## Dept. of Electronics &amp; Communications Engineering

## I B.Tech.- I-Semester

Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A2MA101BS	Linear Algebra and Calculus	BSC	3	1	-	4	40	60	100
A2AP104BS	Applied Physics	BSC	3	1	-	4	40	60	100
A2CS106ES	Programming for Problem Solving	ESC	3	0	0	3	40	60	100
A2ME116ES	Workshop Manufacturing Practice	ESC	0	1	3	2.5	40	60	100
A2EN105HS	English for Skill Enhancement	HSMC	2	-	-	2	40	60	100
A2EC101ES	Elements of Electronics and Communication Engineering	ESC	-	-	2	1	50	-	50
A2AP112BS	Applied Physics Laboratory	BSC	-	-	3	1.5	40	60	100
A2AP113HS	English Language Communication Skills Laboratory	HSMC	-	-	2	1	40	60	100
A2EN114ES	Programming for Problem Solving Laboratory	ESC	-	-	2	1	40	60	100
<b>Total</b>			<b>11</b>	<b>3</b>	<b>12</b>	<b>20</b>	<b>370</b>	<b>480</b>	<b>850</b>
<b>Mandatory Course (Non-Credit)</b>									
A2EC101MC	Technical Seminar-I / Social Innovation	MC	-	-	2	-	100	-	100

## I B.Tech.- II-Semester

Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A2MA201BS	Ordinary Differential Equations and Advanced Calculus	BSC	3	1	-	4	40	60	100
A2CH202BS	Engineering Chemistry	BSC	3	1	-	4	40	60	100
A2ME208ES	Engineering Graphics	ESC	1	0	4	3	40	60	100
A2EE207ES	Basic Electrical Engineering	ESC	2	0	0	2	40	60	100
A2EC201ES	Electronic Devices and Circuits	ESC	2	0	0	2	40	60	100
A2CS202ES	Applied Python Programming Laboratory	ESC	0	1	2	2	40	60	100
A2CH210DS	Engineering Chemistry Laboratory	BSC	-	-	2	1	40	60	100
A2EE215ES	Basic Electrical Engineering Laboratory	ESC	-	-	2	1	40	60	100
A2EC202ES	Electronic Devices and Circuits Laboratory	ESC	-	-	2	1	40	60	100
<b>Total</b>			<b>11</b>	<b>3</b>	<b>12</b>	<b>20</b>	<b>360</b>	<b>540</b>	<b>900</b>
<b>Mandatory Course (Non-Credit)</b>									
A2EC202MC	Technical Seminar-II / Engineering Exploaration	MC	-	-	2	-	100	-	100

II B.Tech.- I-Semester									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A2EC301PC	Analog Circuits	PCC	3	1	-	4	40	60	100
A2EC302BS	Numerical Methods and Complex Variables	BSC	3	-	-	3	40	60	100
A2EC303PC	Digital Logic Design	PCC	3	-	-	3	40	60	100
A2EE304ES	Network Theory	ESC	3	-	-	3	40	60	100
A2EC305PC	Signals and Systems	PCC	3	1	-	4	40	60	100
A2EC306PC	Analog Circuits Laboratory	PCC	-	-	2	1	40	60	100
A2EC307PC	Basic Simulation Laboratory	PCC	-	-	2	1	40	60	100
A2EC308PC	Digital Logic Design Laboratory	PCC	-	-	2	1	40	60	100
Total			15	2	6	20	320	480	800
Mandatory Course (Non-Credit)									
A2EC303MC	Gender Sensitization	MC	2	-	-	-	100	-	100

II B.Tech.- II-Semester									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A2EC401PC	Analog and Digital Communications	PCC	3	-	-	3	40	60	100
A2EC402PC	Electromagnetic Fields and Transmission Lines	PCC	3	-	-	3	40	60	100
A2EC403PC	Electronic Circuit Analysis	PCC	3	-	-	3	40	60	100
A2MA404BS	Random Variables and Stochastic Processes	BSC	3	-	-	3	40	60	100
A2EC405PC	Linear IC Applications	PCC	3	-	-	3	40	60	100
A2EC406PC	Electronic Circuit Analysis Laboratory	PCC	-	-	2	1	40	60	100
A2EC407PC	Linear IC Applications Laboratory	PCC	-	-	2	1	40	60	100
A2EC408PC	Analog and Digital Communications Laboratory	PCC	-	-	2	1	40	60	100
A2EC401PW	Real Time Project/ Field Based Project	PWC	-	-	4	2	50	-	50
Total			15	-	10	20	370	480	850
Mandatory Course (Non-Credit)									
A2EC404MC	Environmental Studies	MC	2	-	-	-	100	-	100

III B.Tech.- I-Semester									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A2EC501PC	Control Systems	PCC	3	-	-	3	40	60	100
A2EC502PC	Microprocessors and Microcontrollers	PCC	3	-	-	3	40	60	100
A2EC503PC	Digital Integrated Circuit Applications	PCC	3	-	-	3	40	60	100
A2MB504HS	Business Economics & Financial Analysis	HSMC	3	-	-	3	40	60	100
A2EC505PC	Data Communications and Networks	PCC	3	-	-	3	40	60	100
A2EC506PC	Microprocessors and Microcontrollers Laboratory	PCC	-	-	2	1	40	60	100
A2EC507PC	Digital Integrated Circuit Applications Laboratory	PCC	-	-	2	1	40	60	100
A2EC508PC	Data Communications and Networks laboratory	PCC	-	-	2	1	40	60	100
A2EC502PW	Industry Oriented, Mini Project / Internship	PWC	-	-	4	2	--	100	100
	MOOCs (For B.Tech. Hons. Degree)*								
Total			15	0	10	20	320	580	900
Mandatory Course (Non-Credit)									
A2EC505MC	Human Values and Professional Ethics	MC	3	-	-	-	100	-	100

III B.Tech.- II-Semester									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A2EC601PC	Digital Signal Processing	PCC	3	-	-	3	40	60	100
A2EC602PC	VLSI Design	PCC	3	-	-	3	40	60	100
A2EC603PC	Antennas and Wave Propagation	PCC	3	-	-	3	40	60	100
	Professional Elective-I	PEC	3	-	-	3	40	60	100
	Open Elective-I	OEC	3	-	-	3	40	60	100
A2EC604PC	VLSI Design Laboratory	PCC	-	-	2	1	40	60	100
A2EC605PC	Digital Signal Processing Laboratory	PCC	-	-	2	1	40	60	100
A2EN613HS	Advanced English Communication Skills	HSMC	-	-	2	1	40	60	100
A2EC603PW	Comprehensive Viva	PWC	-	-	4	2	100	-	100
	MOOCs (For B.Tech. Hons. Degree) *								
Total			15	-	10	20	420	480	900
Mandatory Course (Non-Credit)									
A2EC606MC	Constitution of India	MC	2	-	-	-	100	-	100



IV B.Tech.- I-Semester									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
A2EC701PC	Microwave and Optical Communications	PCC	3	1	-	4	40	60	100
	Professional Elective-II	PEC	3	-	-	3	40	60	100
	Professional Elective-III	PEC	3	-	-	3	40	60	100
	Open Elective-II	OEC	3	-	-	3	40	60	100
A2MB702HS	Management Science	HSMC	2	-	-	2	40	60	100
A2EC703PC	Microwave and Optical Communication Laboratory	PCC	-	-	4	2	40	60	100
A2EC704PW	Project Phase-I	PWC	-	-	6	3	100	--	100
	MOOCs (For B.Tech. Hons. Degree) *								
Total			14	-	10	20	340	360	700

IV B.Tech.- II-Semester									
Course Code	Course Title	Course Area	Hours per Week			Credits	Scheme of Examination Maximum Marks		
			L	T	P		Internal (CIE)	External (SEE)	Total
	Professional Elective-IV	PEC	3	-	-	3	40	60	100
	Professional Elective-V	PEC	3	-	-	3	40	60	100
	Open Elective-III	OEC	3	-	-	3	40	60	100
A2EC805PW	Project Phase-II	PWC	-	-	22	11	40	60	100
	MOOCs (For B.Tech. Hons. Degree)*								
Total			9	-	22	20	160	240	400

**Total Credits =160**

PROFESSIONAL ELECTIVES			
PE-I		PE-II	
A2EC601PE	IoT Architectures and Protocols	A2EC704PE	Mobile Communications and Networks
A2EC602PE	Computer Architecture and Organization	A2EC705PE	Digital Image and Video Processing
A2EC603PE	Electronic Measurements and Instrumentation	A2EC706PE	Embedded System Design
PE-III		PE-IV	
A2EC707PE	Network Security and Cryptography	A2EC810PE	CMOS Analog IC Design
A2EC708PE	Satellite Communications	A2EC811PE	Radar Systems
A2EC709PE	Biomedical Instrumentation	A2EC812PE	Artificial Intelligence
PE-V			
A2EC813PE	Machine Learning		
A2EC814PE	5G and Beyond Communication		
A2EC815PE	System on Chip Architecture		

OPEN ELECTIVES				
S. No.	Name of the Department Offering Open Electives	Open Elective – I (Semester – VI)	Open Elective – II (Semester – VII)	Open Elective – III (Semester – VIII)
1	Electronics and Communication Engineering.	<b>A2EC601OE</b>	<b>A2EC703OE</b>	<b>A2EC805OE</b>
		Digital Electronics for Engineering	Electronic Sensors	Measuring Instruments
		<b>A2EC602OE</b>	<b>A2EC704OE</b>	<b>A2EC806OE</b>
		Principles of Signal Processing	Electronics for Health Care	Communication Technologies

**\*Open Elective** – Students should take Open Electives from List of Open Electives Offered by Other Departments / Branches Only

**Ex:** - A Student of Electronics & Communications Engineering can take Open Electives from all other departments/branches except Open Electives offered by Electronics & Communications Engineering Dept.

# **DETAILED SYLLABUS**

# **I-YEAR (I-SEMESTER)**

**LINEAR ALGEBRA AND CALCULUS****I B.Tech-I Semester****Course Code: A2MA101BS****L T P C****3 1 0 4****COURSE OBJECTIVES:** To learn

1. Concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
2. Concept of Eigen values and eigenvectors and to reduce the quadratic form to canonical form.
3. Evaluation of improper integrals using Beta and Gamma functions.
4. Partial differentiation and finding maxima and minima of function of two and three variables.
5. Evaluation of multiple integrals and their applications.

**COURSE OUTCOMES:** Upon the successful completion of this course, the students will be able to:

1. Write the matrix representation of a set of linear equations and to analyze the solution of the system of equations
2. Find the Eigen values and Eigen vectors and reduce the quadratic form to canonical form using orthogonal transformations.
3. Solve the applications on the mean value theorems and evaluate the improper integrals using Beta and Gamma functions
4. Find the extreme values of functions of two variables with/ without constraints.
5. Evaluate the multiple integrals and apply the concept to find areas, volumes

**UNIT I**

**Matrices:** Matrices: Types of Matrices, Symmetric; Hermitian; Skew-symmetric; Skew-Hermitian; Orthogonal matrices; Unitary Matrices; Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method; System of linear equations; Solving system of Homogeneous and Non-Homogeneous equations. Gauss elimination method; Gauss Seidel Iteration Method.

**UNIT II**

**Eigen Values and Eigen Vectors :** Linear Transformation and Orthogonal Transformation: Eigen values and Eigenvectors and their properties; Diagonalization of a matrix; Cayley-Hamilton Theorem (without proof); Finding inverse and power of a matrix by Cayley-Hamilton Theorem; Quadratic forms and Nature of the Quadratic Forms; Reduction of Quadratic form to Canonical forms by Orthogonal Transformation

**UNIT III**

**Calculus:** Mean value theorems: Rolle's Theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem. Taylor's Series. Definition of Improper Integral: Beta and Gamma functions and their applications.

**UNIT IV**

**Multivariable Calculus:** Definitions of Limit and continuity. Partial Differentiation; Euler's Theorem; Total derivative; Jacobian, Functional dependence & independence, Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

**UNIT V**

**Multivariable Integral Calculus:** Evaluation of Double Integrals (Cartesian and polar coordinates); Change of order of integration (only Cartesian form); Evaluation of Triple Integrals: Change of variables (Cartesian to polar) for double and (Cartesian to Spherical and Cylindrical polar coordinates) for triple integrals. Applications: Areas (by double integrals) and Volumes (by double integrals and triple integrals).

**TEXT BOOKS**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

**REFERENCE BOOKS**

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010

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**APPLIED PHYSICS****I B.Tech-I Semester****Course Code: A2AP104BS****L T P C****3 1 0 4****COURSE OBJECTIVES:** The objectives of this course for the student are to:

1. Understand the basic principles of quantum physics and band theory of solids.
2. Understand the underlying mechanism involved in construction and working principles of various, semiconductor devices.
3. Study the fundamental concepts related to the dielectric, magnetic and energy materials.
4. Identify the importance of nanoscale, quantum confinement and various fabrications techniques.
5. Study the characteristics of lasers and optical fibres.

**COURSE OUTCOMES:** At the end of the course the student will be able to:

1. Understand physical world from fundamental point of view by the concepts of Quantum mechanics and visualize the difference between conductor, semiconductor, and an insulator by classification of solids.
2. Identify the role of semiconductor devices in science and engineering Applications.
3. Explore the fundamental properties of dielectric, magnetic materials and energy for their applications.
4. Appreciate the features and applications of Nanomaterials.
5. Understand various aspects of Lasers and Optical fiber and their applications in diverse fields.

**UNIT I**

**Quantum Physics and Solids:** Introduction to quantum physics, Black body radiation, Planck's law, Photo electric effect, Compton effect, De-Broglie's hypothesis, Wave-particle duality, Davisson and Germer experiment, Heisenberg's Uncertainty principle and its applications, Born's interpretation of the wave function, Schrodinger's time independent wave equation, Particle in one dimensional box.

Solids: Free electron theory (Drude & Lorentz, Sommerfeld) - merits and demerits of classical and quantum mechanics - Bloch's theorem -Kronig-Penney model(qualitative) – E-K diagram-origin of energy bands-classification of solids.

**UNIT II**

**Semiconductors And Devices:** Intrinsic and Extrinsic semiconductors – Hall effect - Direct and Indirect band gap semiconductors -construction, principle of operation and Characteristics of P-N Junction diode, Zener diode and Bipolar junction transistor (BJT)–LED, PIN diode, avalanche photo diode (APD) and solar cells, their structure, materials, working principle and characteristics.

**UNIT III**

**Dielectric, Magnetic Materials and Super Conductors** **Dielectric Materials:** Basic definitions, types of polarizations (qualitative), ferroelectric, piezoelectric and pyro electric materials, applications.

**Magnetic materials:** Basic definitions, Classification of magnetic materials, domain theory for ferromagnetic materials, Hysteresis- soft and hard magnetic materials, magneto striction, magneto resistance, applications.

**Super conductors:** Introduction, properties of super conductors, Meissner effect, Type-I and Type-II super conductors, applications.

**UNIT IV**

**Nanotechnology:** Introduction to Nanotechnology, Nanoscale, Types of nano materials, quantum confinement, surface to volume ratio, Synthesis of nanomaterials - Top-down method: Ball milling method, Sol-gel synthesis, physical vapor deposition (PVD), and Bottom-up method: combustion methods, Chemical vapor deposition method (CVD); characterization techniques - XRD, SEM & TEM Applications of nanomaterials.

**UNIT V**

**Lasers And Fibre Optics: Lasers:** Introduction to interaction of radiation with matter, Characteristics of LASER, Einstein coefficients, Population inversion, Pumping, Principle and working of Laser, Types of Lasers: Ruby laser, Carbon dioxide (CO<sub>2</sub>) laser, He-Ne laser, semiconductor lasers, Applications of laser.

**Fibre Optics:** Introduction to optical fiber, advantages of optical Fibers, total internal reflection construction of optical fiber, acceptance angle, numerical aperture, classification of optical fibers losses in optical fiber, optical fiber for communication system, applications.



**TEXT BOOKS**

1. M. N. Avadhanulu, P.G. Kshirsagar & TVS Arun Murthy” A Text book of Engineering Physics”-S. Chand Publications, 11th Edition 2019.
2. Engineering Physics by Shatendra Sharma and Jyotsna Sharma, Pearson Publication, 2019
3. Semiconductor Physics and Devices- Basic Principle – Donald A. Neamen, Mc Graw Hill, 4th Edition, 2021.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2nd Edition, 2022.
5. Essentials of Nanoscience & Nanotechnology by Narasimha Reddy Katta, Typical Creatives NANO DIGEST, 1st Edition, 2021.

**REFERENCE BOOKS**

1. Quantum Physics, H.C. Verma, TBS Publication, 2nd Edition 2012.
2. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley & Sons, 11th Edition, 2018.
3. Introduction to Solid State Physics, Charles Kittel, Wiley Eastern, 2019.
4. Elementary Solid-State Physics, S.L. Gupta and V. Kumar, Pragathi Prakashan, 2019.
5. A.K. Bhandhopadhyaya - Nano Materials, New Age International, 1st Edition, 2007.
6. Energy Materials a Short Introduction to Functional Materials for Energy Conversion and Storage Aliaksandr S. Bandarenka, CRC Press Taylor & Francis Group
7. Energy Materials, Taylor & Francis Group, 1st Edition, 2022.

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**PROGRAMMING FOR PROBLEM SOLVING****I B.Tech-I Semester****Course Code: A2CS106ES****L T P C****3 0 0 3****COURSE OBJECTIVES:** To learn the fundamentals of computers.

1. To understand the various steps in program development.
2. To learn the syntax and semantics of the C programming language.
3. To learn the usage of structured programming approaches in solving problems.

**COURSE OUTCOMES:** The student will learn

1. To write algorithms and to draw flowcharts for solving problems
2. To convert the algorithms/flowcharts to C programs.
3. To code and test a given logic in the C programming language.
4. To decompose a problem into functions and to develop modular reusable code.
5. To use arrays, pointers, strings and structures to write C programs
6. Searching and sorting problems.

**UNIT I**

Introduction to Programming Compilers, compiling and executing a program. Representation of Algorithm - Algorithms for finding roots of a quadratic equations, finding minimum and maximum numbers of a given set, finding if a number is prime number Flowchart/Pseudo code with examples, Program design and structured programming Introduction to C Programming Language: variables (with data types and space requirements), Syntax and Logical Errors in compilation, object and executable code, Operators, expressions and precedence, Expression evaluation, Storage classes (auto, extern, static and register), type conversion, The main method and command line arguments Bitwise operations: Bitwise AND, OR, XOR and NOT operators Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do- while loops I/O: Simple input and output with scanf and printf, formatted I/O, Introduction to stdin, stdout and stderr. Command line arguments

**UNIT II**

Arrays, Strings, Structures and Pointers: Arrays: one and two dimensional arrays, creating, accessing and manipulating elements of arrays Strings: Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strstr etc.), arrays of strings Structures: Defining structures, initializing structures, unions, Array of structures Pointers: Idea of pointers, Defining pointers, Pointers to Arrays and Structures, Use of Pointers in selfreferential structures, usage of self referential structures in linked list (no implementation) Enumeration data type

**UNIT III**

Preprocessor and File handling in C: Preprocessor: Commonly used Preprocessor commands like include, define, undef, if, ifdef, ifndef Files: Text and Binary files, Creating and Reading and writing text and binary files, appending data to existing files, Writing and reading structures using binary files, Random access using fseek, ftell and rewind functions.

**UNIT IV**

Function and Dynamic Memory Allocation: Functions: Designing structured programs, Declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, Passing arrays to functions, passing pointers to functions, idea of call by reference, Some C standard functions and libraries R22 B.Tech. AI & DS Syllabus JNTU Hyderabad Recursion: Simple programs, such as Finding Factorial, Fibonacci series etc., Limitations of Recursive functions Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays of different data types

**UNIT V**

Searching and Sorting: Basic searching in an array of elements (linear and binary search techniques), Basic algorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms), Basic concept of order of complexity through the example programs

**TEXT BOOKS**

1. Jeri R. Hanly and Elliot B.Koffman, Problem solving and Program Design in C 7th Edition, Pearson
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)

**REFERENCE BOOKS**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill
3. Yashavant Kanetkar, Let Us C, 18th Edition, BPB
4. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
5. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
6. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition
7. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

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**WORKSHOP MANUFACTURING PRACTICE****I B.Tech-I Semester****Course Code: A2ME116ES****L T P C****0 1 3 2.5****COURSE OBJECTIVES:** The course should enable the students to:

1. To Study of different hand operated power tools, uses and their demonstration.
2. To gain a good basic working knowledge required for the production of various engineering products.
3. To provide hands on experience about use of different engineering materials, tools, equipment and processes those are common in the engineering field.
4. To develop a right attitude, team working, precision and safety at work place.
5. It explains the construction, function, use and application of different working tools, equipment and machines.
6. To study commonly used carpentry joints.
7. To have practical exposure to various welding and joining processes.
8. Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.

**COURSE OUTCOMES:** By the end of the course students will be able:

1. Study and practice on machine tools and their operations
2. Practice on manufacturing of components using workshop trades including plumbing, fitting, carpentry, foundry, house wiring and welding.
3. Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
4. Apply basic electrical engineering knowledge for house wiring practice.

**LIST OF EXPERIMENTS****I. TRADES FOR EXERCISES:**

At least two exercises from each trade:

- |              |                                                                                  |
|--------------|----------------------------------------------------------------------------------|
| Experiment-1 | Carpentry – (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)                 |
| Experiment-2 | Fitting – (V-Fit, Dovetail Fit & Semi-circular fit)                              |
| Experiment-3 | Tin-Smithy – (Square Tin, Rectangular Tray & Conical Funnel)                     |
| Experiment-4 | Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern) |
| Experiment-5 | Welding Practice – (Arc Welding & Gas Welding)                                   |
| Experiment-6 | House-wiring – (Parallel & Series, Two-way Switch and Tube Light)                |
| Experiment-7 | Black Smithy – (Round to Square, Fan Hook and S-Hook)                            |

**II. TRADES FOR DEMONSTRATION & EXPOSURE:**

- |              |                                              |
|--------------|----------------------------------------------|
| Experiment-1 | Plumbing, Machine Shop, Metal Cutting        |
| Experiment-2 | Power tools in construction and Wood Working |

**REFERENCE BOOKS**

1. Workshop Practice /B. L. Juneja /Cengage
2. Workshop Manual / K. Venugopal /Anuradha.
3. Workshop Manual - P. Kannaiah/ K. L. Narayana/SciTech
4. Workshop Manual / Venkat Reddy/BSP

**ENGLISH FOR SKILL ENHANCEMENT****I B.Tech-I Semester****Course Code: A2EN105HS****L T P C****2 0 0 2****COURSE OBJECTIVES:** This course will enable the students to:

1. Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
2. Develop study skills and communication skills in various professional situations.
3. Equip students to study engineering subjects more effectively and critically using the theoretical and practical components of the syllabus.

**COURSE OUTCOMES:** Students will be able to:

1. Understand the importance of vocabulary and sentence structures.
2. Choose appropriate vocabulary and sentence structures for their oral and written communication.
3. Demonstrate their understanding of the rules of functional grammar.
4. Develop comprehension skills from the known and unknown passages.
5. Take an active part in drafting paragraphs, letters, essays, abstracts, précis and reports in various contexts.
6. Acquire basic proficiency in reading and writing modules of English.

**UNIT I**

Chapter entitled 'Toasted English' by R.K.Narayan from "*English: Language, Context and Culture*" published by Orient Black Swan, Hyderabad.

**Vocabulary:** The Concept of Word Formation -The Use of Prefixes and Suffixes - Acquaintance with Prefixes and Suffixes from Foreign Languages to form Derivatives - Synonyms and Antonyms

**Grammar:** Identifying Common Errors in Writing with Reference to Articles and Prepositions.

**Reading:** Reading and Its Importance- Techniques for Effective Reading.

**Writing:** Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing precisely – Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

**UNIT II**

Chapter entitled 'Appro JRD' by Sudha Murthy from "*English: Language, Context and Culture*" published by Orient Black Swan, Hyderabad.

**Vocabulary:** Words Often Miss pelt - Homophones, Homonyms and Homographs

**Grammar:** Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

**Reading:** Sub-Skills of Reading – Skimming and Scanning – Exercises for Practice

**Writing:** Nature and Style of Writing- Defining /Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence.

**UNIT III**

Chapter entitled 'Lessons from Online Learning' by F.Haider Alvi, Deborah Hurst et al from "*English: Language, Context and Culture*" published by Orient Black Swan, Hyderabad.

**Vocabulary:** Words Often Confused - Words from Foreign Languages and their Use in English.

**Grammar:** Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.

**Reading:** Sub-Skills of Reading – Intensive Reading and Extensive Reading – Exercises for Practice.

**Writing:** Format of a Formal Letter-Writing Formal Letters E.g., Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with CV/Resume.

**UNIT IV**

Chapter entitled 'Art and Literature' by Abdul Kalam from "*English: Language, Context and Culture*" published by Orient Black Swan, Hyderabad.

**Vocabulary:** Standard Abbreviations in English

**Grammar:** Redundancies and Clichés in Oral and Written Communication.

**Reading:** Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice

**Writing:** Writing Practices- Essay Writing-Writing Introduction and Conclusion -Précis Writing.

**UNIT V**

Chapter entitled 'Go, Kiss the World' by Subroto Bagchi from "*English: Language, Context and Culture*" published by **Orient Black Swan, Hyderabad.**

**Vocabulary:** Technical Vocabulary and their Usage Grammar: Common Errors in English (*Covering all the other aspects of grammar which were not covered in the previous units*)

**Reading:** Reading Comprehension-Exercises for Practice

**Writing:** Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

**Note:** Listening and Speaking Skills which are given under Unit-6 in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.

- **Note:** 1. As the syllabus of English given in AICTE Model Curriculum-2018 for B.Tech First Year is *Open-ended*, besides following the prescribed textbook, it is required to prepare teaching/learning materials by the teachers collectively in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.
- **Note:** 2. Based on the recommendations of NEP2020, teachers are requested to be flexible to adopt Blended Learning in dealing with the course contents. They are advised to teach 40 percent of each topic from the syllabus in blended mode.

**TEXT BOOKS**

1. "English: Language, Context and Culture" by Orient BlackSwan Pvt. Ltd, Hyderabad. 2022. Print.

**REFERENCE BOOKS:**

1. Effective Academic Writing by Liss and Davis (OUP)
2. Richards, Jack C. (2022) Interchange Series. Introduction, 1,2,3. Cambridge University Press
3. Wood, F.T. (2007). Remedial English Grammar. Macmillan.
4. Chaudhuri, Santanu Sinha. (2018). Learn English: A Fun Book of Functional Language, Grammar and Vocabulary. (2<sup>nd</sup> ed.,). Sage Publications India Pvt. Ltd.
5. (2019). Technical Communication. Wiley India Pvt. Ltd.
6. Vishwamohan, Aysha. (2013). English for Technical Communication for Engineering Students. Mc Graw-Hill Education India Pvt. Ltd.
7. Swan, Michael. (2016). Practical English Usage. Oxford University Press. Fourth Edition.



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## **ELEMENTS OF ELECTRONICS AND COMMUNICATION ENGINEERING**

**I B.Tech-I Semester****Course Code: A2EC101ES****L T P C****0 0 2 1**

**COURSE OBJECTIVES:** The objectives of this course for the student are to

1. Understand the various components used in electronic
2. Study how voltmeter and ammeter will be used for measuring
3. Understand various analog and digital ICs

**COURSE OUTCOMES:** Students will be able to

1. Identify the different components used for electronics applications
2. Measure different parameters using various measuring instruments
3. Distinguish various signal used for analog and digital communications

**LIST OF EXPERIMENTS:**

1. Understand the significance of Electronics and Communications Subjects
2. Identify the different passive and active components
3. Color code of resistors, finding the types and values of capacitors
4. Measure the voltage and current using voltmeter and ammeter
5. Measure the voltage, current with Multimeter and study the other measurements using Multimeter
6. Study the CRO and measure the frequency and phase of given signal
7. Draw the various Lissajous figures using CRO
8. Study the function generator for various signal generations
9. Study of Spectrum analyzer and measure the spectrum
10. Operate Regulated power supply for different supply voltages
11. Study the various gates module and write down the truth table of them
12. Identify various Digital and Analog ICs
13. Observe the various types of modulated signals.
14. Know the available Softwares for Electronics and communication applications

**APPLIED PHYSICS LABORATORY****I B.Tech-I Semester****Course Code: A2AP112BS****L T P C****0 0 3 1.5****COURSE OBJECTIVES:** The objectives of this course for the student to

1. Capable of handling instruments related to the Hall effect and photoelectric effect experiments and them Measurements.
2. Understand the characteristics of various devices such as PN junction diode, Zener diode, BJT, LED, solar cell, lasers and optical fiber and measurement of energy gap and resistivity of semiconductor materials.
3. To understand the behavior of Laser and to understand numerical aperture of an optical fibre.
4. Study the behavior of B-H curve of ferromagnetic materials.
5. Understanding the method of least squares fitting.

**COURSE OUTCOMES:** The students will be able to:

1. Know the determination of the Planck's constant using Photo electric effect and identify the material whether it is n-type or p-type by Hall experiment.
2. Appreciate quantum physics in semiconductor devices and opto electronics.
3. understand the directional property of laser and numerical aperture of an optical fibre.
4. Understand the variation of magnetic field and behavior of hysteresis curve.
5. Carried out data analysis.

**Note:** Any 8 experiments are to be performed.**LIST OF EXPERIMENTS:**

1. Determination of work function and Planck's constant using photoelectric effect.
2. To determine Hall co-efficient and carrier concentration of a given semiconductor.
3. Characteristics of series and parallel LCR circuits.
4. V-I characteristics of a p-n junction diode and Zener diode.
5. Input and output characteristics of BJT (CE, CB & CC configurations).
6. a) To study the V-I and P-I characteristics of a Light Emitting Diode (LED).  
b) Plot V-I Characteristics of a solar cell.
7. Determination of Energy gap of a semiconductor.
8. Study B-H curve of a magnetic material.
9. a) Determination of the beam divergence of the given LASER beam.  
b) Determination of Acceptance Angle and Numerical Aperture of an optical fiber.
10. To determine the rigidity modulus of the material of the given wire using Torsional pendulum.

**TEXT BOOKS**

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

## ENGLISH LANGUAGE AND COMMUNICATION SKILLS LABORATORY

**I B.Tech-I Semester****Course Code: A2AP113HS****L T P C****0 0 2 1**

The **English Language and Communication Skills (ELCS) Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

**COURSE OBJECTIVES:** To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning

1. To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
2. To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
3. To improve the fluency of students in spoken English and neutralize the impact of dialects.
4. To train students to use language appropriately for public speaking, group discussions and interviews

**COURSE OUTCOMES:** Students will be able to

1. Understand the nuances of English language through audio-visual experience and group activities
2. Neutralize their accent for intelligibility
3. Speak with clarity and confidence which in turn enhances their employability skills

**Syllabus:** English Language and Communication Skills Lab (ELCS) shall have two parts:

- a. Computer Assisted Language Learning (CALL) Lab
- b. Interactive Communication Skills (ICS) Lab

### Listening Skills:

#### Objectives

1. To enable students, develop their listening skills so that they may appreciate the role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening, so that they can comprehend the speech of people of different backgrounds and regions

*Students should be given practice in listening to the sounds of the language, to be able to recognize them and find the distinction between different sounds, to be able to mark stress and recognize and use the right intonation in sentences.*

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

### Speaking Skills:

#### Objectives

1. To involve students in speaking activities in various contexts
2. To enable students express themselves fluently and appropriately in social and professional contexts
  - Oral practice
  - Describing objects/situations/people
  - Role play – Individual/Group activities
  - Just A Minute (JAM) Session

The following course content is prescribed for the **English Language and Communication Skills Lab**.

#### Exercise – ICALL Lab:

**Understand:** Listening Skill- Its importance – Purpose- Process- Types- Barriers- Effective Listening. **Practice:** Introduction to Phonetics – Speech Sounds – Vowels and Consonants – Minimal Pairs-Consonant Clusters- Past Tense Marker and Plural Marker- *Testing Exercises*

#### ICS Lab:

**Understand:** Spoken vs. Written language- Formal and Informal English.

**Practice:** Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

**Exercise – II**

*Understand:* Structure of Syllables – Word Stress– Weak Forms and Strong Forms – Stress pattern insentences – Intonation.

*Practice:* Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms- Stress pattern insentences – Intonation - *Testing Exercises*

**ICS Lab:**

*Understand:* Features of Good Conversation – Strategies for Effective Communication.

*Practice:* Situational Dialogues – Role Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone Etiquette.

**Exercise - IIICALL Lab:**

*Understand:* **Errors in Pronunciation-Neutralising Mother Tongue Interference (MTI).**

*Practice:* Common Indian Variants in Pronunciation – Differences between British and American Pronunciation -*Testing Exercises*

**ICS Lab:**

*Understand:* Descriptions- Narrations- Giving Directions and Guidelines – Blog Writing

*Practice:* Giving Instructions – Seeking Clarifications – Asking for and Giving Directions – Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions.

**Exercise-IVCALL Lab:**

*Understand:* Listening for General Details.

*Practice:* Listening Comprehension Tests - *Testing Exercises*

**ICS Lab:**

*Understand:* Public Speaking – Exposure to Structured Talks - Non-verbal Communication-Presentation Skills.

*Practice:* Making a Short Speech – Extempore- Making a Presentation.

**Exercise – VCALL Lab:**

*Understand:* Listening for Specific Details.

*Practice:* Listening Comprehension Tests -*Testing Exercises*

**ICS Lab:**

*Understand:* Group Discussion

*Practice:* Group Discussion Minimum Requirement of infrastructural facilities for ELCS Lab:

**1. Computer Assisted Language Learning (CALL) Lab:**

The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.

**System Requirement (Hardware component):**

*Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:*

- i) Computers with Suitable Configuration
- ii) High Fidelity Headphones

**2. Interactive Communication Skills (ICS) Lab :**

**The Interactive Communication Skills Lab:** A Spacious room with movable chairs and audio- visual aids with a Public Address System, a T. V. or LCD, a digital stereo –audio & video system and camcorder etc.

**Source of Material (Master Copy):**

- *Exercises in Spoken English. Part 1,2,3.* CIEFL and Oxford University Press

**Note:** Teachers are requested to make use of the master copy and get it tailor-made to suit the contents of the syllabus.

**Suggested Software:**

- Cambridge Advanced Learners' English Dictionary with CD.
- Grammar Made Easy by Darling Kindersley.
- Punctuation Made Easy by Darling Kindersley.
- Oxford Advanced Learner's Compass, 10<sup>th</sup> Edition.
- English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
- English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
- Digital All
- Orell Digital Language Lab (Licensed Version)

**TEXT BOOKS**

1. (2022). *English Language Communication Skills – Lab Manual cum Workbook*. Cengage Learning India Pvt. Ltd.
2. Shobha, KN & Rayen, J. Lourdes. (2019). *Communicative English – A workbook*. Cambridge University Press
3. Kumar, Sanjay & Lata, Pushp. (2019). *Communication Skills: A Workbook*. Oxford University Press
4. Board of Editors. (2016). *ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities*.
5. Mishra, Veerendra et al. (2020). *English Language Skills: A Practical Approach*. Cambridge University Press.

## PROGRAMMING FOR PROBLEM SOLVING LABORATORY

I B.Tech-I Semester

L T P C

Course Code: A2EN114ES

0 0 2 1

Note: The programs may be executed using any available Open Source/ Freely available IDE Some of the Tools available are:

**CodeLite:** <https://codelite.org/> **Code:Blocks:** <http://www.codeblocks.org/>

**DevCpp:** <http://www.bloodshed.net/devcpp.html> **Eclipse:** <http://www.eclipse.org>

This list is not exhaustive and is NOT in any order of preference]

**COURSE OBJECTIVES:** The students will learn the following:

1. To work with an IDE to create, edit, compile, run and debug programs
2. To analyze the various steps in program development.
3. To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
4. To develop modular, reusable and readable C Programs using the concepts like functions, arrays etc.
5. To write programs using the Dynamic Memory Allocation concept.
6. To create, read from and write to text and binary files

**COURSE OUTCOMES:** The candidate is expected to be able to:

1. Formulate the algorithms for simple problems
2. Translate given algorithms to a working and correct program
3. Correct syntax errors as reported by the compilers
4. Identify and correct logical errors encountered during execution
5. Represent and manipulate data with arrays, strings and structures
6. Use pointers of different types
7. Create, read and write to and from simple text and binary files
8. Modularize the code with functions so that they can be reused

### Practice Sessions:

- a. Write a simple program that prints the results of all the operators available in C (including pre/post increment, bitwise and/or/not, etc.). Read required operand values from standard input.
- b. Write a simple program that converts one given data type to another using auto conversion and casting. Take the values from standard input.

### Simple numeric problems

- a. Write a program for finding the max and min from the three numbers.
- b. Write the program for the simple, compound interest.
- c. Write a program that declares Class awarded for a given percentage of marks, where mark <40%= Failed, 40% to <60% = Second class, 60% to <70%=First class, >= 70% = Distinction. Read percentage from standard input.
- d. Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be:
  - e. 5 x 1 = 5
  - f. 5 x 2 = 10
  - g. 5 x 3 = 15
- h. Write a program that shows the binary equivalent of a given positive number between 0 to 255.

### Expression Evaluation:

- a. A building has 10 floors with a floor height of 3 meters each. A ball is dropped from the top of the building. Find the time taken by the ball to reach each floor. (Use the formula  $s = ut + \frac{1}{2}at^2$  where u and a are the initial velocity in m/sec (= 0) and acceleration in m/sec<sup>2</sup> (= 9.8 m/s<sup>2</sup>)).
- b. 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)
- c. Write a program that finds if a given number is a prime number
- d. Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.
- e. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
- f. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.



- g. Write a C program to find the roots of a Quadratic equation.
- h. Write a C program to calculate the following, where  $x$  is a fractional value. i.  $1 - x/2 + x^2/4 - x^3/6$
- j. Write a C program to read in two numbers,  $x$  and  $n$ , and then compute the sum of this geometric progression:  $1 + x + x^2 + x^3 + \dots + x^n$ . For example: if  $n$  is 3 and  $x$  is 5, then the program computes  $1 + 5 + 25 + 125$ .

### Arrays, Pointers and Functions:

- a. Write a C program to find the minimum, maximum and average in an array of integers.
- b. Write a function to compute mean, variance, Standard Deviation, sorting of  $n$  elements in a single dimension array.
- c. Write a C program that uses functions to perform the following:
- d. Addition of Two Matrices
- e. Multiplication of Two Matrices
- f. Transpose of a matrix with memory dynamically allocated for the new matrix as row and column counts may not be the same.
- g. Write C programs that use both recursive and non-recursive functions
- h. To find the factorial of a given integer.
- i. To find the GCD (greatest common divisor) of two given integers.
- j. To find  $x^n$
- k. Write a program for reading elements using a pointer into an array and display the values using the array.
- l. Write a program for display values reverse order from an array using a pointer.
- m. Write a program through a pointer variable to sum of  $n$  elements from an array.

### Arrays Files:

- a. Write a C program to display the contents of a file to standard output device.
- b. Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.
- c. Write a C program to count the number of times a character occurs in a text file. The file name and the character are supplied as command line arguments.
- d. Write a C program that does the following:  
It should first create a binary file and store 10 integers, where the file name and 10 values are given in the command line. (hint: convert the strings using `atoi` function)  
Now the program asks for an index and a value from the user and the value at that index should be changed to the new value in the file. (hint: use `fseek` function)  
The program should then read all 10 values and print them back.
- e. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file).

### Strings:

- a. Write a C program to convert a Roman numeral ranging from I to L to its decimal equivalent.
- b. Write a C program that converts a number ranging from 1 to 50 to Roman equivalent
- c. Write a C program that uses functions to perform the following operations:
- d. To insert a sub-string into a given main string from a given position.
- e. To delete  $n$  Characters from a given position in a given string.
- f. Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)
- g. Write a C program that displays the position of a character  $ch$  in the string  $S$  or  $-1$  if  $S$  doesn't contain  $ch$ .
- h. Write a C program to count the lines, words and characters in a given text.

### Miscellaneous:

- a. Write a menu driven C program that allows a user to enter  $n$  numbers and then choose between finding the smallest, largest, sum, or average. The menu and all the choices are to be functions. Use a switch statement to determine what action to take. Display an error message if an invalid choice is entered.
- b. Write a C program to construct a pyramid of numbers as follows:

```

1          *          1          1          *
1 2        * *        2 3          2 2        * *
1 2 3      * * *      4 5 6        3 3 3        * *
                                     4 4 4 4        * *
                                     *

```

**Sorting and Searching:**

- a. Write a C program that uses non recursive function to search for a Key value in a given
- b. list of integers using linear search method.
- c. Write a C program that uses non recursive function to search for a Key value in a given
- d. sorted list of integers using binary search method.
- e. Write a C program that implements the Bubble sort method to sort a given list of
- f. integers in ascending order.
- g. Write a C program that sorts the given array of integers using selection sort in descending order
- h. Write a C program that sorts the given array of integers using insertion sort in ascending order
- i. Write a C program that sorts a given array of names

**TEXT BOOKS**

1. Jeri R. Hanly and Elliot B.Koffman, Problem solving and Program Design in C 7th Edition, Pearson
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)

**REFERENCE BOOKS**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, PHI
2. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill
3. Yashavant Kanetkar, Let Us C, 18th Edition, BPB
4. R.G. Dromey, how to solve it by Computer, Pearson (16th Impression)
5. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
6. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition
7. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

## **SOCIAL INNOVATION**

**I B.Tech-I Semester****Course Code: A2EC101MC****L T P C****0 0 2 0**

### **COURSE DESCRIPTION:**

Course Overview: Social Innovation is an open-ended course to develop social connectedness in engineering students through social awareness and social consciousness. This can be done through live field exposure along with faculty led conceptual presentations, real case reviews, self-study assignments, literature and field survey. Through this course, the students are expected to use their engineering knowledge to provide innovative solutions to existing social problems. This course also develops critical thinking ability among the students to develop sustainable solutions.

**COURSE OUTCOMES:** At the end of the course, student will be able to:

1. Develop awareness on social issues faced by local regions.
2. Identify the mind set of human Race and interpret the societal issues as simple, complicated, and complex problems.
3. Identify the need statement along with its main causes and effects.
4. Develop an innovative and sustainable solution for social issues by thinking critically and creatively.

### **MODULE 1**

Introduction to Social Innovation: Core definitions, core elements and common features of social innovation, a typology of social innovation, awakening social consciousness.

### **MODULE 2**

Create Mind sets and Wicked Problems: Seven mind sets – Empathy, Optimism, Iteration, Creative confidence, making it, embracing ambiguity, learning from failures. Distinguish between simple, complicated, and complex problems; describe the characteristics of wicked problems, breakdown a given problem by unpacking its complexity.

### **MODULE 3**

Critical and Creative Thinking for Social Innovation: Definition, engineering thinking and learning, distinguish between creativity and innovation. Models of Creative thinking. [Appreciative Inquiry (AI), Asset Based Community Development (ABCD) and Concept of Bricolage.]

### **MODULE 4**

Process of Social Innovation: Community study, develop questionnaire, identifying the causes of a particular problem.

### **MODULE 5**

Process of Social Innovation: Identify needs, record your learning's.

### **MODULE 6**

Process of Social Innovation: Generate ideas, select promising ideas, prototyping, and testing.

### **MODULE 7**

Social Innovation across Four Sectors - The non-profit sector, public sector, the private sector, the informal sector, links between and cross sectors.

### **MODULE 8**

Stages of Innovation: Social organizations and enterprises, social movements, social software and open source methods, common patterns of success and failure.

### **TEXT BOOKS**

1. Robin Murray, Julie Caulier-Grice, Geoff Mulgan, "The open book of social innovation: Ways to Design, Develop and Grow Social Innovation", The Young Foundation, 2010.
2. Julie Caulier-Grice, Anna Davies, Robert Patrick & Will Norman, The Young Foundation (2012) Social Innovation Overview: A deliverable of the project: "The theoretical, empirical and policy foundations for building social innovation in Europe" (TEPSIE), European Commission – 7th Framework Programme, Brussels: European Commission, DG Research.

**REFERENCE BOOKS**

1. Geoff Mulgan, “Social Innovation: What it is, Why it matters and How it can be accelerated”, The Young Foundation, 2007.
2. Asset Based Community Development (ABCD) Model – <http://www.nurtureddevelopment.org/asset-based-community-development/>
3. Diana Whitney & Amanda Trosten-Bloom, “The Power of Appreciative inquiry – A Practical Guide to Positive Change”, 2nd Edition, Berrett-Koehler Publishers, Inc, 2010.

# **I-YEAR (II-SEMESTER)**

## ORDINARY DIFFERENTIAL EQUATIONS & ADVANCED CALCULUS

I B.Tech-II Semester

Course Code: A2MA201BS

L T P C

3 1 0 4

**COURSE OBJECTIVES:** The students would be able to learn

1. Methods of solving the differential equations of first order.
2. Different methods of solving the differential equations of higher order.
3. Concept, properties of Laplace transform and solving ordinary differential equations using Laplace transforms techniques.
4. The physical quantities involved in engineering field related to vector valued functions.
5. The basic properties of vector valued functions and their applications to line, surface and volume integrals

**COURSE OUTCOMES:** Upon the successful completion of this course, the students will be able to

1. Identify whether the given differential equation of first order is exact or not
2. Solve higher differential equation and apply the concept of differential equation to real world problems
3. Use the Laplace Transform techniques for solving ODE's
4. Evaluate the line, surface and volume integrals and converting them from one to another.
5. Apply Green, Gauss, and Stokes theorem to the integrals.

### UNIT I

**First Order Ordinary Differential Equation:** Exact, linear and Bernoulli's equations: Orthogonal Trajectories (in Cartesian and polar coordinates) Newton's law of cooling, Law of natural growth and decay.

### UNIT II

**Ordinary Differential Equations of Higher Order :** Second order linear differential equations with constant coefficients: non-Homogeneous terms of the type  $e^{ax}$ ,  $\sin ax$ ,  $\cos ax$ , polynomials in  $x$ ,  $e^{ax}(x)$  and  $x V(x)$ ; method of Variation of parameters; Equations reducible to linear ODE with constant coefficients: Legendre's equation, Cauchy-Euler equation. Application to Electrical circuits.

### UNIT III

**Laplace Transforms:** Laplace Transform of standard functions; first shifting theorem, second shifting theorem, Laplace transforms of functions when they are multiplied and divided by 't'. Laplace transforms of derivatives and integrals of function; Evaluation of integrals by Laplace transforms; Laplace transforms of Specific functions (Unit step function, Unit impulsive function); Laplace transform of Periodic functions. Inverse Laplace transform by different methods, Convolution theorem (without Proof), Solving ODEs by Laplace Transform method.

### UNIT IV

**Vector Differentiation:** Vector point functions and Scalar point functions. Gradient, Divergence and Curl. Directional derivatives, Tangent plane and normal line. Vector Identities. Scalar potential functions. Solenoidal and Irrotational vectors.

### UNIT V

**Vector Integration:** Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stokes theorems (statement & their verification)

### TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint,

### REFERENCE BOOKS

1. Paras Ram, Engineering Mathematics, 2nd Edition, CBS Publishes
2. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984

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**ENGINEERING CHEMISTRY****I B.Tech-II Semester****Course Code: A2CH202BS****L T P C****3 1 0 4****COURSE OBJECTIVES:**

1. To bring adaptability to new developments in Engineering Chemistry and to acquire the skills required to become a perfect engineer.
2. To include the importance of water in industrial usage, fundamental aspects of battery chemistry, significance of corrosion it's control to protect the structures.
3. To imbibe the basic concepts of petroleum and its products.
4. To acquire required knowledge about engineering materials like cement, smart materials and Lubricants.

**COURSE OUTCOMES:**

1. Students will acquire the basic knowledge of electrochemical procedures related to corrosion and its control.
2. The students are able to understand the basic properties of water and its usage in domestic and industrial purposes.
3. They can learn the fundamentals and general properties of polymers and other engineering materials.
4. They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs.

**UNIT I**

**Water and its treatment: Introduction to hardness of water** – Estimation of hardness of water by complex metric method and related numerical problems. Potable water and its specifications - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and break - point chlorination. Defluoridation- Determination of F- ion by ion- selective electrode method.

**Boiler troubles:** Sludges, Scales and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning, External treatment methods - Softening of water by ion- exchange processes. Desalination of water – Reverse osmosis.

**UNIT II**

**Battery Chemistry & Corrosion:** Introduction - Classification of batteries- primary, secondary and reserve batteries with examples. Basic requirements for commercial batteries. Construction, working and applications of: Zn-air and Lithium ion battery, Applications of Li-ion battery to electrical vehicles. Fuel Cells- Differences between battery and a fuel cell, Construction and applications of Methanol- Oxygen fuel cell and Solid oxide fuel cell. Solar cells - Introduction and applications of Solar cells.

**Corrosion:** Causes and effects of corrosion – theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion, Types of corrosion: Galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current methods.

**UNIT III**

**Polymeric materials: Definition** – Classification of polymers with examples – Types of polymerizations – addition (free radical addition) and condensation polymerization with examples – Nylon 6:6, Terylene **Plastics:** Definition and characteristics- thermoplastic and thermosetting plastics, Preparation, Properties and engineering applications of PVC and Bakelite, Teflon, Fiber reinforced plastics (FRP).

**Rubbers:** Natural rubber and its vulcanization. **Elastomers:** Characteristics –preparation – properties and applications of Buna-S, Butyl and Thiokol rubber.

**Conducting polymers:** Characteristics and Classification with examples-mechanism of conduction in trans-polyacetylene and applications of conducting polymers. **Biodegradable polymers:** Concept and advantages - Polylactic acid and poly vinyl alcohol and their applications.

**UNIT IV**

**Energy Sources:** Introduction, Calorific value of fuel – HCV, LCV- Dulong's formula. Classification- solid fuels: coal –analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels – composition and uses of natural gas, LPG and CNG, Biodiesel – Transesterification, advantages.



**UNIT V**

**Engineering Materials: Cement:** Portland cement, its composition, setting and hardening.

**Smart materials and their engineering applications:** Shape memory materials- Poly L- Lactic acid. Thermo response materials- Polyacryl amides, Poly vinyl amides

**Lubricants:** Classification of lubricants with examples-characteristics of good lubricants – mechanism of lubrication (thick film, thin film and extreme pressure)- properties of lubricants: viscosity, cloud point, pour point, flash point and fire point.

**TEXT BOOKS**

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010 .
2. Engineering Chemistry by Rama Devi, Venkata Ramana Reddy and Rath, Cengage learning, 2016 .
3. A text book of Engineering Chemistry by M. Thirumala Chary, E. Laxminarayana and K Shashikala, Pearson Publications, 2021.
4. Textbook of Engineering Chemistry by Jaya Shree Anireddy, Wiley Publications.

**REFERENCE BOOKS**

1. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi (2015) .
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi (2011) .

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**ENGINEERING GRAPHICS****I B.Tech-II Semester****Course Code: A2ME208ES****L T P C****1 0 4 3****COURSE OBJECTIVES:**

1. To provide basic concepts in engineering drawing.
2. To impart knowledge about standard principles of orthographic projection of objects.
3. To draw sectional views and pictorial views of solids.

**COURSE OUTCOMES:** Upon the successful completion of this course, the students will be able to:

1. Preparing working drawings to communicate the ideas and information.
2. Read, understand and interpret engineering drawings.

**UNIT I**

**Introduction :** Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Scales –Plain & Diagonal, Introduction to Computer aided drafting – views, commands and conics

**UNIT II**

**Projections :** Projections of Points, Lines and Planes: Principles of Orthographic Projections –Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures. —Auxiliary Planes.

**UNIT III**

**Projection Of Solids: Projection** of Solids and Sectioned Solids: Projections of Regular Solids – Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere, Computer aided projections of solids – sectional views.

**UNIT IV**

**Development Of Lateral Surfaces: Development** of Lateral Surfaces: Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone, Development of surfaces using computer aided drafting

**UNIT V**

**Isometric Projections:** Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views –Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa – Conventions, Conversion of orthographic projection into isometric view using computer aided drafting.

**TEXT BOOKS**

1. Engineering Drawing N.D. Bhatt / Charotar
2. Engineering Drawing / N. S. Parthasarathy and Vela Murali/ Oxford

**REFERENCE BOOKS**

1. Engineering Drawing / Basant Agrawal and McGrawal/ McGraw Hill
2. Engineering Drawing/ M. B. Shah, B.C. Rane / Pearson.
3. Computer Aided Engineering Drawing – K Balaveera Reddy et al – CBS Publishers

**Note: - External examination is conducted in conventional mode and internal evaluation to be done by both conventional as well as using computer aided drafting.**

**BASIC ELECTRICAL ENGINEERING****I B.Tech-II Semester****Course Code: A2EE207ES****L T P C****2 0 0 2****COURSE OBJECTIVES:**

1. To understand DC and Single & Three phase AC circuits
2. To study and understand the different types of DC, AC machines and Transformers.
3. To import the knowledge of various electrical installations and the concept of power, power factor and its improvement.

**COURSE OUTCOMES:** Upon the successful completion of this course, the students will be able to:

1. Understand and analyze basic Electrical circuits
2. Study the working principles of Electrical Machines and Transformers
3. Introduce components of Low Voltage Electrical Installations.

**UNIT I**

D.C. Circuits: Electrical circuit elements (R, L and C), voltage and current sources, KVL & KCL, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

**UNIT II**

A.C. Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance in series R-L-C circuit. Three-phase balanced circuits, voltage and current relations in star and delta connections.

**UNIT III**

Transformers: Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

**UNIT IV**

Electrical Machines: Construction and working principle of dc machine, performance characteristics of dc shunt machine. Generation of rotating magnetic field, Construction and working of a three-phase induction motor, Significance of torque-slip characteristics. Single-phase induction motor, Construction and working. Construction and working of synchronous generator.

**UNIT V**

Electrical Installations: Components of LTS witch gear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

**TEXT BOOKS**

1. D.P.Kothari and I.J.Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4<sup>th</sup> Edition, 2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2<sup>nd</sup> Edition, 2008.

**REFERENCE BOOKS**

1. P.Ramana, M.Suryakalavathi, G.T.Chandrasheker, "Basic Electrical Engineering", S.Chand, 2<sup>nd</sup> Edition, 2019.
2. D.C.Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009

**ELECTRONIC DEVICES AND CIRCUITS****I B.Tech-II Semester****Course Code: A2EC201ES****L T P C****2 0 0 2****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
5. To understand the basic concepts of MOS Amplifiers

**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.
3. Understand the biasing techniques
4. Design and analyze small signal amplifier circuits.
5. Design and analyze Small Signal Low Frequency BJT Amplifiers

**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 and Inductive Filters, Clippers-Clipping at two independent levels, Clamper-Clamping Circuit Theorem, Clamping Operation, Types of Clampers.

**UNIT II**

**Bipolar Junction Transistor (BJT):** Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch, switching times, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self-Bias, Bias Stability, Bias Compensation using Diodes.

**UNIT III**

**Junction Field Effect Transistor (FET):** Construction, Principle of Operation, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and FET, Biasing of FET, FET as Voltage Variable Resistor.

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

**UNIT IV**

**Analysis and Design of Small Signal Low Frequency BJT Amplifiers:** Transistor Hybrid model, Determination of h-parameters from transistor characteristics, Typical values of h- parameters in CE, CB and CC configurations, Transistor amplifying action, 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 V**

**FET Amplifiers:** Small Signal Model, Analysis of JFET Amplifiers, Analysis of CS, CD, CG JFET Amplifiers. MOSFET Characteristics in Enhancement and Depletion mode, Basic Concepts of MOS Amplifiers.

**TEXT BOOKS**

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

**REFERENCE BOOKS**

1. The Art of Electronics, Horowitz, 3rd Edition Cambridge University Press
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, 2Ed., 2008, Mc Graw Hill.

**APPLIED PYTHON PROGRAMMING LABORATORY****I B.Tech-II Semester****Course Code: A2CS202ES****L T P C****0 1 2 2****COURSE OBJECTIVES:**

1. To install and run the Python interpreter
2. To learn control structures.
3. To Understand Lists, Dictionaries in python
4. To Handle Strings and Files in Python

**COURSE OUTCOMES:** After completion of the course, the student should be able to

1. Develop the application specific codes using python.
2. Understand Strings, Lists, Tuples and Dictionaries in Python
3. Verify programs using modular approach, file I/O, Python standard library
4. Implement Digital Systems using Python

**Note:** The lab experiments will be like the following experiment examples**Week -1:**

1. i) Use a web browser to go to the Python website <http://python.org>. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.  
ii) Start the Python interpreter and type `help()` to start the online help utility.
2. Start a Python interpreter and use it as a Calculator
3. i) Write a program to calculate compound interest when principal, rate and number of periods are given.  
ii) Given coordinates (x1, y1), (x2, y2) find the distance between two points
4. Read name, address, email and phone number of a person through keyboard and print the details.

**Week - 2:**

1. Print the below triangle using for loop.  
4 4  
3 3 3  
2 2 2 2  
1 1 1 1 1
2. Write a program to check whether the given input is digit or lowercase character or uppercase character or a special character (use 'if-else-if' ladder)
3. Python Program to Print the Fibonacci sequence using while loop
4. Python program to print all prime numbers in a given interval (use break)

**Week - 3:**

1. i) Write a program to convert a list and tuple into arrays.  
ii) Write a program to find common values between two arrays.
2. Write a function called `gcd` that takes parameters `a` and `b` and returns their greatest common divisor.
3. Write a function called `palindrome` that takes a string argument and returns `True` if it is a palindrome and `False` otherwise. Remember that you can use the built-in function `len` to check the length of a string.

**Week - 4:**

1. Write a function called `is_sorted` that takes a list as a parameter and returns `True` if the list is sorted in ascending order and `False` otherwise.
2. Write a function called `has_duplicates` that takes a list and returns `True` if there is any element that appears more than once. It should not modify the original list.
  - i). Write a function called `remove_duplicates` that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order.
  - ii). The wordlist I provided, `words.txt`, doesn't contain single letter words. So you might want to add "I", "a", and the empty string.
  - iii). Write a python code to read dictionary values from the user. Construct a function to invert its content. i.e., keys should be values and values should be keys.
3. i) Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'  
ii) Remove the given word in all the places in a string?

- iii) Write a function that takes a sentence as an input parameter and replaces the first letter of every word with the corresponding upper-case letter and the rest of the letters in the word by corresponding letters in lower case without using a built-in function?
- 4. Write a recursive function that generates all binary strings of n-bit length

**Week - 5:**

- 1. i) Write a python program that defines a matrix and prints
- ii) Write a python program to perform addition of two square matrices
- iii) Write a python program to perform multiplication of two square matrices
- 2. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions.
- 3. Use the structure of exception handling all general-purpose exceptions.

**Week-6:**

- 1. a. Write a function called draw rectangle that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.
- b. Add an attribute named color to your Rectangle objects and modify draw rectangle so that it uses the color attribute as the fill color.
- c. Write a function called draw point that takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas.
- d. Define a new class called Circle with appropriate attributes and instantiate a few Circle objects. Write a function called draw circle that draws circles on the canvas.
- 2. Write a Python program to demonstrate the usage of Method Resolution Order (MRO) in multiple levels of Inheritances.
- 3. Write a python code to read a phone number and email-id from the user and validate it for correctness.

**Week- 7:**

- 1. Write a Python code to merge two given file contents into a third file.
- 2. Write a Python code to open a given file and construct a function to check for given words present in it and display on found.
- 3. Write a Python code to Read text from a text file, find the word with most number of occurrences
- 4. Write a function that reads a file *file1* and displays the number of words, number of vowels, blank spaces, lower case letters and uppercase letters.

**Week - 8:**

- 1. Import numpy, Plotpy and Scipy and explore their functionalities.
- 2. a) Install NumPy package with pip and explore it.
- 3. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
- 4. Write a program to implement Half Adder, Full Adder, and Parallel Adder
- 5. Write a GUI program to create a window wizard having two text labels, two text fields and two buttons as Submit and Reset.

**TEXT BOOKS**

- 1. Supercharged Python: Take your code to the next level, Overland
- 2. Learning Python, Mark Lutz, O'reilly

**REFERENCE BOOKS**

- 1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
- 2. Python Programming A Modular Approach with Graphics, Database, Mobile, and Web Applications, Sheetal Taneja, Naveen Kumar, Pearson
- 3. Programming with Python, A User's Book, Michael Dawson, Cengage Learning, India Edition
- 4. Think Python, Allen Downey, Green Tea Press
- 5. Core Python Programming, W. Chun, Pearson
- 6. Introduction to Python, Kenneth A. Lambert, Cengage

**ENGINEERING CHEMISTRY LABORATORY****I B.Tech-II Semester****Course Code: A2CH210DS****L T P C****0 0 2 1**

**COURSE OBJECTIVES:** The course consists of experiments related to the principles of chemistry required

for engineering student. The student will learn:

1. Students are able to perform estimations of acids and bases using conductometry, potentiometry.
2. Students will learn to prepare polymers such as Bakelite and Thiokol Rubber in the laboratory.
3. Students will learn skills related to the lubricant properties such as saponification value, surface tension and viscosity of oils.
4. Estimation of hardness of water to check its suitability for drinking purpose.

**COURSE OUTCOMES:** The experiments will make the student gain skills on:

1. Determination of parameters like hardness of water and rate of corrosion of mild steel in various conditions.
2. Able to perform methods such as conductometry, potentiometry in order to find out the concentrations or equivalence points of acids and bases.
3. Students are able to prepare polymers like bakelite and Thiokol Rubber.
4. Estimations saponification value, surface tension and viscosity of lubricant oils.

**LIST OF EXPERIMENTS:****I. Volumetric Analysis:**

1. Estimation of Hardness of water by EDTA Complexometry method.

**II. Conductometry Analysis:**

1. Estimation of the concentration of an acid by Conductometry.

**III. Potentiometry:**

1. Estimation of the amount of Fe<sup>2+</sup> by Potentiometry.

**IV. P<sup>H</sup> Metry:**

1. Determination of an acid concentration using pH meter.

**V. Preparations:**

1. Preparation of Bakelite.
2. Preparation Thiokol Rubber.

**VI. LUBRICANTS:**

1. Estimation of acid value of given lubricant oil.
2. Estimation of Viscosity of lubricant oil using Ostwald's Viscometer.

**VII. Corrosion:**

1. Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.

**VIII. Virtual Lab Experiments:**

1. Construction of Fuel cell and its working.
2. Smart materials for Biomedical applications
3. Batteries for electrical vehicles.
4. Functioning of solar cell and its applications.

**REFERENCE BOOKS**

1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi
2. Vogel's text book of practical organic chemistry 5th edition
3. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
4. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007).



**BASIC ELECTRICAL ENGINEERING LABORATORY****I B.Tech-II Semester****Course Code: A2EE215ES****L T P C****0 0 2 1****COURSE OBJECTIVES:**

1. To measure the electrical parameters for different types of DC and AC circuits using conventional and theorems approach.
2. To study the transient response of various R,L and C Circuits using different excitations.
3. To determine the performance of different types of DC, AC machines and Transformers.

**COURSE OUTCOMES:** After learning the contents of this paper the student must be able to

1. Verify the basic Electrical circuits through different experiments.
2. Evaluate the performance calculations of Electrical Machines and Transformers through various testing methods.
3. Analyze the transient responses of R,L and C Circuits for different input conditions.

**PART-A(Compulsory)**

1. Verification of KVL and KCL
2. Verification of Thevenin's and Norton's theorem
3. Transient Response of Series RL and RC circuits for DC excitation
4. Resonance in series RLC circuit
5. Calculations and Verification of Impedance and Current of RL, RC and RLC series circuits
6. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
7. Performance Characteristics of a DC Shunt Motor
8. Torque-Speed Characteristics of a Three-phase Induction Motor.

**PART-B(any two experiments from the given list)**

1. Verification of Superposition theorem.
2. Three Phase Transformer: Verification of Relationship between Voltages and Currents(Star-Delta, Delta-Delta, Delta-Star, Star-Star)
3. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
4. Measurement of Active and Reactive Power in a balanced Three-phase circuit
5. No-Load Characteristics of a Three-phase Alternator

**TEXTBOOKS:**

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 4<sup>th</sup> Edition, 2019.
2. MS Naidu and S Kamakshaiah, "Basic Electrical Engineering", Tata McGraw Hill, 2<sup>nd</sup> Edition, 2008.

**REFERENCE BOOKS**

1. P. Ramana, M. Suryakalavathi, G.T.Chandrasheker, "Basic Electrical Engineering", S. Chand, 2<sup>nd</sup> Edition, 2019.
2. D.C.Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009
3. M. S. Sukhija, T.K. Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford, 1<sup>st</sup> Edition, 2012.
4. Abhijit Chakrabarti, Sudipta Debnath, Chandan Kumar Chanda, "Basic Electrical Engineering", 2<sup>nd</sup> Edition, McGraw Hill, 2021.
5. L.S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
6. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
7. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

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**ELECTRONIC DEVICES AND CIRCUITS LABORATORY****I B.Tech-II Semester****Course Code: A2EC202ES****L T P C****0 0 2 1****COURSE OBJECTIVES:**

1. To study basic electronic components.
2. To observe characteristics of electronic devices.
3. To observe configuration of CB, CE and CC amplifier.
4. To understand the characteristics of a transistor and SCR
5. To understand the clipper and clampers circuits at reference voltage.

**COURSE OUTCOMES:** Upon completion of the lab, the students will be able to:

1. Measure voltage, frequency and phase of any waveform using CRO.
2. Generate sine, square and triangular waveforms using function generator.
3. Analyze the characteristics of diodes, transistors, rectifiers, amplifiers etc.,
4. To know the characteristics of various components. To analyze clipping and clamping of a signal

**LIST OF EXPERIMENTS (Twelve experiments to be done):****Verify any twelve experiments in H/W Laboratory**

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

**Major Equipment Required for Laboratories:**

1. Regulated Power Suppliers, 0-30V
2. 20 MHz, Dual Channel Cathode Ray Oscilloscopes.
3. Functions Generators-Sine and Square wave signals
4. Multimeters
5. Electronic Components

## **ENGINEERING EXPLORATION**

**I B.Tech-II Semester****Course Code: A2EC202MC****L T P C****0 0 2 0**

### **COURSE DESCRIPTION:**

#### **Course Overview:**

This Course provides an opportunity for freshman students to learn in new ecosystem and is one of the unique outcomes of innovative education ecosystem in digital era of our nation. The focus of this course is on Engineering Design Process, Problem Solving, and Multi-disciplinary skills, Ethics and Data Acquisition and Analysis. This course is co-designed and co-taught by faculty members drawn from multiple engineering disciplines; it follows Project Based Learning (PBL) pedagogy with need statements covering broad themes of environmental, educational, smart appliances, smart agriculture, industrial needs etc. are used by students to carve out problem definitions by linking Sustainable Development Goals defined by United Nation. Students work in teams to solve identified problems and serves as a platform for peer learning and push students in multi-disciplinary design thinking in first year itself.

### **COURSE OUTCOMES:** By the end of the course students will be able to:

1. Compare and contrast the contributions of different types of engineers in the development of a product, process, or system.
2. Apply the common engineering design process to solve complex problems and arrive at viable solution.
3. Explore various contemporary software and hardware tools to provide solutions for the problems.
4. Apply skills needed for successful teamwork including the basics of project management and written and oral communication.
5. Identify the key elements of professional codes of ethics as well as the ethical and societal issues related to the disciplines and their impact on society and the world.

### **LIST OF ACTIVITIES**

#### **WEEK-1**

Introduction to Engineering and Engineering Study: Difference between science and engineering, scientist and engineer needs and wants, various disciplines of engineering, some misconceptions of engineering, Expectation for the 21st century engineer and Graduate Attributes.

#### **WEEK-2**

Engineering Design Process: Design Cycle, Multidisciplinary facet of design, Importance of analysis in engineering design, general analysis procedure, generation of multiple solution, decision matrix, Concepts of reverse engineering and general mechatronics system.

#### **WEEK-3**

Introduction to Open-source platforms: Open-source hardware & software tools, Development (Arduino) of Programming (Tinker CAD Tools) and its Essentials, Introduction to Sensors, Transducers and Actuators and its interfacing with Open-Source H/W & S/W tools.

#### **WEEK-4**

Engineering Ethics: Identifying Engineering as a Profession, Significance of Professional Ethics, Code of Conduct for Engineers.

#### **WEEK-5**

Sustainability: Introduction to sustainability, Sustainability leadership, Life cycle assessment.

#### **WEEK-6**

Project Management & Tools: Introduction, Significance of teamwork, Importance of communication in engineering profession, Checklist, Timeline, Gantt Chart, Significance of documentation.

### **Laboratory Equipment/Software/Tools Required**

1. Open-source Hardware: Microchip ATmega328P (UNO/NANO/MEGA).
2. I/O Peripherals: LCD, Keypad, DC/Servo Motor, Switch, 7-Segment LED modules, GSM, GPS etc.
3. Sensor Tool Kit: Digital RED/WHITE/GREEN/BLUE Light Module, IR, Analog Sound, Soil Moisture, LM35 Analog Linear Temperature, MQ7 Analog Carbon Monoxide etc.
4. Open-source Software: Arduino IDE Version 1.8.5.

### **TEXT BOOKS**

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, Exploring Engineering: An Introduction to Engineering and Design, Academic Press, 3rd edition, 2012.
2. Byron Francis, Arduino: The Complete Beginner's Guide, Create space Independent Publishers, 2016.

**REFERENCE BOOKS**

1. Neerparaj Rai, Arduino Projects for Engineers, 1st edition, BPB Publications, 2016.
2. Simon Monk, Programming Arduino: Getting Started with Sketches, 2nd Edition, McGraw-Hill Education, 2016.
3. W. Richard Bowen, Engineering Ethics – Outline of an aspirational approach, Springer London.

## **II-YEAR (I-SEMESTER)**

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**ANALOG CIRCUITS****II B.Tech-I Semester****Course Code: A2EC301PC****L T P C****3 1 0 4****PRE-REQUISITE:** Electronic Devices and Circuits**COURSE OBJECTIVES:**

1. Learn the concepts of, load line analysis and biasing techniques
2. Learn the concepts of high frequency analysis of transistors.
3. To give understanding of various types of amplifier circuits
4. Learn the concepts of small signal analysis of BJT and FET
5. To familiarize the Concept of feedback in amplifiers so as to differentiate between negative and positive feedback.

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

1. Design the amplifiers with various biasing techniques.
2. Design single stage amplifiers using BJT and FET
3. Design multistage amplifiers and understand the concepts of High Frequency Analysis of BJT.
4. Utilize the Concepts of negative feedback to improve the stability of amplifiers and positive feedback to sustained oscillations.

**UNIT I**

BJT Biasing: Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing Fixed Bias, Self Bias, Bias Stability, Bias Compensation using Diode

Analysis and Design of Small Signal Low Frequency BJT Amplifiers: Transistor Hybrid model, Determination of h-parameters from transistor characteristics, Typical values of h- parameters in CE, CB and CC configurations, Transistor amplifying action, 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 II**

FET- Biasing Techniques

FET Amplifiers: Analysis of CS, CD, CG JFET Amplifiers, comparison of performance with BJT Amplifiers, Basic Concepts of MOSFET Amplifiers, MOS Small signal model, Common source amplifier with resistive, Diode connected and Current source loads, Source follower, Common Gate Stage, Cascode and Folded Cascode Amplifier – frequency response.

**UNIT III**

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

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

**UNIT IV**

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 – Simple problems.

**UNIT V**

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

**TEXT BOOKS**

1. Jacob Millman, Christos C Halkias -Integrated Electronics, McGraw Hill Education.
2. Robert L. Boylestead, Louis Nashelsky -Electronic Devices and Circuits theory, 11<sup>th</sup> Edition, 2009, Pearson

**REFERENCE BOOKS**

1. David A. Bell – Electronic Devices and Circuits, 5<sup>th</sup> Edition, Oxford.
2. Adel S. Sedra, Kenneth C. Smith- Microelectronic Circuits- Theory and Applications, Oxford.
3. Chinmoy Saha, Arindam Halder, Debaati Ganguly -Basic Electronics-Principles and Applications, 2018, Cambridge.



**NUMERICAL METHODS AND COMPLEX VARIABLES****II B.Tech-I Semester****Course Code: A2EC302BS****L T P C****3 0 0 3****COURSE OBJECTIVES:** To learn

1. Expressing periodic function by Fourier series and a non-periodic function by Fourier transforms
2. Various numerical methods to find roots of polynomial and transcendental equations, Concept of finite differences and to estimate the value for the given data using interpolation.
3. Evaluation of integrals using numerical techniques and Solving ordinary differential equations of first order using numerical techniques.
4. Differentiation of complex valued functions and conformal mappings.
5. Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem, and Expansion of complex functions using Taylor's and Laurent's series.

**COURSE OUTCOMES:** After learning the contents of this paper the student must be able to

1. Express any periodic function in terms of sine and cosine
2. Find the root of a given polynomial and transcendental equations, and Estimate the value for the given data using interpolation.
3. Find the numerical solutions for a given first order ODE's.
4. Analyze the complex function with reference to their analyticity.
5. Complex integration using Cauchy's integral, residue theorems and Taylor's and Laurent's series expansions in complex function

**UNIT I**

**Fourier Series & Fourier Transforms:** Fourier series - Dirichlet's Conditions - Half-range Fourier series - Fourier Transforms: Fourier Sine and cosine transforms - Inverse Fourier transforms.

**UNIT II**

**Numerical Methods-I:** Solution of polynomial and transcendental equations: Bisection method, Iteration Method, Newton-Raphson method and Regula-Falsi method. Jacobi iteration method for solving linear systems of equations.

**Finite Differences:** forward differences, backward differences, central differences, symbolic relations and separation of symbols, Interpolation using Newton's forward and backward difference formulae. Central difference interpolation: Gauss's forward and backward formulae, Lagrange's method of interpolation.

**UNIT III**

**Numerical Methods-II:** Numerical integration: Trapezoidal rule and Simpson's  $1/3^{\text{rd}}$  and  $3/8^{\text{th}}$  rules. Ordinary differential equations: Taylor's series, Picard's method, Euler and modified Euler's methods, Runge-Kutta method of fourth order for first order ODE

**UNIT IV**

**Complex Differentiation:** Limit, Continuity and Differentiation of Complex functions. Cauchy-Riemann equations (without proof), Milne-Thomson methods, analytic functions, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties. (All theorems without Proofs), Conformal mappings, Mobius transformations.

**UNIT V**

**Complex Integration:** Line integrals, Cauchy's theorem, Cauchy's Integral formula, zeros of analytic functions, singularities, Taylor's series, Laurent's series, Residues, Cauchy Residue theorem and their properties. (All theorems without Proofs)

**TEXT BOOKS**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36<sup>th</sup> Edition, 2010.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

**REFERENCE BOOKS**

1. M. K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering Computations, New Age International publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9<sup>th</sup> Edition, John Wiley & Sons, 2006.
3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7<sup>th</sup> Edition, Mc-GrawHill 2004.

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**DIGITAL LOGIC DESIGN****II B.Tech-I Semester****Course Code: A2EC303PC****L T P C****3 0 0 3****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.

**COURSE OUTCOMES:** Upon completing this course, the students will be able to

1. Acquire the knowledge on numerical information in different forms and Boolean Algebra theorems.
2. Define Postulates of Boolean algebra and to minimize combinational functions, and design the combinational circuits.
3. Design and analyse sequential circuits for various cyclic functions.
4. Characterize logic families and analyze them for the purpose of AC and DC parameters.

**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**Realization of Logic Gates Using Diodes & Transistors:** AND, OR and NOT Gates using Diodes and Transistors, DCTL, RTL, DTL, TTL, CML and CMOS Logic Families and its Comparison, standard TTL NAND Gate-Analysis & characteristics, TTL open collector O/Ps, Tristate TTL, MOS & CMOS open drain and tri-state outputs, IC interfacing- TTL driving CMOS & CMOS driving TTL.**UNIT III****Combinational Logic Circuits:** Adders, Subtractors, Comparators, Multiplexers, Demultiplexers, Encoders, Decoders and Code converters, Hazards and Hazard Free Relations.**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.**UNIT IV****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.**Sequential Machines:** Finite State Machines, Synthesis of Synchronous Sequential Circuits- Serial Binary Adder, Sequence Detector, Parity-bit Generator, Synchronous Modulo N –Counters.**UNIT V****Finite state machine:** capabilities and limitations, Mealy and Moore models, State equivalence and machine minimization, simplification of incompletely specified machines, Merger graphs. Asynchronous design-modes of operation, Hazards, synthesis of SIC fundamental mode circuits, synthesis of burst mode circuits. Introduction to ASM Charts**TEXT BOOKS**

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

**REFERENCE BOOKS**

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

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**NETWORK THEORY****II B.Tech-I Semester****Course Code: A2EE304ES****L T P C****3 0 0 3****COURSE OBJECTIVES:**

1. To understand Magnetic Circuits, Network Topology
2. To understand Three phase circuits and measurement of power
3. To analyze transients in Electrical systems.
4. To evaluate Network parameters of given Electrical network
5. To design basic filter configurations

**COURSE OUTCOMES:** After this course, the student will be able to

1. Analyze the Electrical Circuits with the concept of Network topology.
2. Analyze the three phase circuits with Star & Delta connected, balanced and unbalanced loads.
3. Analyze the transient behavior of electrical networks for various excitations.
4. Obtain the various network parameters for the given two port networks & represent its transferfunction.
5. Determine the parameters for the design of various filters

**UNIT I**

**Magnetic Circuits:** Faraday's laws of electromagnetic induction – concept of self and mutual inductance – dot convention – coefficient of coupling – composite magnetic circuit - Analysis of series and parallel magnetic circuits

**Network topology:** Definitions– Graph – Tree, Basic cutset and Basic Tieset matrices for planar networks – Loop and Nodal methods of analysis of Networks with dependent & independent voltage and current sources - Duality & Dual networks.

**UNIT II**

Three phase circuits: Phase sequence – Star and delta connection – Relation between line and phase voltages and currents in balanced systems – Analysis of balanced and Unbalanced 3 phase circuits – Measurement of active and reactive power.

**UNIT III**

Transient Analysis: Transient response of R-L, R-C, R-L-C circuits (Series and Parallel combinations) for D.C. and sinusoidal excitations – Initial conditions – Classical method and Laplace transforms methods of solutions.

Transient response of the above circuits for different inputs such as step, ramp, pulse and impulse by using Laplace transforms method.

**UNIT IV**

Network Parameters: Network functions driving point and transfer impedance function networks- poles and zeros –necessary conditions for driving point function and for transfer function Two port network parameters – Z, Y, ABCD and hybrid parameters and their relations– 2- port network parameters using transformed variables.

**UNIT V**

Filters: Introduction to filters –low pass – high pass and band pass – RC, RL, filters- constant K and m derived filters and composite filter design.

**TEXT BOOKS**

1. "William Hayt and Jack E. Kemmerly", "Engineering circuit analysis", Mc Graw Hill Company, 6th edition, 2016.
2. "D. Roy Chowdary", "Networks and systems", New age international publishers, 2009.
3. "N. C. Jagan & C. Lakshminarayana", "Network Theory", B.S Publications, 2014.
4. "A. Chakrabarthy", Circuit Theory, Dhanpat Rai, 2005.

**REFERENCE BOOKS**

1. "Van Valkenburg", "Network Analysis", PHI, 3rd Edition, 2014
2. "Franklin F Kuo," "Network Analysis & Synthesis", Wiley India PVT. Ltd., second Edition, 2006
3. "K.C. A. Smith & R. E. Alley", "Electrical Circuits", Cambridge University Press, 1992

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**SIGNALS AND SYSTEMS****II B.Tech-I Semester****Course Code: A2EC305PC****L T P C****3 1 0 4****COURSE OBJECTIVES:** 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.

**COURSE OUTCOMES:** Upon completing this course the students able to:

1. Characterize various signals, systems and their time and frequency domain analysis, using transform techniques.
2. Identify the conditions for transmission of signals through systems and conditions for physical realization of systems.
3. Use sampling theorem for baseband and band pass signals for various types of sampling and for different duty cycles.
4. Apply the correlation and PSD functions for various applications.

**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:** 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.

**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, Parseval's 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. B.P. Lathi -Signals, Systems & Communications, BSP, 2013.
2. A.V. Oppenheim, A.S. Willsky and S.H. Nawabi -Signals and Systems, 2<sup>nd</sup> Ed., Prentice Hall

**REFERENCE BOOKS**

1. Simon Haykin and Van Veen, A. Rama Krishna Rao, -Signals and Systems, TMH, 2008.
2. Michel J. Robert - Fundamentals of Signals and Systems, MGH International Edition, 2008.
3. C. L. Philips, J. M. Parr and Eve A. Riskin -Signals, Systems and Transforms, 3<sup>rd</sup> Ed., PE,2004.



**ANALOG CIRCUITS LABORATORY****II B.Tech-I Semester****Course Code: A2EC306PC****L T P C****0 0 2 1****COURSE OUTCOMES:** Upon completing this course the students will be able to

1. Design amplifiers with required Q point and analyse amplifier characteristics
2. Examine the effect multistage amplification on frequency response
3. Investigate feedback concept in amplifiers and oscillator

**LIST OF EXPERIMENTS: (Twelve experiments to be done):**

Verify any twelve experiments in H/W Laboratory

1. Perform an experiment to choose Q-point for a Transistor that operate in active region and observe the effect of external Load resistance on Q-point.
2. Design a Self bias Circuit and determine the Q-point of the Transistor and its Stability factor by both simulation and realization with hardware components.
3. Obtain the I/O Characteristics of CE, CB, CC amplifiers. Calculate h-parameters from the Characteristics.
4. Design and Simulate a Common Drain Amplifier with voltage divider bias and determine the Stability factor.
5. Obtain the Drain and Transfer characteristics of CD, CS amplifiers of JFET. Calculate  $g_m$ ,  $r_d$  from the Characteristics.
6. By experiment prove that the voltage gain of Emitter Follower Circuit is one.
7. Design a Common Emitter Amplifier with a gain of 30db and Bandwidth of 10KHZ and plot the frequency response practically.
8. Design a two stage RC Coupled amplifier and prove that gain is increased and analyze the effects of coupling capacitance.
9. Practically prove that the Darlington pair has high input impedance.
10. Draw the high frequency response of common emitter transistor amplifier and calculate  $f_\alpha$ ,  $f_\beta$  and gain bandwidth product.
11. Design a cascode amplifier for a given specifications
12. Design four topologies of feedback amplifiers and draw the frequency response of them with and without feedback.
13. Design an RC phase shift oscillator circuit and derive the gain condition for oscillations practically for given frequency.
14. Design a Colpitts oscillator circuit for the given frequency and draw the output waveform.

**Major Equipment Required for Laboratories:**

1. Regulated Power Suppliers, 0-30V
2. 20 MHz, Dual Channel Cathode Ray Oscilloscopes.
3. Functions Generators-Sine and Square wave signals
4. Multimeters
5. Electronic devices

**BASIC SIMULATION LABORATORY****II B.Tech-I Semester****Course Code: A2EC307PC****L T P C****0 0 2 1****COURSE OUTCOMES:** Upon completing this course, the students will be able to

1. Generate, analyze and perform various operations on Signals/Sequences both in time and Frequency domain
2. Analyze and Characterize Continuous and Discrete Time Systems both in Time and Frequency domain along with the concept of Sampling
3. Generate different Random Signals and capable to analyze their Characteristics
4. Apply the Concepts of Deterministic and Random Signals for Noise removal Applications and on other Real Time Signals

**Note:**

- All the experiments are to be simulated using MATLAB or equivalent software
- Minimum of 15 experiment is to be completed

**LIST OF EXPERIMENTS:**

1. Basic Operations on Matrices.
2. Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit Impulse, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc.
3. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
4. Finding the Even and Odd parts of Signal/Sequence and Real and Imaginary parts of Signal.
5. Convolution for Signals and sequences.
6. Auto Correlation and Cross Correlation for Signals and Sequences.
7. Verification of Linearity and Time Invariance Properties of a given Continuous/Discrete System.
8. Computation of Unit sample, Unit step and Sinusoidal responses of the given LTI system and verifying its physical realizability and stability properties.
9. Gibbs Phenomenon Simulation.
10. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.
11. Waveform Synthesis using Laplace Transform.
12. Locating the Zeros and Poles and plotting the Pole-Zero maps in S-plane and Z-Plane for the given transfer function.
13. Generation of Gaussian noise (Real and Complex), Computation of its mean, M.S. Value and its Skew, Kurtosis, and PSD, Probability Distribution Function.
14. Verification of Sampling Theorem.
15. Removal of noise by Autocorrelation / Cross correlation.
16. Extraction of Periodic Signal masked by noise using Correlation.
17. Verification of Weiner-Khinchine Relations.
18. Checking a Random Process for Stationarity in Wide sense.

**Major Equipment Required for Laboratories:**

1. Computer System with latest specifications connected
2. Window Xp or equivalent
3. Simulation software-MAT LABORATORY or any equivalent simulation software

**DIGITAL LOGIC DESIGN LABORATORY****II B.Tech-I Semester****Course Code: A2EC308PC****L T P C****0 0 2 1****COURSE OUTCOMES:** Upon completing this course, the students will be able to

1. Acquire the knowledge on numerical information in different forms and Boolean Algebra theorems.
2. Define Postulates of Boolean algebra and to minimize combinational functions, and design the combinational circuits.
3. Design and analyze sequential circuits for various cyclic functions.
4. Characterize logic families and analyze them for the purpose of AC and DC parameters.

**LIST OF EXPERIMENTS:**

1. Realization of Logic circuit to generate r's Complement using Logic Gates.
  2. Realization of given Boolean function using universal gates and minimizing the same. Compare the gate count before and after minimization.
  3. Design and realize Full Adder circuit using gates/universal gates. Implement Full Subtractor using full adder.
  4. Designing a 2 – bit Comparator using AND, OR and NOT gates. Realize 4 – bit Comparator using 2– bit Comparators.
  5. Realize 2:1 MUX using the given gates and Design 8:1 using 2:1 MUX.
  6. Implement the given Boolean function using the given MUX(ex: code converters).
  7. Realize a 2x4 Decoder using logic gates and implement 3x8 Decoder using 2x4 Decoder.
  8. Implement the given Boolean function using given Decoders.
  9. Convert Demultiplexer to Decoder and vice versa.
  10. Verification of truth tables of flipflops using different clocks (level triggering, positive and negative edge triggering) also converts the given flipflop from one type to other.
  11. Designing of Universal n-bit shift register using flipflops and Multiplexers. Draw the timing diagram of the Shift Register.
  12. Design a Synchronous binary counter using D-flipflop/given flipflop.
  13. Design an asynchronous counter for the given sequence using given flipflops.
  14. Designing of MOD 8 Counter using JK flipflops.
  15. Designing of sequence detecting State Machine with minimal states using the given flipflops.
  16. Designing of Parity Bit(even/odd) generator using the given flipflops.
  17. Realize all logic gates with TTL logic.
  18. Realize all logic gates with DTL logic.
- \*Design a sequence detector to detect a given sequence and verify practically
- \*Design a serial subtractor for 4 bit binary numbers

**Major Equipment Required for Laboratories:**

1. 5 V Fixed Regulated Power Supply/ 0-5V or more Regulated Power Supply.
2. 20 MHz Oscilloscope with Dual Channel.
3. Bread board and components/ Trainer Kit.
4. Multimeter.

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**GENDER SENSITIZATION****II B.Tech-I Semester****Course Code: A2EC303MC****L T P C****2 0 0 0****COURSE OBJECTIVES:**

1. To Sensitize the students on the gender discrimination.
2. To Familiar them regarding the constitutional safeguard for gender equality.
3. To Train the youth on the socio-economic status of Women
4. To make them understand the implicit gender-based discrimination against women in a lifecycle approach
5. Enable them to know the constitutional provisions and laws relating to gender issues

**COURSE OBJECTIVES:**

1. Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender.
2. Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
3. Students will acquire insight into the gendered division of labor and its relation to politics and economics.
4. Men and women students and professionals will be better equipped to work and live together as equals.
5. Students will develop a sense of appreciation of women in all walks of life..

**UNIT I**

**Understanding Gender:** Introduction: Definition of Gender-Basic Gender Concepts and Terminology- Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

**UNIT II**

**Gender Roles And Relations:**Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and Its Consequences- Declining Sex Ratio. Demographic Consequences-Gender Spectrum: Beyond the Binary

**UNIT III**

**Gender And Labor:**Division and Valuation of Labor-Housework: The Invisible Labor- “My Mother doesn’t Work.” “Share the Load.”-Work: Its Politics and Economics -Fact and Fiction. Unrecognized and Unaccounted work.  
-Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

**UNIT IV**

**Gender - Based Violence:**The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment: Say No! -Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: “Chupulu”.Domestic Violence: Speaking OutIs Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Thinking about Sexual Violence Blaming the Victim-“I Fought for my Life....”

**UNIT V**

**Gender and Culture:**Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues- Gender Sensitive Language-Gender and Popular Literature - Just Relationships: Being Together as Equals Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Rosa Parks- The Brave Heart.

**Note:** Since it is Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

- *Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments. Apart from the above prescribed book, Teachers can make use of any authentic materials related to the topics given in the syllabus on “Gender”.*

**TEXT BOOK**

1. The Textbook, “Towards a World of Equals: A Bilingual Textbook on Gender” written by A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu published by Telugu Akademi, Telangana Government in 2015.

**ASSESSMENT AND GRADING:**

- Discussion & Classroom Participation: 20%
- Project/Assignment: 30%
- End Term Exam: 50%

## **II-YEAR (II-SEMESTER)**

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**ANALOG AND DIGITAL COMMUNICATIONS****II B.Tech-II Semester****Course Code: A2EC401PC****L T P C****3 0 0 3****PREREQUISITE:** Probability theory and Stochastic Processes**COURSE OBJECTIVES:**

1. To develop ability to analyze system requirements of analog and digital communication systems.
2. To understand the generation, detection of various analog and digital modulation techniques.
3. To acquire theoretical knowledge of each block in AM, FM transmitters and receivers.
4. To understand the concepts of baseband transmissions.

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

1. Analyze and design of various continuous wave and angle modulation and demodulation techniques
2. Understand the effect of noise present in continuous wave and angle modulation techniques.
3. Attain the knowledge about AM, FM Transmitters and Receivers
4. Analyze and design the various Pulse Modulation Techniques.

**UNIT I**

**Amplitude Modulation:** Need for modulation, Amplitude Modulation - Time and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves - Switching modulator, Detection of AM Waves - Envelope detector, DSBSC modulation - time and frequency domain description, Generation of DSBSC Waves - Balanced Modulators, Coherent detection of DSB- SC Modulated waves, COSTAS Loop, SSB modulation - time and frequency domain description, frequency discrimination and Phase discrimination methods for generating SSB, Demodulation of SSB Waves, principle of Vestigial side band modulation.

**UNIT II**

**Angle Modulation:** Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave using Bessel functions, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Signal- Armstrong Method, Detection of FM Signal: Balanced slope detector, Phase locked loop, Comparison of FM and AM., Concept of Pre-emphasis and de-emphasis.

**UNIT III**

**Transmitters:** Classification of Transmitters, AM Transmitters, FM Transmitters

**Receivers:** Radio Receiver - Receiver Types - Tuned radio frequency receiver, Superhetrodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, Image frequency, AGC, Amplitude limiting, FM Receiver, Comparison of AM and FM Receivers.

**UNIT IV**

**Pulse Modulation:** Types of Pulse modulation- PAM, PWM and PPM. Comparison of FDM and TDM. Pulse Code Modulation: PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, DPCM, Adaptive DPCM, DM and Adaptive DM, Noise in PCM and DM.

**UNIT V**

**Digital Modulation Techniques:** ASK- Modulator, Coherent ASK Detector, FSK- Modulator, Non- Coherent FSK Detector, BPSK- Modulator, Coherent BPSK Detection. Principles of QPSK, Differential PSK and QAM.

**Baseband Transmission and Optimal Reception of Digital Signal:** A Baseband Signal Receiver, Probability of Error, Optimum Receiver, Coherent Reception, ISI, Eye Diagrams.



**TEXT BOOKS**

1. Simon Haykin -Analog and Digital Communications, John Wiley, 2005.
2. Wayne Tomasi - Electronics Communication Systems-Fundamentals through Advanced, 5<sup>th</sup>Ed., PHI, 2009.

**REFERENCE BOOKS**

1. Herbert Taub, Donald L Schilling, Goutam Saha, -Principles of Communication Systems, 3<sup>rd</sup>Ed., McGraw-Hill, 2008.
2. Dennis Roddy and John Coolean - Electronic Communications, 4<sup>th</sup> Ed., PEA, 2004
3. George Kennedy and Bernard Davis - Electronics & Communication System, TMH, 2004
4. K. Sam Shanmugam - Analog and Digital Communication, Willey, 2005

## ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES

II B.Tech-II Semester

Course Code: A2EC402PC

L T P C

3 0 0 3

**COURSE OBJECTIVES:** Upon completing this course, the students will be able to

1. To learn the Basic Laws, Concepts and proofs related to Electrostatic Fields and Magneto static Fields, and apply them to solve physics and engineering problems.
2. To distinguish between static and time-varying fields, and understand the significance and utility of Maxwell's Equations and Boundary Conditions, and gain ability to provide solutions to communication engineering problems.
3. To study the propagation, reflection and transmission of plane waves in bounded and unbounded media.

**COURSE OUTCOMES:** Upon completing this course, the student able to

1. Acquire the knowledge of Basic Laws, Concept and proofs related to Electrostatic Fields and Magneto static Fields.
2. Characterize the static and time-varying fields, establish the corresponding sets of Maxwell's Equations and Boundary Conditions.
3. Analyze the Wave Equations and classify conductors, dielectrics and evaluate the UPW Characteristics for several practical media of interest.
4. Analyze the Design aspect of transmission line parameters and configurations.

### UNIT I

**Electrostatics:** : Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Energy Density. Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors

### UNIT II

**Magnetostatics:** Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law.

### UNIT III

**Maxwell's Equations (Time Varying Fields):** Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Two Equations for Magneto static Fields, Maxwell's Two Equations for Electrostatic Fields Maxwell's Equations in Different Forms, Conditions at a Boundary Surface - Dielectric-Dielectric and Dielectric-Conductor Interfaces

### UNIT IV

**EM Wave Characteristics:** Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definitions, Relation between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization. Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem

### UNIT V

**Transmission Lines - I:** Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless/Low Loss Characterization, Distortion – Condition for Distortionless and Minimum Attenuation, Loading - Types of Loading, SC and OC Lines,  $\lambda/4$ ,  $\lambda/2$ ,  $\lambda/8$  Lines reflection coefficient, VSWR Smith Chart-Configuration and Applications, Single Stub Matching.

**TEXT BOOKS**

1. William H. Hayt Jr. and John A. Buck- Engineering Electromagnetics, 8<sup>th</sup> Ed., McGraw Hill, 2014
2. Matthew N.O. Sadiku and S.V. Kulkarni - Principles of Electromagnetics, 6<sup>th</sup> Ed., Oxford University Press, Asian Edition, 2015.

**REFERENCE BOOKS**

1. J.D. Kraus -Electromagnetic with Applications ,5<sup>th</sup> Ed., TMH
2. Umesh Sinha, Satya Prakashan -Transmission Lines and Networks, (Tech. India Publications), New Delhi, 2001.
3. J.D. Ryder -Networks, Lines and Fields, 2<sup>nd</sup> Ed., PHI, 1999

**ELECTRONIC CIRCUIT ANALYSIS****II B.Tech-II Semester****Course Code: A2EC403PC****L T P C****3 0 0 3****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 multivibrators using transistors and sweep circuits.

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

1. Design the multistage amplifiers and understand the concepts of High Frequency Analysis of Transistors.
2. Utilize the Concepts of negative feedback to improve the stability of amplifiers and positive feedback to generate sustained oscillations.
3. Design and realize different classes of Power Amplifiers and tuned amplifiers useable for audio and Radio applications.
4. Design Multivibrators and sweep circuits for various applications

**UNIT - I**

**Multistage Amplifiers:** Classification of Amplifiers, Distortion in amplifiers, Different coupling schemes used in amplifiers, Frequency response and Analysis of multistage amplifiers, Casca RC Coupled amplifiers, Cascode amplifier, Darlington pair. Transistor at High Frequency: Hybrid  $\pi$ -model of Common Emitter transistor model,  $f_\alpha$ ,  $f_\beta$  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 – Simple problems.

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

**UNIT - V**

**Multivibrators:** Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors. Time Base Generators: General features of a Time base Signal, Methods of Generating Time Base Waveform, concepts of Transistor Miller and Bootstrap Time Base Generator, Methods of Linearity improvement.

**TEXTBOOKS:**

1. Integrated Electronics, Jacob Millman, Christos C Halkias, McGraw Hill Education.
2. Electronic Devices Conventional and current version -Thomas L. Floyd 2015, Pearson.

**REFERENCE BOOKS:**

1. Electronic Devices and Circuits, David A. Bell – 5th Edition, Oxford.
2. Electronic Devices and Circuits theory– Robert L. Boylestead, Louis Nashelsky, 11th Edition, 2009, Pearson

**RANDOM VARIABLES & STOCHASTIC PROCESSES****II B.Tech-II Semester****Course Code: A2MA404BS****L T P C****3 0 0 3****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
5. To understand the various codings in information theory

**COURSE OUTCOMES:**

1. Upon completing this course, the student will be able to
2. Understand the concepts of Random Process and its Characteristics.
3. Understand the response of linear time Invariant system for a Random Processes.
4. Determine the Spectral and temporal characteristics of Random Signals.
5. Understand the concepts of Noise in Communication systems.

**UNIT I**

The Random Variable: Introduction, Review of Probability Theory, Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, 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 Random Variable, Transformation of a 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 Random Variables, Sum of Several Random Variables, Central Limit Theorem, (Proof not expected). Unequal Distribution, Equal Distributions. 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
3. Signals, Systems & Communications - B.P. Lathi, B.S. Publications, 2003

**REFERENCE BOOKS**

1. Random Processes for Engineers-Bruce Hajck, Cambridge unipress, 2015
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and .Unnikrishna Pillai, PHI, 4th Edition, 2002.
3. Probability, Statistics & Random Processes-K. Murugesan, P. Guruswamy, Anuradha Agencies, 3<sup>rd</sup> Edition, 2003.
4. Statistical Theory of Communication – S.P Eugene Xavier, New Age Publications, 2003

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**LINEAR IC APPLICATIONS****II B.Tech-II Semester****Course Code: A2EC405PC****L T P C****3 0 0 3****PRE-REQUISITE:** Electronic Devices & Circuits**COURSE OBJECTIVES:** The main objectives of the course are:

1. To introduce the basic building blocks of linear integrated circuits.
2. To understand the various filter, oscillators and generations of waveforms
3. To introduce the theory and applications of analog multipliers and PLL.
4. To introduce DAC and ADC and their types

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

1. A thorough understanding of operational amplifiers with linear integrated circuits.
2. Attain the knowledge of functional diagrams and applications of IC 555 and IC 565
3. Design different waveforms using various oscillators
4. Acquire the knowledge about the data converters.

**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.

**UNIT II**

**Op-amp and Applications:** Basic information 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, Schmitt trigger, Multivibrators, introduction to voltage regulators, features of 723

**UNIT III**

**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, sawtooth, square wave and VCO.

**UNIT IV**

**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.

**UNIT V**

**D-A and A-D Converters:** Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder AC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive approximation ADC dual slope integration type ADC, DAC and ADC specifications.

**TEXT BOOKS**

1. Linear Integrated Circuits, D. Roy Chowdhury, New Age International (P) Ltd.
2. Op-Amps & Linear ICs, Ramakanth A. Gayakwad, PHI
3. Operational Amplifiers & Linear Integrated Circuits, R.F. Coughlin & Fredrick F. Driscoll, PHI

**REFERENCES BOOKS:**

1. Operational Amplifiers & Linear Integrated Circuits: Theory & Applications, Denton J. Daibey, TMH.
2. Design with Operational Amplifiers & Analog Integrated Circuits, Sergio Franco, McGraw Hill.
3. Digital Fundamentals - Floyd and Jain, Pearson Education.



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**ELECTRONIC CIRCUIT ANALYSIS LABORATORY****II B.Tech-II Semester****Course Code: A2EC406PC****L T P C****0 0 2 1****COURSE OBJECTIVES:**

1. To prepare the students how to use modern simulation tools such as ESIM, MULTISIM etc. for design, analysis and performance evaluation of electronic circuits.
2. Design, simulate and construct various electronic circuits through software and hardware.
3. To develop problem solving skills in electronic circuits
4. To design electronic circuits
5. To meet desired specifications

**COURSE OUTCOMES**

1. Design different types of Amplifier and Oscillator circuits
2. Simulate different types of Amplifier and Oscillator circuits using software tool
3. Test different types of Amplifiers and Oscillator circuits using hardware

**Note:**

1. Experiments marked with (\*) has to be designed, simulated and verified in hardware.
2. Minimum of 9 experiments to be done in hardware.

**Hardware Testing in Laboratory:**

1. Common Emitter Amplifier (\*)
2. Two Stage RC Coupled Amplifier
3. Cascode Amplifier Circuit (\*)
4. Darlington Pair Circuit
5. Current Shunt Feedback Amplifier Circuit
6. Voltage Series Feedback Amplifier Circuit (\*)
7. RC Phase shift Oscillator Circuit (\*)
8. Hartley and Colpitt's Oscillators Circuit
9. Class A power amplifier
10. Class B Complementary symmetry amplifier (\*)
11. Design a Monostable Multivibrator
12. The output voltage waveform of Miller Sweep Circuit

**Major Equipments required for Laboratories:**

1. Computer System with latest specifications connected
2. Window XP or equivalent
3. Simulation software-Multisim or any equivalent simulation software
4. Regulated Power Suppliers, 0-30V
5. 20 MHz, Dual Channel Cathode Ray Oscilloscopes.
6. Functions Generators-Sine and Square wave signals
7. Multimeters
8. Electronic Components

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**LINEAR IC APPLICATIONS LABORATORY****II B.Tech-II Semester****Course Code: A2EC407PC****L T P C****0 0 2 1****COURSE OBJECTIVES:**

1. To introduce operational amplifier
2. To know the various applications of op amp
3. To give understanding of various types circuits using 741 op amp
4. To learn basic techniques for the design of multivibrators and trigger circuits
5. To understand the concepts of various voltage regulators

**COURSE OUTCOMES:** Upon completion of the LABORATORY, the students will be able to

1. To introduce operational amplifier
2. To know the various applications of op amp
3. To give understanding of various types circuits using 741 op amp
4. To learn basic techniques for the design of multivibrators and trigger circuits
5. To understand the concepts of various voltage regulators

**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

**Major Equipments required for Laboratories:**

1. 5 V Fixed Regulated Power Supply/ 0-5V or more Regulated Power Supply.
2. 20 MHz Oscilloscope with Dual Channel.
3. Bread board and components/ Trainer Kit.
4. Multimeter.

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**ANALOG AND DIGITAL COMMUNICATIONS LABORATORY****II B.Tech-II Semester****Course Code: A2EC408PC****L T P C****0 0 2 1****Note:**

1. Minimum 12 experiments should be conducted:
2. All these experiments are to be simulated first either using MATLAB, COMSIM or any other simulation package and then to be realized in hardware

**LIST OF EXPERIMENTS:**

1. (i) Amplitude modulation and demodulation (ii) Spectrum analysis of AM  
(i) Frequency modulation and demodulation (ii) Spectrum analysis of FM
2. DSB-SC Modulator & Detector
3. SSB-SC Modulator & Detector (Phase Shift Method)
4. Frequency Division Multiplexing & De multiplexing
5. Pulse Amplitude Modulation & Demodulation
6. Pulse Width Modulation & Demodulation
7. Pulse Position Modulation & Demodulation
8. PCM Generation and Detection
9. Delta Modulation
10. Frequency Shift Keying: Generation and Detection
11. Binary Phase Shift Keying: Generation and Detection
12. Generation and Detection (i) DPSK (ii) QPSK

**Major Equipments required for Laboratories:**

1. CROs: 20MHz
2. Function Generators: 2MHz
3. Spectrum Analyzer
4. Regulated Power Supplies: 0-30V
5. MAT LABORATORY/Equivalent Simulation Package with Communication tool box
6. Analog and Digital Modulation and Demodulation Trainer Kits.

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**ENVIRONMENTAL STUDIES****II B.Tech-II Semester****Course Code: A2EC404MC****L T P C****2 0 0 0****COURSE OBJECTIVES:**

1. Understanding the importance of ecological balance for sustainable development.
2. Acquire the knowledge of importance of natural resources & apply conservation techniques.
3. Analyzing the importance of Biodiversity.
4. Estimate the impacts of Environmental pollution, developmental activities and mitigation measures.
5. Evaluation of the environmental policies and regulations.

**COURSE OUTCOMES:**

1. Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles.
2. Able to apply the conservation methods of natural resources.
3. Able to analyze the conservation techniques of biodiversity.
4. Able to apply pollution control methods.
5. Able to understand and apply environmental regulations which in turn helps in sustainable development.

**UNIT I**

**Ecosystems:** Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Bio-magnification.

**UNIT II**

**Natural resources: classification of resources:** Living and Non-Living resources, Water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, Energy resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

**UNIT III**

**Biodiversity and Biotic Resources:** Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and optional values. Hot spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

**UNIT IV**

**Environmental Pollution and Control Technologies:** Environmental Pollution: Classification of pollution, Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. Soil Pollution: Sources and types, Impacts of modern agriculture, degradation of soil. Noise Pollution: Sources and Health hazards, standards, Solid waste: Municipal Solid Waste management, composition and characteristics of e-Waste and its management. Pollution control technologies: Wastewater Treatment methods: Primary, secondary and Tertiary. Concepts of bioremediation.

**Global Environmental Issues and Global Efforts:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions /Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

**UNIT V**

**Environmental Policy, Legislation & Eia:** Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). Towards Sustainable Future: Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building,

**TEXT BOOKS**

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.
3. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.

**REFERENCE BOOKS**

1. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
2. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
3. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
4. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications
5. Introduction to Environmental Science by Y. Anjaneyulu, BS. Publications.

## **III-YEAR (I-SEMESTER)**

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## CONTROL SYSTEMS

**III B.Tech-I Semester****Course Code: A2EC501PC****L T P C****3 0 0 3**

**PREREQUISITE:** Linear Algebra and Calculus, Ordinary Differential Equations and Multivariable Calculus Laplace Transforms, Numerical Methods and Complex variables

**COURSE OBJECTIVES:**

1. To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
2. To assess the system performance using time domain analysis and methods for improving it
3. To assess the system performance using frequency domain analysis and techniques for improving the performance
4. To design various controllers and compensators to improve system performance

**COURSE OUTCOMES:** At the end of this course, students will demonstrate the ability to

1. Understand the modeling of linear-time-invariant systems using transfer function and state- space representations.
2. Understand the concept of stability and its assessment for linear-time invariant systems.
3. Design simple feedback controllers.
4. Understand the concept of state variables.

**UNIT I**

**Introduction to Control Problem:** Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems.

**Feedback Control:** Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

**UNIT II**

**Time Response Analysis of Standard Test Signals:** Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci

**UNIT III**

**Frequency-Response Analysis:** Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion—gain and phase margin. Closed-loop frequency response.

**UNIT IV**

**Introduction to Controller Design:** Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

**UNIT V**

**State Variable Analysis and Concepts of State Variables:** State space model. Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

**TEXT BOOKS**

1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
2. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.
3. Control Systems engineering by A. Nagoor kani.

**REFERENCE BOOKS**

1. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.

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**MICROPROCESSORS AND MICROCONTROLLERS****III B.Tech-I Semester****Course Code: A2EC502PC****L T P C****3 0 0 3****COURSE OBJECTIVES:** The course should enable the students to

1. To familiarize the architecture of microprocessors and micro controllers.
2. To provide the knowledge about interfacing techniques of bus & memory.
3. To study the basic concepts of Addressing Modes and Instruction set of 8051
4. To understand the concepts of ARM architecture.
5. To study the basic concepts of Advanced ARM processors.

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

1. Understands the internal architecture, organization and assembly language programming of 8086 processors.
2. Understands the internal architecture, organization and assembly language programming of 8051/controllers.
3. Understands the interfacing techniques to 8086 and 8051 based systems.
4. Understands the internal architecture of ARM processors and basic concepts of advanced ARM processors.
5. Understands the concept of concepts of Advanced ARM processors

**UNIT I****8086 Architecture:** 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.**Instruction Set and Assembly Language Programming of 8086:** Instruction formats, addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.**UNIT II****Introduction to Microcontrollers:** Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.**8051 Real Time Control:** Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters.**UNIT III****I/O and Memory Interface:** LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.**Serial Communication and Bus Interface:** Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232, USB.**UNIT IV****ARM Architecture:** ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.**UNIT V****Advanced ARM Processors:** Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture.**TEXT BOOKS**

1. Advanced Microprocessors and Peripherals – A. K. Ray and K. M. Bhurchandani, TMH, 2<sup>nd</sup> Edition 2006.
2. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012



**REFERENCE BOOKS**

1. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed, 2004.
2. Microprocessors and Interfacing, D. V. Hall, TMGH, 2nd Edition 2006.
3. The 8051 Microcontrollers, Architecture and Programming and Applications -K. Uma Rao, and Pallavi, Pearson, 2009.
4. Digital Signal Processing and Applications with the OMAP- L138 Experimenter, Donald Reay, WILEY 2012.

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**DIGITAL INTEGRATED CIRCUIT APPLICATIONS****III B.Tech-I Semester****Course Code: A2EC503PC****L T P C****3 0 0 3****COURSE OBJECTIVES:** The main objectives of the course are

1. To understand the various logic families and their electric behaviors
2. To introduce the CMOS and TTL interfacing and their comparisons
3. To know the VHDL hardware description languages and its design elements
4. To understand combinational and sequential logic designs.

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

1. Design the various logic families
2. Implement standard 74XX and CMOS 40XX series ICs
3. Understand the VHDL hardware description language
4. Analyze functionality of combinational and sequential digital circuits

**UNIT I****CMOS Logic:** Introduction to logic families, CMOS logic, CMOS steady state electrical behavior, CMOS dynamic electrical behavior, CMOS logic families.**UNIT II****Bipolar Logic and Interfacing:** Bipolar logic, Transistor logic, TTL families, CMOS/TTL interfacing, low voltage CMOS logic and interfacing, Emitter coupled logic, Comparison of logic families, Familiarity with standard 74XX and CMOS 40XX series-ICs – Specifications.**UNIT III****The VHDL Hardware Description Language:** Design flow, program structure, types and constants, functions and procedures, libraries and packages.**The VHDL Design Elements:** Structural design elements, data flow design elements, behavioral design elements, time dimension and simulation synthesis.**UNIT IV****Combinational Logic Design:** Decoders, encoders, three state devices, multiplexers and demultiplexers, Code Converters, EX-OR gates and parity circuits, comparators, adders & subtractors, ALUs, Combinational multipliers. VHDL modes for the above ICs.**UNIT V****Sequential Logic Design:** Latches and flip-flops, PLDs, counters, shift register, and their VHDL models, synchronous design methodology, impediments to synchronous design.**TEXT BOOKS**

1. Digital Design Principles & Practices – John F. Wakerly, PHI/ Pearson Education Asia, 3rd Ed., 2005.
2. VHDL Primer – J. Bhasker, Pearson Education/ PHI, 3<sup>rd</sup> Edition.

**REFERENCES:**

1. Digital System Design Using VHDL – Charles H. Roth Jr., PWS Publications, 1998.
2. Introduction to Logic Design – Alan B. Marcovitz, TMH, 2<sup>nd</sup> Edition, 2005.
3. Fundamentals of Digital Logic with Verilog Design – Stephen Brown, Zvonko Vranesic, TMH, 2003.
4. Cypress Semiconductors Data Book (Download from website).
5. Fundamentals of Digital Logic with VHDL Design – Stephen Brown and Zvonko Vranesic, McGraw Hill, 2<sup>nd</sup> Edition, 2005.

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**BUSINESS ECONOMICS AND FINANCIAL ANALYSIS****III B.Tech-I Semester****Course Code: A2MB504HS****L T P C****3 0 0 3****COURSE OBJECTIVE:** The course should enable the students to

1. Understand the market dynamics namely demand elasticity of demand and pricing in different market structures.
2. Analyze how capital budgeting decisions are carried out for selecting the best investment proposal.
3. Learn how organizations make important investment and financing decisions.
4. Analyze a company's financial statements and come to a reasoned conclusion about the financial situation of the company.
5. Acquire the basics of how to analyze and interpret the financial statements through ratio analysis.

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

1. Understand microeconomic factors in related to demand analysis and its forecasting
2. Apply the theory of production function and Cost concepts to determine the Break-Even Analysis.
3. Remember different market structures, pricing strategies and different forms business organization
4. Determine the investment decisions of organizations by applying capital budgeting methods and Strategies
5. Interpret the financial statement by using Fundamental accounting concepts and Ratio analysis

**UNIT I****Introduction To Business and Economics: Business:** Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.**Economics:** Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply and Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.**UNIT II****Demand and Supply Analysis:** Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.**Supply Analysis:** Determinants of Supply, Supply Function and Law of Supply.**UNIT III****Production, Cost, Market Structures & Pricing:** Production Analysis, Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.**Cost analysis:** Types of Costs, Short run and long run Cost Functions.**Market Structures:** Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, and Monopolistic Competition.**Pricing:** Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, Cost Volume Profit Analysis.**UNIT IV****Financial Accounting:** Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, and Preparation of Final Accounts.**UNIT V****Financial Analysis Through Ratios:** Concept of Ratio Analysis, Importance, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios – Analysis and Interpretation (simple problems).

**TEXT BOOKS**

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata Mc –Graw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata Mc Graw Hill Education Pvt. Ltd. 2012.

**REFERENCE BOOKS**

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.

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**DATA COMMUNICATIONS AND NETWORKS****III B.Tech-I Semester****Course Code: A2EC505PC****L T P C****3 0 0 3****COURSE OBJECTIVES:** The course should enable the students to

1. To introduce the Fundamentals of data communication networks
2. To demonstrate the Functions of various protocols of Data link layer.
3. To demonstrate Functioning of various Routing protocols.
4. To introduce the Functions of various Transport layer protocols.
5. To understand the significance of application layer protocols

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

1. Know the Categories and functions of various Data communication Networks
2. Design and analyze various error detection techniques.
3. Demonstrate the mechanism of routing the data in network layer
4. Know the significance of various Flow control and Congestion control Mechanisms
5. Know the Functioning of various Application layer Protocols.

**UNIT I**

**Introduction to Data Communications:** Components, Data Representation, Data Flow, Networks- Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks Interconnection of Networks, The Internet - A Brief History, The Internet Today, Protocol and Standards  
- Protocols, Standards, Standards Organizations, Internet Standards. Network Models, Layered Tasks, OSI model, Layers in OSI model, TCP/IP Protocol Suite, Addressing Introduction, Wireless Links and Network Characteristics, Wi Fi: 802.11 Wireless LANs -The 802.11 Architecture,

**UNIT II**

**Data Link Layer:** Links, Access Networks, and LANs- Introduction to the Link Layer, The Services Provided by the Link Layer, Types of errors, Redundancy, Detection vs Correction, Forward error correction Versus Retransmission Error-Detection and Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) , Framing, Flow Control and Error Control protocols , Noisy less Channels and Noisy Channels, HDLC, Multiple Access Protocols, Random Access ,ALOHA, Controlled access, Channelization Protocols. 802.11 MAC Protocol, IEEE 802.11 Frame

**UNIT III**

**The Network Layer:** Introduction, Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks, Inside a Router-Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane, The Internet Protocol (IP): Forwarding and Addressing in the Internet- Datagram format, Ipv4 Addressing, Internet Control Message Protocol(ICMP), Ipv6

**UNIT IV**

**Transport Layer:** Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing, Connectionless Transport: UDP -UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer-Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go- Back-N(GBN), Selective Repeat(SR), Connection Oriented Transport: TCP - The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control - The Cause and the Costs of Congestion, Approaches to Congestion Control

**UNIT V**

**Application Layer:** Principles of Networking Applications – Network Application Architectures, Processes Communicating, Transport Services to avail Laboratorial Applications, Transport Services Provided by the File Transfer: FTP,- FTP Commands and Replies, Electronic Mail in the Internet- STMP, Comparison with HTTP, DNS-The Internet's Directory Service – Service Provided by DNS, Overview of How DNS Works, DNS Records and messages.

**TEXT BOOKS**

1. Computer Networking A Top-Down Approach – Kurose James F, Keith W, 6<sup>th</sup> Edition, Pearson.
2. Data Communications and Networking Behrouz A. Forouzan 4<sup>th</sup> Edition McGraw-Hill Education

**REFERENCES:**

1. Data communication and Networks - Bhusan Trivedi, Oxford university press, 2016
2. Computer Networks -- Andrew S Tanenbaum, 4th Edition, Pearson Education
3. Understanding Communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.

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## MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

**III B.Tech-I Semester****Course Code: A2EC506PC****L T P C****0 0 2 1****COURSE OBJECTIVES:** The course should enable the students to

1. Study the architecture of 8086 microprocessor.
2. Learn the design aspects of I/O and memory interfacing circuits.
3. Study the architecture of 8051 microcontroller

**COURSE OUTCOMES:** the student will be able to

1. Design and implement programs on 8086 microprocessors.
2. Design and implement 8051 microcontroller-based systems
3. Design interfacing circuits with 8051
4. To design various, I/O devices to 8051

**Cycle 1: Using 8086 Processor Kits and/or Assembler (5 Weeks)****Assembly Language Programs to 8086 to Perform**

1. Arithmetic, Logical, String Operations on 16 Bit and 32-Bit Data.
2. Bit level Logical Operations, Rotate, Shift, Swap and Branch Operations.

**Cycle 2: Using 8051 Microcontroller Kit (6 weeks)****Introduction to IDE:**

1. Assembly Language Programs to Perform Arithmetic (Both Signed and Unsigned) 16 Bit Data Operations, Logical Operations (Byte and Bit Level Operations), Rotate, Shift, Swap and Branch Instructions
2. Time delay Generation Using Timers of 8051.
3. Serial Communication from / to 8051 to / from I/O devices.
4. Program Using Interrupts to Generate Square Wave 10 KHZ Frequency on P2.1 Using Timer 0 8051 in 8 bit Auto reload Mode and Connect a 1 HZ Pulse to INT1 pin and Display on Port 0. Assume Crystal Frequency as 11.0592 MHZ

**Cycle 3: Interfacing I/O Devices to 8051(5 Weeks)**

1. 7 Segment Display to 8051.
2. Matrix Keypad to 8051.
3. Sequence Generator Using Serial Interface in 8051.
4. 3, 8 bit ADC Interface to 8051.
5. Triangular Wave Generator through DAC interfaces to 8051.

**TEXT BOOKS**

1. Advanced Microprocessors and Peripherals by A K Ray, Tata McGraw-Hill Education, 2006
2. The 8051 Microcontrollers: Architecture, Programming & Applications by Dr. K. Uma Rao, Andhe Pallavi, Pearson, 2009.

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## DIGITAL INTEGRATED CIRCUIT APPLICATIONS LABOATORY

**III B.Tech-I Semester****Course Code: A2EC507PC****L T P C****0 0 2 1****COURSE OBJECT:** The course should enable the students to

1. Understand the design of decoder and comparators
2. Study the multiplexer and demultiplexer
3. Understand the function of counters and shift registers

**COURSE OUTCOMES:** the student will be able to

1. Design and verify the decoder and comparator
2. Design, Analyze and Implement multiplexer and demultiplexer for given specifications
3. Design, Analyze and Implement shift registers
4. Design, Analyze and Implement memory operations for required specifications.

**Note:** Minimum 12 experiments should be conducted:**LIST OF EXPERIMENTS:**

1. Design a 16 x 4 priority encoder using two 8 x 3 priority encoder
2. Design a 16 bit comparator using 4-bit comparator
3. Design a module 53 counter using two decade counters
4. Design a 450 KHz clock using NAND/ NOR gates
5. Design a 4-bit pseudo random sequence generator using 4-bit ring counter
6. Design a 16 x 1 multiplexer using 8 x 1 multiplexer
7. Design a 16 bit adder/ subtractor using 4-bit adder/ subtractor ICs
8. Plot the transform characteristics of 74H, LS, HS series ICs
9. Design a 4-bit gray to binary and binary to gray converter
10. Design a two digit 7-segment display unit using this display the mod counter of experiment
11. Design an 8-bit parallel load and serial out shift register using two 4-bit shift register
12. Design an 8-bit serial in and serial out shift register using two 4-bit shift register
13. Design a ring counter and twisted ring counter using a 4-bit shift register
14. Design a 4 digital hex counter using synchronous one digit hex counter
15. Design a 4 digital hex counter using asynchronous one digit hex counter

**Major Equipments required for Laboratories:**

1. 20 MHz/ 40 MHz/60 MHz Oscilloscope.
2. 1 MHz Function Generator (Sine, Square, Triangular and TTL).
3. Regulated Power Supply.
4. Multimeter / Volt Meter.



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## **DATA COMMUNICATIONS AND NETWORKS LABORATORY**

**III B.Tech-I Semester****Course Code: A2EC508PC****L T P C****0 0 2 1****COURSE OBJECTIVES:**

1. To understand the TCL script with various nodes
2. To understand the performance of various topologies
3. To introduce the AODV and DSDV routing protocols
4. To understand the performance of IEEE standards
5. To know the analysis of HTTP, DNS and DHCP Protocols

**COURSE OUTCOMES:** Upon completing this LABORATORY, the student will be able to

1. To describe the TCL script for data flow in between nodes
2. To evaluate the performance of various protocols
3. To analyze the TCP AND DSR protocols
4. To evaluate the performance of IEEE standards
5. To simulate and analyze the wired and wireless packets

**Note:**

- A. Minimum of 12 Experiments have to be conducted
- B. All the Experiments may be Conducted using Network Simulation software like NS-2, NSG-2.1 and Wire SHARK/equivalent software.
- C. For Experiments 2 to 10 Performance may be evaluated through simulation by using the parameters Throughput, Packet Delivery Ratio, Delay etc.

**LIST OF EXPERIMENTS:**

1. Writing a TCL Script to create two nodes and links between nodes
2. Writing a TCL Script to transmit data between nodes
3. Evaluate the performance of various LAN Topologies
4. Evaluate the performance of Drop Tail and RED queue management schemes
5. Evaluate the performance of CBQ and FQ Scheduling Mechanisms
6. Evaluate the performance of TCP and UDP Protocols
7. Evaluate the performance of TCP, New Reno and Vegas
8. Evaluate the performance of AODV and DSR routing protocols
9. Evaluate the performance of AODV and DSDV routing protocols
10. Evaluate the performance of IEEE 802.11 and IEEE 802.15.4
11. Evaluate the performance of IEEE 802.11 and SMAC
12. Capturing and Analysis of TCP and IP Packets
13. Simulation and Analysis of ICMP and IGMP Packets
14. Analyze the Protocols SCTP, ARP, NetBIOS, IPX VINES
15. Analysis of HTTP, DNS and DHCP Protocols

**Major Equipments required for Laboratories:**

Required software (Open Source) like NS-2, NSG-2.1 and Wire SHARK

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**HUMAN VALUES AND PROFESSIONAL ETHICS****III B.Tech-I Semester****Course Code: A2EC505MC****L T P C****3 0 0 0****COURSE OBJECTIVE:**

1. To enable the students to imbibe and internalize the Values and Ethical Behavior in the personal and Professional lives.
2. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
3. To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Value based living in a natural way.
4. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behavior and mutually enriching interaction with nature.

**COURSE OUTCOME:**

1. The students will understand the importance of Values and Ethics in their personal lives and professional careers.
2. The students will learn the rights and responsibilities as an employee, team member and a global citizen.

**UNIT I**

Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

**UNIT II**

Basic Theories: Basic Ethical Principles, Moral Developments, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolution, Moral Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.

**UNIT III**

Professional Practices in Engineering: Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession.

Central Responsibilities of Engineers - The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.

**UNIT IV**

Work Place Rights & Responsibilities, Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation.

Ethics in changing domains of research - The US government wide definition of research misconduct, research misconduct distinguished from mistakes and errors, recent history of attention to research misconduct, the emerging emphasis on understanding and fostering responsible conduct, responsible authorship, reviewing & editing.

**UNIT V**

Global issues in Professional Ethics: Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Deflection, Pollution, Ethics in Manufacturing and Marketing, Media Ethics; War Ethics; Bio Ethics, Intellectual Property Rights.

**TEXT BOOKS**

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

**REFERENCE BOOKS**

1. Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, 4e, Cengage learning, 2015.
2. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

## **III-YEAR (II-SEMESTER)**

**DIGITAL SIGNAL PROCESSING****III B.Tech-II Semester****Course Code: A2EC601PC****L T P C****3 0 0 3****PREREQUISITE:** Signals and Systems**COURSE OBJECTIVES:**

1. To provide background and fundamental material for the analysis and processing of digital signals.
2. To understand the fast computation of DFT and appreciate the FFT processing.
3. To study the designs and structures of digital (IIR and FIR) filters and analyze and synthesize for a given specifications.
4. To acquaint in multi-rate signal processing techniques and finite word length effects.

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

1. Understand the LTI system characteristics and Multirate signal processing.
2. Understand the inter-relationship between DFT and various transforms.
3. Design a digital filter for a given specification.
4. Understand the significance of various filter structures and effects of round off errors.

**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

**Multi-rate Digital Signal Processing:** Introduction, Down Sampling, Decimation, Up sampling, Interpolation, Sampling Rate Conversion.

**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 DFT: 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**

**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.

**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.
3. Digital Signal Processing – S. Salivahanan, A. Vallavaraj and C. Gnanapriya, TMH, 2009

**REFERENCE BOOKS**

1. Digital Signal Processing – Fundamentals and Applications – Li Tan, Elsevier, 2008
2. Fundamentals of Digital Signal Processing using MATLABORY – Robert J. Schilling, Sandra L. Harris, Thomson, 2007
3. Digital Signal Processing - A Practical approach, Emmanuel C. Ifeakor and Barrie W. Jervis, 2<sup>nd</sup> Edition, Pearson Education, 2009

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**VLSI DESIGN****III B.Tech-II Semester****Course Code: A2EC602PC****L T P C****3 0 0 3****PREREQUISITE:** Electronic Circuit Analysis; Switching Theory and Logic Design**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 designed with various loads.
3. Give exposure to the design rules to be followed to draw the layout of any logic circuit.
4. Understand basic programmable logic devices and testing of CMOS circuits.

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

1. Acquire qualitative knowledge about the fabrication process of integrated circuits using MOS transistors.
2. Draw the layout of any logic circuit which helps to understand and estimate parasitic effect of any logic circuit
3. Design building blocks of data path systems, memories and simple logic circuits using PLA, PAL, FPGA and CPLD.
4. Understand different types of faults that can occur in a system and learn the concept of testing and adding extra hardware to improve testability of system.

**UNIT I****Introduction:** Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & Bi CMOS**Basic Electrical Properties:** Basic Electrical Properties of MOS and Bi CMOS 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 – PLA, 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 Edition
2. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E Weste, David Harris, Ayan Banerjee, 3<sup>rd</sup> 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 Edition, 1997.
4. VLSI Design- K. Lal Kishore, V. S. V. Prabhakar, I.K International, 2009.

**ANTENNAS AND WAVE PROPAGATION****III B.Tech-II Semester****Course Code: A2EC603PC****L T P C****3 0 0 3****PRE-REQUISITE:** Electromagnetic Theory and Transmission Lines**COURSE OBJECTIVES:** The main objectives are

1. Understand basic terminology and concepts of Antennas.
2. To attain knowledge on the basic parameters those are considered in the antenna design process and the analysis while designing that.
3. Analyze the electric and magnetic field emission from various basic antennas and mathematical formulation of the analysis.
4. To have knowledge on antenna operation and types as well as their usage in real time field.
5. Aware of the wave spectrum and respective band antenna usage and also to know the propagation of the waves at different frequencies through different layers in the existing layered free space environment structure.

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

1. Aware of parameter considerations viz. antenna efficiency, beam efficiency, radiation resistance etc. in the design of an antenna.
2. Capable to analyze the designed antenna and field evaluation under various conditions and formulate the electric as well as the magnetic fields Equation set for Far field and near field conditions.
3. Understand the Array system of different antennas and field analysis under application of different currents to the individual antenna elements
4. Understand the design issues, operation of fundamental antennas like Yagi-Uda, Horn antennas and helical structure and also their operation methodology in practice.
5. Design a lens structure and also the bench step for antenna parameter measurement of testing for their effectiveness.
6. Knowledge about the means of propagation of Electromagnetic wave i.e. free space propagation and also about frequency dependent layer selection, its respective issues for an effective transmission of information in the form of EM wave to a remote location and related issues.

**UNIT I****Antenna Basics:** Introduction, Basic Antenna Parameters - Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height. Related Problems.**Thin Linear Wire Antennas:** Radiation from Small Electric Dipole, Quarterwave Monopole and Halfwave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beamwidths, Directivity, Effective Area and Effective Height. Natural current distributions, fields and patterns of Thin Linear Center-fed Antennas of Different Lengths, Illustrative Problems. Loop Antennas - Introduction, Small Loop, Comparison of Far Fields of Small Loop and Short Dipole, Radiation Resistances and Directivities of Small and Large Loops (Qualitative Treatment).**UNIT II****VHF, UHF AND Microwave Antennas - I:** Arrays with Parasitic Elements, Yagi - Uda Arrays, Folded Dipoles & 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, Illustrative Problems.**UNIT III****VHF, UHF AND Microwave Antennas - II:** Microstrip Antennas - Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas - Geometry and Parameters, Characteristics of Microstrip Antennas. Impact of Different Parameters on Characteristics, Reflector Antennas - Introduction, Flat Sheet and Corner Reflectors, Paraboloidal Reflectors - Geometry, Pattern Characteristics, Feed Methods, Reflector Types - Related Features, Illustrative Problems.**Lens Antennas** - Introduction, Geometry of Non-metallic Dielectric Lenses, Zoning, Tolerances, Applications.



**UNIT IV**

**Antenna Arrays:** Point Sources - Definition, Pattern, 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, Illustrative Problems.

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

**UNIT V**

**Wave Propagation - I:** Introduction, Definitions, Categorizations and General Classifications, Different Modes of Wave Propagation, Ray/Mode Concepts, Ground Wave Propagation (Quantitative Treatment) - Introduction, Plane Earth Reflections, Space and Surface Waves, Wave Tilt, Curved Earth Reflections, Space Wave Propagation - Introduction, Field Strength Variation with Distance and Height, Effect of Earth's Curvature, Absorption, Super refraction, M-Curves and Duct Propagation, Scattering Phenomena, Tropospheric Propagation.

**Wave Propagation - II:** Sky Wave Propagation - Introduction, Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and Skip Distance, Relation between MUF and skip Distance, Multi-hop Propagation.

**TEXT BOOKS**

1. Antennas for All Applications – John D. Kraus and 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, 2nd 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. Transmission and Propagation – E.V.D. Glazier and H.R.L. Lamont, The Services Text Book of Radio, vol. 5, Standard Publishers Distributors, Delhi.
4. Electronic and Radio Engineering – F.E. Terman, McGraw-Hill, 4th edition, 1955.
5. Antennas – John D. Kraus, McGraw-Hill (International Edition), 2nd Ed. 1988.

## IOT ARCHITECTURE AND PROTOCOLS (Professional Elective - I)

III B.Tech-II Semester

Course Code: A2EC601PE

L T P C

3 0 0 3

**COURSE OBJECTIVES** The objectives of this course is to acquire knowledge on the

1. What IoT is and how it works today and to Understand the Architectural Overview of IoT
2. To Understand the IoT Reference Architecture and RealWorld Design Constraints
3. To Understand the various IoT Protocols.
4. To understand and program IoT devices.

**COURSE OBJECTIVES** The students should be able to:

1. Recognize the factors that contributed to the emergence of IoT
2. Design and program IoT devices like Microcontrollers, sensors and actuators.
3. Use real IoT protocols for communication.
4. Define the infrastructure for supporting IoT deployment.
5. Design an IoT device to work with a Cloud Computing infrastructure and Transfer IoT data to the cloud and in between cloud providers.

### UNIT I

**Introduction to IOT: Understanding** IoT fundamentals, IOT Architecture and protocols, Various Platforms for IoT, Real time Examples of IoT, Overview of IoT components and IoT Communication Technologies, Challenges in IOT.

### UNIT II

**Arduino Simulation Environment:** Arduino Uno Architecture, Setup the IDE, Writing Arduino Software, Arduino Libraries, Basics of Embedded C programming for Arduino, Interfacing LED, push button and buzzer with Arduino, Interfacing Arduino with LCD.

**Sensor & Actuators with Arduino:** Overview of Sensors working, Analog and Digital Sensors, Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino, Interfacing of Actuators with Arduino. Interfacing of Relay Switch and Servo Motor with Arduino.

### UNIT III

**Raspberry Pi Programming:** Installing and Configuring the Raspberry Pi, Getting Started with the Raspberry Pi, Using the Pi as a Media Centre, Productivity Machine and Web Server, Remote access to the Raspberry Pi. Preparing Raspberry Pi for IoT Projects.

Creating the Sensor Projects, Creating the actuator Projects, Creating a IoT controller, creating a camera and working with HTTP protocol.

### UNIT IV

**Basic Networking with ESP8266 Wi-Fi module:** Basics of Wireless Networking, Introduction to ESP8266 Wi-Fi Module, Various Wi-Fi library, Web server- introduction, installation, configuration ,Posting sensor(s) data to web server .IoT Protocols ,M2M vs. IOT Communication Protocols.

### UNIT V

**Cloud Platforms for IOT:** Virtualization concepts and Cloud Architecture, Cloud computing, benefits, Cloud services -- SaaS, PaaS, IaaS, Cloud providers & offerings, Study of IOT Cloud platforms, Thing Speak API and MQTT , interfacing ESP8266 with Web services

### TEXT BOOKS

1. Simon Monk, Programming Arduino: Getting Started with Sketches, Second Edition McGraw- Hill Education
2. Peter Waher Learning Internet of Things, Packet publishing.
3. OvidiuVermesan, PeterFriess, IoT-From Research and Innovation to Market deployment, River Publishers

**REFERENCE BOOKS**

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI
3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer.

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## COMPUTER ARCHITECTURE AND ORGANIZATION (Professional Elective - I)

III B.Tech-II Semester

Course Code: A2EC602PE

L T P C

3 0 0 3

**PREREQUISITE:** A Course on “Digital Logic Design and Microprocessors”.**COURSE OBJECTIVES:**

1. The purpose of the course is to introduce principles of computer organization and the basic architectural concepts.
2. It begins with basic organization, design, and programming of a simple digital computer and introduces simple register transfer language to specify various computer operations.
3. Topics include computer arithmetic, instruction set design, microprogrammed control unit, pipelining and vector processing
4. Student will learn the memory organization and I/O systems, and multi-processors.

**COURSE OUTCOMES:**

1. Understand the basics of instructions sets and their impact on processor design.
2. Demonstrate an understanding of the design of the functional units of a digital computer system.
3. Evaluate cost performance and design trade-offs in designing and constructing a computer processor including memory.
4. Design a pipeline for consistent execution of instructions with minimum hazards.

**UNIT I****Digital Computers:** Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.**Register Transfer Language and Micro operations:** Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro-operations, shift micro-operations, Arithmetic logic shift unit.**Basic Computer Organization and Design:** Instruction codes, Computer Registers Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt.**UNIT II****Microprogrammed Control:** Control memory, Address sequencing, micro program example, design of control unit.**Central Processing Unit:** General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.**UNIT III****Data Representation:** Data types, Complements, Fixed Point Representation, Floating Point Representation.**Computer Arithmetic:** Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.**UNIT IV****Input-Output Organization:** Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access.**Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.**UNIT V****Reduced Instruction Set Computer:** CISC Characteristics, RISC Characteristics.**Pipeline and Vector Processing:** Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processor.**Multi Processors:** Characteristics of Multiprocessors, Interconnection Structures, Interprocessor arbitration, Interprocessor communication and synchronization, Cache Coherence.

**TEXT BOOK:**

1. Computer System Architecture – M. Moris Mano, Third Edition, Pearson/PHI.
2. Computer Organization – Car Hamacher, Zvonks Vranesic, Safea Zaky, V<sup>th</sup> Edition, McGraw Hill.
3. Foster ability to identify basic requirements for power electronics based design application.
4. To develop skills to build, and troubleshoot power electronics circuits and ability to understand the use of power converters in commercial and industrial applications.

**REFERENCE BOOKS**

1. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.
2. Structured Computer Organization – Andrew S. Tanenbaum, 4<sup>th</sup> Edition, PHI/Pearson.

## ELECTRONIC MEASUREMENTS AND INSTRUMENTATION (Professional Elective - I)

III B.Tech-II Semester

Course Code: A2EC603PE

L T P C

3 0 0 3

### COURSE OBJECTIVES:

1. It provides an understanding of various measuring system 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. Understanding the concepts of various measuring bridges and their balancing conditions.
4. Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.
5. Understand the importance of signal generators and analyzers in Measurement

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

1. Measure electrical parameters with different meters and understand the basic definition of measuring parameters.
2. Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.
3. Operate an Oscilloscope to measure various signals.
4. Measure various physical parameters by appropriately selecting the transducers.
5. Relate the usage of various instrumentation standards.

### 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, Millimeters, 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, Synchro's, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magnetostrictive Transducers, gyroscopes, accelerometers.

### 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. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbins, W. D. Cooper: PHI 5<sup>th</sup> Edition 2003.
2. Electronic Instrumentation: H. S. Kalsi – TMH, 2<sup>nd</sup> Edition 2004.
3. Electrical and Electronic Measurement and Measuring Instruments – A K Sawhney, Dhanpat Rai & Sons, 2013.

**REFERENCE BOOKS**

1. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
2. Industrial Instrumentation: T.R. Padmanabham Springer 2009.
3. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.

## DIGITAL ELECTRONICS FOR ENGINEERING (Open Elective - I)

III B.Tech-II Semester

Course Code: A2EC601OE

L T P C

3 0 0 3

**PREREQUISITE:** Analog Electronics**COURSE OBJECTIVES prerequisite:**

- To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
- To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits.
- To impart to student the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.
- To implement synchronous state machines using flip-flops.

**COURSE OUTCOMES:** At the end of this course, students will demonstrate the ability to

- Understand working of logic families and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- Be able to use PLDs to implement the given logical problem.

**UNIT I**

**Fundamentals of Digital Systems and Logic Families:** Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

**UNIT II**

**Combinational Digital Circuits:** Standard representation for logic functions, K-map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial ladder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

**UNIT III**

**Sequential Circuits and Systems:** A 1-bit memory, the circuit properties of Bi-stable latch, the clocked SR flip flop, J, K, T and D types flip-flops, applications of flip-flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

**UNIT IV**

**A/D and D/A Converters:** Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs



**UNIT V**

**Semiconductor Memories and Programmable Logic Devices:** Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory (RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

**TEXT BOOKS**

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

**REFERENCE BOOKS**

- 1.A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

## PRINCIPALS OF SIGNAL PROCESSING (Open Elective - I)

III B.Tech-II Semester

Course Code: A2EC602OE

L T P C

3 0 0 3

**Note:** No detailed mathematical treatment is required.

### COURSE OBJECTIVES:

1. To design and realize IIR and FIR filters
2. To find Discrete Fourier Transform of a sequence by using Fast Fourier Transform.
3. To solve Laplace transforms and z-transforms for various signals
4. To understand discrete time signals and systems
5. To explain about signals and perform various operations on it.

### COURSE OUTCOMES:

1. Design and realize IIR and FIR filters from the given specifications.
2. Analyze the continuous and discrete signals and systems
3. Solve Laplace Transform and z-Transform for various signals,
4. Calculate DFT of a given sequence by using Fast Fourier Transform.
5. Define basic signals and its operations, Classify discrete time signals and systems.

### UNIT I

**Introduction To Signals:** Classification of Signals: Analog, Discrete, Digital, Deterministic & Random, Periodic & Aperiodic, Even & Odd, Energy & Power signals. Basic operations on signals: Time shifting, Time scaling, Time reversal, Amplitude scaling and Signal addition. Elementary Signals: Unit step, Unit ramp, Unit parabolic, Impulse, Sinusoidal function, Exponential function, Gate function, Triangular function, Sinc function and Signum function.

### UNIT II

**Discrete Time Signals and Systems:** Discrete Time Signals: Elementary discrete time signals, Classification of discrete time signals: power and energy signals, even and odd signals. Simple manipulations of discrete time signals: Shifting and scaling of discrete-time signals. Discrete Time Systems: Input-Output description of systems, Block diagram representation of discrete time systems, Linear Constant Coefficient Difference Equations, Classification of discrete time systems: linear and nonlinear, time-invariant and variant systems, causal and non causal, stable and unstable systems.

### UNIT III

**Laplace Transforms And Z-Transforms:** Laplace Transforms: Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of Region of Convergence (ROC), Constraints on ROC for various classes of signals, Properties of Laplace transforms. Z-Transforms: Concept of Z-transform of a discrete sequence, Region of convergence in Z-Transform, constraints on ROC for various classes of signals, inverse Z-transform, properties of Z-Transforms.

### UNIT IV

**Fast Fourier Transforms:** Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Radix-2 Fast Fourier Transforms (FFT), Decimation in Time and Decimation in Frequency FFT Algorithms: radix-2 DIT-FFT, DIF-FFT, and Inverse FFT: IDFT-FFT.

### UNIT V

**IIR and FIR Digital Filters: IIR Digital Filters:** Analog filters approximations: Butterworth and Chebyshev, Design of IIR digital filters from analog filters. Realization of IIR filters: Direct form-I, Direct form-II, cascade form and parallel form. **FIR Digital Filters:** Characteristics of FIR digital filters, frequency response. Design of FIR digital filters using window techniques: Rectangular window, Triangular or Bartlett window, Hamming window, Hanning window, Blackman window. Realization of FIR filters: Linear phase and Lattice structures.

### TEXT BOOKS

1. B. P. Lathi, "Signals, Systems and Communications", BS Publications, 2008.
2. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and Applications", 4<sup>th</sup> edition, Pearson Education/PHI, 2007.3.A.V. Oppenheim and R.W. Schaffer, "Discrete Time Signal Processing", 2nd edition., PHI.

**REFERENCE BOOKS**

1. A.V. Oppenheim, A.S. Will sky and S.H. Nawab, “Signals and Systems”, PHI, 2ndEdition, 2013
2. A.AnandKumar, “Signals and Systems”, PHI Publications, ThirdEdition,2013
3. P.Ramesh Babu. “Digital Signal Processing”.
4. Andreas Antoniou, Digital Signal Processing”, TataMcGrawHill,2006.
5. R S Kaler, M Kulkarni,, Umesh Gupta, “A Text book on Digital Signal processing”–I K International Publishing House Pvt .Ltd.
6. M H Hayes, Schaum’s Outlines, “Digital Signal Processing”, Tata Mc-Graw Hill, 2007.

**VLSI DESIGN LABORATORY****III B.Tech-II Semester****Course Code: A2EC604PC****L T P C****0 0 2 1****COURSE OBJECTIVES:**

1. To educate students with the knowledge of Verilog coding and test bench, to write Verilog code for all logic gates, flip-flops, counters and adders etc.
2. Students will be able to compile, simulate and synthesize the Verilog code.

**COURSE OUTCOMES:** Upon completing this LABORATORY, the student will be able to

1. Write Verilog Code for the all-logic gate circuits and their Test Bench for verification, observe the waveform and synthesize the code with the technological library, with the given Constraints

**Note:** Any SIX of the following experiments from each part are to be conducted (Total 12)**PART - I****All the following experiments have to be implemented using HDL**

1. Realize 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. Finite State Machine Design

**PART-II****Layout, physical verification, placement & route for complex design, static timing analysis, IR drop analysis and crosstalk analysis for the following:**

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

Layout of any combinational circuit (complex CMOS logic gate).

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## **DIGITAL SIGNAL PROCESSING LABORATORY**

**III B.Tech-II Semester****Course Code: A2EC605PC****L T P C****0 0 2 1**

The Programs shall be implemented in Software (Using MATLAB / Lab View / C Programming/ Equivalent) and Hardware (Using TI / Analog Devices / Motorola / Equivalent DSP processors).

Note: - Minimum of 12 experiments has to be conducted.

### **COURSE OBJECTIVES:**

1. To make familiar with practical implementation of the digital signal processing.
2. Students can able to develop DSP algorithms for convolution.
3. Realization of various correlation, DFT, filtering of signals.
4. To develop the Signal smoothing, filtering of long duration signals.
5. Students are able to enhance the various Spectral analysis of signals.

**COURSE OUTCOMES:** Upon completing this LABORATORY, the student will be able to Understand the handling of discrete/digital signals using MATLAB

1. Understand the basic operations of Signal processing.
2. Analyze the spectral parameter of window functions
3. Design IIR, and FIR filters for band pass, band stop, low pass and high pass filters.
4. Design the signal processing algorithm using MATLAB & VLAB.

**Note:** Any SIX of the following experiments from each part are to be conducted (Total 12)

### **LIST OF EXPERIMENTS**

1. Generation of Sinusoidal Waveform / Signal based on Recursive Difference Equations
2. Histogram of White Gaussian Noise and Uniformly Distributed Noise.
3. To find DFT / IDFT of given DT Signal
4. To find Frequency Response of a given System given in Transfer Function/ Differential equation form.
5. Obtain Fourier series coefficients by formula and using FET and compare for half sine wave.
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.

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**ADVANCED ENGLISH COMMUNICATION SKILLS  
LABORATORY****III B.Tech-II Semester****Course Code: A2EN613HS****L T P C****0 0 2 1**

The introduction of the Advanced Communication Skills LABORATORY is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context. The proposed course should be a Laboratory course to enable students to use 'good' English and perform the following:

**COURSE OBJECTIVES:**

1. To provide students with a wide range of vocabulary to enable them to take language tests for higher education and employment.
2. To assist students, acquire effective and adequate presentation skills.
3. To improve communication skills of students by making them participate in different language activities.
4. To prepare students for facing interviews self-assuredly.
5. To help students to develop an awareness in studies about the significance of silent reading and comprehension.

**COURSE OUTCOMES:** Students will be able to

1. State meanings, synonyms, antonyms, analogies, idioms, phrases, one-word substitutes, word roots, prefixes and suffixes for words in general.
2. Present and interpret data on select topics using pre-existing slides.
3. Collect data extensively on a social issue and make it public for the sake of enlightening populace.
4. Contribute proactively and extrapolate in group discussions.
5. Make impromptu speeches.

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) LABORATORY:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading& effective googling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – letter writing/Resume writing/ e-correspondence/Technical report writing/ – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/ emails/assignments etc.
5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

**TEXT BOOKS**

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2nd Edition
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5th Edition.
3. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan. Pearson 2007
4. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.

**REFERENCE BOOKS**

1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
2. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
3. English Vocabulary in Use series, Cambridge University Press 2008. 6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
4. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
5. Job Hunting by Colm Downes, Cambridge University Press 2008.
6. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.

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## CONSTITUTION OF INDIA

**III B.Tech-II Semester****Course Code: A2EC606MC****L T P C****2 0 0 0**

The Constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the “basic structure” of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of “Constitutionalism” – a modern and progressive concept historically developed by the thinkers of “liberalism” – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of “constitutionalism” in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India’s legacy of “diversity”. It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be “static” and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it “as one of the strongest court in the world”.

### COURSE CONTENT

1. Meaning of the constitution law and constitutionalism
  2. Historical perspective of the Constitution of India
  3. Salient features and characteristics of the Constitution of India
  4. Scheme of the fundamental rights
  5. The scheme of the Fundamental Duties and its legal status
  6. The Directive Principles of State Policy – Its importance and implementation
  7. Federal structure and distribution of legislative and financial powers between the Union and the States
  8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
  9. Amendment of the Constitutional Powers and Procedure
- The historical perspectives of the constitutional amendments in India**
1. Emergency Provisions: National Emergency, President Rule, Financial Emergency
  2. Local Self Government – Constitutional Scheme in India
  3. Scheme of the Fundamental Right to Equality
  4. Scheme of the Fundamental Right to certain Freedom under Article 19
  5. Scope of the Right to Life and Personal Liberty under Article 21



# **IV-YEAR (I-SEMESTER)**

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**MICROWAVE AND OPTICAL COMMUNICATIONS****IV B.Tech-I Semester****Course Code: A2EC701PC****L T P C****3 1 0 4****PREREQUISITE:** Antennas and Propagation**COURSE OBJECTIVES:**

- 1.To get familiarized with microwave frequency bands, their applications and to understand the limitations and losses of conventional tubes at these frequencies.
- 2.To distinguish between different types of microwave tubes, their structures and principles of microwave power generation.
- 3.To impart the knowledge of Scattering Matrix, its formulation and utility, and establish the S Matrix for various types of microwave junctions.
- 4.Understand the utility of Optical Fibres in Communications

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

1. Known power generation at microwave frequencies and derive the performance characteristics.
2. Realize the need for solid state microwave sources and understand the principles of solid state devices.
3. Distinguish between the different types of waveguide and ferrite components, and select proper components for engineering applications
4. understand the utility of S-parameters in microwave component design and learn the measurement procedure of various microwave parameters.
5. Understand the mechanism of light propagation through Optical Fibres.

**UNIT I**

**Microwave Tubes:** Limitations and Losses of conventional Tubes at Microwave Frequencies, Microwave Tubes – O Type and M Type Classifications, O-type Tubes: 2 Cavity Klystrons – Structure, Reentrant Cavities, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory – Expressions for O/P Power and Efficiency. Reflex Klystrons – Structure, Velocity Modulation and Applegate Diagram, Mathematical Theory of Bunching, Power Output, Efficiency, Oscillating Modes and O/P Characteristics.

**Helix TWTs:** Types and Characteristics of Slow Wave Structures; Structure of TWT and Amplification Process (qualitative treatment), Suppression of Oscillations, Gain Considerations.

**UNIT II**

**M-Type Tubes:** Introduction, Cross-field Effects, Magnetrons – Different Types, Cylindrical Traveling Wave Magnetron – Hull Cut-off and Hartree Conditions, Modes of Resonance and PI-Mode Operation, Separation of PI Mode, o/p characteristics,

**Microwave Solid State Devices:** Introduction, Classification, Applications. TEDs – Introduction, Gunn Diodes – Principle, RWH Theory, Characteristics, Modes of Operation - Gunn Oscillation Modes, Principle of operation of IMPATT and TRAPATT Devices.

**UNIT III**

**Waveguide Components:** Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide Windows, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Different Types, Resistive Card and Rotary Vane Attenuators; Waveguide Phase Shifters – Types, Dielectric and Rotary Vane Phase Shifters, Waveguide Multiport Junctions - E plane and H plane Tees. Ferrites– Composition and Characteristics, Faraday Rotation, Ferrite Components – Gyrator, Isolator,

**UNIT IV**

**Scattering Matrix:** Scattering Matrix Properties, Directional Couplers – 2 Hole, Bethe Hole, [s] matrix of Magic Tee and Circulator.

**Microwave Measurements:** Description of Microwave Bench – Different Blocks and their Features, Errors and Precautions, Measurement of Attenuation, Frequency. Standing Wave Measurements, measurement of Low and High VSWR, Cavity Q, Impedance Measurements.

**UNIT V**

**Optical Fiber Transmission Media:** Optical Fiber types, Light Propagation, Optical fiber Configurations, Optical fiber classifications, Losses in Optical Fiber cables, Light Sources, Optical Sources, Light Detectors, LASERS, WDM Concepts, Optical Fiber System link budget.

**TEXT BOOKS**

1. Microwave Devices and Circuits – Samuel Y. Liao, Pearson, 3rd Edition, 2003.
2. Electronic Communications Systems- Wayne Tomasi, Pearson, 5th Edition

**REFERENCE BOOKS**

1. Optical Fiber Communication – Gerd Keiser, TMH, 4th Ed., 2008.
2. Microwave Engineering - David M. Pozar, John Wiley & Sons (Asia) Pvt Ltd., 1989, 3r ed., 2011 Reprint.
3. Microwave Engineering - G.S. Raghuvanshi, Cengage Learning India Pvt. Ltd., 2012.
4. Electronic Communication System – George Kennedy, 6th Ed., McGrawHill

## MOBILE COMMUNICATIONS AND NETWORKS (Professional Elective – II)

IV B.Tech-I Semester

Course Code: A2EC704PE

L T P C

3 0 0 3

**COURSE OBJECTIVES:** The objectives of the course are:

1. To provide the student with an understanding of the cellular concept, frequency reuse, handoff 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 channel assignment
4. To give the student an understanding types of handoff.
5. To understand challenges and application of Adhoc wireless Networks.

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

1. Known the evolution of cellular and mobile communication system.
2. The student will be able to understand Co-Channel and Non-Co-Channel interferences.
3. Understand impairments due to multipath fading channel and how to overcome the different fading effects.
4. Familiar with cell coverage for signal and traffic, diversity, techniques, frequency management, Channel assignment and types of handoffs.
5. Know the difference between cellular and Adhoc Networks and design goals of MAC Layer protocol.

### 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-Tie 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, effects 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.

**Frequency Management and Channel Assignment:** Numbering and Grouping, Setup Access and Paging Channels, Channel Assignments to Cell Sites and Mobile Units.

### UNIT IV

**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.

### UNIT V

**Ad Hoc Wireless Networks:** Introduction, Cellular and Ad Hoc wireless Networks, Applications and Ad Hoc Wireless Networks, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet, MAC Protocols for Ad Hoc Wireless, Introduction, issues in designing AMAC Protocol for Ad Hoc wireless Networks, Design Goals of AMAC protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols.

**TEXT BOOK:**

1. Mobile Cellular Telecommunications-W.C.Y. Lee, Mc Graw Hill, 2nd Edn., 1989.
2. Wireless Communications-Theodore. S. Rapport, Pearson Education, 2nd Edn., 2002.

**REFERENCE BOOKS**

1. Ad Hoc Wireless Networks: Architectures and Protocols-C. Siva ram Murthy and B.S. Manoj, 2004, PHI.
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.

## DIGITAL IMAGE AND VIDEO PROCESSING (Professional Elective - II)

IV B.Tech-I Semester

Course Code: A2EC705PE

L T P C

3 0 0 3

**PREREQUISITE:** Digital Signal Processing**COURSE OBJECTIVES:**

1. The student will be able to understand the quality improvement methods of Image.
2. To study the basic digital image and video filter operations.
3. Understand the fundamentals of Image Compression.
4. Understand the representation of video.
5. Understand the principles and methods of motion estimation.

**COURSE OUTCOMES:**

1. The students will learn image representation, filtering, compression.
2. Students will learn the basics of video processing, representation, motion estimation.
3. Students will learn the basic digital image and video filter operations.
4. Implement the various steps of video processing and motion estimation

**UNIT – I****Fundamentals of Image Processing and Image Transforms**

Basic steps of Image Processing System Sampling and Quantization of an image, Basic relationship between pixels.

**Image Segmentation**

Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region based segmentation.

**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.

**UNIT – III****Image Compression**

Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models: Lossy & Lossless, Huffman coding, , Bit plane coding, Transform coding, Predictive coding, Wavelet coding, Lossy Predictive coding, 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, 3<sup>rd</sup> ed., Pearson.
2. Video Processing and Communication – Yao Wang, Joem Ostermann and Ya-quin Zhang. 1<sup>st</sup> Ed., PH Int.

**REFERENCE BOOKS:**

1. Digital Video Processing – M. Tekalp, Prentice Hall International
2. Digital Image Processing – S.Jayaraman, S.Esakkirajan, T.Veera Kumar –TMH, 2009

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## **EMBEDDED SYSTEM DESIGN** **(Professional Elective - II)**

**IV B.Tech-I Semester****Course Code: A2EC706PE****L T P C****3 0 0 3****PREREQUISITE:** Microprocessors and Microcontrollers; Computer Organization and Operating Systems**COURSE OBJECTIVES:**

1. To provide an overview of Design Principles of Embedded System.
2. To provide clear understanding about the role of firmware.
3. To understand the necessity of operating systems in correlation with hardware systems.
4. To learn the methods of interfacing and synchronization for tasking.

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

1. To understand the selection procedure of Processors in the embedded domain.
2. Design Procedure for Embedded Firmware.
3. To visualize the role of Real time Operating Systems in Embedded Systems.
4. To evaluate the Correlation between task synchronization and latency issues

**UNIT I**

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

**UNIT II**

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

**UNIT III**

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

**UNIT IV**

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

**UNIT V**

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, Methods to Choose an RTOS.

**TEXT BOOKS**

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.
2. Embedded Systems - Raj Kamal, TMH.

**REFERENCE BOOKS**

1. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
2. Embedded Systems – Lyla, Pearson, 2013
3. An Embedded Software Primer - David E. Simon, Pearson Education.



## NETWORK SECURITY AND CRYPTOGRAPHY

### (Professional Elective – III)

IV B.Tech-I Semester

Course Code: A2EC707PE

L T P C

3 0 0 3

#### COURSE OBJECTIVES:

1. Understand the basic concept of Cryptography and Network Security, their mathematical models
2. To understand the necessity of network security, threats/vulnerabilities to networks and countermeasures
3. To understand Authentication functions with Message Authentication Codes and Hash Functions.
4. To provide familiarity in Intrusion detection and Firewall Design Principles

#### UNIT I

Security Services, Mechanisms and Attacks, A Model for Internetwork security, Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques.

**Modern Techniques:** Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Block Cipher Design Principles.

#### UNIT II

**Encryption:** Triple DES, International Data Encryption algorithm, Blowfish, RC5, Characteristics of Advanced Symmetric block Ciphers. Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.

#### UNIT III

**Public Key Cryptography:** Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.

**Number Theory:** Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.

#### UNIT VI

**Message Authentication and Hash Functions:** Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs. Hash and Mac Algorithms: MD-5, Message digest Algorithm, Secure Hash Algorithm.

**Digital signatures and Authentication Protocols:** Digital signatures, Authentication Protocols, Digital signature standards.

**Authentication Applications:** Kerberos, Electronic Mail Security: Pretty Good Privacy, SIME/MIME.

#### UNIT V

**IP Security:** Overview, Architecture, Authentication, Encapsulating Security Payload, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction.

**Intruders, Viruses and Worms:** Intruders, Viruses and Related threats.

**Fire Walls:** Fire wall Design Principles, Trusted systems.

#### TEXT BOOKS

1. Cryptography and Network Security: Principles and Practice – William Stallings, Pearson Education.
2. Network Security: The complete reference, Robert Bragg, Mark Rhodes, TMH, 2004.

#### REFERENCE BOOKS

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.
2. Fundamentals of Network Security by Eric Maiwald (Dreamtech press)
3. Principles of Information Security, Whitman, Thomson.
4. Introduction to Cryptography, Buchmann, Springer.

## SATELLITE COMMUNICATIONS (Professional Elective-III)

IV B.Tech-I Semester

Course Code: A2EC708PE

L T P C

3 0 0 3

**PREREQUISITE:** Analog and Digital Communications**COURSE OBJECTIVES:**

1. To acquired foundation in orbital mechanics and launch vehicles for the satellites.
2. To provide basic knowledge of link design of satellite.
3. To understand multiple access systems and earth station technology
4. To understand the concepts of satellite navigation and GPS.

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

1. Understand basic concepts and frequency allocations for satellite communication, orbital mechanics and launch vehicles.
2. Envision the satellite sub systems and design satellite links for specified C/N.
3. Understand the various multiple access techniques for satellite communication systems and earth station technologies.
4. Known the concepts of LEO, GEO Stationary Satellite Systems and satellite navigation

**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 Antennas, Equipment Reliability and Space Qualification.**UNIT III****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 Examples.**Multiple Access:** Frequency Division Multiple Access (FDMA), Inter modulation, 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.**UNIT V****Low Earth Orbit and Geo-Stationary Satellite Systems:** Orbit Considerations, Coverage and Frequency Consideration, Delay & Throughput Considerations, System Considerations, Operational NGSO Constellation Designs.**Satellite Navigation & 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, 2nd Edition, 2003.
2. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, 2nd 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.
3. Fundamentals of Satellite Communications – K.N. Raja Rao, PHI, 2004
4. Satellite Communications – Dennis Roddy, McGraw Hill, 4<sup>th</sup> Edition, 2009.

## BIOMEDICAL INSTRUMENTATION (Professional Elective-III)

IV B.Tech-I Semester

Course Code: A2EC709PE

L T P C

3 0 0 3

### COURSE OBJECTIVES:

1. Identify significant biological variables at cellular level and ways to acquire different bio-signals.
2. Elucidate the methods to monitor the activity of the heart, brain, eyes and muscles.
3. Introduce therapeutic equipment for intensive and critical care.
4. Outline medical imaging techniques and equipment for certain diagnosis and therapies.

### COURSE OUTCOMES: After completion of the course the student is able to:

1. Understand biosystems and medical systems from an engineering perspective.
2. Identify the techniques to acquire record and primarily understand physiological activity of the human body through cell potential, ECG, EEG, BP and blood flow measurement and EMG.
3. Understand the working of various medical instruments and critical care equipment.
4. Know the imaging techniques including CT, PET, SPECT and MRI used in diagnosis of various medical conditions.

### UNIT I

**Bio-Potential Signals and Electrodes:** Bio-signals and their characteristics, Organization of cell, Nernst equation of membrane, Resting and Action potentials. Bio-amplifiers, characteristics of medical instruments, problems encountered with measurements from living systems. Bio-potential electrodes – Body surface recording electrodes, internal electrodes, micro electrodes. Bio-chemical transducers – reference electrode, the pH electrodes, Blood gas electrodes.

### UNIT II

**Cardiovascular Instrumentation:** Heart and cardiovascular system Heart electrical activity, blood Pressure and heart sounds. Cardiovascular measurements electro cardiograph – electrocardiogram, ECG Amplifier, Electrodes and leads, ECG recorder principles. Types of ECG recorders. Principles of blood pressure and blood flow measurement.

### UNIT III

**Neurological Instrumentation:** Neuronal communication, electro encephalogram (EEG), EEG Measurements EEG electrode-placement system, interpretation of EEG, EEG system Block diagram, preamplifiers and amplifiers. EMG block diagram and Stimulators

### UNIT IV

**Equipment for Critical Care:** Therapeutic equipment - Pacemaker, Defibrillator, Shortwave diathermy, Hemodialysis machine. Respiratory Instrumentation - Mechanism of respiration, Spirometry, Pneumotachograph, Ventilators.

### UNIT V

**Principles of Medical Imaging:** Radiography, computed Radiography, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear Medicine, Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET), Ultrasonography, Introduction to Telemedicine.

### TEXT BOOKS

1. Hand-book of Biomedical Instrumentation – by R.S. Khandpur, McGraw-Hill, 2003.
2. Medical Instrumentation, Application and Design – by John G. Webster, John Wiley.

### REFERENCE BOOKS

1. Biomedical Instrumentation and Measurements – by Leslie Cromwell, F.J. Weibell, E.A. Pfeiffer, PHI.
2. Principles of Applied Biomedical Instrumentation – by L.A. Geddes and L.E. Baker, John Wiley and Sons.
3. Introduction to Biomedical equipment technology-by Joseph Carr and Brown.

## ELECTRONIC SENSORS (Open Elective-II)

IV B.Tech-I Semester

Course Code: A2EC703OE

L T P C

3 0 0 3

### COURSE OBJECTIVES:

1. Learn the characterization of sensors.
2. Known the working of Electromechanical, Thermal, Magnetic and radiation sensors.
3. Understand the concepts of Electro analytic and smart sensors
4. Able to use sensors in different applications

### COURSE OUTCOMES:

- 1 Learn about sensor Principle, Classification and Characterization.
- 2 Explore the working of Electromechanical, Thermal, Magnetic, radiation and Electro analytic sensors
- 3 Understand the basic concepts of Smart Sensors
- 4 Design

### UNIT I

**Sensors / Transducers:** Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization. Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges - Inductive Sensors: Sensitivity And Linearity of the Sensor – Types-Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors

### UNIT II

**Thermal Sensors:** Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index thermo sensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors

### UNIT III

**Magnetic sensors:** Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto resistive Sensing, Semiconductor Magneto resistors, Hall, Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchros.

### UNIT IV

**Radiation Sensors:** Introduction, Basic Characteristics, Types of Photo resistors/ Photo detectors, Xray and Nuclear Radiation Sensors, Fibre Optic Sensors Electro analytical Sensors: The Electrochemical Cell, The Cell Potential - Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization, Reference Electrodes, Sensor Electrodes, Electro ceramics in Gas Media.

### UNIT V

**Smart Sensors:** Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing - Data Communication, Standards for Smart Sensor Interface, the Automation Sensors –Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing – Sensors for environmental Monitoring

### TEXT BOOKS

1. “Sensors and Transducers - D. Patranabis” –PHI Learning Private Limited., 2003.
2. Introduction to sensors- John veteline, aravind raghu, CRC press, 2011

### REFERENCE BOOKS

1. Sensors and Actuators, D. Patranabis, 2nd Ed., PHI, 2013.
2. Make sensors: Terokarvinen, kemo, karvinen and villey valtokari, 1st edition, maker media, 2014.

## ELECTRONICS FOR HEALTHCARE (Open Elective-II)

IV B.Tech-I Semester

Course Code: A2EC7040E

L T P C

3 0 0 3

**COURSE OBJECTIVES:** The student should be made:

1. To gain knowledge about the various physiological parameters both electrical and non-electrical and the methods of recording and also the method of transmitting these parameters
2. To study about the various assist devices used in the hospitals
3. To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

**COURSE OUTCOMES:**

1. Know the human body electro- physiological parameters and recording of bio-potentials
2. Comprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.
3. Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators
4. Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies , and bio-telemetry principles and methods
5. Know about recent trends in medical instrumentation

### UNIT I

**Electro-Physiology And Bio-Potential Recording:** Sources of bio medical signals, Bio-potentials, Biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

### UNIT II

**Bio-Chemical And Non Electrical Parameter Measurement:** pH, PO<sub>2</sub>, PCO<sub>2</sub>, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

### UNIT III

**Assist Devices:** Cardiac pacemakers, DC Defibrillator, Dialyser, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems.

### UNIT IV

**Physical Medicine and Biotelemetry:** Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry.

### UNIT V

**Recent Trends in Medical Instrumentation:** Telemedicine, Insulin Pumps, Radio pill, Endomicroscopy, Brain machine interface, Lab on a chip.

### TEXT BOOKS

1. Leslie Cromwell, —Biomedical Instrumentation and Measurement, Prentice Hall of India, New Delhi, 2007.
2. Joseph J.Carr and John M.Brown, —Introduction to Biomedical Equipment Technology, John Wiley and Sons, New York, 2004.

### REFERENCE BOOKS

1. Khandpur, R.S., —Handbook of Biomedical Instrumentation, TATA Mc Graw-Hill, New Delhi, 2003.
2. John G.Webster, —Medical Instrumentation Application and Design, 3rd Edition, Wiley India Edition, 2007

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**MANAGEMENT SCIENCE****IV B.Tech-I Semester****Course Code: A2MB702HS****L T P C****2 0 0 2****COURSE OBJECTIVES:**

This course is intended to familiarize the students with the framework for the managers and leaders available for understanding and making decisions relating to issues related organizational structure, production operations, marketing, Human resource Management, product management and strategy.

**COURSE OUTCOMES:** By the end of the course, the student will be in a position to

1. Plan organizational structure for a given context in the organization carry out production operations through work study.
2. Carry out production operations through Work study.
3. Understand the markets, customers and competition better and price the given products appropriately.
4. Ensure quality for a given product or service.
5. Plan and control the HR function better.
6. Plan, schedule and control projects through PERT and CPM.
7. Evolve a strategy for a business or service organization.

**UNIT I**

**Introduction to Management and Organisation:** Concepts of Management and organization- nature, importance and Functions of Management, Systems Approach to Management - Taylor's Scientific Management Theory- Fayal's Principles of Management- Maslow's theory of Hierarchy of Human Needs- Douglas McGregor's Theory X and Theory Y - Herzberg Two Factor Theory of Motivation - Leadership Styles, Social responsibilities of Management, Designing Organisational Structures: Basic concepts related to Organization - Departmentation and Decentralisation, Types and Evaluation of mechanistic and organic structures of organization and suitability.

**UNIT II**

**Operations and Marketing Management:** Principles and Types of Plant Layout-Methods of Production(Job, batch and Mass Production), Work Study - Basic procedure involved in Method Study and Work Measurement - Business Process Reengineering(BPR) - Statistical Quality Control: control charts for Variables and Attributes (simple Problems) and Acceptance Sampling, TQM, Six Sigma, Deming's contribution to quality, Objectives of Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Store Records - JIT System, Supply Chain Management, Functions of Marketing, Marketing Mix, and Marketing Strategies based on Product Life Cycle, Channels of distribution.

**UNIT III**

**Human Resources Management (HRM):** Concepts of HRM, HRD and Personnel Management and Industrial Relations (PMIR), HRM vs PMIR, Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating - Capability Maturity Model (CMM) Levels - Performance Management System.

**UNIT IV**

**Project Management (PERT/ CPM):** Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing (simple problems).

**UNIT V**

**Strategic Management and Contemporary Strategic Issues:** Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Environmental Scanning, Value Chain Analysis, SWOT Analysis, Steps in Strategy Formulation and Implementation, Generic Strategy alternatives. Benchmarking and Balanced Score Card as Contemporary Business Strategies.

**TEXT BOOKS**

1. Stoner, Freeman, Gilbert, Management, 6th Ed, Pearson Education, New Delhi, 2004.
2. P. Vijay Kumar, N. Appa Rao and Ashnab, Chnalill, Cengage Learning India, 2012.

**REFERENCE BOOKS**

1. Kotler Philip and Keller Kevin Lane: Marketing Management, Pearson, 2012.
2. Koontz and Weihrich: Essentials of Management, McGraw Hill, 2012.
3. Thomas N. Duening and John M. Ivancevich Management - Principles and Guidelines, Biztantra, 2012.
4. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2012.
5. Samuel C. Certo: Modern Management, 2012.
6. Schermerhorn, Capling, Poole and Wiesner: Management, Wiley, 2012.
7. Parnell: Strategic Management, Cengage, 2012.
8. Lawrence R Jauch, R. Gupta and William F. Glueck: Business Policy and Strategic Management Science, McGraw Hill, 2012.



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## **MICROWAVE AND OPTICAL COMMUNICATIONS LABORATORY**

**IV B.Tech-I Semester****Course Code: A2EC703PC****L T P C****0 0 4 2**

**COURSE OBJECTIVES:** At the end of the course the student will be able to

1. Verify characteristics of Reflex Klystron.
2. Analyze various parameters of Waveguide Components.
3. Estimate the power measurements of RF Components such as directional Couplers.
4. Demonstrate characteristics of various optical sources.
5. Measure data Rate, Numerical Aperture and Losses in Optical Link.

**COURSE OUTCOMES:** At the end of the course students will be able to

1. Identify the characteristics of reflex klystron and Gunn diode
2. Analyze the various measuring parameters.
3. Measure the power of Directional Couplers
4. Analyze the characteristics of Optical Sources by conducting experiments and measuring various parameters.
5. Analyze the various measuring parameters of numerical aperture and losses in optical link

### **LIST OF EXPERIMENTS**

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Attenuation measurement
4. Directional Coupler Characteristics.
5. Scattering parameters of wave guide components
6. Frequency measurement.
7. Impedance measurement
8. VSWR measurement
9. Characterization of LED.
10. Characterization of Laser Diode.
11. Intensity modulation of Laser output through an optical fiber.
12. Measurement of Data rate for Digital Optical link.
13. Measurement of Numerical Aperture of fiber cable.
14. Measurement of losses for Optical link

**Note:** Any Twelve of the Following Experiments

## **IV-YEAR (II-SEMESTER)**

## CMOS ANALOG IC DESIGN (Professional Elective-IV)

**IV B.Tech-II Semester**  
**Course Code: A2EC810PE**

**L T P C**  
**3 0 0 3**

**PREREQUISITE:** Analog Electronics

**COURSE OBJECTIVES:** Analog circuits play a very crucial role in all electronic systems and due to continued miniaturization, many of the analog blocks are not getting realized in CMOS technology.

1. To understand most important building blocks of all CMOS analog ICs
2. To study the basic principle of operation, the circuit choices and the tradeoffs involved in the MOS transistor level design common to all analog CMOS ICs.
3. To understand specific design issues related to single and multistage voltage, current and differential amplifiers, their output and impedance issues, bandwidth, feedback and stability.
4. To understand the design of differential amplifiers, current amplifiers and OP AMPs.

**COURSE OUTCOMES:** After studying the course, each student is expected to be able to:

1. Design basic building blocks of CMOS analog ICs.
2. Carry out the design of single and two stage operational amplifiers and voltage references.
3. Determine the device dimensions of each MOSFETs involved.
4. Design various amplifiers like differential, current and operational amplifiers.

### UNIT I

**MOS Devices and Modeling:** The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small- Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

### UNIT II

**Analog CMOS Sub-Circuits:** MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

### UNIT III

**CMOS Amplifiers:** Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

### UNIT IV

**CMOS Operational Amplifiers:** Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

### UNIT V

**Comparators:** Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

### TEXT BOOKS

1. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.
2. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition, 2010.

### REFERENCE BOOKS

1. Analog Integrated Circuit Design- David A. Johns, Ken Martin, Wiley Student Edn, 2013.
2. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMHEdition.
3. CMOS: Circuit Design, Layout and Simulation- Baker, Li and Boyce, PHI.

## RADAR SYSTEMS (Professional Elective-IV)

IV B.Tech-II Semester

Course Code: A2EC811PE

L T P C

3 0 0 3

### COURSE OBJECTIVES:

1. To derive the basic radar equation and its dependence on various parameters
2. To study Doppler Effect and its applications with respect to pulsed Doppler radar.
3. To understand moving target indicator and to study its application.
4. To study and understand the effect of noise on radar signal detection.
5. To study the various types of Radar Receivers and Transmitter systems

### COURSE OUTCOMES:

 At the end of the course, the student would be able to

1. Demonstrate the basic principle of RADAR System.
2. Solve the RADAR Equation and to calculate Transmitter power.
3. Analyze the working principle of CW and Frequency Modulated Radar.
4. Draw the block diagram of FM-CW Radar and also calculate Measurement errors.
5. Analyze the principle of each and every block of MTI and Pulse Doppler Radar.

### UNIT I

**Introduction:** Nature of Radar, Maximum Unambiguous Range, Radar Waveforms, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Related Problems.

**Radar Equation:** Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise and SNR, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment). Related Problems.

### 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 (Approaching/ Receding Targets), FM-CW altimeter, Measurement Errors, Multiple Frequency CW Radar.

### UNIT III

**MTI and Pulse Doppler Radar:** Introduction, Principle, MTI Radar with - 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. Non-coherent MTI, MTI versus Pulse Doppler Radar.

### UNIT IV

**Tracking Radar:** Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two- coordinates), Phase Comparison Monopulse. Target Reflection Characteristics and Angular Accuracy. Tracking in Range, Acquisition and Scanning Patterns. Comparison of Trackers.

**Detection of Radar Signals in Noise:** Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise.

### UNIT V

**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, Series versus Parallel Feeds, Applications, Advantages and Limitations.

### TEXT BOOKS

1. Introduction to Radar Systems – Merrill I. Skolnik, Second Edition, McGraw-Hill, 1981.

**REFERENCE BOOKS**

1. Introduction to Radar Systems – Merrill I. Skolnik, Third Edition, Tata McGraw-Hill, 2001.
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

## ARTIFICIAL INTELLIGENCE (Professional Elective-IV)

IV B.Tech-II Semester

Course Code: A2EC812PE

L T P C

3 0 0 3

### 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.

### COURSE OUTCOMES:

1. Ability to 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. Possess the skill for representing knowledge using the appropriate technique for a given problem.
4. Possess the ability to apply AI techniques to solve problems of game playing, 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 BOOKS**

1. 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.

## MACHINE LEARNING (Professional Elective-V)

IV B.Tech-II Semester

Course Code: A2EC813PE

L T P C

3 0 0 3

**PREREQUISITES:** 1. Data Structures 2. Knowledge on statistical methods**COURSE OBJECTIVES:** This course explains machine learning techniques such as

1. Decision tree learning, Bayesian learning etc.
2. To understand computational learning theory.
3. To study the pattern comparison techniques.

**COURSE OUTCOMES:**

1. Understand the concepts of computational intelligence like machine learning
2. Ability to get the skill to apply machine learning techniques to address the real time problems in different areas.
3. Understand the Neural Networks and its usage in machine learning application.

### UNIT I

Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search, find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias. Decision Tree Learning – Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

### UNIT II

Artificial Neural Networks-1– Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm. Artificial Neural Networks-2- Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics in artificial neural networks. Evaluation Hypotheses – Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

### UNIT III

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm. Computational learning theory – Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning. Instance-Based Learning- Introduction, k-nearest neighbour algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

### UNIT IV

Genetic Algorithms – Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms. R18 B.Tech. CSE (AIML) III & IV Year JNTU Hyderabad Learning Sets of Rules – Introduction, sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution. Reinforcement Learning – Introduction, the learning task, Q-learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

### UNIT V

Analytical Learning-1- Introduction, learning with perfect domain theories: PROLOG-EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge. Analytical Learning-2- Using prior knowledge to alter the search objective, using prior knowledge to augment search operators. Combining Inductive and Analytical Learning – Motivation, inductive-analytical approaches to learning, using prior knowledge to initialize the hypothesis.



**TEXT BOOKS**

1. Machine Learning – Tom M. Mitchell, - MGH

**REFERENCE BOOKS**

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis.

## 5G AND BEYOND COMMUNICATION (Professional Elective-V)

IV B.Tech-II Semester

Course Code: A2EC814PE

L T P C

3 0 0 3

### COURSE OBJECTIVES:

1. To understand the overall network architecture and protocols for LTE networks, including control plane protocols and user plane protocols.
2. To learn the downlink physical layer of LTE systems in detail, including: how OFDMA technology is adopted in LTE.
3. To learn the uplink physical layer of LTE systems in detail, including: uplink PHY design in LTE
4. To understand

### COURSE OUTCOMES:

 At the end of the course, the student would be able to

1. Understand the various practical deployment aspects of LTE networks
2. Understand the basic features of LTE-Advanced networks, including: carrier aggregation, MIMO enhancements, relaying, and interference coordination enhancements.
3. Understanding of the basic features of emerging 5G wireless networks, including mmWave communications, massive MIMO,

### UNIT I

**5G Communications:** Introduction to 5G Communication, mmWave Communications Massive MIMO Machine Type Communications (MTC) Device-to-Device Communications (D2D, Pro Se) Vehicle-to-Vehicle Communications (V2X) Tactile Internet.

### UNIT II

**Network Architecture and Protocols** Introduction to Network Architecture and Protocols Control plane protocols, User plane protocols,

### UNIT III

**Physical Layer for Downlink:** OFDMA Technology Overview and Downlink PHY Design, Synchronization and Cell Search, Reference Signals and Channel Estimation, Downlink Physical Data and Control Channels, Link Adaptation and Channel Coding, Multiple Antenna Techniques, Multi-User Scheduling and Interference Coordination, Broadcast Operation.

**Physical Layer for Uplink:** Uplink PHY Design, Uplink Reference Signals Uplink Physical Channel Structure, Uplink Capacity and Coverage, Random Access for Uplink, Uplink Transmission Procedures

### UNIT IV

**Practical Deployment Aspects:** User Equipment Positioning, Radio Propagation Environment, Radio Frequency Aspects, Radio Resource Management, Paired and Unpaired Spectrum, Picocells, Femtocells, and Home eNodeBs Self Optimizing Networks, LTE System Performance

### UNIT V

**LTE Advanced:** Introduction to LTE Advanced, Carrier Aggregation, Multiple Antenna Techniques for LTE Advanced, Relaying, Additional Features of LTE Release-10 and Future Direction

### TEXTBOOK:

1. Stefania Sesia (Editor), Issam Toufik (Editor), Matthew Baker (Editor), LTE, The UMTS Long Term Evolution: From Theory to Practice, Wiley, 2nd Edition, Sept. 2011, ISBN-10: 0470660252 | ISBN-13: 978-0470660256.

### REFERENCE BOOKS

1. Houman Zarrinkoub, "Understanding LTE with MATLAB: From Mathematical Modeling to Simulation and Prototyping", Wiley, March 2014.
2. Christopher Cox, "An Introduction to LTE: LTE, LTE-Advanced, SAE and 4G Mobile Communications", Wiley, 2012.
3. Amitabha Ghosh, Rameepat Ratasuk, "Essentials of LTE and LTE-A," Cambridge University Press, 2011.
4. Farooq Khan, "LTE for 4G Mobile Broadband: Air Interface Technologies and Performance", Cambridge University Press, 2009.

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## **SYSTEM ON CHIP ARCHITECTURE** **(Professional Elective-V)**

**IV B.Tech-II Semester****Course Code: A2EC815PE****L T P C****3 0 0 3****PREREQUISITE:** Embedded System Design**COURSE OBJECTIVES:**

1. To introduce the architectural features of system on chip.
2. To imbibe the knowledge of customization using case studies.

**COURSE OUTCOMES:**

1. Expected to understand SOC Architectural features.
2. To acquire the knowledge on processor selection criteria and limitations
3. To acquires the knowledge of memory architectures on SOC.
4. To understands the interconnection strategies and their customization on SOC.

**UNIT – I:**

Introduction to the System Approach: System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

**UNIT – II:**

Processors: Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

**UNIT – III:**

Memory Design for SOC: Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I , and D – Caches , Multilevel Caches, Virtual to real translation , SOC Memory System , Models of Simple Processor – memory interaction.

**UNIT - IV:**

Interconnect Customization: Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization:

**UNIT – V:**

Configuration: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance- Specific design, Customizable Soft Processor, Reconfiguration - overhead analysis and trade-off analysis on reconfigurable Parallelism.

**TEXT BOOKS:**

1. Computer System Design System-on-Chip by Michael J. Flynn and Wayne Luk, Wiley India Pvt.Ltd.
2. ARM System on Chip Architecture – Steve Furber –2nd Eed., 2000, Addison Wesley Professional.

**REFERENCE BOOKS:**

3. Design of System on a Chip: Devices and Components – Ricardo Reis, 1st Ed., 2004, Springer
4. Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology) – Jason Andrews – Newnes, BK and CDROM
5. System on Chip Verification – Methodologies and Techniques –Prakash Rashinkar, Peter Paterson and Leena Singh L, 2001, Kluwer Academic Publishers.

## MEASURING INSTRUMENTS (Open Elective – III)

IV B.Tech-II Semester

Course Code: A2EC805OE

L T P C

3 0 0 3

### COURSE OBJECTIVES:

1. It provides an understanding of various measuring system 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. Understanding the concepts of various measuring bridges and their balancing conditions.
4. Provides understanding of use of various measuring techniques for measurement of different physical parameters using different classes of transducers.
5. Discussion about the importance of signal generators and analyzers in Measurement

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

1. Measure electrical parameters with different meters and understand the basic definition of measuring parameters.
2. Use various types of signal generators, signal analyzers for generating and analyzing various real-time signals.
3. Operate an Oscilloscope to measure various signals.
4. Measure various physical parameters by appropriately selecting the transducers.
5. Relate the usage of various instrumentation standards.

### 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, Millimeters, 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, Synchro's, Special Resistance Thermometers, Digital Temperature sensing system, Piezoelectric Transducers, Variable Capacitance Transducers, Magnetostrictive Transducers, gyroscopes, accelerometers.

### 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. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbins, W. D. Cooper: PHI 5<sup>th</sup> Edition 2003.
2. Electronic Instrumentation: H. S. Kalsi – TMH, 2<sup>nd</sup> Edition 2004.
3. Electrical and Electronic Measurement and Measuring Instruments – A K Sawhney, Dhanpat Rai & Sons, 2013.

**REFERENCE BOOKS**

1. Electronic Instrumentation and Measurements – David A. Bell, Oxford Univ. Press, 1997.
2. Industrial Instrumentation: T.R. Padmanabham Springer 2009.
3. Electronic Measurements and Instrumentation – K. Lal Kishore, Pearson Education 2010.

## COMMUNICATION TECHNOLOGIES (Open Elective-III)

IV B.Tech-II Semester

Course Code: A2EC806OE

L T P C

3 0 0 3

**COURSE OBJECTIVES:** The objectives of this subject are to:

1. Understand the basics of communication technology
2. Understand the concepts of data communication and various protocols
3. Learn the concepts of optical communication and cellular mobile system
4. Understand the concept of satellite communication , radar systems and various sensor networks , GPS

**COURSE OUTCOMES:** Upon completing this course the students able to:

1. Analyze the concepts of communication technologies and its types
2. Differentiate the various communications methodologies based on the applications
3. Analyze the optical communication and its classifications
4. Analyze the satellite communication ,radar systems, GPS Navigations

### UNIT I

**Introduction to Communication Technology:** What is Communication Technology, how communication technology works, types of Communication Technologies, Barriers to Communication Technology

### UNIT II

**Data Communications:** Components, Data Representation, Data Flow, Networks Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks Interconnection of Networks, The Internet - A Brief History, The Internet Today, Protocol and Standards - Protocols, Standards, Standards Organizations, Internet Standards. Network Models, Layered Tasks, OSI model, Layers in OSI model.

### UNIT III

**Optical Communications:** Optical Fiber types, Light Propagation, Optical fiber Configurations, Optical fiber classifications, Losses in Optical Fiber cables, Light Sources, Optical Sources, Light Detectors, LASERS.**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, Concept of Frequency Reuse, Channel Interference, System Capacity, Cell Splitting, Sectoring.

### UNIT IV

**Satellite Communications:** Introduction to Satellite Communication, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency Allocations for Satellite Services, Applications, Future Trends of Satellite Communications**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.

### UNIT V

**Introduction to Sensor Networks:** Definition of sensors, Definition of networks, Unique constraints and challenges, Advantage of sensor networks, Applications of sensor networks, Types of wireless sensor networks. Global Positioning System: 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. Communication Technology by Everett M. Rogers
2. Data Communications and Networking Behrouz A. Forouzan 4<sup>th</sup> Edition McGraw-Hill Education
3. Optical Communication by M. Mukunda Rao

### REFERENCE BOOKS:

1. Optical Fiber Communications: Principles and Practice, 3e by John M.Senior
2. Mobile Cellular Telecommunications: Analog and Digital Systems by William .C. Y Lee