ACADEMIC REGULATIONS (R18)

COURSE STRUCTURE AND DETAILED SYLLABUS

(CHOICE BASED CREDIT SYSTEM (CBCS))

ELECTRONICS & COMMUNICATION ENGINEERING

For

B. Tech. - Regular Four Year Degree Course

(Applicable for the batches admitted from 2018 - 2019)

&

B. Tech. - Lateral Entry Scheme

(Applicable for the batches admitted from 2019 - 2020)

CMR INSTITUTE OF TECHNOLOGY

(UGC - Autonomous)

Approved by AICTE, Permanently Affiliated to JNTUH, Accredited by NAAC with A Grade and NBA

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FOREWORD

CMR Institute of Technology, established in the year 2005, Approved by AICTE, New Delhi, Permanently Affiliated to JNTUH, twice Accredited by NBA, Achieved UGC Autonomous Status and has been bestowed with NAAC 'A' Grade in July 2018 for its remarkable academic accomplishments accompanied by its unflinching spirit and dedication to impart quality technical education to the deserving aspirants. The institution has commenced functioning independently within the set norms prescribed by UGC and AICTE. The performance of the institution manifests the confidence that the prestigious monitoring body, the UGC has on it, in terms of upholding its spirit and sustenance of the expected standards of functioning on its own consequently facilitating the award of degrees for its students. Thus, an autonomous institution is provided with the necessary freedom to have its own **curriculum, examination system and monitoring mechanism**, independent of the affiliating University but under its observance.

CMR Institute of Technology takes pride for having won the confidence of such distinguished academic bodies meant for monitoring the quality in technology education. Besides, the institution is delighted to sustain the same spirit of discharging the responsibilities that it has been conveying since a decade to attain the current academic excellence, if not improving upon the standards and ethics. Consequently, statutory bodies such as the Academic Council and the Boards of Studies have been constituted under the supervision of the Governing Body of the College and with the recommendations of the JNTU Hyderabad, to frame the regulations, course structure and syllabi for autonomous status.

The autonomous regulations, course structure and syllabi have been framed in accordance with the vision and mission of the institution along with certain valuable suggestions from professionals of various ancillary fields such as the academics, the industry and the research, all with a noble vision to impart quality technical education and contribute in catering full-fledged engineering and management graduates to the society.

All the faculty members, the parents and the students are requested to study all the rules and regulations carefully and approach the Principal to seek any clarifications, if needed, 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 institution and for brightening the career prospects of engineering and management graduates.

CMR INSTITUTE OF TECHNOLOGY

Vision: To create world class technocrats for societal needs.

Mission: Impart global quality technical education for a better future by providing appropriate learning environment through continuous improvement and customization.

Quality Policy: Strive for global excellence in academics & research to the satisfaction of students and stakeholders.

Department of Electronics & Communication Engineering (ECE)

Vision: To be a centre of excellence in the field of electronics and communication engineering where learners are nurtured in a scholarly environment to meet global challenges

Mission: Provide conducive environment to hone up the learners' technical skills by imparting quality education in the field of electronics and communication engineering to fulfill societal needs

I. PROGRAMME EDUCATIONAL OBJECTIVES (PEO's)

PEO1: Graduate will have effective foundation in mathematics, science, engineering, technology, management, humanities and various other interdisciplinary subjects for successful career in electronics and communication engineering and related fields.

PEO2: Graduate will be able to design and develop innovative systems that contribute to socio-economic development and/or pursue higher education and research.

PEO3: Graduate exhibits professional ethics, communication skills, teamwork and adapts to changing environments of engineering and technology by engaging in lifelong learning.

II. PROGRAMME OUTCOMES (PO's)

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
13. **PSO1:** Identify the complex problems and develop solutions in the area of communication, signal processing, VLSI, embedded systems, IoT and Artificial Intelligence.
14. **PSO2:** Demonstrate proficiency in utilization of software and hardware tools along with analytical skills to arrive at appropriate solutions.

Academic Regulations (R18)
B.Tech. - Regular Four Year Degree Programme
(For batches admitted from the academic year 2018 - 19)
&
B.Tech. - Lateral Entry Scheme
(For batches admitted from the academic year 2019 - 20)

PREAMBLE

For pursuing four year under graduate Bachelor Degree Programme in Engineering (B.Tech.) offered by **CMR Institute of Technology** under Autonomous status will herein be referred to as CMRIT (Autonomous).

All the specified rules are herein approved by the Academic Council. These rules will be in force and are applicable to students admitted from the Academic Year 2018-19 onwards. Any reference to "Institute" or "College" in these rules and regulations stand for CMRIT (Autonomous).

Choice Based Credit System (CBCS) has been adopted since 2017-18 under Autonomous status.

All the rules and regulations specified shall hereafter 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, CMRIT (Autonomous) shall be The Chairman, Academic Council.

1. UNDER GRADUATE PROGRAMS OFFERED (E&T)

CMRIT (Autonomous), affiliated to JNTUH, offers 4 Year (8 Semesters) **B.Tech.** Degree Programme in the following Branches of Engineering:

1) B.Tech. - Civil Engineering
2) B.Tech. - Mechanical Engineering
3) B.Tech. - Electronics and Communication Engineering
4) B.Tech. - Computer Science and Engineering

2. ADMISSION CRITERIA AND MEDIUM OF INSTRUCTION

2.1. Admission into first year of four year B.Tech. (Regular) Degree Programme:

2.1.1. Eligibility: A candidate seeking admission into the first year of four year B. Tech. Degree Programme should have:

(i) Passed either Intermediate Public Examination (IPE) 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 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 TSEAMCET examination conducted by TSCHE for allotment of a seat by the Convenor, TSEAMCET.

2.1.2. Admission Procedure: Admissions are made into the first year of four year B.Tech. Degree Programme as per the stipulations of the TSCHE.

(a) Category A: 70% of the seats are filled through TSEAMCET counseling.
(b) Category B: 30% of the seats are filled by the Management.

2.2. Admission into the second year of four year B. Tech. (Regular) Degree Programme Under Lateral Entry Scheme.

2.2.1 Eligibility: A candidate seeking admission into the II year I Semester B. Tech. Regular Degree Programme under Lateral Entry Scheme (LES) should have passed the qualifying examination (B.Sc. Mathematics or Diploma in concerned course) and have secured a rank at Engineering Common Entrance Test TSECET (FDH). Admissions are made in accordance with the instructions received from the Convenor, TSECET and Government of Telangana State.

2.2.2 Admission Procedure: Admissions are made into the II year of four year B.Tech. (Regular) Degree Programme through Convenor, TSECET (FDH) against the sanctioned intake in each Programme of study as lateral entry student.

2.3. Branch Transfers: There shall be no Branch transfers after the completion of Admission Process.

2.4. Medium of Instruction: The Medium of Instruction and Examinations for the entire B.Tech. programme will be in **English** only.

3. B.Tech. PROGRAMME STRUCTURE

3.1 Admitted under Four year B. Tech. (Regular) degree Programme:

3.1.1 A student after securing admission shall pursue the under graduate programme in B.Tech. for a minimum period of **four** academic years (8 semesters), and a maximum period of **eight** academic years (16 semesters) starting from the date of commencement of first year first semester, failing which, students shall forfeit their seat in B.Tech course.

3.1.2 As per AICTE guidelines, a 3-week 'Mandatory **Induction Programme'** shall be offered to I-B.Tech. students to acquaint the newly admitted students with the professional environment and prepare them for the academic schedules ahead.

3.1.3 The entire B.Tech. programme is structured for a total of 160 credits. Distribution of credits Semester-wise is available in the respective course structure.

3.1.4 Each student shall register and secure 160 credits (with CGPA $\geq$ 5) for the completion of the under graduate programme and award of the B.Tech. degree.

3.2 Admitted under Lateral Entry Scheme (LES) into B. Tech. degree Programme:

3.2.1 After securing admission into II year B.Tech. I Semester, the LES students shall pursue a course of study for not less than three academic years (6 Semesters) and not more than six academic years (12 Semesters), failing which students shall forfeit their seat in B.Tech. programme.

3.2.2 The student shall register and secure 122 credits (with CGPA $\geq$ 5) from II year to IV year B.Tech. programme (LES) for the award of B.Tech. degree.

3.3 The Course Structure is designed based on the AICTE Model Curriculum (Jan-2018) for Under-Graduate Degree Courses in Engineering & Technology. **UGC / AICTE** specified definitions / descriptions are adopted appropriately for various terms and abbreviations used in these Academic Regulations / Norms, which are listed below:

3.3.1 Semester Scheme: Each B.Tech. (Regular) Programme is of 4 Academic Years (8 Semesters) and B.Tech. (LES) Programme is of 3 Academic Years (6 Semesters)), with the academic year being divided into two semesters of 22 weeks ($\geq$ 90 Instructional days per semester) each, each Semester having - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)', Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and Curriculum / Course Structure as suggested by AICTE are followed.

3.3.2 Credit Courses:

a) All Subjects / 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:

Theory		Practical	
1 Hr. Lecture (L) per week	1 credit	1 Hr. Practical (P) per week	0.5 credit
1 Hr. Tutorial (T) per week	1 credit	2 Hrs Practical (Lab) per week	1.0 credit

All Mandatory Courses, Study Tour, Guest Lecture, etc., will not carry any Credits.

b) **Contact Hours:** Weekly contact hours – maximum of 30 hours per week (i.e. 1 hour = 60 Minutes) including credit and non-credit courses.

3.3.3 Subject / Course Classification and Nomenclature:

CMRIT has followed the guidelines specified by AICTE / UGC / JNTUH. The subjects / courses offered in B.Tech. programme are broadly classified as mentioned below.

S. No.	Category	Breakup of Credits (AICTE)	Breakup of Credits (CMRIT)
1	Humanities and Social Sciences including Management courses (HSMC)	12*	09.0
2	Basic Science Courses (BSC)	25*	22.0
3	Engineering Science courses including workshop, drawing, basics of Electrical / Mechanical / Computer etc. (ESC)	24*	25.5
4	Professional core courses (PCC)	48*	65.5
5	Professional Elective courses relevant to chosen specialization / branch (PEC)	18*	15.0
6	Open subjects – Electives from other technical and /or emerging subjects (OEC)	18*	09.0
7	Project work, seminar and internship in industry or appropriate work place / academic and research institutions in India / abroad (PRJ)	15*	14.0
8	Mandatory Courses (Environmental Sciences, Induction program, Indian Constitution, Essence of Indian Traditional Knowledge, etc) (MC)	(non-credit)	(non-credit)
Total Credits		**160***	**160**

**Minor variation is allowed as per need of the respective disciplines.*

4. COURSE REGISTRATION

4.1 A '**faculty advisor or counselor**' shall be assigned to each student to advise the student about the B.Tech. programme, course structure and curriculum, choice / option for subjects / courses, based on his/her competence, progress, pre-requisites and interest.

4.2 The academic section of the college invites 'registration forms' from students before the beginning of the semester through online submission, ensuring '**date** and **time stamping**'. The online registration requests for any 'current semester' shall be completed **before the commencement of SEEs (Semester End Examinations) of the 'preceding semester'**.

4.3 A student can apply for **online** registration, **only after** obtaining the '**written approval**' from his faculty advisor or counselor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with Head of the Department, faculty advisor and the student.

4.4 A student has to register for all subjects/courses in a semester as specified in the course structure and may be permitted to register one additional theory subject / course limited to 3 credits, based on the student's **progress** and SGPA / CGPA, and completion of the '**pre-requisites'** as indicated for various subjects/courses, in the department course structure and syllabus contents.

4.5 If the student submits ambiguous choices or multiple options or erroneous (incorrect) entries during **online** registration for the subject(s) / course(s) under a given / specified course group / category as listed in the course structure, only the first mentioned subject / course in that category will be taken into consideration.

4.6 Subject / course options exercised through **online** registration are final and **cannot** be changed or inter- changed; further, alternate choices will not be considered. However, if the subject / course that has already been listed for registration by Head of the 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.

4.7 Dropping of additional registered subject / course (refer 4.4) may be permitted only after obtaining prior approval from the faculty advisor / counselor, '**within a period of 15 days**' from the commencement of that semester.

4.8 **Open electives**: Students have to choose one open elective wherever offered from the list of open electives given for their stream. Students should opt for open electives offered by other departments / branches only.

4.9 **Professional electives**: Students have to choose professional elective wherever offered from the list of professional electives given. However, students may opt for professional elective subjects offered in the related area.

4.10 **Mandatory Courses (Non-Credit):** All mandatory courses wherever offered require prior registration.

5. SUBJECTS / COURSES TO BE OFFERED

5.1 A typical Section (or Class) Strength for each Semester shall be 60. A subject / course may be offered to the students, **if only** a minimum 1/3 of students register to the course. The Maximum Strength of a Section is limited to 80 (60 + 1/3 of the Section Strength).

i) More than **one faculty member** 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 '**first come first serve** basis and CGPA criterion' (i.e. the first focus shall be on early **on-line entry** from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student).

ii) If more entries for registration of a subject come into picture, then the concerned Head of the Department shall take necessary decision, whether or not to offer such a subject / course for **two (or multiple) sections**.

6. ATTENDANCE REQUIREMENTS

6.1 A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum 75% of attendance in aggregate (excluding the days of midterm examinations) for all the subjects / courses, excluding attendance in mandatory courses in that semester.

6.2 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.

6.3 A stipulated fee shall be payable towards condoning of shortage of attendance.

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

6.5 **Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled. They will not be promoted to the next semester.** They may seek re-registration for all those subjects registered in that semester in which student was detained, by seeking re-admission into that semester as and when offered; in case if there are any professional electives and / or open electives, the same may also be re-registered, if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the **same** set of elective subjects offered under that category.

6.6 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

7. ACADEMIC REQUIREMENTS

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no. 6.

7.1 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% marks (25 out of 70 marks) in the semester end examination (SEE), and a minimum of 40% of marks in the sum total of the Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) taken together; in terms of letter grades, this implies securing **C** grade or above in that subject / course.

7.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to summer internship and project courses, if student secures not less than 40% of the total marks in each of them. The student would be treated as failed, if student does not submit a report on his project(s), or does not make a presentation of the same before the evaluation committee as per the schedule. Student may reappear once for each of the above evaluations, when they are scheduled again; if he fails in such 'one re-appearance' evaluation also, student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

7.3 Promotion Rules

7.3.1 Four year B.Tech. (Regular):

S. No.	Promotion	Conditions to be fulfilled
1	First year first semester to first year second semester	Regular course of study of first year first semester.
2	First year second semester to second year first semester	**(i)** Regular course of study of first year second semester. **(ii)** Must have secured at least 19 credits out of 38 credits i.e., 50% credits up to first year second semester from all the relevant regular and supplementary examinations whether the student takes those examinations or not.
3	Second year first semester to second year second semester	Regular course of study of second year first semester.
4	Second year second semester to third year first semester	**(i)** Regular course of study of second year second semester.

		(ii) Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Third year first semester to third year second semester	Regular course of study of third year first semester.
6	Third year second semester to fourth year first semester	**(i)** Regular course of study of third year second semester. **(ii)** Must have secured at least 72 credits out of 120 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester.

7.3.2 Four year B.Tech. (LES):

S. No.	Promotion	Conditions to be fulfilled
1	Second year first semester to second year second semester	Regular course of study of second year first semester.
2	Second year second semester to third year first semester	**(i)** Regular course of study of second year second semester. **(ii)** Must have secured at least 21 credits out of 42 credits i.e., 50% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester to third year second semester	Regular course of study of third year first semester.
4	Third year second semester to fourth year first semester	**(i)** Regular course of study of third year second semester. **(ii)** Must have secured at least 49 credits out of 82 credits i.e., 60% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester.

7.4 A student has to register for all subjects covering 160 credits (122 credits in case of LES) as specified and listed (with the relevant course / subject classifications as mentioned) in the course structure, fulfill all the attendance and academic requirements for 160 credits (122 credits in case of LES) securing a minimum of **'C'** grade or above in each subject, and 'earn all 160 credits (122 credits in case of LES) securing SGPA ≥ 5.0 (in each semester), and CGPA (at the end of each successive semester) ≥ 5.0, to successfully complete the under graduate programme.

7.5 If a student registers for '**additional subjects'** (in the parent department or other departments / branches of engineering) other than those listed subjects totaling to 160 credits (122 credits in case of LES) as specified in the course structure of parent department, the performances in those '**additional subjects**' (although evaluated and graded using the same procedure as that of the required 160 credits (122 credits in case of LES)) will not be taken into account while calculating the SGPA and CGPA. For such '**additional subjects'** registered, % of 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 regulations 6 and 7.1 to 7.4 above.

7.6 A student eligible to appear in the semester end examination for any subject / course, but absent from it or failed (thereby failing to secure **'C'** grade or above) may reappear for that subject / course in the supplementary examination as and when conducted. In such cases, internal marks (CIE) assessed earlier for that subject / course will be carried over, and added to the marks to be obtained in the SEE supplementary examination for evaluating performance in that subject.

7.7 A student **detained in a semester due to shortage of attendance may be re-admitted when the same semester is offered in the next academic year for fulfillment of academic requirements**. The academic regulations under which student has been readmitted shall be applicable. However, no grade allotments or SGPA / CGPA calculations will be done for the entire semester in which student has been detained.

7.8 A student detained **due to lack of credits, shall be promoted to the next academic year only after acquiring the required academic credits.** The academic regulations under which student has been readmitted shall be applicable.

8. EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

8.1 The performance of a student in each semester shall be evaluated subject-wise / course-wise (irrespective of credits assigned) with a maximum of 100 marks. These evaluations shall be based on 30 marks allotted for CIE (Continuous Internal Evaluation) and 70 marks for SEE (Semester End Examination), and a letter grade corresponding to the percentage of marks obtained shall be given.

8.2 Evaluation of Theory Subjects / Courses

A) Continuous Internal Evaluation: For each theory subject, during the semester, there shall be 2 mid-term examinations of 30 marks each. Each mid-term examination consists of subjective paper for 25 marks & assignment for 5 marks and the final CIE marks (for total of 30) are calculated by taking 80% weightage from best of the two mid examinations and 20% weightage from the least scored mid examination marks in each subject.

- 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.
- The subjective paper shall be conducted for duration of 90 minutes. Each subjective paper shall contain 2 parts (Part-A and Part-B). Part-A consists of one compulsory question with five sub questions carrying two marks each. Part-B consists of 3 essay questions carrying five marks each with internal choice; the student has to answer all 3 questions.
- First assignment should be submitted before the commencement of the first mid-term examinations, and the second assignment should be submitted before the commencement of the second mid-term examinations. The assignments shall be specified / given by the concerned subject teacher.

B) Semester End Examinations: The duration of SEE is 3 hours. The details of the question paper pattern are as follows:

- The end semester examinations will be conducted for 70 marks consisting of two parts viz. i) **Part- A** for 20 marks, ii) **Part - B** for 50 marks.
- Part-A is compulsory, which consists of ten questions (two from each unit) carrying 2 marks each.
- Part-B consists of five questions (numbered from 11 to 15) carrying 10 marks each. One question from each unit (may contain sub-questions) with internal choice.

8.3 Evaluation of Practical / Design / Drawing Subjects /Courses: In any semester, a student has to complete a minimum of 10 experiments / exercises in each laboratory course and get the record certified by the concerned Head of the Department to be eligible for Semester End Examination.

For practical subjects, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 30 internal marks and 70 marks for Semester End Examination (SEE).

A) Continuous Internal Evaluation (CIE): For each practical subject, during the semester, there shall be 2 mid-term examinations of 30 marks each. Each mid-term examination consists of day-to-day work evaluation for 20 marks and internal test for 10 marks conducted by the concerned laboratory teacher for duration of 90 minutes. 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. The final CIE marks (for total of 30) are calculated by taking 80% weightage from best of the two mid examinations and 20% weightage from the least scored mid examination marks in each practical subject.

B) Semester End Examination (SEE): The SEE for practical subject / course shall be conducted at the end of the semester with duration of 3 hours by one internal and one external examiner appointed by the Head of the Institution as per the recommendation of the concerned Head of the Department.

8.4 Evaluation of Summer Internship: The Summer internship I & II (4 - 6 weeks each) registered by the students in consultation with course coordinator and carried out in Industries and/or R&D Organizations immediately after their IV and VI semester course work respectively, the completion report will be assessed in subsequent semester(s) as 'Satisfactory' or 'Unsatisfactory' by a committee consisting of Head of the Department, supervisor and a senior faculty member of the department.

8.5 Evaluation of Project work: Student(s) shall start the Project Work during the VII Semester as per the instructions of the Project Guide / Supervisor assigned by the Head of the Department. The topics for Summer Internship and Project Stage – I shall be different from one another.

a) The Project Work shall be carried out in two stages: Project-I (Stage – I) during VII Semester and Project-II (Stage – II) during VIII Semester. The student has to prepare two independent Project Work Reports – *one each during each stage*. First Report shall include the Project Work carried out under Stage – I, and the Second Report (Final Report) shall include the Project Work carried out under Stage – I and Stage – II put together. Stage – I and Stage – II of the Project Work shall be evaluated for 100 marks each.

b) Out of the total 100 marks allotted for each stage of the Project Work, 30 marks shall be for the Continuous Internal Evaluation(CIE), and 70 marks shall be for the End Semester Viva-voce Examination (SEE). The marks earned under CIE for both the stages of the Project shall be awarded by the Project Guide / Supervisor (based on the continuous evaluation of student's performance during the two Project Work stages); and the marks earned under SEE shall be awarded by the Project Viva-voce Committee (based on the work carried out, report prepared and the presentation made by the student at the time of Viva-voce Examination).

c) For the Project Stage - I, the Viva-voce shall be conducted at the end of the VII Semester by the Department Evaluation Committee comprising of the Head of the Department , One Senior Faculty member and Supervisor. The Project Stage – II Viva-voce shall be conducted by the Committee comprising of an External Examiner appointed by the Head of the Institution, Head of the Department and Project Supervisor at the end of the VIII Semester.

d) If a student does not appear (or fails) for any of the two Viva-voce examinations at the scheduled times as specified above, he may be permitted to reappear for Project Stage - I and/or Project Stage - II Viva-voce examinations, as and when they are scheduled again in that semester; if he fails in such 'one reappearance' evaluation also, he has to reappear for the same in the next subsequent semester(s), as and when they are scheduled, as supplementary candidate.

8.6 **Evaluation of Mandatory Non-Credit Courses:** There shall be only CIE for all mandatory (non credit) courses, instead of marks or letter grade '**Satisfactory'** or "**Unsatisfactory'** shall be indicated and this will not be counted for the computation of SGPA / CGPA. The student has to maintain a minimum of 65% attendance and secure not less than 40% in the CIE and then only the student is declared as **pass** and will be qualified for the award of the degree.

9. GRADING PROCEDURE

9.1 Marks will be awarded to indicate the performance of the student in each theory subject, lab / practical's/design/drawing practice, Summer Internship – I & Summer Internship – II and Project-I & Project-II based on the percentage of marks obtained in Continuous Internal Evaluation plus Semester End Examination, both taken together, as specified in item 8 above, a corresponding letter grade shall be given.

9.2 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 (≥ 90% , ≤ 100%)	O (Outstanding)	10
Below 90% but not less than 80% (≥ 80% , < 90%)	A^+ (Excellent)	9
Below 80% but not less than 70% (≥ 70% , < 80%)	A (Very Good)	8
Below 70% but not less than 60% (≥ 60% , < 70%)	B^+ (Good)	7
Below 60% but not less than 50% (≥ 50% , < 60%)	B (above Average)	6
Below 50% but not less than 40% (≥ 40% , < 50%)	C (Average)	5
Below 40% (< 40%)	F (Fail)	0
Absent	Ab	0

9.3 A student obtaining '**F'** grade in any subject shall be considered **'failed**' and will be required to reappear as '**Supplementary Student**' in the Semester End Examination (SEE), as and when offered. In such cases, Continuous Internal Examination (CIE) in those subject(s) will remain same as those obtained earlier.

9.4 A letter grade does not imply any specific % of marks.

9.5 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, student has to repeat all the subjects / courses pertaining to that semester, if detained.

9.6 A student earns grade point (GP) in each subject / course, on the basis of the letter grade obtained 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

9.7 The student passes the subject / course only when GP ≥ 5 (C grade or above).

9.8 The Semester Grade Point Average (SGPA) is calculated by dividing the sum of credit points (ΣCP) 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

$$\textbf{SGPA } (S_i) = \sum (C_i \text{ X } G_i) / \sum C_i$$

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

9.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in 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:

$$\textbf{CGPA} = \sum (C_i \text{ X } S_i) / \sum C_i$$

where S_i is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester.

Illustration of calculation of SGPA					Illustration of calculation of CGPA			
Course /Subject	Credits	Letter Grade	Grade Points	Credit Points	Sem.	Credits	SGPA	Credits x SGPA
Course 1	4	A	8	4 x 8 = 32	Sem I	19	7	19 x 7= 133
Course 2	3	O	10	3 x 10 = 30	Sem II	19	6	19 x 6= 114
Course 3	3	C	5	3 x 5 = 15	Sem III	21	6.5	21 x 6.5 =136.5
Course 4	3	B	6	3 x 6 = 18	Sem IV	21	6	21 x 6 = 126
Course 5	1.5	A^+	9	1.5x9 = 13.5	Sem V	20	7.5	20 x 7.5 =150
Course 6	1.5	A	8	1.5x8 = 12	Sem VI	20	8	20 x 8 = 160
Course 7	1.5	B^+	7	1.5x7 = 10.5	Sem VII	20	8.5	20 x 8.5 =170
Course 8	1.5	A^+	9	1.5x9 = 13.5	Sem VIII	20	8	20 x 8 = 160
Total	**19**		**62**	**144.5**	**Total**	**160**		**1149.5**
SGPA = 144.5/19 = 7.60					**CGPA = 1149.5/160 = 7.18**			

9.10 For merit ranking or comparison purposes or any other listing, **only** the '**rounded off**' values of the CGPAs will be used.

9.11 For calculations listed in Item 9.6–9.10, 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.

10 PASSING STANDARDS

10.1 A student shall be declared '**successful'** or '**passed**' in a semester, if student secures a GP ≥ 5 ('C' grade or above) in every subject/course in that semester (i.e. when student gets an SGPA ≥ 5.00 at the end of that particular semester); and a student shall be declared '**successful**' or '**passed**' in the entire under graduate programme, only when a student gets a CGPA ≥ 5.00 for the award of the degree as required.

10.2 After the completion of each semester, a grade card or grade sheet (or transcript) shall be issued to all the registered students of that semester, indicating the letter grades and credits earned. it will show the details of the courses registered (course code, title, no. of credits, grade earned etc.), credits earned, SGPA, and CGPA.

10 DECLARATION OF RESULTS

11.1 Computation of SGPA and CGPA are done using the procedure listed in 9.6 – 9.9.

11.2 The conversion formula from CGPA to percentage of Marks:

Percentage of Marks = (final CGPA – 0.5) x 10

12 AWARD OF DEGREE

12.1 After a student has satisfied the requirement prescribed for the completion of the program and is eligible for the award of B. Tech. degree the student shall be placed in one of the following four classes based on CGPA:

Class Awarded	Grade to be Secured	Remarks
First Class with Distinction	≥ 8 CGPA	From the aggregate marks secured from 160 Credits for Regular Students and 122 Credits for Lateral Entry Students.
First Class	≥ 6.5 to < 8 CGPA	
Second Class	≥ 5.5 to < 6.5 CGPA	
Pass Class	≥ 5.00 to < 5.5 CGPA	
FAIL	CGPA < 5	

12.2 First class with distinction will be awarded to those students who clear all the subjects in single attempt during their regular course of study by fulfilling the following conditions:

(i) Should have passed all the subjects/courses in '**first appearance'** within the first 4 academic years (or 8 sequential semesters) for B.Tech. (Regular) and first 3 academic years (or 6 sequential semesters) for B.Tech. (LES) from the date of commencement of first year first semester for B.Tech. (Regular) and II year I semester for B.Tech. (LES).

(ii) Should have secured a CGPA ≥ 8.00, at the end of each of the 8 sequential semesters (6 sequential semesters for LES), starting from I year I semester (starting from II year I semester for LES) onwards.

(iii) Should not have been detained or prevented from writing the end semester examinations in any semester due to shortage of attendance or any other reason, shall be placed in '**first class with distinction'**.

12.3 **Award of Medals:** Students fulfilling the conditions listed under item 12.2 alone will be eligible for award of '**College Ranks**' and '**Medals**'.

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

12.5 **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 transcripts will also be issued if required after the payment of requisite fee and also as per norms in vogue.

13 WITH HOLDING OF RESULTS

If the student has not paid the fees to the Institute at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and the student 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.

14 SUPPLEMENTARY EXAMINATIONS

Supplementary examinations for odd semester subjects will be conducted along with even semester regular examinations and vice versa.

15. TRANSITORY REGULATIONS

a) A student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed after having undergone the degree programme, may be considered eligible for readmission to the

same subjects / courses (or equivalent subjects/ courses, as the case may be), and same professional electives / open electives (or from set / category of electives or equivalents suggested, as the case may be) as and when they are offered (within the time-frame of 8 years from the date of commencement of student's first year first semester).

b) A student who has failed in any subject under any regulation has to pass those subjects in the respective regulations.

c) 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 R18 Regulations. The performance evaluation of the student will be done as per the rules and regulations applicable at the time of admission(s) regarding award of grade and/or class as the case may be.

d) If a student readmitted to R18 Regulations, has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R18 Regulations will be substituted by another subject to be suggested by the CMRIT Academic Council.

e) **Promotion Rule:** Where the credits allotted to a semester/year under the regulations studied in are different from that under R18 regulations for the corresponding semester/year, the promotion rules of R18 vide section 7.3 shall be applied after normalization. Normalization is done by scaling down or up the number of credits of a semester/year under the previous regulations to equal the number of credits of the corresponding semester/year under R18 regulations and revising the secured credits also in the same proportion.

16 STUDENT TRANSFERS

There shall be no transfers from other colleges / streams.

17 RULES OF DISCIPLINE

17.1 Any attempt by any student to influence the teachers, examiners, faculty members and staff of Controller of Examination office for undue favours in the exams, and bribing them either for marks or attendance will be treated as malpractice case and the student can be debarred from the college.

17.2 When the performance of the student in any subject(s) is cancelled as a punishment for indiscipline, student is awarded zero marks in that subject(s).

17.3 When the student's answer book is confiscated for any kind of attempted or suspected malpractice the decision of the Malpractice Prevention Committee is final.

18. MALPRACTICE

18.1 **Malpractice Prevention Committee:** The committee shall examine the student's malpractice and indiscipline cases occurred, while conducting the examinations and recommend appropriate punishment to the Academic Council after taking explanation from the student and concerned invigilator as per the malpractice rules mentioned below. The committee consists of

a) Controller of Examinations - Chairman
b) Addl. Controller of Examinations.- Convener
c) Subject Expert - Member
d) Head of the Department of which the student belongs to - Member
e) The Invigilator concerned - Member

18.2 Malpractice 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.
1(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	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has

	paper during the examination or answer book or additional sheet, during or after the examination.	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.	

19. SCOPE

i) The Academic Regulations should be read as a whole, for the purpose of any interpretation.

ii) The above mentioned rules and regulations are applicable in general to both B.Tech. (Regular) and B.Tech. (LES), unless and otherwise specific.

iii) 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.

20. REVISION AND AMENDMENTS TO REGULATIONS

The Academic Council may revise or amend the academic regulations, course structure or syllabi at any time, and the changes or amendments made shall be applicable to all students with effect from the dates notified by the Academic Council.

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COURSE STRUCTURE

B.Tech. – R-18 COURSE STRUCTURE

(Applicable from the batch admitted during 2018-19 and onwards)

I – Semester (I – B.Tech. – I - Semester)							
S. No.	Subject Code	Subject	POs	Hours Per Week			Credits
				L	T	P	
1	BSC-101	Engineering Mathematics – I (Linear Algebra & Calculus)	1,2,12	3	1	-	4
2	BSC-107	Engineering Chemistry	1,2,12	3	-	-	3
3	ESC-101	Basic Electrical & Electronics Engineering	1,2,3,12	3	-	-	3
4	ESC-103	Programming for Problem Solving	1,2,3,12	3	-	-	3
5	BSC-108	Engineering Chemistry Lab	4	-	-	3	1.5
6	ESC-102	Basic Electrical & Electronics Engineering Lab	4	-	-	3	1.5
7	ESC-104	Programming for Problem Solving Lab	4	-	-	3	1.5
8	ESC-110	IT & Engineering Workshop	1,5,9,10	-	-	3	1.5
TOTAL				**12**	**01**	**12**	**19**
Mandatory Course (Non-Credit)							
9	MC-101	Technology Exploration for Social Innovation Lab - I	1 to 14	-	-	2	-

II – Semester (I – B.Tech. – II - Semester)							
S. No.	Subject Code	Subject	POs	Hours Per Week			Credits
				L	T	P	
1	BSC-102	Engineering Mathematics – II (Advanced Calculus)	1,2,12	3	1	-	4
2	BSC-103	Applied Physics	1,2,12	3	-	-	3
3	HSMC-101	English	10,12	2	-	-	2
4	ESC-105	Data Structures	1,2,3,12	3	-	-	3
5	ESC-109	Engineering Graphics	1,5,10	1	-	4	3
6	BSC-104	Applied Physics Lab	4	-	-	3	1.5
7	HSMC-102	English Language and communication Skills Lab	5,10	-	-	2	1
8	ESC-106	Data Structures Lab	4	-	-	3	1.5
TOTAL				**12**	**01**	**12**	**19**
Mandatory Course (Non-Credit)							
9	MC-102	Technology Exploration for Social Innovation Lab – II	1 to 14	-	-	2	-

Note: **Students need to carry out virtual lab experiments by registering on to the AICTE referred portal https://vlabs.ac.in**

III – Semester (II – B.Tech. – I - Semester)							
S. No.	Subject Code	Subject	POs	Hours Per Week			Credits
				L	T	P	
1	BSC-202	Numerical Methods and Complex Analysis	1,2,12	3	1	-	4
2	ESC-207	Networks and Measurements	1,2,3,12,13	3	-	-	3
3	ESC-208	Probability Theory & Stochastic Processes	1,2,12,13	3	-	-	3
4	EC-PCC-211	Analog Electronics	1,2,3,12,13	3	-	-	3
5	EC-PCC-212	Signals and Systems	1,2,12,13	3	-	-	3
6	EC-PCC-213	Analog Electronics Lab	4,5,14	-	-	3	1.5
7	EC-PCC-214	Networks and Measurements Lab	4,5,14	-	-	2	1
8	ESC-209	Scripting Languages Lab	1,2,3,4,5,14	-	-	3	1.5
9	BSC-203	Computational Mathematics Lab using Sci Lab	3,4,5,14	-	-	2	1
TOTAL				**15**	**01**	**10**	**21**
Mandatory Course (Non-Credit)							
10	MC-202	Environmental Sciences	1,6,7,12	2	-	-	-

IV – Semester (II – B.Tech. – II - Semester)							
S. No.	Subject Code	Subject	POs	Hours Per Week			Credits
				L	T	P	
1	EC-PCC-221	Pulse & Digital Circuits	2,3,12,13	3	1	-	4
2	EC-PCC-222	Linear & Digital IC Applications	2,3,12,13	3	-	-	3
3	EC-PCC-223	Electromagnetic Theory & Transmission Lines	1,2,12,13	3	1	-	4
4	EC-PCC-224	Digital Design and Computer Organization	2,3,12,13	3	-	-	3
5	EC-PCC-225	Control Systems	1,2,12	3	-	-	3
6	EC-PCC-226	Pulse & Digital Circuits Lab	4,5,14	-	-	2	1
7	EC-PCC-227	Linear & Digital IC Applications Lab	4,5,14	-	-	2	1
8	EC-PCC-228	Simulation Lab	4,5,14	-	-	2	1
9	EC-PCC-229	Digital Design Lab through Verilog	4,5,14	-	-	2	1
TOTAL				**15**	**02**	**08**	**21**
Mandatory Course (Non-Credit)							
10	MC-201	Gender Sensitization Lab	9,12	-	-	2	-

Note: Summer Internship – I (Mandatory Course) carried out during Summer Vacation between IV semester & V semester and evaluated in V semester.

V – Semester (III – B.Tech. – I - Semester)							
S. No.	Subject Code	Subject	POs	Hours Per Week			Credits
				L	T	P	
1	EC-PCC-311	Analog and Digital Communication	2,3,8,12,13	3	1	-	4
2	EC-PCC-312	Antenna & Wave Propagation	2,3,12,13	3	-	-	3
3	EC-PCC-313	Digital Signal Processing	2,3,6,12,13	3	-	-	3
4	EC-PCC-314	Micro Processors & Micro Controllers	2,3,7,12,13	3	-	-	3
5	EC-PCC-315	Internet of Things	2,3,6,7,12,13	3	-	-	3
6	EC-PCC-316	Analog and Digital Communication Lab	4,5,14	-	-	2	1
7	EC-PCC-317	Digital Signal Processing Lab	4,5,14	-	-	2	1
8	EC-PCC-318	Micro Processors & Micro Controllers Lab	4,5,14	-	-	2	1
9	EC-PCC-319	Internet of Things Lab	4,5,14	-	-	2	1
TOTAL				**15**	**01**	**8**	**20**
Mandatory Course (Non-Credit)							
10	MC-311	Employability Skills - I	9,10	3	-	-	-
11	MC-312	Summer Internship - I	1 to 14	-	-	-	-

VI – Semester (III – B.Tech. – II - Semester)							
S. No.	Subject Code	Subject	POs	Hours Per Week			Credits
				L	T	P	
1	EC-PCC-321	Microwave Engineering	2,3,12,13	3	-	-	3
2	EC-PCC-322	VLSI Design	2,3,7,12,13	3	-	-	3
3	EC-PCC-323	Artificial Intelligence	1,2,3,6,12,13	3	-	-	3
4	**Professional Elective – I**			3	-	-	3
	EC-PEC-301	C: Information Theory & Coding	2,3,8,12,13				
	EC-PEC-302	D: Data Mining and Analytics	1,2,3,5,12				
	EC-PEC-303	P: Digital Image Processing	2,5,12,13				
	EC-PEC-304	S: Operating Systems	1,2,12				
5	**Open Elective – I**			3	-	-	3
	OEC-301	CE: Disaster Management	2,7,8,12				
	OEC-302	ME: Fundamentals of Operation Research	1,2,12				
	OEC-303	ECE: Electronic Measurements and Instrumentation	1,2,12				
	OEC-304	CSE: Java Programming	1,2,3,5,12				
	OEC-305	HSMC: Indian Culture and Constitution	8,12				
6	EC-PCC-324	Microwave Engineering Lab	4,5,14	-	-	2	1
7	EC-PCC-325	VLSI Design Lab	4,5,14	-	-	2	1
8	EC-PCC-326	Artificial Intelligence Lab	4,5,14	-	-	2	1
9	HSMC-301	Advanced English Communication Skills Lab	5,10	1	-	2	2
TOTAL				**16**	**-**	**08**	**20**
Mandatory Course (Non-Credit)							
10	MC-321	Employability Skills - II	9,10	3	-	-	-

Note: Summer Internship – II carried out during Summer Vacation between VI semester & VII semester and evaluated in VII semester.

VII – Semester (IV – B.Tech. – I - Semester)							
S. No.	Subject Code	Subject	POs	Hours Per Week			Credits
				L	T	P	
1	EC-PCC-411	Data Communication & Computer Networks	2,12,13	3	-	-	3
2	**Professional Elective – II**			3	-	-	3
	EC-PEC-401	C: Satellite Communications	2,3,6,12,13				
	EC-PEC-405	D: Machine Learning and Data Sciences	2,3,6,12,13				
	EC-PEC-409	P: Embedded Systems	2,3,5,7,12,13				
	EC-PEC-413	S: Cyber-Physical Systems	2,3,5,6,12,13				
3	**Professional Elective – III**			3	-	-	3
	EC-PEC-402	C: Radar Engineering	2,3,7,12,13				
	EC-PEC-406	D: Blockchain Technology	2,3,5,6,12,13				
	EC-PEC-410	P: Low Power VLSI Design	2,3,4,12,13				
	EC-PEC-414	S: Digital Marketing	2,3,5,6,8,12				
4	**Professional Elective – IV**			3	-	-	3
	EC-PEC-403	C: Cellular and Mobile Communications	2,3,6,12,13				
	EC-PEC-407	D: FPGA – CPLD Architectures	2,3,6,12,13				
	EC-PEC-411	P: Cyber Security	2,4,5,6,8,12,13				
	EC-PEC-415	S: Application Specific Integrated Circuits	2,3,4,12,13				
5	**Open Elective – II**			3	-	-	3
	OEC-401	CE: Environmental Impact Assessment	6,7,10,12				
	OEC-403	ME: Non-Conventional Energy Sources	6,7,12				
	OEC-405	ECE: Principles of Communication Systems	1,2,3,12				
	OEC-407	CSE: Database Management Systems	1,2,3,5,12				
	OEC-409	HSMC: Intellectual Property Rights	1,6,8,10,12				
6	HSMC-402	Technical Writing Skills Lab	5,10	-	-	2	1
7	EC-PCC-412	Data Communication & Computer Networks Lab	4,5,14	-	-	2	1
8	EC-PRJ-413	Project – I	1 to 14	-	-	6	3
TOTAL				**15**	**-**	**10**	**20**
Mandatory Course (Non-Credit)							
9	MC-411	Summer Internship - II	1 to 14	-	-	-	-

VIII – Semester (IV – B.Tech. – II - Semester)							
S. No.	Subject Code	Subject	POs	Hours Per Week			Credits
				L	T	P	
1	HSMC-401	Management, Economics and Accountancy	11,12	3	-	-	3
2	**Professional Elective – V**			3	-	-	3
	EC-PEC-404	C: Wireless Communications	2,3,5,8,12,13				
	EC-PEC-408	D: Virtual Reality	1,2,3,4,5,6				
	EC-PEC-412	P: Quantum Computing	1,2,3,5,12,13				
	EC-PEC-416	S: Software Defined Radio	2,3,5,7,12,13				
3	**Open Elective – III**			3	-	-	3
	OEC-402	CE: Green Building Technologies	1,2,7,12				
	OEC-404	ME: Fundamentals of Robotics	1,2,5,12				
	OEC-406	ECE: Fundamentals of Embedded Systems	1,2,3,12				
	OEC-408	CSE: Web Technologies	2,3,5,6,12				
	OEC-410	HSMC: Principles of Entrepreneurship	7,8,9,11,12				
4	EC-PRJ-421	Project - II	1 to 14	-	-	22	11
TOTAL				**9**	**-**	**22**	**20**

I-B.TECH.-I-SEMESTER SYLLABUS

ENGINEERING MATHEMATICS – I
(Linear Algebra and Calculus)

I-B.Tech-I-Sem. **L T P C**
Subject Code BSC-101 **3 1 - 4**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	solve system of linear equations by using matrices	3	2	1
CO2	find Eigen values and Eigen vectors	3	2	1
CO3	analyze the nature of sequences and series	3	2	1
CO4	verify mean value theorems and evaluate improper integrals by using Beta and Gamma functions	3	2	1
CO5	find the extreme values of functions of two variables	3	2	1

Unit-I: Matrices **9 hours**

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 **11 hours**

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: Sequences &Series **(4 + 6) 10 hours**

Part A: Sequence: Definition of a Sequence, limit; Convergent, Divergent and Oscillatory sequences. Series: Convergent, Divergent and Oscillatory Series; Series of positive terms; Comparison test, p-test, D-Alembert's ratio test; Raabe's test.

Part B: Cauchy's Integral test; Cauchy's root test
Alternating series: Leibnitz test; Alternating Convergent series: Absolute and Conditionally Convergence.

Unit-IV: Calculus **9 hours**

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

Unit-V: Multivariable calculus (Partial Differentiation and applications) **9 hours**

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.

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

References:
1. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Pub., Reprint, 2008.
2. Higher Engineering Mathematics, Ramana B.V., TMH, 11th Reprint.

ENGINEERING CHEMISTRY

I-B.Tech.-I-Sem. **L T P C**
Subject Code: BSC-107 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	determine the hardness of water and various treatment methods	3	2	1
CO2	apply the concepts of electrochemistry and corrosion control	3	2	1
CO3	explain the principles of spectroscopy and its applications	3	2	1
CO4	illustrate the various fuels, synthesis of polymers and drugs	3	2	1
CO5	analyze the properties of engineering materials	3	2	1

Unit-I: Water and its treatment **9 hours**

Introduction – hardness of water – causes of hardness – types of hardness: temporary and permanent – expression and units of hardness – Estimation of hardness of water by complexometric method. Numerical problems. Boiler troubles: Sludge's, scales and Caustic embrittlement. Internal treatment of Boiler feed water – Calgon conditioning – Phosphate conditioning – Colloidal conditioning – Softening of water by ion exchange processes. Potable water and its specifications- Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and Ozonization Desalination of water – Reverse osmosis. Deflouridation - Nalgonda technique.

Unit-II: Electrochemistry and Corrosion **10 hours**

Electrochemistry: Introduction, conductance - specific, equivalent and molar conductance, Electrode-Types of electrodes – Construction and functioning of Standard hydrogen electrode, calomel electrode, Determination of p^H of a solution by using glass electrode. Nernst equation – electrochemical series and its applications. Electrochemical cells: Daniel cell – cell notation, cell reaction and cell EMF – Numerical problems Batteries: Primary (Lithium cell) and secondary batteries (Lead – acid storage battery and Lithium ion battery).
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 cathodic methods-protective coatings-metallic coatings-hot dipping and cementation.

Unit-III: Spectroscopic techniques and applications **(5 + 4) 9 hours**

Part A: Principles of spectroscopy and applications of electronic spectroscopy. Vibrational and rotational spectroscopy.

Part B: Basic concepts of nuclear magnetic resonance Spectroscopy- chemical shift. Introduction to Magnetic resonance imaging.

Unit-IV: Reaction Mechanism and synthesis of drug molecules **11 hours**

Substitution reactions: Nucleophilic substitution reactions: Mechanism of SN1, SN2 reactions. Electrophilic and nucleophilic addition reactions: Addition of HBr to propene. Markownikoff and anti Markownikoff's additions. Grignard additions on carbonyl compounds. Elimination reactions: Dehydrohalogenation of alkyl halides. Saytzeff rule. Oxidation reactions: Oxidation of alcohols using $KMnO_4$ and chromic acid. Reduction reactions: reduction of carbonyl compounds using $LiAlH_4$& $NaBH_4$. Hydroboration of olefins. Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.

Unit-V: Engineering Materials **9 hours**

Cement: Portland cement, its composition, setting and hardening of Portland cement. Special cements-white cement, waterproof cement, high alumina cement, acid resistant cement.
Refractories: Classification and characteristics of refractories, properties and applications of Refractories.

Lubricants: Classification of lubricants with examples – characteristics of a 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.

Nanomaterials: Introduction to nanomaterials, preparation of CNT'S by CVD method, properties and applications of CNT'S. General applications of nanomaterials.

Textbooks:

1. Engineering Chemistry by P.C Jain and M.Jain, Dhanpatrai Publishing Company, New Delhi 2010.
2. Engineering Chemistry by Rama Devi, Venkata Ramana Reddy and Rath, Cengage learning, New Delhi. 2016.
3. Fundamentals of Molecular Spectroscopy, by C.N. Banwell.
4. Organic Chemistry: Structure and Function by K.P.C. Volhardt and N.E. Schore, 5th Edition.

References:

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

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

I-B.Tech.-I-Sem. **L T P C**
Subject Code: ESC-101 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12
CO1	solve electrical circuits using circuit laws	3	3	2	1
CO2	explain the concepts of single phase and three phase AC circuits	3	3	2	1
CO3	elaborate the working principles and construction of AC and DC machines	3	3	2	1
CO4	evaluate the functioning of electronic devices and their applications	3	3	2	1
CO5	illustrate the configurations and biasing techniques of BJT	3	3	2	1

Unit-I: Introduction to Electrical Circuits **11 hours**

Electrical circuit elements (R, L and C), Types of sources, Source Transformation, ohm's law Kirchhoff's Laws, Network reduction techniques – series, parallel, series-parallel, star-to-delta, delta-to-star transformation, Mesh and Nodal Analysis, Superposition ,Reciprocity, Thevenin's, Norton's and Maximum power transformer Theorems for dc excitation. Simple problems

Unit-II: Single phase & 3-phase AC circuits: **8 hours**

1-phase AC circuits: Introduction, Sinusoidal alternating quantities, RMS values, Average values, form factor and peak factor, AC through RL, RC & RLC circuits.
3-phase AC circuits: Introduction, line voltage, line current relations power equation in star and delta connections of power equation in star & delta connections of 3-phase systems, Advantages of 3-phase systems.

Unit-III: Electrical Machines & P-N Junction Diode **(5 + 5) 10 hours**

Part-A: Electrical Machines: Construction, Working principle and applications of electric dc generator & DC motor, single phase transformer & 3-ph induction motor.

Part-B: P-N Junction Diode: PN Junction diode- V-I Characteristics, Ideal versus Practical, Temperature dependence, Diode as a Switch.

Unit-IV: Rectifiers & Special Purpose Devices **9 hours**

Rectifiers: Diode as a Rectifier - Half Wave Rectifier, Full Wave rectifier with centre tapped transformer, Bridge Rectifier.
Special Purpose Devices: Breakdown Mechanisms in Semi-Conductor Diodes, Zener diode characteristics, Use of Zener diode as simple regulator, Principle of operation and Characteristics of SCR.

Unit-V: Bipolar Junction Transistor (BJT) **10 hours**

Construction, Principle of Operation, Symbol, Amplifying Action, CB, CE, CC configurations. DC & AC load line, stability factor, Need for biasing & biasing techniques.

Textbooks:

1. Circuit Theory (Analysis and synthesis) - A. Chakrabarti, Dhanpat Rai & co (Pvt) Ltd 7th Ed, 2015
2. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006.
3. Electrical Technology- vol-II B L Theraja, S.Chand publications

References:

1. Introduction to Electronic Devices and Circuits-Rober T. Paynter, Pearson Education.
2. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
3. Electronic Devices and Circuits – 2nd Edition by Muhammad H.Rashid, Cengage Learning.

PROGRAMMING FOR PROBLEM SOLVING

I-B.Tech.- I- Sem. **L T P C**
Subject Code: ESC-103 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12
CO1	write simple programs using C language	3	3	2	2
CO2	design structured programs using functions	3	3	2	2
CO3	develop programs using arrays, strings and pointers	3	3	2	2
CO4	construct programs for heterogeneous data	3	3	2	2
CO5	implement various file operations in C programming	3	3	2	2

Unit-I: Introduction to Programming **11 hours**

Introduction to components of a computer system: primary and secondary memory, processor, Input/output devices, operating system, compilers, creating, compiling and executing a program. Introduction to Algorithms: Representation of Algorithm/Pseudo code, Flowchart, Structure chart with examples, Program development steps.

Introduction to C Programming Language: identifiers, data types, variables , constants, Operators, Expression evaluation, precedence, Preprocessor commands, Conditional Branching and Loops: Writing and evaluation of conditions and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do-while loops.

Unit-II: Arrays and Functions **8 hours**

Arrays: Concepts, using arrays in C, One dimensional, two dimensional arrays, multidimensional arrays, array applications- linear search, binary search and bubble sort, C program examples.

Functions: Designing Structured Programs, Functions, user defined functions, Standard functions, Parameter passing in functions, Storage classes-auto, register, static, extern, recursion- recursive functions, differences between recursion and iteration, Simple programs, such as Finding Factorial, GCD, Fibonacci series etc., Limitations of recursion, example C programs.

Unit-III: Pointers and Strings **(5 + 5) 10 hours**

Part A: Pointers: Defining pointers, pointers to pointers, Pointer Arithmetic, accessing arrays using pointers, void pointer, Null pointer, Dangling Pointer, dynamic memory allocation functions.

Part B: Strings: Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strcmp, strstr, etc.), arrays of strings.

Unit-IV: Structures and Unions **10 hours**

Structures - Defining structures, initializing structures, accessing structures, operations on structures, Nested structures, structures containing arrays, arrays of structures, structures and functions, self-referential structures, enum, typedef, bit fields; **Unions -** Defining unions, initializing unions, accessing unions, differences between Structures and unions, C programming examples.

Unit-V: File handling in C **9 hours**

Files - Concept of a file ,Text and Binary files, Differences between text and binary files, File opening modes , Opening and Closing files, file input / output functions, file status functions (error handling), Random access using fseek, ftell and rewind functions, C programming examples.

Textbooks:

1. Computer Science: A Structured Programming Approach Using C, B. A. Forouzan and R. F. Gilberg, 3rd Edition, Cengage Learning.
2. Programming in ANSI C, E. Balaguruswamy, TMH.

References:

1. The C Programming Language, B.W. Kernighan and Dennis M. Ritchie, 2nd Edition, Pearson.
2. C: The Complete Reference, Herbert Schildt, TMH, 4th Edition.

ENGINEERING CHEMISTRY LAB

I-B.Tech.-I-Sem. **L T P C**
Subject Code: BSC-108 **- - 3 1.5**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4
CO1	determine the hardness in water samples to solve societal problems	3
CO2	estimate the strength of the given solutions	3
CO3	analyze adsorption and viscosity of various fluids	3
CO4	synthesize the various organic compounds used in medical industry	3
CO5	verify and understand the distribution coefficient	3

LIST OF EXPERIMENTS: (PERFORM ANY 10 EXPERIMENTS)

Volumetric Analysis:

1. Determination of total hardness of water by complexo metric method using EDTA.
2. Estimation of ferrous ion by dichrometry.

Instrumentation:

3. Estimation of HCl by Conductometric titrations.
4. Estimation of Acetic acid by Conductometric titrations.
5. Estimation of HCl by Potentiometric titrations.
6. Estimation of Fe^{2+} by Potentiometer using $KMnO_4$.
7. Estimation of copper by colorimetric method

Preparations:

8. Synthesis of Aspirin and paracetamol.

Physical properties:

9. Determination of viscosity of a liquid by using Ostwald's viscometer.
10. Determination of surface tension of a given liquid using stalagmometer.
11. Verification of Freundlich adsorption isotherm-adsorption of acetic acid on charcoal.
12. Determination of partition coefficient of acetic acid between n-butanol and water.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Assessment of ground water quality of specified area.
2. Determination of Viscosity of castor oil and groundnut oil.
3. Preparation of petroleum jelly.
4. Preparation of soaps and liquid hand wash.
5. Recycling of waste water.
6. Drinking water purification.
7. Estimation of manganese in pyrolusite.
8. Determination of ferrous ion in cement.
9. Determination of P^H values of various soft drinks.
10. Studies on the effect of metal coupling on corrosion.

References:

1. Engineering Chemistry Lab manual - Department of FED - CMRIT, Hyd.

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB

I-B.Tech.-I-Sem. **L T P C**
Subject Code: ESC-102 **- - 3 1.5**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4
CO1	design electrical circuits to verify circuit laws and network theorems	3
CO2	find the efficiency of AC and DC machines	3
CO3	verify the V-I characteristics of various electronic devices	3
CO4	determine the efficiency of various rectifiers	3
CO5	illustrate the configurations of Bi-polar junction transistor	3

LIST OF EXPERIMENTS

Note: Minimum of 6 experiments to be conducted from each part.

Part-A: Electrical lab

1. Verification of KVL & KCL.
2. Verification of Superposition theorem & reciprocity theorem.
3. Verification of maximum power transfer theorem. Verification on DC.
4. Experimental determination of Thevenin's Theorem equivalent circuits.
5. Experimental determination of Norton's Theorem equivalent circuits
6. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
7. Brake Test on DC Shunt Motor. (To draw the performance curves).
8. Performance characteristics of a 3-phase induction motor.

Part-B: Electronics Lab

9. Forward and reverse bias characteristics of PN-Junction Diode.
10. Zener diode V-I characteristics and Zener diode as voltage regulator.
11. Efficiency of Half wave rectifier.
12. Efficiency of Full wave rectifier.
13. Input & output characteristics of Transistor in CB configuration.
14. Input & output characteristics of Transistor in CE configuration.
15. SCR Characteristics.
16. Design and verification of self-bias circuit.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Design a regulated power supply.
2. Design a voltmeter.
3. Design a voltage doubler circuit.
4. Design a line follower using DC motor.
5. Design an automatic fan controller.
6. Design a burglar alarm.
7. Design an automatic irrigation system using soil moisture sensor.
8. Design a Water level indicator using transistor.
9. Design a brake failure indicator.
10. Design an IR transmitter and receiver.

Reference:

1. Basic Electrical & Electronics Engineering Lab manual, FED, CMRIT, Hyd.

PROGRAMMING FOR PROBLEM SOLVING LAB

I-B.Tech-I-Sem. **L T P C**
Subject Code: ESC-104 **- - 3 1.5**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4
CO1	execute simple programs using C compiler	3
CO2	apply control statements in designing programs	3
CO3	design programs using functions, arrays, strings and pointers	3
CO4	construct programs for heterogeneous data	3
CO5	implement various file operations in C programming	3

LIST OF EXPERIMENTS

Week 1: Familiarization with programming environment

1. Write a program to print sample strings like “hello world”, “Welcome to C Programming” with different formats using escape sequences.
2. Write a Program to print different data types in C and their ranges.
3. Write a Program to initialize, assign & print variables of different data types.

Week 2: Operators

1. Write a Program to demonstrate arithmetic operators. (+,-,*,/,%)
2. Write a Program to demonstrate relational operators.(<,>,<=,>=,==,!=)
3. Write a program to check equivalence of two numbers using conditional operator.
4. Write a Program to demonstrate pre increment and post increment. (++a, a++ where a is a value to be initialized)

Week 3: Simple C programs

1. Write a Program to read radius value from the keyboard and calculate the area of circle
2. Write a Program to calculate simple interest.
3. Write a Program to convert temperature. (Fahrenheit –Centigrade and vice-versa)
4. Write a program for computing the volume of sphere, cone and cylinder assume that dimensions are integers use type casting where ever necessary.

Week 4: Decision Statements

1. Write 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.
2. Write a Program to calculate roots of quadratic equation (using if-else).
3. Write a Program to perform arithmetic operations using switch case.
4. Write a Program to display colors using switch case (VIBGYOR).

Week 5: Loops

1. Write a program to calculate sum of individual digits of a given number.
2. Write a program to print prime numbers in the given range.
3. Write a program to read 2 numbers x and n then compute the sum of the Geometric Progression. $1+x+ x^2+x^3+ - - - - - - - +x^n$
4. 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    * *
                                          *
```

Week 6: 1-D arrays

1. Write a program to store 10 elements in the 1-D array and print sum of the array.
2. Write a program to print minimum and maximum elements in the 1-D array.
3. Write a program to search the given element by using linear search and binary search.
4. Write a program to sort the given elements using bubble sort technique.

Week 7: 2-D arrays

1. Write a program to perform matrix addition.
2. Write a program to perform matrix multiplication.
3. Write a program to print the transpose of a matrix.

Week 8: Functions

1. Write a program to find product of two numbers using functions without arguments, without return type.
2. Write a program to find difference of two numbers using functions without arguments, with return type.
3. Write a program to find sum of two numbers using functions with arguments &without return type.
4. Write a program to find product of two numbers using functions with arguments, with return type.

Week 9: Functions and Recursion

1. Write a program to swap two numbers using
   a) Call by Value
   b) Call by Reference. (Using pointers)
2. Write a program to calculate factorial, GCD and Fibonacci series of n terms using recursion and non-recursion functions.
3. Write C program that reads two integers x and n and calls a recursive function to compute x^n
4. Write a C program that reads two integers and calls a recursive function to compute ${}^nC_r$

Week 10: Strings

1. Write a program to demonstrate various string manipulations using built-in functions.
2. Write a program to print the given strings in ascending order.
3. Write a program to verify the given string is palindrome or not (without using built-in functions and with using built-in functions).
4. Write a program to concatenate two strings using arrays without using strcat.

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Week 11: Structures

1. Write a program to find total marks of individual student and average marks for 10 students using structures.
2. Write a program to illustrate passing an entire structure to a function.
3. Write a C Program to perform addition and multiplication of two complex numbers using structures.

Week 12: File operations

1. Write a C program to display the contents of a file to standard output device.
2. Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.
3. 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).
4. Write a C program to count the number of times a character occurs in a text file.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Pay roll management system.
2. Fee collection system.
3. Employee's Management System.
4. Library management.
5. Department store system.
6. Personal Dairy Management System.
7. Telecom Billing Management System.
8. Bank Management System.
9. Contacts Management.
10. Medical Store Management System.

Reference:

1. Programming for Problem Solving Lab Manual, FED, CMRIT, Hyd.

IT & ENGINEERING WORKSHOP

I-B.Tech.-I-Sem. **L T P C**
Subject Code: ESC-110 **- - 3 1.5**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO5	PO9	PO10
CO1	install and make use of operating systems and MS office tools	3	3	2	2
CO2	configure fire walls and trouble shoot network connections	3	3	2	2
CO3	apply safety norms while handling the workshop equipment	3	1	3	2
CO4	prepare required models using various engineering trades	3	1	3	2
CO5	make use of various power tools	3	1	3	2

LIST OF EXPERIMENTS

PART-A: IT Workshop

Week-1: WINDOWS OPERATING SYSTEM & DRIVERS INSTALLATION

Windows 7, Windows 8 and Windows 10. LAN, graphics, audio, video and command prompt, commands.

Week-2: NETWORK CONNECTIONS & TROUBLESHOOTING

IP configurations, connecting devices in LAN through bridge, hub, switch; Wi-Fi, Li-Fi and Bluetooth settings; Crimping: Crossover, strait over. Hardware and software troubleshooting.

Week-3: Cyber Hygiene

Introduction to Virus, worms, threats. Threats on internet, Configure the Systems to be internet safe, Install antivirus, personal firewall, block pop-ups, block active x downloads

Week-4: MS Word

Prepare the project document and resume.

Week-5: MS Excel

Spreadsheet basics, modifying worksheets, formatting cells, formulas and functions, sorting and filtering, charts.

Week-6: MS Power Point

Power point screen, working with slides, add content, work with text, working with tables, graphics, slide animation, reordering slides, adding sound to a presentation.

PART-B: Engineering Workshop

Week-7: House Wiring

Power point, light fitting and switches.

Week-8 & 9: Carpentry

Study of tools and joints; Practice in planning, chiseling, marking and sawing; Joints: Cross joint, T joint, Dove tail joint.

Week-10 &11: Fitting

Study of tools, practice in filing, cutting, drilling and tapping; Male and female joints, stepped joints.

Week-12 & 13: Tin Smithy & Black Smithy

Tin smithy:-Preparation of Open scoop, Cylinder, square/rectangular tray, **Black Smithy**:-S-Hook, Square /Hexagonal headed bolt.

Week 14: Demonstration of Power Tools

Bench drilling machine, hand drilling machine, power hacksaw, grinding machine and wood cutting machine.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Design monthly budget planner using Ms Excel.
2. Design a Photo album using Ms Power Point.
3. Design of various certificates / brochure using Ms Word.
4. Design a video presentation using open source tools.
5. Preparation of truncated prism.
6. Make Round tee pipe.
7. Design electrical wiring plan for a house.
8. Prepare decorative series lights / dim & bright lighting.
9. Preparation of door stoppers / hinges.
10. Preparation of tool handles.

Reference:

1. IT & Engineering Workshop Lab Manual, FED, CMRIT, Hyd.

TECHNOLOGY EXPLORATION FOR SOCIAL INNOVATION LAB - I
MANDATORY COURSE (NON-CREDIT)

I-B.Tech.-I-Sem. **L T P C**
Subject Code: MC-101 **- 3 - -**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1 to PO14
CO1	identify the problems	3
CO2	illustrate social innovation	3
CO3	choose suitable processes	3
CO4	design suitable prototype	3
CO5	develop feasibility report	3

Week 1 & 2: Introduction to Engineering: what is engineering, difference between science, engineering and technology. Requirement of a scientist and engineer. Misconceptions about engineering, Expectation for the 21st century engineer.

Week 3 & 4: Introduction to Social Innovation: Core definitions, Core elements and common features of social innovation, a topology of social innovations, Fields for social innovation, History of social innovation

Week 5: social and economic change: The shape of the economy to come, Understanding social change-individuals, Movements and organizations.

Week 6: Process of Social Innovation: Prompts – identifying needs, Proposals – generating ideas, Prototyping – testing the idea in practice, Sustaining-developing a business model, Scaling and diffusion-growing social innovations

Week 7: Systematic change: Different sectors for social innovation and stages of social innovation.

Week 8: Engineering Design: Engineering Design Process, Multidisciplinary facet of design.

Week 9 & 10: Charts: Pair wise comparison chart, Introduction to Mechatronics system, generation of multiple solutions, Pugh Chart.

Week 11: PCB Design: Motor and battery sizing concepts, introduction to PCB design .

Week 12: Social Innovation: Designing the social innovations and Examples.

Week 13 &14: Case Studies: Report writing and documentation, Presentation of the case studies with a focus on impact and vision on society.

Reference:

1. A Hand Book on Technology Exploration for Social Innovation - I, FED, CMRIT, Hyd.

I-B.TECH.-II-SEMESTER SYLLABUS

ENGINEERING MATHEMATICS – II
(Advanced Calculus)

I-B.Tech.-II-Sem. **L T P C**
Subject Code: BSC-102 **3 1 - 4**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	solve linear and non-linear ordinary differential equations	3	2	1
CO2	solve linear and non-linear partial differential equations	3	2	1
CO3	evaluate the line, surface and volume integrals and convert them from one to another by using multiple integrals	3	2	1
CO4	determine vector field, scalar field, gradient, divergence and curl by using vector differentiation	3	2	1
CO5	solve the line, surface and volume integrals by using vector integration	3	2	1

Unit-I: Differential Equations **11 hours**

Exact & Reducible to exact, Linear and Bernoulie's Differential Equations. Applications; Newton's law of cooling, law of natural growth and decay. Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type e^{ax}, Sin ax, cos ax, polynomials in x, $e^{ax}V(x)$, xV(x),method of Variation of parameters.

Unit-II: Partial Differential Equations **8 hours**

Formation of partial differential equations-by elimination of arbitrary constants and arbitrary functions–solutions of first order linear (Lagrange) equations and nonlinear equations (Four standard types) – Method of Separation of Variables.

Unit-III: Multiple Integration **(5 + 5) 10 hours**

Part A: Double integrals (Cartesian &polar), change of order of integration in double integrals, Change of variables (Cartesian to polar).

Part B: Applications: areas and volumes (Cartesian), Triple integrals (Cartesian).

Unit-IV: Vector Differentiation **9 hours**

Vector Differentiation: Vector point functions and scalar point functions. Gradient, Divergence and Curl. Directional derivatives, Scalar potential functions. Solenoidal and Irrational vectors, Vector Identities.

Unit-V: Vector Integration **10 hours**

Vector Integration: Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stokes (without proofs) and related Problems.

Textbooks:

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 Edn., Pearson, Reprint, 2002.

References:

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

APPLIED PHYSICS

I-B.Tech.-II- Sem. **L T P C**
Subject Code: BSC-103 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	explain the principles of Quantum Mechanics	3	2	1
CO2	analyze various electron theories of conduction in solids	3	2	1
CO3	classify semiconductors and relate functioning of semiconductor devices	3	2	1
CO4	illustrate principles and applications of lasers and optical fibers	3	2	1
CO5	outline dielectric and magnetic properties of materials	3	2	1

Unit-I: Principles of Quantum Mechanics **9 hours**

Waves and Particles, de Broglie Hypothesis, Matter Waves, Davisson and Germer's Experiment, Heisenberg's Uncertainty Principle, Physical Significance of the Wave Function , Schrödinger's Time Independent Wave Equation –Particle in 1- Dimensional potential box extended to 3-dimension.

Unit-II: Introduction to solids **9 hours**

Quantum free electron theory, Estimation of Fermi energy, Dependence of Fermi level on temperature, Density of states.
Bloch's theorem, Kronig – Penny model, E – K diagram, origin of energy bands, Classification of materials on the basis of energy bands, Effective mass of electron.

Unit-III: Semiconductor Physics and Devices **(6 + 5) 11 hours**

Part-A: Introduction, Calculation of carrier concentration in Intrinsic &, Extrinsic Semiconductors, Direct and Indirect band gaps, Fermi Level in Intrinsic and Extrinsic Semiconductors, Hall Effect.

Part-B: Formation of PN Junction, Open Circuit PN Junction, Energy Level Diagram of PN Diode, I-V Characteristics of PN Junction diode. Solar cell, LED.

Unit-IV: Lasers & Fiber Optics **9 hours**

Characteristics of Lasers, Absorption, Spontaneous and Stimulated Emission of Radiation, Einstein's Coefficients and Relation between them, Population Inversion, Lasing Action, Ruby Laser, Helium-Neon Laser, Semiconductor Diode Laser, Applications of Lasers.
Principle of Optical Fiber, Construction of Fiber, Acceptance Angle And Acceptance Cone, Numerical Aperture, Types of Optical Fibers: Step Index And Graded Index Fibers, Application of Optical Fiber in Communication Systems.

Unit-V: Dielectric & Magnetic Properties **10 hours**

Introduction Dielectric properties, Electronic, Ionic and Orientation Polarizations and Calculation of Polarizabilities: Ionic and Electronic – Internal Fields in Solids, Clausius – Mossotti Equation, Ferro-electricity and Piezo-electricity; Applications.
Introduction magnetic properties, Origin of Magnetic Moment, Bohr Magneton, Classification of Dia, Para and Ferro Magnetic Materials on the basis of Magnetic Moment, Domain Theory of Ferro Magnetism on the basis of Hysteresis Curve, Soft and Hard Magnetic Materials, Applications.

Textbooks:

1. Principles of physics by Halliday, Resnick, Walker, Wiley India Pvt. Ltd, 9th Edition.
2. Introduction to solid state physics by Charles Kittel, Wiley India Pvt. Ltd, 7thEdition.

References:

1. Applied Physics by P.K.Mittal, I K International Publishers.
2. Engineering Physics by P.K.Palanisamy, Scitech Publishers.

ENGLISH

I-B.Tech.-II-Sem. **L T P C**
Subject Code: HSMC-101 **2 - - 2**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO10	PO12
CO1	acquire proficiency in RAWLS skills	3	1
CO2	demonstrate the acquired language in written and spoken contexts	3	1
CO3	express, restate and respond appropriately by comprehending the given data	3	1
CO4	develop proficiency to succeed in academic activities, research and career	3	1
CO5	excel in professional and social etiquette	3	1

SYLLABUS

Reading Skills:

Objectives:

To develop an awareness in students about the significance of silent reading and comprehension.
To develop students' ability to guess meanings of words from the context and grasp the overall message of the text, draw inferences, etc., by way of:

- Skimming and Scanning the text
- Intensive and Extensive Reading
- Reading for Pleasure
- Identifying the topic sentence
- Inferring lexical and contextual meaning
- Recognizing Coherence/Sequencing of Sentences

NOTE: The students will be trained in reading skills using the prescribed texts for detailed study. They will be tested in reading comprehension of different 'unseen' passages which may be taken from authentic texts, such as magazines/newspaper articles.

Writing Skills:

Objectives:

1. To develop an awareness in the students about writing as an exact and formal skill
2. To create an awareness in students about the components of different forms of writing, beginning with the lower order ones through;
   - Writing of sentences
   - Use of appropriate vocabulary
   - Paragraph writing
   - Coherence and cohesiveness
   - Narration / description
   - Note Making
   - Formal and informal letter writing
   - Describing graphs using expressions of comparison

Unit –I **7 hours**

('The Raman Effect' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.)

Vocabulary Building: The Concept of Word Formation --The Use of Prefixes and Suffixes.
Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.
Reading: Reading and Its Importance- Techniques for Effective Reading.
Basic Writing Skills: 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 **6 hours**

('Ancient Architecture in India' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.)

Vocabulary: Synonyms and Antonyms.
Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.
Reading: Improving Comprehension Skills – Techniques for Good Comprehension
Writing: Format of a Formal Letter-**Writing Formal Letters** E.g.., Letter of Complaint, Letter of Requisition, Job Application with Resume.

Unit –III **(3 + 3) 6 hours**

('Blue Jeans' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.)

Part A: Vocabulary: Acquaintance with Prefixes and Suffixes from Foreign Languages in English to form Derivatives-Words from Foreign Languages and their Use in English.
Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.

Part B: Reading: Sub-skills of Reading- Skimming and Scanning
Writing: Nature and Style of Sensible Writing- **Defining- Describing** Objects, Places and Events – **Classifying**- Providing Examples or Evidence

Unit-IV **7 hours**

('What Should You Be Eating' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.)

Vocabulary: Standard Abbreviations in English
Grammar: Redundancies and Clichés in Oral and Written Communication.
Reading: Comprehension- Intensive Reading and Extensive Reading
Writing: Writing Practices--Writing Introduction and Conclusion - Essay Writing-Précis Writing.

Unit-V **6 hours**

('How a Chinese Billionaire Built Her Fortune' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.)

Vocabulary: Technical Vocabulary and their usage
Grammar : Common Errors in English
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.

Textbook:

1. Sudarshana, N.P. and Savitha, C. (2018). English for Engineers. Cambridge University Press.

References:

1. Swan, M. (2016). Practical English Usage. Oxford University Press.
2. Kumar, S and Lata, P.(2018). Communication Skills. Oxford University Press.
3. Wood, F.T. (2007).Remedial English Grammar. Macmillan.
4. Zinsser, William. (2001). On Writing Well. Harper Resource Book.
5. Hamp-Lyons, L. (2006).Study Writing. Cambridge University Press.
6. Exercises in Spoken English. Parts I –III. CIEFL, Hyderabad. Oxford University Press.

DATA STRUCTURES

I-B.Tech.-II–Sem. **L T P C**
Subject Code: ESC-105 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12
CO1	classify different data structures to design efficient programs	3	3	2	2
CO2	identify appropriate sorting and searching techniques	3	2	2	2
CO3	illustrate operations and applications of linear data structures	3	3	2	2
CO4	explain various concepts of non-linear data structures	3	3	2	2
CO5	choose an appropriate hashing technique for a given problem	3	3	2	2

Unit – I: Introduction to Data Structures, Searching and Sorting **11 hours**

Basic concepts - Introduction to data structures, classification of data structures, operations on data structures, abstract data type, algorithms, different approaches to design an algorithm, recursive algorithms.
Searching and Sorting techniques - Linear search and binary search, Bubble sort, selection sort, insertion sort, quick sort, merge sort, and comparison of sorting algorithms.

Unit – II: Linear Data Structures **8 hours**

Stack - Primitive operations, implementation of stacks using Arrays, applications of stacks: arithmetic expression conversion and evaluation.
Queue - Primitive operations; Implementation of queues using Array, Types of Queue: Simple queue, circular queue and priority queue, applications of linear queue.

Unit – III: Linked Lists **(5 + 5) 10 hours**

Part A: Linked lists -Introduction, singly linked list, representation of a linked list in memory, operations on a single linked list: Traversing, searching, insertion, deletion. Applications of linked lists: Polynomial representation and sparse matrix manipulation.

Part B: Types of linked lists - Doubly linked lists, Circular linked lists, linked list representation and operations of Stack, linked list representation and operations of queue.

Unit – IV: Non Linear Data Structures **10 hours**

Trees - Basic Tree Terminologies, binary tree, binary tree representation, array and linked representations, binary tree traversal, application of trees;
Types of Trees – Binary Search Tree: properties and operations, Balanced search trees: AVL tree; M-Way search trees: B tree.

Unit – V: Graphs and Hashing **9 hours**

Graphs- Basic terminologies and representations, graph implementation, graph search and traversal algorithms, Application of graphs.
Hashing and Collision- Introduction, hash tables, hash functions, collisions, applications of hashing.

Textbooks:

1. Mark A. Weiss, “Data Structures and Algorithm Analysis in C”, Pearson, 2nd Edition, 1996.
2. Ellis Horowitz, SatrajSahni, Susan Anderson Freed, “Fundamentals of Data Structures in C”, Universities Press, 2nd Edition 2008.

References:

1. ReemaThareja, “Data Structures using C”, Oxford University Press, 2nd Edition, 2014.
2. S. Lipschutz, “Data Structures”, Tata McGraw Hill Education, 1st Edition, 2008.
3. Tanenbaum, Langsam, Augenstein, “Data Structures Using C”, Pearson, 1st Edition, 2003.

ENGINEERING GRAPHICS

I-B.Tech.-II-Sem. **L T P C**
Subject Code: ESC-109 **1 - 4 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO5	PO10
CO1	apply engineering drawing concepts in technical graphic communication	3	3	2
CO2	construct conic sections using various methods	3	3	2
CO3	draw orthographic projections of points, lines, planes and solids	3	3	2
CO4	draw development of solid surfaces	3	3	2
CO5	draw the conversions of orthographic to isometric projections & vice versa	3	3	2

List of Experiments:

Week 1: Introduction to engineering drawing and AutoCAD software, Lettering, dimensioning practice and Geometrical Constructions.

Week 2: Conic sections: General method, Construction of Ellipse, Parabola.

Week 3: Construction of Hyperbola, Epicycloid.

Week 4: Construction of hypocycloid, involutes.

Week 5: Orthographic Projections: Principles of Orthographic projections, Projections of Points.

Week 6: Projections of lines simple position, inclined to one plane.

Week 7: Projections of Lines inclined to both the planes.

Week 8: Projections of planes inclined to one plane and both the planes.

Week 9: Projections of Solids simple position.

Week 10: Projections of Solids inclined to one plane.

Week 11: Projections of Solids inclined to both the planes.

Week 12: Development of surfaces: Development of Prisms and Cylinders, Pyramids and Cones.

Week 13: Isometric projections: isometric views of lines, planes and solid figures; Conversion of Isometric to Orthographic views (3D to 2D).

Week 14: Conversion of Orthographic to Isometric views (2D to 3D).

Textbooks:

1. Engineering Drawing N.D. Bhatt, Charotar.
2. A Text Book of Engineering Drawing, Basant Agarwal.

References:

1. A Text Book of Engineering Drawing, Dhawan R K, S. Chand.
2. Engineering Graphics with Auto CAD, James D Bethune, Pearson Education.

APPLIED PHYSICS LAB

I-B.Tech.-II–Sem. **L T P C**
Subject Code: BSC-104 **- - 3 1.5**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4
CO1	demonstrate the electrical properties of a semiconductor	3
CO2	compare practical results with theoretical calculations in electrical circuits	3
CO3	demonstrate the properties of lasers and optical fibers	3
CO4	find the energy gap of a semiconductor and identify its band structure	3
CO5	examine electrical resonance in LCR circuits	3

List of Experiments: (Any 08 experiments compulsory)

1. Determination of Energy Gap of a Semiconductor.
2. Time constant of an R-C Circuit.
3. Stewart and Gee's method - Magnetic field along the axis of current carrying coil-
4. Bending Losses of Fibers & Evaluation of numerical aperture of given fiber.
5. Determination of Resonance frequency of an LCR circuit.
6. Verify the characteristics of a Solar Cell.
7. Diffraction Grating-Determination of wavelengths of a LASER source.
8. Verify the characteristics of a Light Emitting Diode.
9. Verify the characteristics of a Laser Diode.
10. Calculation of Hall Voltage across the sample material.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Determine the Horizontal component of earth's magnetic field using Tangent law.
2. Determine refractive index of a liquid using Newton's rings.
3. Design a tank circuit for a given resonance frequency and verify resonance principle.
4. Determine the width of slit using single slit diffraction pattern.
5. Determine dispersive power of liquids by using spectrometer and hallow prism.
6. Convert mechanical energy to light energy using principle of energy conservation.
7. Design mobile phone detector.
8. Design a counter using Photo cell characteristics.
9. Determine Fermi energy of a given semiconductor material.
10. Design a circuit to detect breakage in a conducting wire.

Reference:

1. Applied Physics Lab Manual, FED, CMRIT, Hyd.

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

I- B.Tech-II-Sem. **L T P C**
Subject Code: HSMC-102 **- - 2 1**

The **Language Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO5	PO10
CO1	identify the nuances of the language through multimedia experience	3	3
CO2	express clearly with right accent, intonation to overcome MTI	3	3
CO3	demonstrate formal and informal English in real life scenarios	3	3
CO4	develop speaking and listening skills	3	3
CO5	appraise communication and correspond effectively	3	3

COMPUTER ASSISTED LANGUAGE LEARNING (CALL) LAB

Exercise – I (Week 1 & 2): Introduction to Phonetics -Speech Sounds -Vowels and Consonants

Exercise – II (Week 5): Pronunciation I: Syllable Division, Accent & Stress

Exercise – III (Week 8): Pronunciation II: Intonation and Rhythm

Exercise – IV (Week 11): Errors in pronunciation – the Influence of Mother Tongue (MTI)

Exercise – V (Week 14): Listening Comprehension (Specific & General)

INTERACTIVE COMMUNICATION SKILLS (ICS) LAB

Exercise – I (Week 3 & 4): JAMs

Exercise – II (Week 6 & 7): Role Play: Situational Dialogues

Exercise – III (Week 9 & 10): Descriptions & Formal Presentations

Exercise – IV (Week 12 & 13): Communication at Workplace and Interviews Skills

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Common Errors in English
2. Listening Skills
3. Phonetics
4. Writing Skills
5. Reading Skills
6. Letter Writing
7. Report Writing
8. Vocabulary
9. Body Language
10. Functional English

Reference:

1. English Language and Communication Skills Lab Manual, FED, CMRIT, Hyd.

DATA STRUCTURES LAB

I-B.Tech.-II-Sem. **L T P C**
Subject Code: ESC-106 **- - 3 1.5**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4
CO1	implement various searching and sorting techniques	3
CO2	demonstrate basic operations of stack and queues using arrays and linked lists	3
CO3	apply stack data structure to solve various computing problems	3
CO4	demonstrate and apply different methods for traversing graphs	3
CO5	construct binary search tree	3

Week-1: Searching Techniques

Write C programs for implementing the following searching techniques.

a. Linear search. b. Binary search.

Week-2: **Sorting Techniques**

Write C programs for implementing the following sorting techniques to arrange a list of integers in ascending order.

a. Bubble sort. b. Insertion sort. c. Selection sort.

Week-3: **Sorting Techniques**

Write C programs for implementing the following sorting techniques to arrange a list of integers in ascending order.

a. Quick sort. b. Merge sort

Week-4: Implementation of Stack and Queue

a. Write C programs to design and implement Stack and its operations using Arrays.
b. Write C programs to design and implement Queue and its operations using Arrays.

Week-5: **Applications of Stack**

a. Write C program by using Stack operations to convert infix expression into postfix expression.
b. Write C program by using Stack operations for evaluating the postfix expression.

Week-6: **Implementation of Single Linked List**

Write a C program that uses functions to perform the following operations on single linked list.

(i) Creation (ii) insertion (iii) deletion (iv) traversal

Week-7: Implementation of Circular Single Linked List

Write a C program that uses functions to perform the following operations on Circular linked list.

(i) Creation (ii) insertion (iii) deletion (iv) traversal

Week-8: Implementation of Double Linked List

Write a C program that uses functions to perform the following operations on double linked list.

(i) Creation (ii) insertion (iii) deletion (iv) traversal in both ways.

Week-9: Implementation of Stack Using Linked List

Write a C program to implement stack using linked list.

Week-10: Implementation of Queue Using Linked List

Write a C program to implement queue using linked list.

Week-11: Graph Traversal Techniques

Write C programs to implement the following graph traversal algorithms:

a. Depth first search.
b. Breadth first search.

Week-12: Implementation of Binary Search Tree

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

a. Create a binary search tree.
b. Traverse the above binary search tree recursively in pre-order, post-order and in-order.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Write a program to create a one dimensional array at run time using a user defined function with user given number of elements into it. Also write separate functions that would allow you to insert and delete elements into/from this array at any arbitrary location.
2. WAP to add and subtract following polynomials $5x^2 – 3xy + y – 2x^2 – y^2+5xy – x + y$ using array.
3. Write a program to create one dimensional - two dimensional and three dimensional arrays in memory and then verify the various address calculation formulae for any arbitrary element of these arrays.
4. Write a program to implement a sparse matrix for the given matrix A.
5. Write a program to implement a queue using stack operations.
6. WAP to convert the following expression to its postfix equivalent using stack
   I. ((A+B)* D) ^ (E – F)
   II. A+ (B * C – (D / E ^ F) * G) * H Where ^: raise to the power
7. Implement a program to evaluate any given postfix expression. Test your program for the evaluation of the equivalent postfix form of the expression (- (A*B)/D) ↑ C+E – F * H * I for A = 1 - B = 2 - D = 3 - C = 14 - E = 110 - F = 220 - H = 16.78 - I = 364.621.
8. WAP to declare a priority queue using two-dimensional array - store elements and priority. Display the elements according to priority from higher to lower.
9. Let $X = (x_1 - x_2 - \dots x_n)$ -$Y = (y_1 - y_2 - \dots y_n)$ be two lists with a sorted sequence of elements. Write a program to merge the two lists together as a single list Z with m + n elements. Implement the lists using array and singly linked list.
10. Write a menu driven program which will maintain a list of mobile phone models - their price - name of the manufacturer – storage capacity etc. - as a doubly linked list. The menu should make provisions for inserting information pertaining to new mobile phone models - delete obsolete models - and update data such as price besides answering queries such as listing all mobile phone models within a price range specified by the user and listing all details given a mobile phone model.

Reference:

1. Data Structures Lab Manual, FED, CMRIT, Hyd.

TECHNOLOGY EXPLORATION FOR SOCIAL INNOVATION LAB - II
MANDATORY COURSE (NON-CREDIT)

I-B.Tech.-II-Sem. **L T P C**
Subject Code: MC-102 **- - 2 -**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1 to PO14
CO1	deploy suitable mechanisms	3
CO2	develop platform based innovations	3
CO3	demonstrate data acquisition and analytical skills	3
CO4	execute projects using suitable management techniques	3
CO5	adapt ethics and code of conduct	3

Week 1: Mechanisms: Basic Components of a Mechanism, Degrees of Freedom or Mobility of a Mechanism.

Week 2 & 3: Mechanisms & Examples: 4 Bar Chain, Crank Rocker Mechanism, Slider Crank Mechanism. Example: Simple Robotic Arm building.

Week 4: Platform based development: Introduction to various platform based development (arduino) programming and its essentials.

Week 5 & 6: Introduction to Arduino: Introduction to sensors, transducers and actuators and its interfacing with arduino.

Week 7: Data Acquisition and Analysis: Types of Data, Descriptive Statistics techniques as applicable to different types of data.

Week 8 & 9: Analysis: Types of graphs as applicable to different types of data, Usage of Microsoft Excel tool for descriptive statistics, Data Acquisition(Temperature and humidity) using Sensors. Exporting acquired data to Microsoft Excel and analysis using visual representation.

Week 10: Project Management: Introduction to Agile practices, Significance of team work, Importance of communication in engineering profession.

Week 11: Tools: Checklist, Timeline, Gantt chart, Significance of documentation.

Week 12: Engineering Ethics: Identifying Engineering as a Profession, Significance of Professional Ethics, Code of Conduct for Engineers.

Week13 & 14: Ethical Dilemmas: Identifying Ethical Dilemmas in different tasks of engineering, Applying Moral Theories and codes of conduct for resolution of Ethical Dilemmas.

Reference:

1. A Hand Book on Technology Exploration for Social Innovation - II, FED, CMRIT, Hyd.

II-B.TECH.-I-SEMESTER SYLLABUS

NUMERICAL METHODS AND COMPLEX VARIABLES

II-B.Tech.-I-Sem. **L T P C**
Subject Code: BSC-202 **3 1 - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	solve transcendental, linear and non-linear system of equations using numerical methods	3	2	1
CO2	find the numerical solutions for first order initial value problems and integrals	3	2	1
CO3	solve ODE by using Laplace transforms	3	2	1
CO4	analyze the complex functions with reference to their analyticity	3	2	1
CO5	expand complex functions using Taylor's, Laurent's and Residue theorems	3	2	1

Unit-I: Algebraic and transcendental Equations and Curve fitting **9 hours**

Algebraic and transcendental Equations: Introduction, Bisection Method, Method of False position, Iteration method and Newton Raphson method.
Curve Fitting: Fitting a linear, second degree, exponential and power curve by method of least squares.

Unit-II: Numerical Integration and Solution of Ordinary Differential equations **9 hours**

Numerical Integration: Trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rule.
Solution of Ordinary Differential equations: Taylor's series, Picard's method of successive approximations, Euler's method, Runge - Kutta method (second and fourth order)

Unit-III: Laplace Transforms and Inverse Laplace Transform **(6 + 4) 10 hours**

Part-A: Laplace Transforms: Laplace Transform of standard functions; first 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 Special functions; Laplace transform of periodic functions.

Part-B: Inverse Laplace Transform: Inverse Laplace transform by different methods.

Unit-IV: Complex Variables (Differentiation) **10 hours**

Complex Variables (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.

Unit-V: Complex Variables (Integration) **10 hours**

Complex Variables (Integration): Line integrals, Cauchy's integral Theorem, Cauchy's integral formula and Generalized Cauchy's Integral formula. Zeros of analytic functions and singularities. Taylor's Series, Laurent's series (without proof), Residues and Cauchy's Residue theorem.

Text Books:

1. Introductory methods of numerical analysis - S.S. Sastry, PHI, 4^{th} Edition, 2005.
2. Higher Engineering Mathematics - B.S. Grewal, Khanna Publishers, 36^{th} Edition, 2010.
3. Complex Variables and Applications by J.W. Brown and R.V. Churchill, Mc-Graw Hill, 2004

References:

1. Numerical methods for Scientific and Engineering Computations - M. K. Jain, SRK Iyengar, R.K. Jain New Age International publishers.
2. Advanced Engineering Mathematics - Erwin kreyszig, 9th Edition, John Wiley & Sons, 2006.

NETWORKS AND MEASUREMENTS

II-B.Tech.-I-Sem. **L T P C**
Subject Code: ESC-207 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12	PO13
CO1	assess the parameters of two port networks	3	3	2	2	3
CO2	evaluate the transient analysis in electrical circuits	3	3	2	2	3
CO3	design resonant circuits and magnetic circuits	3	3	2	2	3
CO4	analyze various filters and DC bridges	3	3	2	2	3
CO5	determine unknown parameters of AC bridges	3	3	2	2	3

Unit-I: Two Port Networks **9 hours**

Impedance Parameters, Admittance Parameters, Hybrid Parameters, Transmission (ABCD) Parameters, Interconnection of Two Port networks in Series, Parallel and Cascaded configurations, Illustrative problems.

Unit-II: Transient Analysis (First and Second Order Circuits) **9 hours**

Transient Response of RL, RC and RLC Circuits for DC excitations, Initial Conditions with source, Solution using Differential Equations approach and Laplace Transform Method.

Unit-III: Resonance & Magnetic circuits **(5 + 5) 10 hours**

Part-A: Resonance: series and parallel resonance circuits, resonance frequency, quality factor and band width determination.

Part-B: Magnetic circuits: Magnetic circuits-Faraday's laws of electromagnetic induction-concept of self and mutual inductance-coefficient of coupling.

Unit-IV: Filters and DC Bridges **10 hours**

Filters: Classification of Filters, Constant-k -Low Pass Filter and High Pass Filters; Band Pass filter and Band Elimination filters, Illustrative Problems.

DC Bridges: Method of measuring low, medium and high resistance – sensitivity of Wheat-stone's bridge, Kelvin's double bridge for measuring low resistance.

Unit-V: AC Bridges **10 hours**

Measurement of inductance - Maxwell's bridge, Hay's bridge, Anderson's bridge. Measurement of capacitance and loss angle –Desaunty's Bridge – Schering Bridge.

Text Books:

1. Circuit Theory (Analysis and synthesis) -A. Chakrabarti, Dhanpat Rai&co (Pvt) Ltd 7th Ed,2015
2. Electrical Measurements and Measuring Instruments - E.W. Golding and F.C. Widdis, fifth Edition, Wheeler Publishing
3. Electrical & Electronic Measurement & Instruments - A.K.Sawhney Dhanpat Rai & Co. Pvt. Ltd.

References:

1. Engineering Circuit Analysis by William Hayt and Jack E Kemmerly, MGH, 5th Edition, 1993.
2. Electric Circuits - J.Edminister and M.Nahvi – Schaum's Outlines, TMH, 1999.
3. Network Theory - Sudhakar and Shyam Mohan, TMH.

PROBABILITY THEORY AND STOCHASTIC PROCESSES

II-B.Tech.-I-Sem. **L T P C**
Subject Code: ESC-208 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12	PO13
CO1	apply the concepts of probability and random variables	3	3	2	3
CO2	evaluate the distribution and density functions of single random variables	3	3	2	3
CO3	solve the problems related to multiple random variables	3	3	2	3
CO4	analyze the stochastic process and its temporal characteristics	3	3	2	3
CO5	outline the spectral characteristics of stochastic process	3	3	2	3

Unit-I: Probability and Random Variable **10 hours**

Probability: Probability introduced through Sets and Relative Frequency, Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, Independent Events.
Random Variable: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables.

Unit-II: Distribution & Density Functions and Operation on One Random Variable – Expectations **10 hours**

Distribution & Density Functions: Distribution and Density functions and their Properties - Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh and Conditional Distribution, Methods of defining Conditional Event, Conditional Density and Properties.
Operation on One Random Variable – Expectations: Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable, Transformation of a Discrete Random Variable.

Unit-III: Multiple Random Variables and Operations **(5 + 5) 10 hours**

Part A: Multiple Random Variables: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density - Point Conditioning, Conditional Distribution and Density - Interval conditioning, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem (Proof not expected).

Part B: Operations on Multiple Random Variables: 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.

Unit-IV: Stochastic Processes - Temporal Characteristics **9 hours**

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, Nth 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 and its Properties.

Unit-V: Stochastic Processes - Spectral Characteristics **9 hours**

Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function,

Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function, Linear System Response of Mean and Mean-squared Value, Autocorrelation Function, Cross-Correlation Functions. Power Density Spectrum of Response, Cross-Power Spectral Density of Input and Output.

Text Books:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, 4th Edition, 2001, TMH.
2. Probability and Random Processes - Scott Miller, Donald Childers, 2nd Edition, Elsevier, 2012.

References:

1. Probability, Random Variables and Stochastic Processes - thanasios Papoulis and S. Unnikrishna Pillai, 4th Edition, TMH.
2. Theory of Probability and Stochastic Processes - Pradip Kumar Gosh, University Press.
3. Probability and Random Processes with Application to Signal Processing - Henry Stark and John W. Woods, 3rd Edition, PE.

ANALOG ELECTRONICS

II-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PCC-211 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12	PO13
CO1	analyze single stage amplifiers at low frequencies	3	3	2	2	3
CO2	design multistage amplifiers at high frequencies using transistors	3	3	2	2	3
CO3	illustrate feedback amplifiers and oscillators	3	3	2	2	3
CO4	examine the power and tuned amplifiers	3	3	2	2	3
CO5	interpret various FET Amplifiers	3	3	2	2	3

Unit- I: Small Signal Low Frequency BJT Amplifiers **9 hours**

BJT Hybrid model, Analysis of CE, CB and CC configurations using h-parameters , Analysis of CE, CC, and CB Amplifiers and CE Amplifier with emitter resistance using simplified CE Hybrid model, miller's theorem and its dual, Design of single stage RC coupled amplifier.

Unit-II: Small Signal High Frequency BJT Amplifiers **9 hours**

Frequency response of BJT amplifier – Analysis at high frequencies, The Hybrid- π
Common Emitter transistor model, CE short circuit current gain, current gain with resistive load.
Multistage Amplifiers: Low frequency response of BJT Amplifiers, effect of coupling and bypass capacitors. Different coupling schemes used in amplifiers, Analysis of Cascaded RC Coupled amplifiers, Cascode amplifier, Darlington pair.

Unit-III: Feedback Amplifiers and Oscillators **(5 + 5) 10 hours**

Part-A: Feedback Amplifiers: Classification of 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.
Part-B: Oscillators: Condition for oscillations. RC and LC type Oscillators –Generalized analysis of LC oscillators, Hartley, and Colpitts Oscillators – RC-phase shift Oscillator usig BJT.

Unit-IV: Large Signal Amplifiers **12 hours**

Class A Power Amplifier- series fed and Transformer Coupled Amplifier, class –B power amplifier- Push Pull and Complimentary Symmetry Amplifier,– Principle of operation of class –C Amplifier.
TUNED AMPLIFIERS: Introduction, Q-Factor, Small Signal Tuned Amplifiers, Effect of Cascading single Tuned amplifiers on Bandwidth, Effect of Cascading Double Tuned amplifiers on Bandwidth, Stagger Tuned Amplifiers.

Unit-V: FET Amplifiers **8 hours**

Analysis of JFET Amplifiers, Analysis of CS, CD, CG JFET Amplifiers, comparison of performance with BJT Amplifiers, Basic Concepts of MOS Amplifiers, MOSFET Characteristics in Enhancement and Depletion mode, MOS Small signal model, Common source amplifier with resistive load.

Text Books:

1. Integrated Electronics - Jacob Millman, Christos C Halkias, TMH.
2. Electronic Devices and Circuits - David A. Bell – 5 th Edition, Oxford.

References:

1. Introductory Electronic Devices and Circuits, Robert T. Paynter, 7th Edition, 2009, PEI.
2. Electronic Devices and Circuit Theory - Robert L.Boylestad, Louis Nashelsky, 9th Edition, PEI.

SIGNALS AND SYSTEMS

II-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PCC-212 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12	PO13
CO1	interpret various types of signals and systems	3	3	2	3
CO2	determine the convolution and correlation on various signals	3	3	2	3
CO3	evaluate the response of the systems using Laplace and Z-transforms	3	3	3	3
CO4	determine the convolution and correlation on various signals	3	3	2	3
CO5	apply the mathematical modelling to LTI systems for processing signals	3	3	3	3

Unit-I: Signal Analysis **9 hours**

Signal Analysis: Classification of signals, Basic elementary signals, Operations on Signals, 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.

Unit-II: Convolution, Correlation of Signals and Fourier Series **10 hours**

Convolution, Correlation of Signals: Convolution and their properties, Correlation of signals, Cross Correlation and auto correlation of functions, properties of correlation functions, relation between convolution and correlation.
Fourier Series: Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

Unit-III: Fourier Transforms and Laplace Transforms **(5 + 5) 10 hours**

Part–A: Fourier Transforms: Deriving Fourier Transform from Fourier series**,** Fourier Transform of Arbitrary Signals, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Introduction to Hilbert Transform.

Part–B: Laplace Transforms: Review of Laplace Transforms (L.T), Properties of L.T, Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Relation between L.T and F.T.

Unit - IV: Sampling and Z-Transforms **10 hours**

Sampling: Sampling theorem –Types of Sampling - Impulse Sampling, Natural and Flat top Sampling, Aliasing**,** introduction to Band Pass Sampling.
Z–Transforms: Concept of Z-Transform, Region of Convergence in Z-Transform, Inverse Z-transform, Z-transforms properties, Z-transforms of standard signals.

Unit-V: Signal Transmission through Linear Systems **9 hours**

Classification of 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, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics.

Text Books:

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

References:

1. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2nd Edition.
2. Signals and Systems - A.Rama Krishna Rao – 2008, TMH.

ANALOG ELECTRONICS LAB

II-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PCC-213 **- - 3 1.5**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PO14
CO1	design and analyze the transistor amplifier circuits	3	3	3
CO2	design and analyze the FET amplifiers	3	3	3
CO3	Design and analyze the feedback amplifiers	3	3	3
CO4	Design and analyze the Oscillators	3	3	3
CO5	Design and analyze the large signal amplifiers	3	3	3

LIST OF EXPERIMENTS (Design any **six** using hardware and any **ten** simulation using Multisim or P-spice or Equivalent Simulation Software)

1. Common Emitter Amplifier
2. Common Base Amplifier
3. Common Collector Amplifier
4. Common Source amplifier
5. Two Stage RC Coupled Amplifier
6. Current Shunt and Voltage Series Feedback Amplifier
7. Cascode Amplifier
8. Wien Bridge Oscillator using Transistors
9. RC Phase Shift Oscillator using Transistors
10. Class A Power Amplifier (Transformer less)
11. Class B Complementary Symmetry Amplifier
12. Hartley and Colpitt's Oscillator
13. Single Tuned Voltage Amplifier
14. Darlington Pair

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

Design and develop circuits for the following:

1. Battery Charger
2. Water level alarm
3. Low cost fire alarm
4. Stop watch
5. High-Low voltage delay alarm
6. Electronic watchdog
7. Mini audio amplifier
8. Street light automatic intensity controller
9. Smart burglar alarm
10. Clap based fan switching system

Reference:

1. Analog Electronics Lab Manual, Department of ECE, CMRIT, Hyd.

NETWORKS AND MEASUREMENTS LAB

II-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PCC-214 **- - 2 1**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PO14
CO1	design two port network to verify various parameters	3	3	3
CO2	analyze transients for series circuits using DC excitation	3	3	3
CO3	evaluate resonance and magnetic circuits	3	3	3
CO4	design filters and draw its characteristics	3	3	3
CO5	examine unknown components of various bridges	3	3	3

List of Experiments: (Any 12 experiments to be performed)

1. Two Port Network Parameters- Z-Y Parameters.
2. Two Port Network Parameters h and ABCD Parameters.
3. Transient Response of Series RL and RC Circuits Using DC Excitation
4. Transient Response of RLC Series Circuit Using DC Excitation
5. Series Resonance Circuits- Timing, Resonant Frequency, Band Width and Q-Factor Determination for RLC Network.
6. Parallel Resonance Circuits - Timing, Resonant Frequency, Band Width and Q-Factor determination for RLC Network.
7. Determination of Self, Mutual Inductances And Coefficient Of Coupling
8. Constant –K Low Pass Filter - Design And Test
9. Constant –K High Pass Filter - Design And Test
10. Measurement of Resistance by Kelvin's Double Bridge
11. Measurement of capacitor by using Schering Bridge
12. Measurement of inductance by using Anderson Bridge.
13. Measurement of Parameters of A Choke Coil Using 3 Voltmeter and 3 Ammeter
14. Maxwell's Inductance Capacitance Bridge

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Design of Energy Meter Based Manipulating of Domestic Electricity Bill
2. Design of Power Supply With Auto Switching
3. Design of AC Power Strength Controller System
4. Design of Battery Charger Circuit Using SCR
5. Design of Water Level Alarm Circuit
6. Design of Low Cost Fire Alarm Circuit
7. Design of Smart Locks System For Home Appliances
8. Design of Smart Meter with Non-Intrusive Load Monitoring
9. Design of Hand Movement Based Electric Device Control
10. Design of Power Supply Indication System

Reference:

1. Networks and Measurements Lab Manual, Department of ECE, CMRIT, Hyd.

SCRIPTING LANGUAGES LAB

II-B.Tech.-I-Sem. **L T P C**
Subject Code: ESC-209 **- - 3 1.5**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO4	PO5	PO14
CO1	distinguish various scripting languages	3	3	3	3	3	3
CO2	develop programs using shell script	3	3	3	3	3	3
CO3	create applications using PHP	3	3	3	3	3	3
CO4	build applications using perl	3	3	3	3	3	3
CO5	construct programs using python	3	3	3	3	3	3

I. Shell Script

1. Write a shell script that accepts a file name, starting and ending line numbers as arguments and display all the lines between the given line numbers.
2. Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments to it.
3. Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or directory and reports accordingly. Whenever the argument is a file, the number of lines on it is also reported.
4. Write a shell script that accepts a file names as its arguments, counts and reports the occurrence of each word that is present in the file argument file in other argument files.

II. Personal Home Page (PHP)

1. Write a PHP script to print prime numbers between 1 - 50.
2. PHP script to
   a) Find the length of a string b) Count no of words in a string.
   c) Reverse a string. d) Search for a specific string.
3. Write a PHP script to merge two arrays and sort them as numbers, in descending order.
4. Write a PHP script that reads data from one file and write into another file.
5. Write a PHP script to validate user login page (i.e. user name and password).

III. Practical Extraction Reporting Language (PERL)

1. a) Write a Perl script to find the largest number among three numbers.
   b) Write a Perl script to print the multiplication tables from 1-10 using subroutines.
2. Write a Perl program to implement the following list of manipulating functions
   a) Shift b) Unshift c) Push
3. Write a Perl script to substitute a word, with another word in a string.
4. Write a Perl script to validate IP address and email address.
5. Write a Perl script to print the file in reverse order using command line arguments

IV. Python

1. Write a python program to solve a quadratic equation.
2. a) Write a python program to find the factorial of a number.
   b) Write a python program to generate Fibonacci series.
3. Write a python program to make a simple calculator.
4. Write a python program to sort words in alphabetical order.
5. Write a python program to add two matrices.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Create a Phone Directory using shell script with various operations in it (Add contact, Search contact, Delete contact, View phone directory etc.).
2. Create a File Management System using shell script with various operations in it (Create file/directory, Search file/directory, Delete file/directory, View files and directories etc.).
3. Design and develop an ERP System for Student Management using PHP (Add Students, Add/Modify Marks to a Student, View Scores of a Student, Delete Student, View all Students etc.).
4. Develop Hospital Management System using PHP (Add Patients, Add/Modify Patient details, View Patient data, Delete Patient, View all Patients etc.).
5. Develop Hotel Management System using PHP (Book Room, Booked Room details, Vacate Room, Raise Complaint, View Complaint status, View Available/Booked Rooms status etc.).
6. Write a Perl script to perform various operations on matrices (Create matrix, Add Matrices, Subtract Matrices, Multiply Matrices, Transpose Matrix, Matrix Determinant etc.)
7. Write a Perl script to create a package and add modules to it and use them in another package/module.
8. Write a python program to implement a class for ATM and include functions required for it.
9. Write a python script that creates several modules and create a new program that imports these modules and functions in the modules.
10. Write a python program to implement a class for Library and include functions required for it.

Reference:

1. Scripting Languages Lab Manual, Department of ECE, CMRIT, Hyd.

COMPUTATIONAL MATHEMATICS LAB USING Sci LAB

II-B.Tech-I-Sem. **L T P C**
Subject Code: BSC-203 **- - 3 1**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO3	PO4	PO5	PO14
CO1	solve problems on Linear Algebra and plotting of Graphs	3	3	3	3
CO2	find roots of an equation using various Methods	3	3	3	3
CO3	fit a curve for straight line, parabola, exponential and power curves	3	3	3	3
CO4	solve ordinary differential equations using Numerical techniques	3	3	3	3
CO5	solve ordinary integral equations using Numerical techniques	3	3	3	3

LIST OF EXPERIMENTS

Week-01: Introduction to Sci Lab, History, Features and Local Environment.
Week-02: Basic operations on Matrices (Characteristic Equations, Eigen values and Eigen vectors).
Week-03: Plotting of Graphs and finding Roots of Polynomials.
Week-04: Find the root of equation by Bisection and Regula-Falsi Methods.
Week-05: Find the root of equation by Iteration and Newton Raphson Methods
Week-06: Fit a straight line and second degree polynomial curves using method of least square.
Week-07: Fit a power curve using method of least square.
Week-08: Fit a exponential curve using method of least square.
Week-09: Basic operations on Differential Equations / Integrations and find the area by using Trapezoidal rule.
Week-10: Find the area by using Simpsons 1/3rd rule and 3/8th rule.
Week-11: Find the solution of a given Differential Equation by using Euler's method.
Week-12: Find the solution of a given Differential Equation by using Runge-Kutta method (2^{nd} and 4^{th} Order).

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Demonstrate the battery discharge function graphically by adopting a mathematical model.
2. Apply inverse Laplace transforms in image processing for getting the better image.
3. Evaluate the trigonometric functions using Laplace transforms.
4. Illustrate the laminar flow of heat through partial differential equations.
5. Design a mathematical model to explain the functioning of Global positioning system (GPS)
6. Design a mathematical model for the construction of flyover
7. Model any art craft using mathematical calculations (electrical / non-electrical)
8. Prepare a detailed report on usage of mathematical concepts in overcoming "risk vs reward" situations in day to day life.
9. 2-D plotting using SCI-lab.
10. 3-D plotting using SCI-lab.

Reference:

1. Computational Mathematics Lab using Sci Lab Manual, FED, CMRIT, Hyd.

ENVIRONMENTAL SCIENCES
MANDATORY COURSE (NON-CREDIT)

II-B.Tech.-I-Sem. **L T P C**
Subject Code: MC-202 **2 - - -**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO6	PO7	PO12
CO1	identify the role of ecosystem for livelihood	3	3	3	2
CO2	interpret methods to sustain environmental resources	3	3	3	2
CO3	outline bio-diversity and its relevance to ecological balance	3	3	3	2
CO4	explain laws and legislations on environmental protection	3	3	3	3
CO5	evaluate technologies for achieving sustainable development	3	3	3	2

Unit I: Ecosystem **6 hours**

Introduction to ecosystem: Definition, Scope and Importance; Classification of ecosystem; Structure and functions of ecosystem food chain food web, ecological energetic, eco-pyramids, carrying capacity; Biogeochemical cycles (Carbon and Nitrogen Cycles), flow of energy.

Unit II: Natural Resources **7 hours**

Renewable and Non–renewable resources–Importance, uses, classification of natural resources (i) forest: deforestation, timber extraction & conservation (ii) water: conflicts over water, dams – benefits &effects; use and over exploitation of water resources, (iii) mineral :use and exploitation, effects on mining, (iv) energy resources: growing needs, renewable and non renewable energy sources, use of alternative energy (v) land resources: land degradation, landslides, soil erosion and desertification; role of an individual in conservation of natural resources and equitable use.

Unit III: Biodiversity **(3 + 2) 5 hours**

Part A: Definition and levels of biodiversity, Values of biodiversity Bio– geographical classification of India; hot spots of biodiversity; India as a mega diversity nation; Threats to biodiversity; Endangered and endemic species of India.

Part B: Conservation of biodiversity: In–situ and Ex–situ conservation; Case studies.

Unit IV: Environmental Pollution & Control Technologies **8 hours**

Types of environmental pollution; **Air pollution**: major air pollutants, sources, effects, control measures, National Air Quality Standards. Water pollution: sources, impacts & control technologies-ETP, watershed management, rain water harvesting, Water Quality standards. Soil pollution: sources, causes & impacts on modern agriculture. Noise pollution. Solid waste Management- causes, effects and control measures; E-waste. **Global Environmental Issues and Treaties**: Global warming, ozone layer depletion. International protocol, Kyoto and Montreal protocol. Population Explosion.

Unit V: Environmental Acts, EIA & Sustainable Development **6 hours**

Environment Protection Acts: Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act and Forest Conservation Act, Environment (Protection) Act, 1986. EIA: conceptual facts, base line data acquisition, EIS, EMP. **Sustainable development**-causes & threats, strategies for achieving sustainable development; CDM and concept of green building, life cycle assessment(LCA); Ecological foot print. **Role of Information Technology** in Environment - Remote Sensing, GIS.

Textbooks:

1. Environmental Science by Y. Anjaneyulu, B S Publications (2004).
2. Environmental studies by Rajagopalan R (2009), Oxford University Press, New Delhi.

References:

1. Environmental Science and Technology by M. Anji Reddy(2007), B.S Publications.
2. Environmental Studies by Anubha Kaushik (2006), 4th edition, New age International Publications

II-B.TECH.-II-SEMESTER SYLLABUS

PULSE & DIGITAL CIRCUITS

II-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PCC-221 **3 1 - 4**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO12	PO13
CO1	design of linear wave shaping circuits for various applications	3	3	2	3
CO2	construct nonlinear wave shaping circuits	3	3	2	3
CO3	demonstrate the switching characteristics of diode and transistor	3	3	2	3
CO4	design and analyze multi-vibrator circuits and time-base generators	3	3	2	3
CO5	develop circuits using the concepts of sampling gates and logic families	3	3	2	3

Unit-I: Linear Wave Shaping **9 hours**

High pass, low pass RC circuits, their Response for Sinusoidal, Step,Pulse, Square, and Ramp inputs. High pass RC Network as Differentiator and Low pass RC circuit as an integrator, Attenuators and its application as a CRO, RL and RLC circuits and their response for step input.

Unit–II: Non-Linear Wave Shaping **10 hours**

Diode clippers, Transistor clippers, clipping at two independent levels, Comparators, Applications of Voltage Comparators, clamping operation, Clamping Circuit taking Source and Diode Resistances into account, Clamping circuit theorem, practical clamping circuits, effect of diode characteristics on clamping voltage, Synchronized Clamping.

Unit–III: Steady State Switching Characteristics of Devices **(5 + 5) 10 hours**

Part-A: Diode as a switch, Piece Wise Linear Diode Characteristics, Diode Switching Times, Transistor Acts as a Switch.

Part-B: Breakdown Voltages, transistor in saturation, temperature variation of saturation parameters, transistor-switching times.

Unit – IV Multivibrators and Time Base Generators **10 hours**

Multivibrators: Design and Analysis of Bistable,Monostable and Astable Multivibrators, and Schmitt Trigger using Transistors
Time Base Generators: General features of a time base signal, methods of generating time base waveform, Miller and Bootstrap time base generators – basic principles, Transistor miller time base generator, Transistor Bootstrap time base generator, Current time base generators.

Unit –V Sampling Gates and Realization of Logic Gates **10 hours**

Sampling Gates: Basic operating principles of sampling gates, unidirectional and bi-directional Sampling gates, four diode sampling gate, reduction of pedestal in gate circuits.
Realization of Logic Gates Using Diodes and Transistors: AND,OR,NOT gates using Diodes and Transistors, DCTL, RTL, DTL, TTL and CML logic families and their comparisons.

Textbooks:

1. Pulse, Digital and Switching Waveforms- Jacob Millman, Herbert Taub (2008) 3rd Edn., TMH.

References:

1. Pulse and Digital Circuits, Anand Kumar (2005), PHI.
2. Pulse and Digital Circuits, Mothiki S. Prakash Rao (2006), TMH.

LINEAR AND DIGITAL IC APPLICATIONS

II-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PCC-222 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO12	PO13
CO1	describe various stages of operational amplifier	3	2	2	3
CO2	design active filters, PLL and 555 timers	3	3	2	3
CO3	analyze various ADCs and DACs	3	3	2	3
CO4	construct various combinational circuits using IC's	3	3	2	3
CO5	build various sequential circuits using IC's	3	3	2	3

Unit-I: Operational Amplifier **9 hours**

Ideal and Practical Op-Amp, Op-Amp Characteristics-DC and AC Characteristics, Features of 741 Op-Amp, Modes of Operation -inverting, Non-inverting, Differential, instrumentation Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

Unit-II: OP-AMP, IC-555 & IC 565 Applications **10 hours**

Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of1st order LPF & HPF Butterworth Filters, Waveform Generators- Triangular, Sawtooth, Square Wave,IC555 Timer - Functional Diagram, Monostable and Astable Operations, Applications, IC 565 PLL Block Schematic, Description of individual Blocks, Applications.

Unit-III: Data Converters **(5 + 5) 10 hours**

Part-A: Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC.

Part-B: Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC specifications.

Unit-IV: Digital Integrated Circuits **10 hours**

Classification of integrated Circuits, Comparison of Various Logic families, Combinational Logic ICs- Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs, Code Converters, Decoders, Demultiplexers, LED & LCD Decoders with drivers Encoders, Priority Encoders, Multiplexers, Magnitude Comparators.

Unit-V: Sequential Logic IC'S **9 hours**

Familiarity with commonly available 74XX & CMOS 40XX Series ICs- RS, JK, JK Master - Slave, D and T Type Flip-Flops & their Conversions, Synchronous & Asynchronous Counters, Decade Counters, Shift Registers & Applications.

Text Books:

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

References:

1. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2nd Ed., 2003.
2. Digital Design Principles & Practices – John Wakerly, Pearson Education.
3. Applications and Design with Analog Integrated Circuits - J.Michael Jacob- PHI, 1996.

ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

II-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PCC-223 **3 1 - 4**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12	PO13
CO1	illustrate the concepts of electric fields	3	2	2	3
CO2	interpret the concepts of magnetic fields	3	2	2	3
CO3	explain EM wave characteristics	3	3	2	3
CO4	summarize the fundamental concepts of transmission line theory	3	3	2	3
CO5	analyze transmission lines using smith chart or classical theory	3	3	2	3

Unit –I: Electrostatics **10 hours**

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

Unit –II: Magnetostatics **9 hours**

Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law, Illustrative Problems.
Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements, Conditions at a Boundary Surface : Dielectric-Dielectric and Dielectric-Conductor Interfaces, Illustrative Problems.

Unit –III: EM Wave Characteristics **(5 + 5) 10 hours**

Part-A: EM Wave Characteristics–I: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, all relations between E & H, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization, Illustrative Problems.

Part-B: EM Wave Characteristics–II: Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Theorem – Applications, Illustrative Problems.

Unit –IV: Transmission Lines–I **10 hours**

Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Losslessness/Low Loss Characterization, Distortion – Condition for Distortionlessness and Minimum Attenuation, Loading - Types of Loading, Illustrative problems.

Unit –V: Transmission Lines – II **9 hours**

Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. UHF Lines as Circuit Elements; $\lambda/4$, $\lambda/2$, $\lambda/8$ Lines – Impedance Transformations, Significance of Zmin and Zmax, Smith Chart – Configuration and Applications, Single Stub Matching, Illustrative problems.

Text Books:

1. Principles of Electromagnetics – Matthew N.O. Sadiku and S.V. Kulkarni, 6th Edition, Oxford University Press, Aisan Edition, 2015.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, 2nd Edition. 2000, PHI.
3. Transmission Lines and Networks – Umesh Sinha, Satya Prakashan, 2001, Tech. India Pub.

References:

1. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, 7th Edition, 2006, TMH.
2. Networks, Lines and Fields – John D. Ryder, 2nd Edition, 1999, PHI.

DIGITAL DESIGN AND COMPUTER ORGANIZATION

II-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PCC-224 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO12	PO13
CO1	interpret number systems and codes	3	2	2	3
CO2	solve boolean expressions and analyze combinational circuits	3	3	3	3
CO3	design the sequential circuits	3	3	3	3
CO4	illustrate various micro operations	3	2	2	3
CO5	explain basics of various types of memories	3	2	2	3

Unit-I **9 hours**

Digital Systems, Binary Numbers, Number base conversions, Octal, Hexadecimal and other base numbers, complements, signed binary numbers, Floating point number representation, binary codes, Error detection and correction, binary storage and registers, binary logic, Boolean algebra and logic gates, Basic theorems and properties of Boolean Algebra, Boolean functions, canonical and standard forms, Digital Logic Gates.

Unit-II **10 hours**

Gate–Level Minimization, The K-Map Method, Three-Variable Map, Four-Variable Map, Five-Variable Map, sum of products, product of sums simplification, Don't care conditions, NAND and NOR implementation and other two level implementations, Exclusive-OR function.
Combinational Circuits: Adders, Subtractors, comparators, Multiplexers, Demultiplexers, Decoders, Encoders and Code converters.

Unit- III **(5 + 5) 10 hours**

Part-A: Sequential circuits: Introduction: Basic Architectural Distinctions between Combinational and Sequential circuits, The Binary Cell, Latches, Flip Flops: SR, JK, Race Around Condition in JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Design of a Clocked Flip-Flop, Timing and Triggering Consideration, Clock Skew, Conversion from one type of Flip-Flop to another.

Part-B: Registers and Counters: Shift Registers, Data Transmission in Shift Registers, Operation of Shift Registers, Shift Register Configuration, Bidirectional Shift Registers, Applications of Shift Registers, Design and Operation of Ring and Twisted Ring Counter, Operation Of Asynchronous And Synchronous Counters.

Unit- IV **10 hours**

Register Transfer and Microoperations - Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit.

Unit –V **9 hours**

Processor Organization: Introduction to CPU, Register Transfers, Execution of Instructions, Multiple Bus Organization, Hardwired Control, Microprogrammed Control Memory Organization: Concept of Memory, RAM, ROM memories, memory hierarchy, cache memories, virtual memory, secondary storage, memory management requirements.

Textbooks:

1. Digital Design, M. Morris Mano, M.D.Ciletti, 5th Edition, Pearson.
2. Computer System Architecture, M. Morris Mano, 3rd Edition, Pearson.

References:

1. Switching and Finite Automata Theory, Z. Kohavi, Tata McGraw Hill.
2. Fundamentals of Logic Design, C. H. Roth, L. L. Kinney, 7th edition, Cengage Learning.

CONTROL SYSTEMS

II–B.Tech.-II–Sem. **L T P C**
Subject Code: EC-PCC-225 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	explain mathematical models of control systems in continuous time	3	3	2
CO2	determine the transient and steady state performances of a control system	3	3	2
CO3	analyze the stability by using R-H criterion and root-locus concepts	3	3	2
CO4	evaluate the stability analysis in frequency domain	3	3	2
CO5	examine the controllability and observability of a system	3	3	2

Unit- I: Introduction **10 hours**

Concepts of Control Systems: Basics of control systems, classifications and their differences with examples. Transfer function, modeling of electric systems, translational and rotational mechanical systems, block diagram reduction technique, signal flow graph, feedback characteristics-effects of feedback.

Unit-II: Time Response Analysis **9 hours**

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

Unit-III: Stability Analysis **(5 + 5) 10 hours**

Part-A: The concept of stability: Routh stability criterion – qualitative stability and conditional stability.

Part-B: Root Locus Technique: The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci.
Frequency Response Analysis: Introduction, Frequency domain specifications-Bode Diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain Margin-Stability Analysis from Bode Plots.

Unit-IV: Stability Analysis in Frequency Domain **9 hours**

Polar Plots, Nyquist Plots and applications of Nyquist criterion to find the stability - Effects of adding poles and zeros to G(s)H(s) on the shape of the Nyquist diagrams. Classical Control Design Techniques: Compensation techniques – Lag, Lead, and Lead Lag Controllers design in frequency Domain, PID Controllers.

Unit-V: State Space Analysis of Continuous Systems **10 hours**

Concepts of state, state variables and state model, derivation of state models from block diagrams, Concepts of observability and controllability, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and its Properties.

Text Books:

1. Control Systems Engineering - I. J. Nagrath and M. Gopal, New Age International 5th Edn, 2009
2. Automatic Control Systems - John Wiley and sons, 8th Edition, 2003.

References:

1. Control Systems- N. K. Sinha New Age International (P) Limited Publishers, 3rd Edition, 1998.

PULSE & DIGITAL CIRCUITS LAB

II-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PCC-226 **- - 3 1**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PO14
CO1	design linear and non linear wave shaping circuits	3	3	3
CO2	analyze multivibrators and its applications	3	3	3
CO3	create oscillations and sweep signals using UJT and Boot strap circuits	3	3	3
CO4	illustrate the switching characteristics of transistor	3	3	3
CO5	demonstrate the operation of logic gates and sampling gates	3	3	3

List of Experiments: (Minimum 12 experiments to be conducted)

1. Linear wave Shaping
   a. RC Low Pass Circuit for different time constants
   b. RC High Pass Circuit for different time constants
2. Non-linear wave shaping
   a. Transfer characteristics and response of Clippers:
      i) Positive and Negative Clippers
      ii) Clipping at two independent levels
   b. The steady state output waveform of clampers for a square wave input
      i) Positive and Negative Clampers
      ii) Clamping at different reference voltage
3. Comparison Operation of different types of Comparators
4. Switching characteristics of a transistor
5. Design a Bistable Multivibrator and draw its waveforms
6. Design an Astable Multivibrator and draw its waveforms
7. Design a Monostable Multivibrator and draw its waveforms
8. Response of Schmitt Trigger circuit for loop gain less than and greater than one
9. UJT relaxation oscillator
10. The output- voltage waveform of Boot strap sweep circuit
11. The output- voltage waveform of Miller sweep circuit
12. Pulse Synchronization of An Astable circuit
13. Response of a transistor Current sweep circuit
14. Sampling gates
    a. Response of Unidirectional gate
    b. Response of Bidirectional gate using transistors
15. Study of logic gates

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Design RC circuits for triggering.
2. Design the switching circuits.
3. Design the Pulse generators.
4. Design of analog clock.
5. Water level indicator using transistors.
6. Burglar Alarm.
7. Mobile Phone Detector.
8. Crystal Tester Circuit Diagram.
9. Electronic Motor Control Circuit Diagram.
10. Fire Alarm Circuit Diagram.

Reference:

1. Pulse & Digital Circuits Lab Manual, Department of ECE, CMRIT, Hyd.

LINEAR & DIGITAL IC APPLICATIONS LAB

II-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PCC-227 **- - 2 1**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PO14
CO1	construct circuits for various applications using Op-Amp IC741	3	3	3
CO2	design various applications with specific ICs	3	3	3
CO3	model various sequential and combinational circuits using digital ICs	3	3	3
CO4	design and analyze synchronous and asynchronous counters using digital ICs	3	3	3
CO5	implement the sequential circuits	3	3	3

List of Experiments (Minimum 12 experiments to be conducted): ***Design and Implementation of***

Part-I: Linear IC Experiments (Any 6 Experiments)

1. Op-amp Applications-Adder, Subtractor, Comparator, Amplifier.
2. Integrator and Differentiator using IC741 Op-Amp.
3. Active Filter Applications-LPF, HPF (First Order).
4. IC 741 waveform Generators- Sine, Square wave and Triangular waves.
5. IC 555 Mono Stable and Astable Multivibrator Circuits.
6. a)Schmitt Trigger Circuits-using IC741.
   b)IC 565 – PLL applications.
7. Voltage regulator IC 723, three terminal voltage regulators- 7805, 7809, 7912.

Part-II: Digital IC Experiments (Any 6 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 Comparators.
3. Design a model to 53 counter using two decade counters.
4. Design a 16 x 1 multiplexer using 8 x 1 multiplexer.
5. Design a 16 bit Adder / Sub tractor using 4 – bit Adder / Sub tractor IC's.
6. Design a 4 – bit Gray to Binary and Binary to Gray Converter.
7. Design an 8 bit parallel load and serial out shift register using two 4 bit shift register.
8. Design an 8 bit Serial in and serial out shift register using two 4 bit shift register.
9. Design a 4 digit hex counter using synchronous one digit hex counters.
10. Design a 4 digit hex counter using Asynchronous one digit hex counters.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Electronic fuse using op-amp 741.
2. Dark activated relay circuit using IC 741.
3. DIY Digital Thermometer using IC 741.
4. Shadow sensor Alarm using IC 741.
5. Temperature controlled DC fan using IC 741.
6. Break failure indicator using IC 555.
7. Panic Alarm circuit using IC 741 and IC 555.
8. Rain alarm circuit using IC 555 timer.
9. High power car voltage regulator using IC 741 and voltage regulators.
10. Digital Fan speed regulator using digital IC'S and voltage regulators.

Reference:

1. Linear & Digital IC Applications Lab Manual, Department of ECE, CMRIT, Hyd.

SIMULATION LAB

II-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PCC-228 **- - 2 1**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PO14
CO1	interpret various types of signals and systems with the basic signal operations	3	3	3
CO2	analyze the signals in frequency domain using Fourier Transform and Z Transform	3	3	3
CO3	evaluate the distribution and density functions of single random variables	3	3	3
CO4	examine the stability of the control systems by using R-H criterion and root-locus concepts	3	3	3
CO5	apply the concepts of electric field and electric potential	3	3	3

Software/Tools to be Used: MATLAB

List of Experiments (Minimum of 3 experiments to be performed from each part)

Part – A: S & S

1. Introduction to MATLAB
2. Generation of Various Signals and Sequences (Periodic and aperiodic).
3. Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
4. Convolution for Signals and sequences.
5. Write a programme to find Fourier Transform, Laplace Transform and Z Transform for a given signal.

Part – B: PTSP

1. Generate Gaussian noise (Real and Complex), Compute its mean, M.S. Value and its Skew, Kurtosis, and PSD, Probability Distribution Function.
2. Distribution and density functions of standard random variables.
3. Auto Correlation and Cross Correlation for Signals and Sequences.
4. Verification of wiener – Khinchine relations.
5. Checking a random process for stationary in wide sense.

Part – C: CS

1. Write a program for complete root locus system with open loop transfer function.
2. Write a program to determine the stability of a system with a given characteristic equation using Routh criterion.
3. Write a program to draw polar plot for a given transfer function.
4. Write a program to draw Bode plot for a given transfer function.
5. Write a program to obtain state transition matrix for a given matrix.

Part – D: EMTL

1. Write a programme to calculate total electric flux.
2. Write a programme to calculate electric potential.
3. Write a programme to calculate electric field of a cylindrical capacitor.
4. Write a programme for divergence and curl of the Magnetic field.
5. Write a programme to study transmission line parameters.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Find the trigonometric Fourier series coefficients of a rectangular periodic signal. Reconstruct the signal by combining the Fourier series coefficients with appropriate weightings.
2. The signal x (t) is defined as below. The signal is sampled at a sampling rate of 1000 samples per second. Find the power content and power spectral density for this signal.
3. Find the magnitude and phase response of first order low pass and high pass filter. Plot the responses in logarithmic scale.
4. Transformation of the independent variable, Shifting (Delay & Advance), Reversing, Scaling.
5. Lead-Lag Compensator.
6. Transfer Function of a D.C Motor.
7. Distribution and Density Functions of Standard Random Variables.
8. Checking a random process for Stationarity in wide sense.
9. Energy generator using static magnetic fields.
10. Mobile phone charger using magnetic current.

Reference:

1. Simulation Lab Manual, Department of ECE, CMRIT, Hyd.

DIGITAL DESIGN LAB THROUGH VERILOG

II-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PCC-229 **- - 2 1**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PO14
CO1	examine basic logic gates	3	3	3
CO2	implement boolean functions using universal gates	3	3	3
CO3	construct various combinational logic circuits	3	3	3
CO4	analyze the operation of flip-flops	3	3	3
CO5	design registers and counters using flip-flops	3	3	3

List of Experiments (Minimum of 12 experiments to be performed)

1. Introduction to Verilog HDL.
2. Analyze logic gates.
3. Realization of a Boolean function by using NAND-NAND and NOR-NOR logic.
4. Design of Half-Adder, Full-Adder, Half-Subtractor, Full-Subtractor.
5. Design of 8:1 Mux and 1: 8 deMux.
6. Desig of 16:1 Mux using two 8:1 Mux
7. Design of 3:8 Decoder.
8. Design of 8:3 Priority Encoder.
9. Design of 4 Bit Binary to Gray code Converter.
10. Design of 4 Bit Binary to BCD Converter.
11. Design code converter which converts EX-3 to BCD.
12. Design an 8 Bit parity generator.
13. Design of N bit comparator.
14. Design of all 1 bit memory elements (SR, JK, D, T flip flops).
15. Design of 8-Bit Shift Register.
16. Design of Synchronous 8-bit ring Counter.
17. Design of MOD-5 and MOD-8 counters.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. BCD to 7-segment display controller
2. Logical function unit
3. Process line controller
4. Calendar subsystem
5. Arithmetic circuits
6. Integer representations
7. Digital Bank Token number Display
8. Arithmetic / Logic units
9. PLA/PAL
10. Johnson Counter

Reference:

1. Digital Logic Design Lab through Verilog Manual, Department of ECE, CMRIT, Hyd.

GENDER SENSITIZATION LAB
(MANDATORY COURSE - NON- CREDIT)

II-B.Tech.-II-Sem. **L T P C**
Subject Code: MC-201 **- - 2 -**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO9	PO12
CO1	identify gender issues in contemporary India	2	3
CO2	explain gender roles, spectrum, relationships etc	3	2
CO3	analyze gender issues related to sexual harassment and violence	3	3
CO4	assess gender and human rights	3	3
CO5	adapt to the societal need to end prejudices and achieve gender equality	2	3

Unit-I: UNDERSTANDING GENDER **6 hours**

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 **6 hours**

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 LABOUR **(4+ 4) 8 hours**

Part-A: Division and Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics.
Part-B: Fact and Fiction. Unrecognized and Unaccounted work. Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming.
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Unit-IV: GENDER - BASED VIOLENCE **6 hours**

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 **6 hours**

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.

Text Book:

1. Towards a world of equals, A bilingual textbook on gender, Telugu Akademi, Hyderabad.

Note: 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".

ASSESSMENT AND GRADING: (1) Discussion & Classroom Participation: 20%
(2) Project/Assignment: 30% (3) End Term Exam: 50%

III-B.TECH.-I-SEMESTER SYLLABUS

ANALOG AND DIGITAL COMMUNICATION

III-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PCC-311 **3 1 - 4**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO8	PO12	PO13
CO1	analyze various analog modulation and demodulation schemes	3	3	2	2	3
CO2	explain various angle modulation and demodulation schemes	3	3	2	2	3
CO3	demonstrate AM, FM transmitters and receivers	3	3	2	2	3
CO4	distinguish pulse modulation and pulse code modulation schemes	3	3	2	2	3
CO5	illustrate digital modulation schemes and compute BER	3	3	2	2	3

Unit-I **11 hours**

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, 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 **8 hours**

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 **(5 + 5) 10 hours**

Part-A: Transmitters: Classification of transmitters, AM transmitters, FM transmitters.
Noise sources: Thermal noise source Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figure, Average Noise Figure of cascaded networks, Narrow band noise, Quadrature representation of narrow band noise.

Part-B: Receivers: Radio receiver-receiver types-tuned radio frequency receiver, super heterodyne 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 **10 hours**

Information Theory: 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.
Pulse Modulation: Types of pulse modulation-PAM, PWM, PPM, comparison of FDM and TDM.
Pulse Code Modulation: PCM generation and reconstruction, non-uniform quantization and companding, DPCM, adaptive DPCM, DM and adaptive DM, noise in PCM and DM.

Unit-V **9 hours**

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.

Textbooks:

1. Analog and Digital Communications - Simon Haykin, John Wiley, 2005.
2. Electronics Communication Systems-Fundamentals thru Advanced-Wayne Tomasi, 5thEd, PHI.

References:

1. Communication Systems Engineering- Proakis J. G. and Salehi M., Pearson Education, 2002.
2. Electronic Communications – Dennis Roddy and John Coolean , 4th Edition , PEA, 2004
3. Electronics & Communication System – George Kennedy and Bernard Davis, TMH 2004

ANTENNAS AND WAVE PROPAGATION

III-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PCC-312 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO12	PO13
CO1	explain the radiation of electromagnetic waves from antennas	3	3	2	3
CO2	implement antenna arrays	3	3	2	3
CO3	design antennas at HF and VHF	3	3	3	3
CO4	analyze antennas at UHF and measure antenna parameters	3	3	3	3
CO5	identify the characteristics and effects on Radio Wave Propagation	3	3	2	3

Unit-I **10 hours**

Antenna Fundamentals: Introduction, radiation mechanism, antenna parameters, E&H field patterns, retarded potentials, Radiation from small electric dipole, quarter wave monopole and half wave dipole – current distributions. Antenna theorems – applicability and proofs for equivalence of characteristics, loop antennas, short dipole.

Unit-II **9 hours**

Antenna arrays: Two element arrays –different cases, principle of pattern multiplication, N–element uniform linear arrays: broadside, end fire arrays and binomial arrays.

Unit-III **(5 + 5) 10 hours**

Part-A: HF Antennas: Introduction, travelling wave radiators: basic concepts, long wire antennas: field strength calculations and patterns, V& Inverted V-antennas, rhombic antennas and design relations.

Part-B: VHF Antennas: Yagi-Uda antenna, folded dipole antenna and its characteristics, helical antennas: significance, geometry and basic properties.

Unit-IV **9 hours**

UHF, Microwave antennas and Measurements: Reflector antennas: flat sheet and corner reflectors. Parabolic reflectors: geometry, characteristics, types of feeds. Horn antennas: types and optimum horns. Lens antennas: geometry and features. Design of Micro strip antennas.
Antenna Measurements: Sources of errors, Patterns, directivity and gain (comparison, absolute and 3-antenna methods) measurements.

Unit-V **10 hours**

Wave Propagation: Fundamental equation for free-space propagation and basic transmission loss calculations; Ground wave propagation - wave tilt, flat and spherical earth considerations; Sky Wave Propagation - Formation of ionosphere layers and their characteristics, Expression for refractive index, Critical frequency, Skip distance, MUF for flat and curved earths, Virtual height; Space Wave Propagation - Mechanism, LOS and radio horizon; Tropospheric wave propagation – radius of curvature of path, effective earth‘s radius, M-curves and duct propagation.

Textbooks:

1. Antennas for all applications – John D. Kraus and Ronald J. Marhefka, TMH, 2003, 3/e.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2000, 2/e.

References:

1. Antenna Theory, C.A. Balanis, John Wiley & Sons, 2001, 2/e.
2. Antennas and Wave Propagation, K.D. Prasad, Satya Prakashan, Tech India Pub., 2001.

DIGITAL SIGNAL PROCESSING

III-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PCC-313 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO6	PO12	PO13
CO1	analyze discrete times signals in the time and frequency domains	3	3	2	3	3
CO2	implement DFT and FFT on time domain signals	3	3	2	3	3
CO3	design IIR filters using various techniques	3	3	2	3	3
CO4	design FIR filters using various techniques	3	3	2	3	3
CO5	illustrate Multirate Signal Processing	3	3	2	2	3

Unit-I **10 hours**

Introduction to Digital Signal Processing: Discrete Time Signals & Sequences, Linear Shift Invariant Systems, Stability, and Causality, Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems
Z-Transform: Review of Z-transforms, stability and causality, Response of an LTI system using Z-transform, Frequency Response of Stable Systems, Realization of Digital Filters – Direct, Canonic, Cascade and Parallel Forms, Transposed structures.

Unit-II **9 hours**

Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Circular convolution, Computation of DFT: Over-Lap Add Method, Over-Lap Save Method, Relation between DFT and Z-Transform.
Fast Fourier Transforms: Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT, and FFT with General Radix-N.

Unit-III **(5 + 5) 10 hours**

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 **9 hours**

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 **10 hours**

Multirate Digital Signal Processing: Decimation by a factor D, interpolation by a factor I, sampling rate conversion by a rational factor I/D, Filter Design & Implementation for sampling rate conversion, Multi stage Implementation of sampling rate conversion.

Textbooks:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009.

References:

1. Digital Signal Processing – Fundamentals and Applications – Li Tan, Elsevier, 2008.
2. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling, Sandra L. Harris, Thomson, 2007.
3. Digital Signal Processing – S.Salivahanan, A.Vallavaraj and C.Gnanapriya, TMH, 2009.

MICROPROCESSORS AND MICROCONTROLLERS

III-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PCC-314 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO7	PO12	PO13
CO1	illustrate the internal architecture and organization of 8086	3	3	2	2	3
CO2	analyze 8086 ALPs and interfacing devices	3	3	2	2	3
CO3	explain the architecture of 8051 microcontroller	3	3	2	3	3
CO4	interface memory, I/O and advanced peripherals with 8051	3	3	2	3	3
CO5	adapt the architecture and instruction set of ARM processor	3	3	2	3	3

Unit-I **9 hours**

8086 Architecture: Fundamentals of 8-bit microprocessor and 16-bit microprocessor, 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Signal descriptions of 8086, - Minimum mode and maximum mode of operation, Timing diagram, memory interfacing to 8086(static RAM and EPROM). Interrupts of 8086.Comparison of 8-bit microprocessor and 16-bit microprocessor

Unit-II **10 hours**

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.
Programmable Interfacing Devices: 8255 PPI-various modes of operation and interfacing to 8086. Interfacing key board and display controller- 8279, stepper motor and D/A and A/D converter interfacing, Interrupt structure of 8086, Vector interrupt table. Interrupt service routines. 8259 PIC architecture and interfacing cascading of interrupt controller and its importance.

Unit –III **(5 + 5) 10 hours**

Part –A:Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051,comparison of microprocessor and microcontroller.
Part-B: 8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters.

Unit-IV **9 hours**

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, UART; External Communication Interfaces-RS232, USB.

Unit-V **10 hours**

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.

Textbooks:

1. Advanced Microprocessors and Peripherals – A. K. Ray and K.M. Bhurchandani, 2nd Edn, TMH.
2. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed.

References:

1. Microprocessors and Interfacing, D. V. Hall, TMGH, 2nd Edition 2006.
2. ARM System Developers guide, Andrew N Sloss, Dominic Symes, Chris Wright, Elsevier, 2012

INTERNET OF THINGS

III-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PCC-315 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO6	PO7	PO12	PO13
CO1	explain IoT and its components	3	2	3	3	3	3
CO2	interface I/O devices, sensors and communication modules	3	2	3	3	3	3
CO3	design IoT methodology using python	3	3	3	3	3	3
CO4	solve IoT application frame work	3	3	3	3	3	3
CO5	develop IoT for real time applications	3	2	3	3	3	3

Unit-I: Fundamentals of IoT **10 hours**

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

Unit-II: Elements of IoT **10 hours**

Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces; Software Components- Programming API's (using Python/Node.js/Arduino) for Communication; Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

Unit-III: Developing IoT **(4 + 5) 9 hours**

Part A: Introduction, IoT Design Methodology. Installing Python, Python Data Types & Data Structures.

Part B: Logical Design using Python: Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations, Classes, Python Packages.

Unit-IV: IoT Application **10 hours**

Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Logistics, Agriculture, Industry, Health & Life Style; Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

Unit-V: IoT Case Studies **9 hours**

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

Textbook:

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.

References:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things -A hands -on approach", Universities Press, 2015, ISBN: 9788173719547
2. Manoel Carlos Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.
3. Marco Schwartz, "Internet of Things with the Arduino Yun", Packet Publishing, 2014.
4. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.

ANALOG AND DIGITAL COMMUNICATION LAB

III-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PCC-316 **- - 2 1**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PO14
CO1	test analog modulation and demodulation techniques	3	3	3
CO2	demonstrate time and frequency division multiplexing	3	3	3
CO3	design the pulse modulation and demodulation techniques	3	3	3
CO4	compare PCM , DPCM and DM	3	3	3
CO5	classify digital modulation and demodulation waveforms	3	3	3

Note: All these experiments are to be simulated and then realized in hardware.

List of Experiments (Minimum 12 experiments should be conducted):

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

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. FM-transmitter-circuit
2. Cell-phone-detector-circuit
3. FM-remote-encoder-decoder
4. Wireless-mobile-battery-charger
5. Street-lights-that-glow-on-detecting-vehicle-movement
6. RFID-based-attendance-system
7. Mobile-controlled-home-appliances
8. Wireless-electronic-notice-board
9. GSM based industrial security system
10. Wireless temperature alarm

Reference:

1. Analog and Digital Communication Lab Manual, Department of ECE, CMRIT, Hyd.

DIGITAL SIGNAL PROCESSING LAB

III-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PCC-317 **- - 2 1**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PO14
CO1	classify various types of signals and perform linear operations on the signals	3	3	3
CO2	compute linear and circular convolution	3	3	3
CO3	analyze the principles of DIT FFT and DIF FFT algorithms	3	3	3
CO4	design digital IIR and FIR filter using various techniques	3	3	3
CO5	apply Multirate concepts in sampling rate conversion applications	3	3	3

LIST OF EXPERIMENTS

Part-A (Minimum **10** experiments to be conducted using software**):**

1. Generation of Sinusoidal waveform / signal based on recursive difference equations.
2. Impulse and step response of first order and second order systems.
3. Find frequency response of a given system given in (Transfer Function / Diff. Equation Form).
4. Find DFT / IDFT of given DT signal.
5. Find linear convolution using Overlap-add and Overlap-Save method.
6. Find circular convolution of given two sequences.
7. Implementation of FFT of given sequence.
8. Determination of Power Spectrum of a given signal(s).
9. Implementation of LP and HP IIR filter for a given sequence.
10. Implementation of BP and BS IIR filter for a given sequence.
11. Implementation of LP and HP FIR filter for a given sequence.
12. Implementation of BP and BS FIR filter for a given sequence.
13. Implementation of Decimation Process.
14. Implementation of Interpolation Process.
15. Implementation of I/D sampling rate converters.

Part-B (Minimum **6** experiments to be implemented on hardware**):**

1. Generation of Sine wave and square wave.
2. Find frequency response of a given system given in (Transfer Function/ Diff. Equation Form).
3. Find DFT of given DT signal.
4. Linear convolution of given two sequences.
5. Implementation of FFT of given sequence.
6. Implementation of LP and HP IIR/FIR filter for a given sequence.
7. Implementation of Decimation Process.
8. Implementation of Interpolation Process.
9. Implementation of I/D sampling rate converters.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Person Identification Based On Teeth Recognition
2. Digital Watermarking To Hide Text Messages
3. Heart Rate Measuring device using Fingertip
4. Traffic Signs Detection using MATLAB
5. Improved Speech Communication in Car
6. Signature Verification System
7. Bone Fracture Detection System
8. Object Tracker Based on Color
9. Diabetic Retinopathy Detection From Retinal Images
10. Defect Detection In Ceramic Tiles

Reference:

1. Digital Signal Processing Lab Manual, Department of ECE, CMRIT, Hyd.

MICROPROCESSORS AND MICROCONTROLLERS LAB

III-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PCC-318 **- - 2 1**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PO14
CO1	interpret programs for various problems using 8086 microprocessor	3	3	3
CO2	develop interfacing between 8086 microprocessor and various peripherals	3	3	3
CO3	compile programs on Microcontroller based systems	3	3	3
CO4	interface 8051 ports with various peripherals	3	3	3
CO5	design Microprocessor and Microcontroller based systems	3	3	3

List of Experiments (Minimum of 14 experiments to be conducted):

1. Programs for 16 bit arithmetic operations for 8086 (using Various Addressing Modes).
2. Program for sorting an array for 8086.
3. Program for searching for a number or character in a string for 8086
4. Program for code conversions for 8086
5. Program for counting for number of add and even numbers in an array for 8086
6. Program for string manipulations for 8086.
7. Program for digital clock design using 8086.
8. Interfacing ADC and DAC to 8086.
9. Parallel communication between two microprocessors using 8255.
10. Serial communication between two microprocessor kits using 8251.
11. Interfacing to 8086 and programming to control stepper motor.
12. Programming using arithmetic, logical and bit manipulation instructions of 8051.
13. Program and verify Timer/Counter in 8051.
14. Program and verify Interrupt handling in 8051.
15. UART Operation in 8051.
16. Communication between 8051 kit and PC.
17. Interfacing LCD to 8051.
18. Interfacing Matrix/Keyboard to 8051.
19. Data Transfer from Peripheral to Memory through DMA controller 8237/8257.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Traffic light control
2. Digital clock
3. Display Controller
4. Digital Lock
5. Temperature Controller
6. A Bidirectional Visitors Counter
7. Water Level Controlling using Micro Controller
8. Electronic Voting Machine
9. Automated Street Lighting System
10. Access Control using RFID System

Reference:

1. Microprocessors and Microcontrollers Lab Manual, Department of ECE, CMRIT, Hyd.

INTERNET OF THINGS LAB

III-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PCC-319 **- - 2 1**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PO14
CO1	improve working on basic IoT devices	3	3	3
CO2	determine learning and utilization of IoT devices	3	3	3
CO3	develop automation work-flow in IoT enabled environment	3	3	3
CO4	recommend working on advance IoT systems	3	3	3
CO5	take part in practicing and monitoring remotely	3	3	3

List of Experiments (Minimum **10** experiments to be conducted**)**

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smart phone using Bluetooth.
6. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smart phone using Bluetooth.
7. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to cloud.
8. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from cloud.
9. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.
10. Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.
11. Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.
12. Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Air Pollution Meter.
2. Smart Garbage Collector.
3. SMART Garage Door.
4. Humidity & Temperature Monitoring.
5. Baggage Tracker.
6. Smart Trash Collector.
7. Liquid Level Monitor.
8. Circuit Breakage Detection.
9. Human Safety Night Patrolling IOT Project.
10. Anti-Theft Flooring System.

Reference:

1. Internet of Things Lab Manual, Department of ECE, CMRIT, Hyd.

EMPLOYABILITY SKILLS – I
MANDATORY COURSE (NON-CREDIT)

III-B.Tech.-I-Sem. **L T P C**
Subject Code: MC-311 **3 - - -**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO9	PO10
CO1	demonstrate verbal and written skills effectively	3	3
CO2	develop professional correspondence skills	3	3
CO3	build proficiency in quantitative reasoning	3	3
CO4	improve critical thinking skills	3	3
CO5	exhibit confidence in facing the interview process	3	3

Unit–I **10 Hours**

Verbal Ability: Fundamentals of Grammar - Sentence Structure - Parts of Speech.
Analytical Skills: Averages - Basic Concepts, combined mean, average principles, wrong values taken, number added or deleted, average speed.
Percentages - Basic Concepts, conversions, finding percentages from given numbers, quantity increases or decreases by given percentage, population increase by given percentage, comparisons, consumption when a commodity price increase or decrease and applications.
Data Interpretation - Introduction to Data Interpretation, quantitative and qualitative data, Tabular Data, Line Graphs, Bar Chart, Pie Charts, X-Y Charts.

Unit–II **10 Hours**

Verbal Ability: Synonyms and Antonyms, Homonyms and Homophones, Word Formation, Idioms and Phrases, Analogy, One-word Substitutes.
Analytical Skills: Reasoning - Number Series, Letter Series, Series completion and correction, Coding and Decoding.

Unit–III **(4 + 4) 8 Hours**

Part-A: Verbal Ability: Exercises on Common Errors in Grammar.
Analytical Skills: Word analogy-Applied analogy.

Part-B: Verbal Ability: Vocabulary Enhancement, Study skills and using a Dictionary.
Analytical Skills: Classifications, verbal classification.

Unit–IV **10 Hours**

Verbal Ability: Paragraph writing, Picture description, Text Completion, Essay writing.
Analytical Skills: Reasoning Logical Diagrams - Simple diagrammatic relationship, Multi diagrammatic relationship, Venn-diagrams, Analytical reasoning.

Unit–V **10 Hours**

Verbal Ability: Sentence Equivalence, Comparison and Parallelism, Letter writing and e-mail writing.
Analytical Skills: Reasoning Ability - Blood Relations, Seating arrangements, Directions, Decision making.

Activities List:

1. Regular cumulative practice tests.
2. Quiz, Crossword, Word-search and related activities.
3. Picture Description including Description of Photos/Images/Posters/Advertisement Analysis etc.,

Reference:

1. Employability Skills – I Manual, FED, CMRIT, Hyd.

SUMMER INTERNSHIP - I
MANDATORY COURSE (NON-CREDIT)

III-B.Tech.-I-Sem. **L T P C**
Subject Code: MC-312 - - - -

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1 to PO14
CO1	utilize the domain knowledge with modern tools to solve real world problems	3
CO2	analyze the industrial processes that results in the end product / service	3
CO3	extend global needs for professional ethics, responsibility and communication	3
CO4	function well as an individual, member or leader in diverse teams	3
CO5	make use of engineering knowledge for societal sustenance	3

Guidelines:

1. The student has to complete the internship for a period of 4 to 6 weeks during summer vacation between IV Semester & V Semester.
2. The internship can be carried out in any industry / R&D Organization / Research Institute / Premier Educational Institutes like IITs, NITs and IIITs etc.
3. The registration process of internship should be completed before the commencement of IV-semester end examinations.
4. The registration process for internship involves:
   a) Students have to approach respective course coordinator with name of proposed company / organization in which they wish to carry out internship.
   b) The Department shall nominate guide to supervise the interns.
   c) Student has to obtain a no objection certificate (NOC) in the prescribed format from the department and submit the same to the respective organization.
   d) Student has to submit acceptance letter issued by the respective organization to the course coordinator.
5. The internal guide has to visit place of internship at least once during student's internship.
6. The students shall report the progress of the internship to the guide in regular intervals and seek advice.
7. After the completion of Internship, students shall submit a final report along with internship and attendance certificates to the course coordinator with the approval of internal guide.
8. The evaluation of internship shall be done during V-Semester.
9. The student has to give a PPT presentation for duration of 10 to 15 minutes in the presence of departmental evaluation committee consists of Head of the Department, Internal Guide and Two Senior Faculty from the respective departments.
10. After the successful presentation by the student, the evaluation committee recommends the result as satisfactory for the internship. In case of students who have not registered for internship / not submitted the internship certificate and report, the V-Semester result will not be declared till completion.

III-B.TECH.-II-SEMESTER SYLLABUS

MICROWAVE ENGINEERING

III-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PCC-321 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO12	PO13
CO1	identify the need of microwaves and transmission line characteristics	3	2	2	3
CO2	analyze electromagnetic wave propagation and microwave components	3	3	2	3
CO3	explain the operation of various microwave tubes	3	2	2	3
CO4	determine measurement parameters using microwave equipments	3	3	2	3
CO5	develop microwave systems for various applications	3	3	2	3

Unit-I **9 hours**

Introduction to Microwaves: Microwave Spectrum. bands, advantages and applications.
Model of Microwave Transmission: Concept of mode, TE, TM and TEM modes, Impossibility of TEM mode, mode characteristics–Cut-off Frequencies, Phase & Group Velocities, Wavelengths, Impedance Relations, power transmission and Losses. Illustrative Problems.

Unit-II **10 hours**

Analysis of Microwave Transmission Lines: Rectangular Waveguides– solution of wave equations in rectangular coordinates, TE/TM mode analysis, expressions for fields, characteristic equation; Introduction to MMIC-Strip line, Micro strip line.
Passive Microwave Devices: Cavity Resonators, E plane, H plane &, Magic Tee, Directional Couplers and Attenuators; Ferrite Components – Faraday rotation, Gyrator, Isolator and Circulator.

Unit-III **(5 + 5) 10 hours**

Part-A: Active Microwave Devices: Microwave tubes- conventional tubes, limitations & losses; O-type Tubes-2 Cavity Klystron, Reflex Klystron and TWT Structure(Velocity Modulation Process and Applegate Diagram).

Part-B: M-Type Tubes: Cylindrical Traveling Wave Magnetron, PI-Mode Operation; Principle of operation of Gunn Diode and IMPATT diode.

Unit-IV **10 hours**

Scattering Matrix: Significance, Properties; S Matrix Calculations for E plane, H plane & Magic Tee, Circulator and Isolator, Illustrative Problems.
Microwave Measurements: Description of Microwave Bench, Power (Bolometer), Attenuation, Frequency, Standing Wave and Impedance Measurements.

Unit-V **9 hours**

Microwave systems: Introduction to Radar, Satellite Communication, RFID and GPS.
Modern Trends in Microwaves Engineering: Effect of Microwaves on human body, Microwave Imaging, Medical, Civil and Military, EMI/ EMC.

Textbooks:

1. R.E. Collins, Microwave Circuits, TMH.
2. K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house.

References:

1. Pozar, Microwave Engineering, wiley publishers, 4th Third Edition, 2012.
2. M.L. Sisodia and G.S.Raghuvanshi, Microwave Circuits and Passive Devices, Wiley Eastern Ltd., New Age International Publishers Ltd., 1995.
3. Samuel Y. Liao, “Microwave Devices and Circuits”, PHI, 3rd Edition, 1994.
4. M. Kulkarni, “Microwave and Radar Engineering”, Umesh Publications1998

VLSI DESIGN

III-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PCC-322 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO7	PO12	PO13
CO1	interpret various MOS transistor fabrication techniques	3	2	3	3	3
CO2	illustrate operation and electrical characteristics of MOS transistor	3	2	2	3	3
CO3	discuss VLSI Design flow, Stick diagrams, layout, design rules	3	3	2	3	3
CO4	outline the concepts of MOS circuits	3	3	2	3	3
CO5	interpret scaling and various levels of CMOS testing	3	3	2	3	3

Unit-I **9 hours**

Introduction: Introduction to IC technology, Basic MOS transistors, Enhancement and depletion modes of transistor action. Fabrication process of NMOS, PMOS,CMOS and Bi-CMOS technology and comparison between CMOS and bipolar technologies.

Unit-II **10 hours**

Basic Electrical properties of MOS circuits: Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds. CMOS Inverter analysis and design, Bi-CMOSInverters.MOS Transistor conductance and output conductance, MOS transistor figure of merit, Pass transistors, nMOS inverter , Determination of pull up to pull down ratio for an nMOS inverter driven by another nMOS inverter and for an nMOS inverter driven through one or more pass transistors, Alternate forms of pull up, CMOS inverter, BiCMOS Inverters.

Unit-III **(5 + 5) 10 hours**

Part-A: VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2μm CMOS Design rules for wires, Contacts and Transistors.

Part-B: Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

Unit-IV **9 hours**

Basic concepts of MOS Circuits: Sheet resistance, Sheet resistance concept applied to MOS transistors and inverters, Area capacitance of layers , standard unit of capacitance, some area capacitance calculations, The delay unit, inverter delays, Driving large capacitance loads, Propagation delays, wiring capacitances, Fan-in and Fan-out characteristics, Choice of layers, CMOS steady state electrical behavior, CMOS dynamic electrical behavior.

Unit-V **10 hours**

Scaling of MOS Circuits: Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling.
CMOS Testing: Need for CMOS testing, design strategies for test Manufacturing test principles, Design for testability (DFT) - Adhoc testing, Scan design, Built in self-test (BIST).

Textbooks:

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

References:

1. CMOS logic circuit Design - John. P. Uyemura, Springer, 2007.
2. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.

ARTIFICIAL INTELLIGENCE

III-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PCC-323 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO6	PO12	PO13
CO1	explain the concepts of artificial intelligence	3	3	3	3	2	3
CO2	illustrate various search algorithms	3	3	3	3	2	3
CO3	adapt various probabilistic reasoning approaches	3	3	2	3	3	3
CO4	elaborate Markov decision process	3	3	2	3	2	3
CO5	perceive various reinforcement learning approaches	3	3	2	3	3	3

Unit-I: Introduction **8 Hours**

Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree.

Unit-II: Search Algorithms **10 Hours**

Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.

Unit-III: Probabilistic Reasoning **(6 + 4) 10 Hours**

Part-A: Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference.

Part-B: Temporal Model, Hidden Markov Model.

Unit-IV: Markov Decision Process **10 Hours**

MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.

Unit-V: Reinforcement Learning **10 Hours**

Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning.

Textbooks:

1. Elaine Rich & Kevin Knight, 'Artificial Intelligence', 3rd Edition, TMH, 2008.
2. Russel and Norvig, 'Artificial Intelligence', Pearson Education, PHI, 2003.

References:

1. Trivedi, M.C., "A Classical Approach to Artifical Intelligence", Khanna Publishing House, Delhi.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011.
3. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010.

INFORMATION THEORY AND CODING
(Professional Elective –I)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PEC-301 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO8	PO12	PO13
CO1	apply the concepts of information theory and entropy	3	3	3	2	3
CO2	explain communication channel models	3	3	2	2	3
CO3	analyze various channel coding techniques	3	3	2	2	3
CO4	design BCH codes	3	3	3	2	3
CO5	develop error control codes	3	3	3	2	3

Unit-I **9 hours**

Information Entropy Fundamentals: Uncertainty, Information theory, Information rate, entropy for discrete ensembles, Source coding Theorem, Huffman coding, Shannon-Fano coding, Encoding of discrete sources, Markov sources.

Unit-II **10 hours**

Information Channels: Communication channel models, channel matrix, Joint probability matrix, Mutual Information, Discrete Memory less channels, channel capacity, channel coding theorem, channel capacity theorem, channel capacity of: Binary Symmetric channel, Continuous channels and applications.

Unit-III **(5 + 7) 12 hours**

Part-A: Block Codes: Types of codes, Definitions and Principles of Linear block codes, Hamming weight, Hamming distance, Hamming codes -Error correction and detection, Minimum distance decoding - Single parity codes.

Part-B: Cyclic Codes: Properties of cyclic codes, Syndrome calculation and error detection, Encoding and decoding of cyclic codes.

Unit-IV **8 hours**

BCH Codes: Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials and examples.

Unit-V **10 hours**

Error Control Coding: Convolutional codes–code tree, trellis, state diagram, encoding and decoding. Sequential search and Viterbi algorithm; Principle of Turbo coding, Comparison of Error Rates in Coded and Uncoded Transmission.

Textbooks:

1. Information Theory, Coding and Cryptography, R Bose, TMH, 2007
2. Information and Coding, N. Abramson, TMH, 1963.

References:

1. Introduction to Data Compression, K Sayood, 3/e, Elsevier 2006
2. Introduction to Error Control Codes, S Gravano, Oxford University Press 2007
3. Digital Communication, Amitabha Bhattacharya, TMH 2006

DATA MINING AND ANALYTICS
(Professional Elective –I)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PEC-302 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12
CO1	summarize fundamentals of data mining	3	2	2	2
CO2	illustrate various mining association rules	3	3	2	2
CO3	make use of classification and clustering techniques	3	3	3	2
CO4	outline various data analytics techniques	3	2	2	2
CO5	solve statistical problems using R programming	3	3	3	3

Unit-I **8 hours**

Introduction to Data Mining: Kinds of Data, Data mining Functionalities – Interesting Patterns Task Primitives, Issues in Data Mining, Data Preprocessing.

Unit-II **10 hours**

Mining Frequent, Associations and Correlations: Basic Concepts, Frequent Itemset Mining Methods:, Apriori Algorithm: Finding Frequent Itemsets by Confined Candidate Generation, Generating Association Rules from Frequent Itemsets, Improving the Efficiency of Apriori, From Association Analysis to Correlation Analysis.

Unit-III **(6 + 6) 12 hours**

Part-A: Classification: Basic Concepts, Algorithm for Decision Tree Induction, Attribute Selection Measures. Bayes Classification Methods, Bayesian Belief Networks, a Multilayer Feed-Forward Neural Network, k-Nearest-Neighbor Classifiers.

Part-B: Clustering: Cluster Analysis, Partitioning Methods: k-Means and k-Medoids, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering.

Unit-IV **9 hours**

Data Definitions and Analysis Techniques: Introduction to statistical learning and R-Programming, Elements, Variables, and Data categorization, Levels of Measurement, Data management and indexing.

Unit-V **9 hours**

Basic Analysis Techniques: Statistical hypothesis generation and testing, Chi-Square test, t-Test, Analysis of variance, Maximum likelihood test, regression, Practice and analysis with R.

Textbooks:
1. Data Mining- Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006.
2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.
3. An Introduction to Statistical Learning: with Applications in R, G James, D. Witten, T Hastie, and R. Tibshirani, Springer, 2013.

References:
1. Data mining Techniques and Applications, Hongbo Du Cengage India Publishing
2. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
3. Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer.

DIGITAL IMAGE PROCESSING
(Professional Elective –I)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PEC-303 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO5	PO12	PO13
CO1	explain image fundamentals and transforms	3	2	2	3
CO2	utilize image enhancement and color image processing techniques	3	3	3	3
CO3	make use of image restoration techniques and wavelets	3	3	3	3
CO4	apply image segmentation and morphological image processing	3	3	3	3
CO5	analyze image compression techniques	3	3	3	3

Unit-I **9 hours**

Digital Image Fundamentals: Elements of visual perception, image sensing and acquisition, image Sampling and quantization; basic relationships between pixels–neighborhood, adjacency, Connectivity, distance measures.
Image Transforms: 2-D FFT, Walsh, Hadamard, Discrete Cosine, Haar, Slant and Hotelling Transforms, properties.

Unit-II **10 hours**

Image Enhancements and Filtering: Gray level transformations, histogram equalization and Specifications; pixel-domain smoothing filters – linear and order-statistics; pixel-domain sharpening filters – first and second derivative; frequency domain filters – low-pass and high-pass.
Color Image Processing: Color models–RGB, YUV, HSI; Color transformations– formulation, Color complements, color slicing, tone and color corrections; Color image smoothing and Sharpening; Color Segmentation.

Unit-III **(5 + 5) 10 hours**

Part-A: Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, LMS Filters, Constrained Least Squares Restoration, Interactive Restoration.

Part-B:Wavelets and Multi-resolution image processing: Uncertainty principles of Fourier Transform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution Analysis, wavelets and Sub band filter banks, wavelet packets.

Unit-IV **10 hours**

Image Segmentation: Detection of discontinuities, edge linking and boundary detection; thresholding–global and adaptive; region-based segmentation.
Morphological Image Processing: Dilation-Structuring Element Decomposition; Erosion; Combining Dilation and Erosion; Opening and Closing, Hit or Miss Transformation.

Unit-V **9 hours**

Image Compression: Redundancy–inter-pixel and psycho-visual; Lossless compression –predictive, entropy; Lossy compression- predictive and transform coding; Still image compression standards – JPEG and JPEG-2000.

Textbooks:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, 3rd edition 2008, Pearson Education.

References:

1. Anil Kumar Jain, Fundamentals of Digital Image Processing, 2nd edition 2004, PHI.

OPERATING SYSTEMS
(Professional Elective –I)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PEC-304 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	outline various concepts operating systems and Linux utilities	3	3	2
CO2	solve synchronization problems by using process management and API s	3	3	2
CO3	adapt various deadlock handling and memory management mechanism	3	3	2
CO4	analyze various file management system	3	3	2
CO5	make use of I/O Management and security mechanisms	3	3	2

Unit-I **9 hours**

Operating Systems Overview: Introduction, Operating System Objectives and functions, Evolution of operating System, Example Systems.
Operating Systems Structures: Operating system services and systems calls, system programs, operating system structure.

Unit-II **10 hours**

Process Management: Process concepts, process state, process control block, scheduling queues, process scheduling, Threads Overview, Threading issues.
Concurrency and Synchronization: Cooperating Processes, Inter-process Communication, Principles of Concurrency, Mutual Exclusion, Software and hardware approaches, Semaphores, Monitors, Message Passing, and Classic problems of synchronization.

Unit-III **(5 + 5) 10 hours**

Part-A: Deadlocks: System model, deadlock characterization, deadlock prevention, detection and avoidance, recovery from deadlock banker‘s algorithm.

Part-B: Memory Management: Basic concepts, swapping, contiguous memory allocation, paging, structure of the page table, segmentation, virtual memory, demand paging, page-replacement algorithms, thrashing.

Unit-IV **10 hours**

File Management System: Concept of a file, access methods, directory structure, file system mounting, file sharing, protection. File system implementation: file system structure, file system implementation, directory implementation, allocation methods, free-space management, efficiency and performance.

Unit-V **9 hours**

I/O Management System: Mass storage structure - overview of mass storage structure, disk structure, disk attachment, disk scheduling algorithms, swap space management, stable storage implementation, tertiary storage structure.
Protection & Security: Protection mechanisms, OS Security issues, threats, Intruders, Viruses.

Text Books:
1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles, 10th Edition, 2018, Wiley India Private Limited, New Delhi.
2. Internal and Design Principles, Stallings, 5th Edition, 2005, Pearson education, PHI.

References:
1. Andrew S. Tanenbaum, Modern Operating Systems, 2nd Edition, 2007, PHI, India.
2. Operating System a Design Approach-Crowley, TMH.
3. Operating Systems – A concept based approach – DM Dhamdhere, 2nd Edition, TMH.

DISASTER MANAGEMENT
(Open Elective - I)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-301 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO7	PO8	PO12
CO1	analyze impact of disasters	3	2	3	3
CO2	choose suitable disaster management mechanism	3	3	3	3
CO3	make use of appropriate measures for capacity building to reduce risks	2	2	3	2
CO4	develop strategies to cope up with disasters	3	3	3	3
CO5	build disaster management plan	2	3	3	3

Unit-I **10 hours**

Understanding Disaster: Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional)
Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards

Unit–II **9 hours**

Disaster Management Mechanism: Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

Unit-III **(5 + 5)10 hours**

Capacity Building: Capacity Building: Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

Unit- IV **9 hours**

Coping with Disaster: Coping Strategies; alternative adjustment processes – Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management.

Unit-V **10 hours**

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India Organizational structure for disaster management in India - Preparation of state and district, Disaster management plans.

Textbooks:

1. Manual on Disaster Management, National Disaster Management, Agency Govt. of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.
3. Disaster Science and Management by T. Bhattacharya, TMH, 2015.

References:

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BSP 2009.
2. National Disaster Management Plan, Ministry of Home affairs, Government of India. (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

FUNDAMENTALS OF OPERATIONS RESEARCH
(Open Elective-I)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-302 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	formulate and solve linear programming problem using various methods	3	2	3
CO2	solve transportation and assignment problems	3	3	3
CO3	compute sequencing and inventory model problems	2	2	3
CO4	analyze waiting lines and game theory problems	3	3	3
CO5	evaluate replacement and dynamic programming problems	2	3	3

Unit-I **10 hours**

Introduction to Operations Research: Basics definition, scope, objectives, phases, models, applications and limitations of Operations Research.
Linear Programming Problem Formulation, Graphical solution, Simplex method, Artificial variables techniques: Two-phase method, Big M method.

Unit-II **9 hours**

Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: MODI method.
Assignment model: Formulation. Hungarian method for optimal solution. Solving unbalanced problem. Traveling salesman problem and assignment problem.

Unit-III **(5 + 5) 10 hours**

Part-A: Sequencing: Introduction, Flow-Shop sequencing, n jobs through two machines, n jobs through three machines, Job shop sequencing, two jobs through m machines.

Part-B: Inventory: Introduction, Single item, Deterministic models - Purchase inventory models with one price break and multiple price breaks -Stochastic models - demand may be discrete variable or continuous variable - Single Period model and no setup cost.

Unit-IV **10 hours**

Theory of Games: Introduction, Terminology- Solution of games with saddle points and without saddle points- 2 x 2 games, dominance principle, m x 2 & 2 x n games -graphical method.
Waiting Lines: Introduction, Terminology-Single Channel-Poisson arrivals and Exponential Service times-with infinite population and finite population models-Multichannel-Poisson arrivals and exponential service times with infinite population.

Unit-V **9 hours**

Dynamic Programming: Introduction, Terminology - Bellman's Principle of Optimality - Applications of dynamic programming- Project network - CPM and PERT networks - Critical path scheduling.

Text Books:

1. Operations Research, J.K.Sharma 4th Edition, Mac Milan.
2. Introduction to O. RIHilIier & Libermannf, TMH.

References:

1. Introduction to O.R, Hamdy A. Taha, PHl.
2. Operations Research, A.M.Natarajan, P. Balasubramaniam, A.Tamilarasi, Pearson Education.
3. Operations Research I Wagner, PHI Publications.

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION
(Open Elective-I)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-303 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	apply the fundamental concepts of measuring instruments	3	2	2
CO2	distinguish signal generators and signal analyzers	3	3	2
CO3	make use of oscilloscopes	3	2	2
CO4	identify various transducers	3	3	2
CO5	develop bridges for various measuring parameters	3	2	2

Unit-I **10 hours**

Block Schematics of Measurement: Performance characteristics-static characteristics, dynamic characteristics; measuring instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC voltmeters and Current Meters, Ohmmeters, Multi-meters; meter protection; Extension of Range; True RMS Responding voltmeters; specifications of instruments.

Unit-II **9 hours**

Signal Analyzers: AF, HF Wave Analyzers, Heterodyne wave Analyzers, Power Analyzers; capacitance-voltage Meters; oscillators; signal generators-sweep frequency generators: AF, RF, pulse and square wave, arbitrary waveform & function generators and Specifications.

Unit-III **(5 + 5) 10 hours**

Part-A: Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, CRO Probes. Applications-measurement of Time period and frequency specifications.

Part-B: Special Purpose Oscilloscopes: introduction to dual trace, dual beam CROs, sampling oscilloscopes, storage oscilloscopes, digital storage CROs.

Unit-IV **10 hours**

Transducers: Classification of transducers; force and displacement transducers; resistance thermometers; hotwire anemometers; LVDT; thermocouples, Synchros, special resistance thermometers; digital temperature sensing system; Piezoelectric; variable capacitance transducers; magneto strictive transducers.

Unit-V **9 hours**

Bridges: Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge; measurement of physical parameters-flow, displacement, level, humidity, moisture, force, pressure, vacuum level, temperature measurements; data acquisition systems.

Textbooks:

1. Electronic Instrumentation: H.S.Kalsi, TMH 2nd Edition 2004.
2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D.Cooper: PHI, 5th Edition, 2003.

References:

1. Electronic Instrumentation and Measurements- David A. Bell, Oxford Univ. Press, 1997.
2. Electronic Measurements and Instrumentation K. Lal Kishore, Pearson Education 2010.

JAVA PROGRAMMING
(Open Elective-I)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-304 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO5	PO12
CO1	write simple java programs using OOP concepts	3	2	2	3	2
CO2	develop programs using inheritance and polymorphism	3	2	3	3	2
CO3	create packages and interfaces	3	2	3	3	2
CO4	build efficient code using multithreading and exception handling	3	2	3	3	2
CO5	design real-time applications using applets	3	2	3	3	2

Unit-I **10 hours**

Java Basics: History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, OOP concepts, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, parameter passing, recursion, exploring String class.

Unit-II **9 hours**

Inheritance and Polymorphism: Types of inheritance, member access rules, super uses, using final with inheritance, the object class and its methods, method overloading and overriding, dynamic binding, abstract classes and methods.

Unit-III **(5 + 5) 10 hours**

Part-A: Packages and Inner classes: Defining, creating and accessing a package, CLASSPATH, importing packages, inner classes – local, anonymous and static.

Part-B: Interfaces: Defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces, differences between classes and interfaces.

Unit-IV **9 hours**

Exception handling: Concepts of exception handling, benefits of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes.
Multithreading: Differences between multi-threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication.

Unit-V **10 hours**

Applets: Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.

Textbooks:

1. Java the complete reference, 8th Edition, Herbert Schildt, TMH.

References:

1. Java How to Program, H. M. Dietel and P. J. Dietel, Sixth Edition, Pearson Education, PHI.
2. Introduction to Java programming, Y. Daniel Liang, Pearson Education.

INDIAN CULTURE AND CONSTITUTION
(Open Elective-I)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-305 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO8	PO12
CO1	identify paradigm shift in indian culture	3	1
CO2	explain features of languages, religions and holy books	3	2
CO3	illustrate provisions of Indian constitution	3	3
CO4	appreciate the structure of Indian administration system	3	3
CO5	appraise the role of Election Commission of India	3	2

Unit –I **10 hours**

Indian Culture: Characteristics of Indian culture, significance of geography on Indian culture, society in India through ages, religions in ancient period, caste system, communalism and modes of cultural exchange.

Unit-II **9 hours**

Indian Languages, Religions and Literature: Evolution of script and languages in India, the Vedas and holy books of various religions. religion and philosophy in India; ancient period – Prevedic, Vedic religion, Buddhism and Jainism.

Unit-III **(5 + 5) 10 hours**

Part A: Indian Constitution: Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Fundamental Rights and Duties.

Part B: Union Administration: Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.

Unit-IV **10 hours**

State Administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Structure and functions Election Commission: Role and Functioning.
District's Administration: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Unit-V **9 hours**

Local Administration: Introduction to local self government, Organizational Hierarchy (Different departments), ZP administration, Mandal level and Village level administration.
Election Commission: Role, structure and Functions of Election Commission of India. Introduction to different welfare boards.

Reference:

1. A Hand Book on Indian Culture and Constitution, FED, CMRIT, Hyderabad.

MICROWAVE ENGINEERING LAB

III-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PCC-324 **- - 2 1**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PO14
CO1	interpret the characteristics of microwave devices	3	3	3
CO2	determine scattering parameters of various microwave components	3	3	3
CO3	analyze various parameters of waveguide components	3	3	3
CO4	measure VSWR and antenna pattern	3	3	3
CO5	design a microwave communication link using microwave bench	3	3	3

LIST OF LAB EXPERIMENTS (Minimum 10 experiments to be conducted)

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Directional Coupler Characteristics.
4. VSWR Measurement.
5. Measurement of Waveguide Parameters.
6. Measurement of Impedance of a given Load.
7. Measurement of Scattering Parameters of E plane Tee.
8. Measurement of Scattering Parameters of H plane Tee.
9. Measurement of Scattering Parameters of Magic Tee.
10. Measurement of Scattering Parameters of Circulator.
11. Attenuation Measurement.
12. Microwave Frequency Measurement.
13. Antenna Pattern Measurements.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Electronic tuning range of a Reflex Klystron
2. Directivity of a Directional Coupler
3. Transmission Coefficient of Various loads
4. Reflection Coefficient of a Matched Termination
5. Return loss of a SS Tuner
6. VSWR of a Horn antenna
7. Electronic tuning sensitivity of a Reflex klystron
8. Attenuation of a fixed attenuator
9. Properties of an E and H Plane TEE
10. Properties of a MAGIC TEE

Reference:

1. Microwave Engineering Lab Manual, Department of ECE, CMRIT, Hyd.

VLSI DESIGN LAB

III-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PCC-325 **- - 2 1**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PO14
CO1	test logic gates	3	3	3
CO2	design combinational circuits	3	3	3
CO3	develop sequential circuits	3	3	3
CO4	analyze finite state machines	3	3	3
CO5	construct CMOS circuit schematics and their layouts	3	3	3

List of Experiments (Any **six** experiments from each part are to be conducted):

Design and implementation of the following CMOS digital/analog circuits using **Cadence / Mentor Graphics / Synopsys / Equivalent** CAD tools:

E-CAD programs: Programming can be done using any complier. Down load the programs on FPGA/CPLD boards and performance testing may be done using pattern generator (32 channels) and logic analyzer apart from verification by simulation with any of the front end tools.

1. HDL code to realize all the logic gates.
2. Design of 2-to-4 decoder.
3. Design of 8-to-3 encoder (without and with priority).
4. Design of 8-to-1 multiplexer and 1-to-8 demultiplexer.
5. Design of 4 bit binary to gray code converter.
6. Design of 4 bit comparator.
7. Design of Full adder using 3 modeling styles.
8. Design of flip flops: SR, D, JK, T.
9. Design of 4-bit binary, BCD counters (synchronous / asynchronous reset).
10. Finite State Machine Design.

VLSI programs: Introduction to layout design rules - Layout, physical verification, placement & route for complex design, static timing analysis, IR drop analysis and crosstalk analysis of the following:

1. CMOS inverter.
2. CMOS NOR / NAND gates.
3. CMOS XOR gates.
4. CMOS MUX gates.
5. CMOS half / full adder.
6. Static / Dynamic logic circuit (register cell).
7. Latch.
8. Pass transistor.
9. Layout of any combinational circuit (complex CMOS logic gate).
10. Analog Circuit simulation (AC analysis) – CS and CD amplifier.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Design and Implementation of a Barrel Shifter.
2. Design of FIFO memory using Verilog.
3. Design of 7T SRAM cell.
4. Design 16 bit RISC processor.
5. Design Car parking system using Verilog.
6. Design a Ripple carry Adder.
7. Design a ring counter using Verilog.
8. Design a Alarm clock on FPGA using Verilog.
9. Design a multiplier using Carry look Ahead Adder
10. Design a 5 to 32 Decoder using Verilog.

Reference:

1. VLSI Design Lab Manual, Department of ECE, CMRIT, Hyd.

ARTIFICIAL INTELLIGENCE LAB

III-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PCC-326 **- - 2 1**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PO14
CO1	illustrate various search techniques	3	3	3
CO2	solve real-time problems using graph theory	3	3	3
CO3	develop various games using AI techniques	3	3	3
CO4	adapt Bayesian probability model	3	3	3
CO5	design programs based on Markov decision process	3	3	3

List of Experiments (Using Python)

1. Write a program to implement BFS Traversal.
2. Write a program to implement DFS Traversal.
3. Write a program to implement A* Search.
4. Write a program to implement Travelling Salesman Problem.
5. Write a program to implement Graph Coloring Problem.
6. Write a program to implement Missionaries and Cannibals Problem.
7. Write a program to implement Water Jug Problem.
8. Write a program to implement Hangman game.
9. Write a program to implement Tic-Tac-Toe game.
10. Write a program to implement 8 Queens Problem
11. Write a program to implement Bayesian Network.
12. Write a program to implement Hidden Markov Model.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Intelligent vehicles using Artificial Intelligence.
2. Smart ICU Predictive detection of deterioration of seriously ill patients using Artificial Intelligence.
3. Artificial Intelligence Innovation.
4. Prevention against Cyber security Threats using Artificial Intelligence.
5. Efficient, Scalable Processing of Patient Data using Artificial Intelligence.
6. Smart Bike Share Programs using Artificial Intelligence.
7. Automatic Document Classification using Bayesian theorem.
8. Automated Geophysical Feature Detection using Artificial Intelligence.
9. Artificial Intelligence for Records Management.
10. Artificial Intelligence in e-Commerce.

Reference:

1. Artificial Intelligence Lab Manual, Department of CSE, CMRIT, Hyd.

ADVANCED ENGLISH COMMUNICATION SKILLS LAB

III-B.Tech.-II-Sem. **L T P C**
Subject Code: HSMC-301 **1 - 2 2**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO5	PO10
CO1	assess and utilize vocabulary in an effective way	3	3
CO2	interpret interpersonal relationships	3	3
CO3	elaborate academic reading and writing skills	3	3
CO4	formulate appropriate communication techniques in various contexts	3	3
CO5	adapt to different work-place and socio-cultural scenarios	3	3

List of Experiments:

Week 1 & 2: Importance of Non-Verbal Communication – Synonyms and Antonyms, One-word substitutes, Prefixes and Suffixes, Idioms, Phrases and Collocations.

Week 3: Conversations, Self introduction, Role Play.

Week 4: General Vs Local Comprehension, Reading for Facts, Guessing Meaning from context, Skimming, Scanning, Inferring Meaning.

Week 5: Unseen Passages on various topics.

Week 6 & 7: Structure and Presentation of different types of Writing – e-correspondence / Technical Report Writing.

Week 8: Letter Writing, Resume Writing, CV, E-mail Writing, Memo Writing.

Week 9 & 10: Oral Presentations (individual or group) and Written Presentation through Posters/ Projects / Reports / e-mails / Assignments, etc.

Week 11: JAMs, Seminars, PPTs, Debate Sessions

Week 12 & 13: Dynamics of Group Discussion, Organization of Ideas and Rubrics of Evaluation – Concept and Process, Interview Preparation Techniques.

Week 14: Group Discussion and Mock Interviews.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Role Play / Debate
2. Office Communication
3. Presentation Skills
4. Public Speaking
5. Interview Skills
6. Telephone Skills
7. Article Writing
8. Workplace etiquette
9. Video Resume / resume writing
10. Group Discussion

Reference:

1. Advanced English Communication Skills Lab Manual, FED, CMRIT, Hyd.

EMPLOYABILITY SKILLS – II
MANDATORY COURSE (NON-CREDIT)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: MC-321 **3 - - -**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO9	PO10
CO1	make use of soft skills to become a professional team member	3	3
CO2	develop professional correspondence skills	3	3
CO3	apply knowledge of decision making, leadership, motivation	3	3
CO4	adapt principles of quantitative aptitude to achieve qualitative results	3	3
CO5	exhibit confidence in facing the interview process	3	3

Unit-I **10 Hours**

Soft Skills:

Introduction to Soft Skills: Self awareness and Self esteem, Discipline, Integrity, Attitude, Change and Adaptability.

Quantitative Aptitude:

Number Systems: Basic Concepts, Number Systems: Natural numbers, whole numbers, integers, fractions, Rational Numbers, Irrational Numbers, Real Numbers, Divisibility Rules, Logic Equations, Remainder theorem, Unit digit calculation

Progressions & Inequalities: Basic Concepts, Types: arithmetic, geometric, harmonic progression and applications.

Unit-II **9 Hours**

Soft Skills:

People Skills: Relationships - Personal & Professional Relationships – Rapport Building – Personal Space; Definition of Motivation –Motivation – Self-motivation; Time Management – Stephen Covey's time management.

Quantitative Aptitude:

Profit and Loss: Basic Concepts, discounts, marked price and list price, dishonest shopkeeper with manipulated weights, successive discounts etc.

Interest (Simple and Compound): Basic Concepts, Yearly, Half-yearly, and quarterly calculations, multiples, differences between simple and compound interest.

Ratio and Proportion: Basic Concepts of ratio and proportion, continued or equal proportions, mean proportions, invest proportion, alternative proportion, division proportion, compound proportion, duplication of ratio, finding values, coins and currencies, etc.

Unit–III **(5 + 5) 10 Hours**

Part-A:

Soft Skills:

Teamwork: Definition of Team, Team Dynamics – Specialization and Teamwork – Rewards of Teamwork.

Quantitative Aptitude:

Speed, Time and Distance: Basic Concepts, Single train problems, two train problems: some point same side, some point opposite sides, relative speed, different points meeting at common points, different points same side (different timings vs. same timings), ratios, number of stoppages, average speed, etc.

Part-B:

Soft Skills:

Leadership: Definition of Leadership, Leading a Team, Leadership Qualities – Leader vs Manager – Leadership Styles.

Quantitative Aptitude:

Time and Work: Basic Concepts, comparative work, mixed work, alternative work, middle leave and middle join, ratio efficiency.

Unit-IV **10 Hours**

Soft Skills:

Problem Solving and Decision Making: Definitions – Problem Solving and Decision Making – Hurdles in Decision Making - Case studies.

Quantitative Aptitude:

Permutations and combinations: Basic Concepts, differences between permutations and combinations, always together-never together, alternative arrangement, fixed positions, double fixations, items drawing from a single group, items drawing from a multiple group, total ways of arrangement with repetitions and without repetitions, dictionary, handshakes or line joining between two points or number of matches , sides and diagonals, etc.
Clocks and Calendars: Basic Concepts, Angle between minute hand and hour hand, reflex angle, hours hand angle, time gap between minute hand and hour hand, relative time: coincide, opposite sides and right angle, mirror images, faulty clock (slow/fast), miscellaneous, calendar.

Unit-V **9 Hours**

Soft Skills:

Preparation for Interviews: Body Language – Posture - Dressing and Grooming – Researching the Industry and the Organization- Types of Interviews – First Impressions – Dos and Don'ts of an Interview.

Quantitative Aptitude:

Geometry and Mensuration: Basic concepts, types of angles.
Plane figures: rectangles, squares, triangles, quadrilateral, areas, perimeters, etc.
Solid figures: cubes, cuboids, cylinders-area (total surface area and lateral surface area), volumes, perimeters.
Others: Parallelogram, Rhombus, Trapezium, Circle, Sector, Segment, Cone, Sphere, Hemisphere, etc.

Activities List:

1. Regular cumulative practice tests
2. Quiz, Crossword, Word-search and related activities
3. 5-minute presentations about concepts learnt
4. JAM and Picture Narration.
5. Mock Interviews.

Reference:

1. Employability Skills – II Manual, FED, CMRIT, Hyd.

IV-B.TECH.-I-SEMESTER SYLLABUS

DATA COMMUNICATION & COMPUTER NETWORKS

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PCC-411 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO12	PO13
CO1	explain basics of networking and physical layer	3	2	3
CO2	interpret protocols of data link layer	3	2	3
CO3	illustrate network layer and communication protocols	3	2	3
CO4	outline transport layer protocols	3	2	3
CO5	make use of various protocols of application layer	3	2	3

Unit-I **09 hours**

Basics of Networking: Components – Direction of Data flow – Networks – Components and Categories – Types of Connections – Topologies – Protocols and Standards – ISO /OSI model, TCP/IP model.
Physical layer: Digital transmission, Multiplexing, Transmission Media, Switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks.

Unit-II: Data link layer **11 hours**

Functionalities of Data link layer - Introduction, Framing, Error Detection and Correction – Parity – LRC – CRC- Hamming code, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC, Point to Point Protocols. Random access, Controlled access, Channelization, Collision Free Protocols.
LAN - LAN - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11

Unit-III **09 hours**

Part-A: Basics of Network Layer - Logical Addressing, Internetworking, Tunneling, Address mapping.

Part-B: Communication Protocols - ICMP, IGMP, Forwarding, Unicast Routing Protocols, Multicast Routing Protocols.

Unit-IV: Transport Layer **10 hours**
Connection Oriented and Connectionless Protocols - Process to Process Delivery,UDP and TCP protocols, SCTP.
Congestion Control - Data Traffic, Congestion, Congestion Control, QoS, Integrated Services, Differentiated Services, QoS in Switched Networks.

Unit-V: Application layer **10 hours**

DNS - Domain name space, DNS in internet, Electronic mail.
Protocols and Network Security - FTP, WWW, HTTP, SNMP, Network Security, Cryptography.

Textbooks:

1. Behrouz A. Forouzan, “Data Communications and Networking”, 4thEdition, TMH, 2006.
2. Andrew S Tanenbaum, “Computer Networks”, 4th Edition, Pearson Education/PHI.

References:

1. P.C. Gupta, “Data communications and computer Networks”, PHI.
2. S.Keshav, “An Engineering Approach to Computer Networks”, 2nd Edition, Pearson Education.

SATELLITE COMMUNICATIONS
(Professional Elective – II)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PEC-401 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO6	PO12	PO13
CO1	summarize orbital effects on satellite communications	3	2	3	2	3
CO2	interpret the subsystems of satellite	3	3	3	3	3
CO3	classify various multiple access and spread spectrum techniques	3	3	2	2	3
CO4	compare satellite subsystems with earth station technology	3	3	3	2	3
CO5	outline the satellite navigation and global positioning system	3	3	3	3	3

Unit-I **10 hours**

Introduction: Brief history of Satellite systems; Principles, architecture, advantages, disadvantages, applications and frequency bands used for satellite communication.
Orbital Mechanics and Launchers: Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbital determination, Launches and Launch vehicles, Orbital effects in communication systems performance.

Unit–II **9 hours**

Satellite Subsystems: Attitude and Orbit control system, Telemetry, Tracking, Commanding and Monitoring, Power Systems, Communication Subsystems, Satellite antennas, Equipment reliability and Space qualification.

Unit-III **(5 + 5) 10 hours**

Part-A: Multiple Access: Frequency Division Multiple Access (FDMA), Intermodulation, calculation of C/N. Time Division Multiple Access (TDMA), Frame structure, Examples.

Part-B: Satellite Switched TDMA Onboard processing, DAMA, Code Division Multiple Access (CDMA), Spread Spectrum Transmission and Reception.

Unit-IV **9 hours**

Satellite Link Design: Basic transmission theory, system noise temperature and G/T ratio, Design of down links, Uplink design, Design of satellite links for specified C/N, System design examples.
Earth Station Technology: Introduction, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial Interface, Primary Power test methods.

Unit-V **10 hours**

Low Earth Orbit and Geo-Stationary Satellite Systems: Orbit considerations, Coverage and Frequency Consideration, Delay and Throughput considerations, Systems considerations, Operational NGSO Constellation Designs.
Satellite Navigation and 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.

Textbooks:

1. Satellite Communications - Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.

References:

1. Satellite Communications: Design Principles- M. Richharia, B S publications, 2nd Edition, 2003.
2. Satellite Communication- D.C Agarwal, Khanna Publications, 5th Edition.

MACHINE LEARNING AND DATA SCIENCES
(Professional Elective - II)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PEC-405 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO6	PO12	PO13
CO1	demonstrate the required mathematical foundations for ML& DS	3	3	3	3	3
CO2	outline the functionalities of machine learning	3	3	3	3	3
CO3	illustrate learning algorithms & data science basics	3	3	2	2	3
CO4	build data science applications using Python based toolkits	3	3	3	3	3
CO5	use recommender systems and sentiment analysis in real time applications	3	3	3	3	3

Unit-I: Mathematical Foundations **10 hours**

Linear Algebra: Vectors, Matrices, Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Correlation and Causation, Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem, Hypothesis and Inference: Statistical Hypothesis Testing, Confidence Intervals, Phacking, Bayesian Inference.

Unit-II: Machine Learning **10 hours**

Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning, Introduction to Bayes Theorem, Linear Regression-model assumptions, regularization (lasso, ridge, elastic net), Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest, Classification Errors.

Unit-III: Advanced Machine Learning and Introduction to Data Sciences **(4 + 5) 10 hours**

Part-A: Find-S: finding a maximally specific hypothesis, Analysis of Time Series- Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks - Learning and Generalization, Overview of Deep Learning.

Part-B: Introduction to Data Science: Concept of Data Science, Traits of Big data, Web Scraping, Analysis vs reporting, Data Science in business.

Unit-IV: Programming Tools for Data Science **9 hours**

Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK, Visualizing Data: Bar Charts, Line Charts, Scatterplots, Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction.

Unit-V: Recommender Systems and Sentiment Analysis **10 hours**

Recommender Systems: Introduction, Content-Based Filtering, Collaborative Filtering, Hybrid Recommenders.
Sentiment Analysis: Introduction, Data Cleaning, Text Representation.

Textbooks:

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media(unit-1)
2. Jeeva Jose, "Machine Learning", Khanna Publishing House, Delhi. (unit-2&3)
3. Chopra Rajiv, "Machine Learning", Khanna Publishing House, Delhi. (unit2&4)
4. Introduction to data science by Igual, Laura & Seguí, Santi, Springer. (unit-5)

References:

1. Machine Learning – Tom M. Mitchell, TMH.
2. Jain V.K., "Data Sciences", Khanna Publishing House, Delhi.

EMBEDDED SYSTEMS
(Professional Elective – II)

IV-B.Tech-I-Sem. **L T P C**
Subject Code: EC-PEC-409 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO7	PO12	PO13
CO1	analyze the basic concepts of embedded systems	3	2	2	2	3	3
CO2	illustrate typical embedded system	3	2	3	3	3	3
CO3	adapt the knowledge of interfacing in embedded domain	3	3	3	2	3	3
CO4	compile embedded systems programming	3	3	3	2	3	3
CO5	explain the various real time operating system concepts	3	2	3	2	3	3

Unit-I **9 hours**

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 **10 hours**

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.

Unit-III **(5 + 5) 10 hours**

Part-A: Interfacing: LCD, LED, Relay, DC Motor, Stepper Motor, Servo Motor, DAC, ADC.
Part-B: FIR Filters, Sample and Hold, PID controller, Communication Interface: Onboard and External Communication Interfaces.

Unit-IV **10 hours**

Embedded Programming Concepts: Software programming in Assembly language and High Level Language, Data types, Structures, Modifiers, Loops and Pointers, Macros and Functions, object oriented Programming, Embedded Programming in C++ & JAVA.
Programming Embedded Systems in C:Reading Switches Introduction, Basic techniques for reading from port pins, Example: Reading and writing bytes, Adding Structure to your Code Introduction, Object-oriented programming with C, Meeting Real-Time Constraints Introduction, Creating 'hardware delays' using Timer 0 and Timer 1, Examples.

Unit-V **9 hours**

Real -Time Operating Systems: OS services, process and memory management, basic design using an RTOS, task scheduling models, interrupt latency, response of task as performance metrics.
Types of RTOS: RT Linux, Micro C/OS-II, Vx works, Embedded Linux, tiny OS, and basic concepts of android OS.

Textbooks:

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.
2. Embedded Systems - Raj Kamal, TMH.
3. An Embedded Software Primer, David Simon, Addison Wesley, 2000

References:

1. An Embedded software premier-. David Simon, Pearson education, 2007
2. Embedded C by Michael J. Pont, A Pearson.

CYBER-PHYSICAL SYSTEMS
Professional Elective – II)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PEC-413 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12	PO13
CO1	outline the necessity of cyber physical system	3	2	2	3	2	3
CO2	analyse the future challenges & social impact of CPS	3	3	3	3	3	3
CO3	illustrate the computing fundamentals of CPS	3	3	3	2	2	3
CO4	demonstrate the applications & system requirements of CPS	3	3	3	2	3	3
CO5	appraise various applications of CPS	3	3	3	3	3	3

Unit-I: Introduction **9 hours**

Introduction: Cyber-physical systems, application domains, significance, importance of safety, Hybrid systems vs. Cyber-physical systems, Multi dynamical systems, how to learn about cyber physical systems, computational thinking of cyber physical systems.

Unit-II: Social Impact on Work Lives of the Future **10 hours**

Introduction, Economic, Social, and Organizational Challenges, Changing Demand in the World of Work, Greater Product Individualization and Shifting Factors of Global Influence, Cyber-Physical Systems and STEM Development: NASA Digital Astronaut Project.

Unit-III: Computing fundamentals in CPS **(5 + 5) 10 hours**

Part-A: Study of Systems, Standard Forms of System: Input-Output Description, State-Variable Description, Controllability, Observability, and Identifiability, Analytical Solutions of Linear Systems Models.

Part-B: Solution of state equations using the Laplace transform, Eigen values of the linear vector-equation systems, steady-state errors of systems; case study in systems stability analysis.

Unit-IV: Requirements & Applications **9 hours**

Requirements Engineering, Interoperability, Real-Time Systems, GPU Computing Communication, Consumer, Health, Transportation, Smart Cities and the Internet of Everything, Smart Cities and the Internet of Everything, Cyber-Physical Systems and STEM Development: NASA Digital Astronaut Project.

Unit-V: Social impact & Case Study **9 hours**

Economic, Social, and Organizational Challenges, Changing Demand in the World of Work, Greater Product Individualization and Shifting Factors of Global Influence, Vehicle Tracking System, RFID-Based Vehicle Tracking system, Requirements Analysis.

Textbooks:

1. Platzer, André. Logical Foundations of Cyber-Physical Systems. Heidelberg: Springer, 2018.
2. Möller, Dietmar PF. "Guide to computing fundamentals in cyber-physical systems." *Computer Communications and Networks. Springer, Heidelberg* (2016).

References:

1. Rajkumar, Raj, Dionisio De Niz, and Mark Klein. Cyber-physical systems. Addison-Wesley Professional, 2016.
2. Suh, Sang C., et al., eds. *Applied cyber-physical systems*. Springer New York, 2014.

RADAR ENGINEERING
(Professional Elective – III)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PEC-402 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO7	PO12	PO13
CO1	outline radar fundamentals andradar equation	3	2	2	2	3
CO2	explain various types of radars	3	2	2	2	3
CO3	summarize the working principle of CW-FM radar	3	2	2	2	3
CO4	illustrate target detection and tracking	3	2	2	2	3
CO5	classify various transmitters & receivers	3	3	3	2	3

Unit-I **10 hours**

Introduction: Radar Block Diagram and Operation, Simple form of Radar Equation, Radar Frequencies, Waveforms and Applications, Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise and SNR, Integration of Radar Pulses, Transmitter Power, Radar Cross Section of simple Targets, PRF and Range Ambiguities, Modified Radar Range Equation, Illustrative Problems.

Unit-II **9 hours**

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. MTI versus pulse doppler radar.

Unit-III **(5 + 5) 10 hours**

Part-A: FM-CW Radar: Range and Doppler Measurement, Block Diagram and Characteristics (Approaching / Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar.

Part-B: 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, Illustrative Problems

Unit-IV **9 hours**

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one and two coordinates), Phase Comparison Monopulse. Tracking in Range, Acquisition and Scanning Patterns. Comparison of Trackers.

Unit-V **10 hours**

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**.**
Radar Receivers: Noise Figure and Noise Temperature. Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Applications, Advantages and Limitations.

Textbook:

1. Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2nd Edn.

References:

1. Radar Principles, Technology, Applications-Byron Edde, Pearson Education.2004

BLOCKCHAIN TECHNOLOGY
(Professional Elective - III)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PEC-406 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12	PO13
CO1	explain the fundamentals of Blockchain techniques	3	2	2	3	3	3
CO2	analyze various consensus problems	3	3	3	3	2	3
CO3	adapt Blockchain technology to improve business	3	3	3	3	2	3
CO4	make use of Ethereum frameworks to write smart contract	3	3	3	3	2	3
CO5	interpret Blockchain technology in real time applications	3	3	3	3	2	3

Unit-I **10 hours**

Introduction: What is Blockchain, the business backdrop, the problem area, Relation to bitcoin, Requirements for Blockchain in a business environment, Requirements deep dive, Leverage Blockchain benefits, why Blockchain is relevant for business.
Consensus: shared reference data example, Provenance: supply chain example, Immutability: audit and compliance example, Finality: letter of credit example, Industry use cases, Customer adoption.

Unit-II **10 hours**

The Consensus Problem (Cryptocurrency): Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for Blockchain - Garay model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS).

Unit-III **(4 + 6) 10 hours**

Part-A: Transform your Business with Blockchain: IBM and Hyperledger relationship: Blockchain for business, Hyperledger Composer, Public references, IBM engagement model, Set up the Hyperledger Composer Playground, Transfer assets in a Blockchain network, Explore editor views archive data.

Part-B: Bitcoin - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin.

Unit-IV **8 hours**

Ethereum: Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts.

Unit-V **10 hours**

Trends and Topics: Zero Knowledge proofs and protocols in Blockchain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves - Zcash.

Textbook:

1. Narayanan, Arvind, et al. Bitcoin and cryptocurrency technologies: A comprehensive introduction. Princeton University Press, 2016.

References:

1. Vigna, Paul, and Michael J. Casey. The Truth Machine: The Blockchain and the Future of Everything. Picador, 2019.
2. Gerard, David. Attack of the 50 foot blockchain: Bitcoin, blockchain, Ethereum & smart contracts. David Gerard, 2017.
3. De Filippi, Primavera De Filippi. Blockchain and the law: The rule of code. Harvard University Press, 2018.

LOW POWER VLSI DESIGN
(Professional Elective – III)

IV-B. Tech.-I-Sem. **L T P C**
Subject Code: EC-PEC-410 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO4	PO12	PO13
CO1	explain the concepts of low-power design	3	2	2	2	3
CO2	design low-voltage and low-power circuits	3	3	3	3	3
CO3	apply low power design techniques	3	3	3	3	3
CO4	develop low-voltage low power adders and multipliers	3	3	3	3	3
CO5	evaluate low-voltage low-power memories	3	3	3	3	3

Unit-I **10 hours**

Fundamentals: Need for Low Power Circuit Design; Sources of Power Dissipation–Switching Power, Short Circuit Power, Leakage Power and Glitching Power Dissipations; Short Channel Effects–Drain Induced Barrier Lowering and Punch Through; Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

Unit-II **9 hours**

Low-Power Design Approaches: Low-Power Design through Voltage Scaling; VTCMOS and MTCMOS circuits; Architectural Level Approach–Pipelining and Parallel Processing Approaches; Switched capacitance minimization approaches-System level, Circuit level and Mask level measures.

Unit-III **(5 + 5) 10 hours**

Part-A: Low-Voltage Low-Power Adders: Introduction and Standard Adder Cells, CMOS Adder Architectures-Ripple carry, Carry Select, Carry Save and Carry Look-Ahead Adders.

Part-B: Low Voltage Low-Power Design Techniques –Latest Trends and Power Supply Voltage, Low Voltage Low-Power Logic Styles.

Unit-IV **9 hours**

Low-Voltage Low-Power Multipliers: Introduction to multiplication, types of multiplier Architectures-Braun, Baugh-Wooley, Booth multiplier, Introduction to Wallace Tree multiplier.

Unit-V **10 hours**

Low-Voltage Low-Power Memories: Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Pre-charge and Equalization Circuit, Low Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

Textbooks:

1. Low-Voltage, Low-Power VLSI Subsystems, Kiat-Seng Yeo, Kaushik Roy, TMH.
2. CMOS Digital Integrated Circuits - Analysis and Design, Sung-Mo Kang, Yusuf Leblebici, TMH, 2011.

References:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective, Ming-BO Lin, CRC Press.
2. Low Power CMOS Design, Anantha Chandrakasan, IEEE Press, Wiley International, 1998.

DIGITAL MARKETING
(Professional Elective – III)

IV-B. Tech.-I-Sem. **L T P C**
Subject Code: EC-PEC-414 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO8	PO12
CO1	outline the importance of digital marketing	2	1	2	3	3	3
CO2	use search engine optimization to achieve business goals	3	2	3	3	3	3
CO3	adapt social media for business promotion	3	3	3	3	3	3
CO4	identify link building techniques for content consideration	3	2	3	3	3	3
CO5	apply digital marketing techniques in real time applications	3	3	3	3	3	3

Unit-I: Introduction **9 hours**

Introduction: digital marketing, Digital vs. Real Marketing, Digital Marketing Channels, Creating initial digital marketing plan, Content management, SWOT analysis, Target group analysis, Web design, Optimization of Web sites.

Unit-II: Search Engine Optimization (SEO) **11 hours**

Introduction, writing the SEO content – title, meta tags, image tags, html tags, content writing essentials, Google adwords, Google adsense, Google webmaster tools, on and off page optimization, web crawlers, keyword strategy; SEO friendly website design, hosting & integration.

Unit-III: Social media in business **(4 + 5) 9 hours**

Part-A: Wikipedia, Facebook, Instagram, LinkedIn, Google – advertising, analytics, ads visibility, bulk emailing essentials, integration of social media buttons into business website.

Part-B: campaign budgeting, cost control, resource planning, strengthen your brand, Generate leads, Get more visibility online, Connect with your audience, link exchange, registering with directories, data visualization.

Unit-IV: Link building and content consideration **10 hours**

Precursors to link building, elements of link building, finding your competition, analyzing your competition, competitor tracking, becoming a resource, content duplication, content verticals, sitemaps.

Unit-V: Applications **9 hours**

Travel portal - Makemytrip, Yatra, IRCTC; E-commerce – Amazon, flipkart; Song portals – Wynk.

Textbooks:

1. Jerkovic, John I. SEO warrior: essential techniques for increasing web visibility. "O'Reilly Media, Inc.", 2009.
2. The Art of SEO : Mastering Search Engine Optimization Eric Enge, Stephan Spencer, Rand Fishkin, Jessie C Stricchiola; O'Reilly Media

References:

1. SEO: Search Engine Optimization Bible Jerri L. Ledford; Wiley India; 2nd Edition

CELLULAR AND MOBILE COMMUNICATIONS
(Professional Elective – IV)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PEC-403 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO6	PO12	PO13
CO1	demonstrate the performance criteria of cellular systems	3	2	2	3	3
CO2	identify various types of interference and frequency planning	3	2	2	3	3
CO3	illustrate cell coverage, cell site and mobile antennas	3	2	2	3	3
CO4	summarize frequency management and channel assignment	3	2	2	3	3
CO5	classify various multiple access and spread spectrum techniques	3	2	2	3	3

Unit-I **9 hours**

Introduction to Cellular systems: Introduction to cellular mobile system, Generations of wireless mobile systems, Performance criteria, Basic cellular system, Hexagonal shaped cells, cellular geometry, concept of frequency reuse, trunking and grade of service, Improving capacity of cellular systems: Cell splitting, Sectoring, Micro cell concept, Handoff and dropped calls.

Unit-II **10 hours**

Interference and frequency planning: Introduction to Interference and system capacity, Co-channel Interference reduction factor, Desired C/I from a normal case in a Omni directional Antenna system, Design of directional Antenna system, Adjacent channel interference: Next channel and neighboring channel interference, Frequency management: Numbering, grouping of channels, channel types, channel assignment: fixed channel assignment, non-fixed channel assignment Interference in heterogeneous network, Effect of lowering the antenna height.

Unit-III **(5 + 5) 10 hours**

Part-A: Cell Coverage for Signal and Traffic: Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, and general formula for mobile propagation over water and flat open area, near and long distance propagation.

Part-B: Cell Site and Mobile Antennas: Space Diversity Antennas, Umbrella Pattern Antennas, Minimum Separation of Cell Site Antennas, Mobile Antennas.

Unit-IV **9 hours**

Frequency Management and Channel Assignment: Numbering And Grouping, Setup Access And Paging Channels, Channel Assignments to Cell Sites and Mobile Units, Channel Sharing and Borrowing, Sectorization, Overlaid Cells, non Fixed Channel Assignment.

Unit-V **10 hours**

Multiple Access Techniques: FDMA, TDMA, CDMA, Time-division multiple access (TDMA), code division multiple access (CDMA), CDMA capacity, probability of bit error considerations, CDMA compared with TDMA.
Spread Spectrum Techniques: Direct sequence spread spectrum, Frequency Hopping Spread spectrum techniques.

Textbooks:

1. Mobile Cellular Telecommunications — W.C.Y. Lee, 2nd Edition, 1989, TMH.
2. Wireless Communications – Theodore. S. Rapport, Pearson Education, 2nd Edition, 2002

References:

1. Principles of Mobile Communications - Gordon L. Stuber, Springer International, 2nd Edn, 2001.
2. Modern Wireless Communications-Simon Haykin, Michael Moher,Pearson Education, 2005.

FPGA – CPLD ARCHITECTURES
(Professional Elective – IV)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PEC-407 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO6	PO12	PO13
CO1	apply knowledge of logic gates for various design applications	3	3	3	3	3
CO2	get familiar with Programmable Logic CPLD's	3	2	2	3	3
CO3	comprehend FPGA Architectures	3	3	3	3	3
CO4	Illustrate various architectures and device technologies of PLD"s	3	2	2	3	3
CO5	analyze system level design on FPGA architectures	3	3	3	3	3

Unit-I **10 hours**

Implementation with NAND – NOR gates, Review of Logic Design, designing with multiplexers, implementation of logic functions with look-up tables, minimization of combinational functions based on a) Circuit size, gates and literals i.e. space & power b) number of levels of logic i.e. time or circuit depth. The Quine-McCluskey Algorithm, Multi level logic minimization, covering, factored forms, technology mapping, review of finite state machines, one hot encoding

Unit-II **9 hours**

Programmable Logic: Introduction, programmable logic devices (PLDs), SPLDs, CPLDs, fundamentals of PLD circuits, PLD symbology, PLD architectures: Progrmmable Read Only Memories (PROMs), Programmable Array Logic (PAL), ALTERA CPLDs

Unit-III **(5 + 5) 10 hours**

Part-A:FPGAs: Introduction, Programming Technologies: SRAM, Antifuse, EPROM and EEPROMXilinx FPGAs, Actel, Altera, Concurrent Logic FPGAs. Crosspoint Solutions FPGA, translation to XNF format, Partition, Place and route

Part-B: Technology mapping for FPGAs: Logic Synthesis, logic Optimization, Lookup Table Technology Mapping, Mapping into Xilinx 3000 CLBs, Multiplexer Technology, Mapping.

Unit-IV **10 hours**

Logic Block Architecture: Logic Block functionality Versus area-efficiency, Impact of Logic Block Functionality in FPGA performance, Routing for FPGAs: Segmented Channel Routing, Routing for Symmetrical FPGAs, CGE detailed router Algorithm. Flexibility of FPGA routing architectures: Logic Block, Connection Block, Tradeoffs in Flexibilities of the S and C blocks, A theoretical model for FPGA routing.

Unit-V **9 hours**

Platform FPGA architectures, Multi-FPGA Systems: Xilinx Virtex II Pro Platform FPGA, Altera Stratix Platform FPGA, Serial I/O, Memories, CPUs and Embedded Multipliers, Multi FPGA systems: Interconnecting Multiple FPGAs, partitioning, Novel architectures.

Textbooks:

1. Digital Design using Field Programmable Gate Arrays, Park K. Chan, Samiha Mourad, Pearson, 1994.
2. Digital Systems: Principles & Applications, Ronald J Tocci, Neal S. Widmer, Gregory L. Moss, 10th Edition, Pearson, 2009.
3. Field Programmable Gate Arrays, Stephen D. Brown, Robert J Francis, Jonathan Rose, Ivonko G. Vranesic, Springer International Edition, First Indian Print 2007.
4. FPGA-based System Design, Wayne Wolf, Pearson Education, First Impression, 2009.

CYBER SECURITY
(Professional Elective – IV)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PEC-411 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO4	PO5	PO6	PO8	PO12	PO13
CO1	explain cyber security terminologies	2	2	2	2	2	2	2
CO2	identify various cyber offences	3	3	3	3	3	3	3
CO3	apply various tools and methods to control cybercrime	3	3	3	3	3	3	3
CO4	make use of standards and cyber laws to enhance cyber security	3	3	3	3	3	3	3
CO5	illustrate the importance of security policies & IT Act	3	3	2	3	3	3	3

Unit-I: Introduction **9 hours**

Essential Terminologies: NIA, Risks, Breaches, Threats, Attacks, Exploits. Information gathering (Social Engineering, Foot Printing & Scanning). Open Source/ Free/ Trial Tools: nmap, zenmap, Port scanners, Network scanners. Forming an incident response team, Reporting crime, Operating System attacks, Application attacks, Reverse engineering, Cracking techniques and Financial frauds.

Unit-II: Cyber Offences **10 hours**

Introduction, how criminals plan the attacks, social engineering, cyber stalking, cyber cafe and cybercrimes, Botnets: The fuel for cybercrime, attack vector, Cloud computing.

Unit-III: Tools and Methods Used in Cybercrime: **(5 + 3) 8 hours**

Part-A: Introduction, proxy servers and anonymizers, phishing, password cracking, keyloggers and spywares, virus and worms, DoS and DDoS attacks, SQL injection, buffer overflow.

Part-B: Trojan horse and backdoors, steganography.

Unit-IV: Cyber Security Audit & Standards **9 hours**

risk assessment and management, asset classification, crisis management plan, resources recovery strategy, security testing, international standards, analysis and logging, security certification.

Unit-V: Security Policy & IT ACT **9 hours**

Security policies, why policies should be developed, WWW policies, email security policies, policy review process- corporate policies, sample security policies, publishing and notification requirement of the policies. Information Security Standards-ISO, cyber laws in India; IT Act 2000 provisions, Intellectual Property Law: Copy right law, software license, semiconductor law and patent law.

Textbooks:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA
2. Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, TMH.

References:

1. Charles P. Pfleeger, Shari Lawerance Pfleeger, “Analysing Computer Security ”, Pearson.
2. Schou, Shoemaker, “Information Assurance for the Enterprise”, TMH.
3. Chander, Harish,” Cyber Laws And It Protection ” , PHI, New Delhi, India

APPLICATION SPECIFIC INTEGRATED CIRCUITS
(Professional Elective – IV)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PEC-415 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO4	PO12	PO13
CO1	explain various types of ASICs and its libraries	3	2	2	2	3
CO2	illustrate programmable ASICs and logic cells	3	3	3	3	3
CO3	make use of I/O cells, interconnects and programmable ASICs	3	3	3	3	3
CO4	summarize low level design entry and logic synthesis	3	3	3	3	3
CO5	design ASICs using various techniques	3	3	3	3	3

Unit-I **10 hours**

Introduction to ASICs: Types of ASICs, Design Flow, Case Study, Economics of ASICs, ASIC Cell Libraries, Transistors as resistors, Transistor Parasitic Capacitance, Logical Effort, Library Cell Design, Library Architecture, Gate-Array Design, Standard Cell Design, Data Path Cell Design.

Unit- II **9 hours**

Programmable ASICs and Logic Cells: The Anti-fuse, Static Ram, EPROM and EEPROM Technology, Practical Issues, Specifications, PREDP Benchmarks, FPGA Economics, Actel ACT, Xilinx LCA, Altera Flex, Altera Max.

Unit-III **(5 + 5) 10 hours**

Part-A: I/O Cells and Interconnects: DC Output, AC Output, DC input, AC input, Clock input, Power input Xilinx I/O block, Other I/O Cells, Actel ACT .

Part-B: Programmable ASIC Design Software: Xilinx LCA, Xilinx EPLD, Xilinx Vivado Altera Max 5000 and 7000, Altera Max 9000, Altera FLEX, Zync Boards, Design Systems, Logic Synthesis, The Half gate ASIC.

Unit-IV **9 hours**

Low Level Design Entry and Logic Synthesis: Schematic Entry, Low level Design Languages, PLA Tools, EDIF, A logic synthesis example, A Comparator/MUX, Inside a Logic Synthesizer, Synthesis of Viterbi Decoder, Verilog and Logic synthesis, VHDL and Logic Synthesis, Finite State Machine Synthesis, Memory Synthesis, The Engine Controller, Performance Driven Synthesis, Optimization of the Viterbi decoder.

Unit-V **10 hours**

Simulation, Test and ASIC Construction: Types of Simulation, The Comparator/MUX Example, Logic Systems, How Logic Simulation Works, Cell Models, Delay Models, Static Timing Analysis, Formal Verification, Switch Level Simulation, Transistor Level Simulation, The importance of test, Boundary Scan Test, Faults, Faults Simulation, Automatic Test Pattern Generator, Scan Test, Built in Self-Test, A simple test Example, Physical Design, CAD Tools, System Partitioning, Estimating ASIC Size, Power Dissipation, FPGA Partitioning, Partitioning Methods.

Textbooks:

1. Application Specific Integrated Circuits, Michael John Sebastian Smith, Pearson, 2003.
2. Integrated Circuit Engineering, L.J.Herbst, Oxford Science Publications, 1996.

References:

1. Advanced ASIC Chip Synthesis using Synopsis Design compiler,Himanshu Bhatnagar,2nd Edition, Kluwer Academic, 2001.

ENVIRONMENTAL IMPACT ASSESSMENT
(Open Elective-II)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: OEC-401 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO6	PO7	PO10	PO12
CO1	identify the attributes to be considered for EIA	3	3	3	3
CO2	assess impact of deforestation	3	3	3	3
CO3	interpret impact prediction, significance of soil quality and mitigation	3	3	2	3
CO4	conduct environmental audit and prepare reports	3	3	2	3
CO5	illustrate environmental policies and provisions	3	3	3	3

Unit-I **10 hours**

Basic concept of EIA: Initial environmental Examination, Elements of EIA, factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters. E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis.

Unit-II **9 hours**

Assessment of impact of development activities on vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

Unit-III **(5 + 4) 9 hours**

Part A: Procurement of relevant soil quality, impact prediction, assessment of impact significance.

Part B: Identification and incorporation of mitigation measures for enhancement of soil quality.

Unit-IV **10 hours**

Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report, Post Audit activities.

Unit-V **10 hours**

The Environmental Protection Act, The water Act, The Air (Prevention & Control of pollution Act.), Motor Act, Wild life Act. Case studies and preparation of Environmental Impact assessment statement for various Industries.

Textbooks:

1. Environmental Pollution by R.K. Khitoliya S. Chand.
2. Environmental Impact Assessment, Barthwal, R. R. New Age International Publications.

References:

1. Larry Canter – Environmental Impact Assessment, TMH.
2. Suresh K. Dhaneja - Environmental Science and Engineering, S.K. Kataria & Sons Publication.
3. Bhatia, H. S. - Environmental Pollution and Control, Galgotia Publication, Pvt., Ltd., Delhi.

NON-CONVENTIONAL ENERGY SOURCES
(Open Elective-II)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: OEC-403 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO6	PO7	PO12
CO1	analyze global and national energy scenarios	3	3	3
CO2	illustrate the various solar energy systems	3	3	3
CO3	demonstrate the aspects related to wind energy power plants	3	3	3
CO4	build the power plants using bio gas	3	3	3
CO5	estimate the power generation in hydroelectric plants	3	3	3

Unit-I **10 hours**

Global and National Energy Scenario: Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non-renewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO_2 reduction potential of renewable energy- concept of Hybrid systems.

Unit-II **9 hours**

Solar Energy: Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems.

Unit-III **(5 + 5) 10 hours**

Part-A: Wind Energy: Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy.

Part-B: Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Wind mill component design, economics and demand side management, energy wheeling, and energy banking concepts. Safety and environmental aspects, wind energy potential and installation in India.

Unit-IV **10 hours**

Biogas: Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications.

Unit-V **9 hours**

Hydel Energy: Small hydro Power Plant - Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power.

Textbooks:

1. Non-Conventional Energy Sources by G.D. Rai.
2. Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd., 1986.

PRINCIPLES OF COMMUNICATION SYSTEMS
(Open Elective-II)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: OEC-405 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12
CO1	outline the fundamentals of communication systems	3	2	2	2
CO2	analyze various analog modulation and demodulation schemes	3	3	3	2
CO3	explain sampling theorem, pulse modulation and multiplexing techniques	3	3	3	2
CO4	illustrate digital modulation schemes	3	3	2	2
CO5	develop source and channel coding techniques	3	3	3	2

Unit-I **9 hours**

Fundamentals of communication systems: Block diagram of communication system; types of communications-analog and digital; Noise–types of noise, sources of noise, calculation of noise in linear systems, and noise figure.

Unit-II **10 hours**

Methods of Modulation: Need for modulation; Types of modulation, generation and detection of AM, DSB-SC, SSB-SC. Angle modulation: frequency & phase modulations, Narrow band and Wide band FM, comparison of AM, FM & PM.

Unit-III **(5 + 5) 10 hours**

Part-A: Pulse Modulations: Sampling theorem, Nyquist criteria, introduction to PAM, PWM and PPM.

Part-B: Multiplexing techniques: TDM, FDM, asynchronous multiplexing.

Unit-IV **10 hours**

Digital Communication: Advantages; Working principle of PCM; comparison of PCM, DM, ADM, ADPCM; introduction to digital modulation techniques-ASK, FSK, PSK, DPSK, QPSK.

Unit-V **9 hours**

Information Theory: Concept of information; rate of information and entropy; Coding efficiency-Shanon-Fano and Huffman coding; introduction to error detection and correction codes.

Textbooks:

1. Communication Systems Analog and Digital – R.P. Singh & SD Sapre, TMH, 20th reprint, 2004.
2. Principles of Communications – H. Taub and D. Schilling, TMH, 2003.

References:

1. Electronic Communication Systems – Kennedy and Davis, TMH, 4th edition, 2004.
2. Communication Systems Engineering – John. G. Proakis and Masoud Salehi, PHI, 2nd Ed. 2004.

DATABASE MANAGEMENT SYSTEMS
(Open Elective-II)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: OEC-407 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO5	PO12
CO1	design databases using E-R model	3	3	3	3	2
CO2	construct database using relational model	3	3	3	3	2
CO3	formulate SQL queries to interact with database	3	3	3	3	2
CO4	make use of transaction control commands	3	3	3	3	2
CO5	apply normalization on database to eliminate redundancy	3	3	3	3	2

Unit-I **11 hours**

Introduction to Database Systems: Introduction and applications of DBMS, Purpose of data base, History of database, Database architecture - Abstraction Levels, Data Independence, Database Languages, Database users and DBA.
Introduction to Database Design: Database Design Process, Data Models, ER Diagrams - Entities, Attributes, Relationships, Constraints, keys, Generalization, Specialization, Aggregation, Conceptual design with the E-R model for large Enterprise.

Unit-II **9 hours**

Relational Model: Introduction to the relational model, Integrity constraints over relations, Enforcing integrity constraints, Querying relational data, Logical database design: E-R to relational, Introduction to views, Destroying/altering tables and views.

Unit-III **(5 + 4) 9 hours**

Part-A: SQL Basics: DDL, DML, DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, in operator.

Part-B: Functions: Aggregate functions, Built-in functions - numeric, date, string functions, set operations.

Unit-IV **10 hours**

Sub-queries: Introduction, correlated sub-queries, use of group by, having, order by, join and its types, Exist, Any, All, view and its types.
Transaction control commands: ACID properties, concurrency control, Commit, Rollback, save point, cursors, stored procedures, Triggers.

Unit-V **10 hours**

Normalization: Introduction, Normal forms - 1NF, 2NF, 3NF, BCNF, 4NF and 5NF, concept of De-normalization and practical problems based on these forms.

Textbooks:

1. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, TMH.
2. Abraham Silberschatz, Henry F.Korth, S.Sudarshan, Database System Concepts, 6th Edn, TMH.

INTELLECTUAL PROPERTY RIGHTS
(Open Elective-II)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: OEC-409 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO6	PO8	PO10	PO12
CO1	outline basics of intellectual property law	3	3	2	3	3
CO2	identify the various trademarks	3	3	2	3	3
CO3	analyze patent and copy rights law	3	3	3	3	3
CO4	differentiate trade secret and unfair practice	3	3	3	3	3
CO5	summarize new developments in Intellectual Property Rights	3	3	3	3	3

Unit-I **10 hours**

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

Unit-II **9 hours**

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

Unit-III **(5 + 4) 9 hours**

Part-A: Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Part-B: Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

Unit-IV **10 hours**

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.
Unfair competition: Misappropriation right of publicity, false advertising.

Unit-V **10 hours**

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.
International overview on intellectual property, international - trade mark law, copy right law, international patent law, international development in trade secrets law.

Textbooks:

1. Intellectual property right, Deborah, E. Bouchoux, cengage learning.
2. Intellectual property right - Unleashing the knowledge economy, prabuddha ganguli, TMH.

TECHNICAL WRITING SKILLS LAB

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: HSMC-402 **- - 2 1**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO5	PO10
CO1	make use of language for understanding discourse and make notes	3	3
CO2	demonstrate command over using library resources for academic and other pursuits	3	3
CO3	apply knowledge of English language for creative and academic purposes	3	3
CO4	adapt principles in conveying good professional ethics	3	3
CO5	exhibit thorough awareness on research-oriented activities and career development	3	3

List of Experiments

1. Definition of Writing – difference between General and Academic writing process - gathering ideas for academic writing - organizing ideas into sentences –language of writing - analysis of material.
   Assignment: exercises on creative, academic and other written formats.

2. Note making and Note taking techniques - collecting notes - writing outlines – precis writing - writing rough drafts.
   Assignment: exercises on precise writing and note making & taking techniques.

3. Description of mechanisms and processes – Information transfer process – technical vocabulary.
   Assignment: information transfer exercises such as flow charts, pai charts, and discussion on technical vocabulary.

4. Library and Digital Resources - Internet as a Tool for research - reference and research techniques - Proposal writing.
   Assignment: exercises on information gathering techniques using various online and manual resources on the topic assigned; samples on abstracts and research proposals.

5. Technical writing – types – process of technical writing – style and language – editing strategies to achieve appropriate technical style.
   Assignment: dealing with samples of technical reports and writing reports.

6. Technical communication - audience analysis, and persuasion – understanding graphic aids in technical reports.
   Assignment: showing various graphs of sample reports.

7. Elements of the Formal Research Report – Thesis Writing - Title - Abstract – Synopsis – Conclusions – Suggestions - References.
   Assignment: samples of project reports and written exercises on elements mentioned.

8. Job hunt - Resume - Cover Letter - Networking and Professional Success - Sources of networking - Research about Job Profile, Company, Competitors & Industry - Body Language and Grooming.
   Assignment: exercises on cover letter, job application, emails, resume writing, etc. discussion on personality development techniques.

9. Plagiarism and Professional Ethics - understanding Plagiarism and Tools to check plagiarism - Ethics of Research - Engineering ethics - Awareness of Professional Ethics.
   Assignment: exploration of plagiarism checks mechanisms and discussion on professional ethics.

10. Presentation styles - Inforgraphics - types & tools for presentation - audience-centered presentations - cross-cultural communication.
    Assignment: exercises on Oral Presentation.

Text/Reference Books:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004.
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York,2003.
4. Raman Sharma, Technical Communications, Oxford Publication, London,2004.
5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN:07828357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi2002.
7. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN0402213)

DATA COMMUNICATION & COMPUTER NETWORKS LAB

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: EC-PCC-412 **- - 2 1**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO4	PO5	PO14
CO1	build the wireless LAN and Ethernet LAN protocols connection via hubs, switches	3	3	3
CO2	analyze the performance of various protocols in different layers	3	3	3
CO3	develop the communicate between two desktop computers via switch/router	3	3	3
CO4	apply network commands & configuration commands to network topologies	3	3	3
CO5	design of access control list configurations in packet tracer	3	3	3

List of Experiments

1. Connect the computers in Local Area Network
2. Configure Host IP, Subnet Mask and Default Gateway in a system in LAN (TCP/IP configuration)
3. Establish peer to peer network connection using two systems (direct connection or via switch/router) in a LAN for sharing the drives and folders
4. Study of basic network commands and network configuration commands
5. Configure different Network topologies
6. Simulation of Ethernet LAN protocol connected via hubs, switches
7. Simulation of Wireless LAN
8. Configure a Network using Distance Vector Routing algorithm
9. Configure a Network using Link State Routing Algorithm
10. Standard access control list (ACL) configuration in packet tracer.
11. Extended access control list (ACL) configuration in packet tracer.
12. Building a LAN with HUBs and Switches.

Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Creating of a LAN and connectivity test in the LAN
2. Creation of VLAN and VLAN trunking.
3. Case Study: Campus Network Operation Center Visit.
4. Basic Router Configuration, Static Routing Implementation
5. Implementation of Dynamic/interior/exterior routing (RIP, OSPF, BGP)
6. Firewall Implementation, Router Access Control List (ACL)
7. Packet capture and header analysis by wire-shark (TCP,UDP,IP)
8. Basic Frame Relay Implementation with PVC
9. DNS, Web, DHCP, FTP server configuration
10. Design and Implementation of a Wi-Fi Based Home Automation System

Reference:

1. Data Communication & Computer Networks Lab Manual, Department of CSE, CMRIT, Hyd.

PROJECT - I

IV-B.Tech.-I-Sem.	L	T	P	C
Subject Code: EC-PRJ-413	-	-	6	3

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1 to PO14
CO1	identify the problem statement, assess the scope and develop a prototype	3
CO2	execute the project using modern tools and prepare the report	3
CO3	demonstrate leadership, management skills for project development with ethics	3
CO4	function effectively as individual / member / leader in project teams	3
CO5	make use of engineering knowledge for societal sustenance	3

Guidelines:

The objective of the project work is to imbibe students with technical, analytical and innovative ideas to facilitate with theoretical and practical learning pertaining to relevant domain of interest. An individual or a peer of 2-5 students work under the guidance / mentorship of a departmental faculty with the aim of addressing solution to real world / societal problems using various R & D techniques. The team work fosters the communication and leadership skills among peers to survive and exercise during their career.

The project work normally includes:

1. Survey and study of published literature on the approved / assigned topic.
2. Conduct preliminary Analysis / Modeling / Simulation / Experiment / Design / Feasibility / ethnographical study.
3. Prepare an abstract/synopsis on the opted topic and present before Departmental Review Committee (DRC).
4. Prepare an Action Plan for conducting the investigation, including team work.
5. Apply suitable methodology for Designing / Modelling / Simulation / Experimentation as needed.
6. Develop an end product or process along with conclusions, recommendations and future scope.
7. Present and execute the project before DRC for CIE.
8. Prepare and publish a paper in Conference / Journal, if possible.
9. Prepare and submit the final dissertation in the prescribed format to the Department.
10. Present and execute the project before External Committee for viva-voce.

SUMMER INTERNSHIP - II
MANDATORY COURSE (NON-CREDIT)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: MC-411 - - - -

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1 to PO14
CO1	utilize the domain knowledge with modern tools to solve real world problems	3
CO2	analyze the industrial processes that results in the end product / service	3
CO3	extend global needs for professional ethics, responsibility and communication	3
CO4	function well as an individual, member or leader in diverse teams	3
CO5	make use of engineering knowledge for societal sustenance	3

Guidelines:

1. The student has to complete the internship for a period of 4 to 6 weeks during summer vacation between VI Semester & VII Semester.
2. The internship can be carried out in any industry / R&D Organization / Research Institute / Premier Educational Institutes like IITs, NITs and IIITs etc.
3. The registration process of internship should be completed before the commencement of IV-semester end examinations.
4. The registration process for internship involves:
   e) Students have to approach respective course coordinator with name of proposed company / organization in which they wish to carry out internship.
   f) The Department shall nominate guide to supervise the interns.
   g) Student has to obtain a no objection certificate (NOC) in the prescribed format from the department and submit the same to the respective organization.
   h) Student has to submit acceptance letter issued by the respective organization to the course coordinator.
5. The internal guide has to visit place of internship at least once during student's internship.
6. The students shall report the progress of the internship to the guide in regular intervals and seek advice.
7. After the completion of Internship, students shall submit a final report along with internship and attendance certificates to the course coordinator with the approval of internal guide.
8. The evaluation of internship shall be done during VII-Semester.
9. The student has to give a PPT presentation for duration of 10 to 15 minutes in the presence of departmental evaluation committee consists of Head of the Department, Internal Guide and Two Senior Faculty from the respective departments.
10. After the successful presentation by the student, the evaluation committee recommends the result as satisfactory for the internship. In case of students who have not registered for internship / not submitted the internship certificate and report, the VII-Semester result will not be declared till completion.

IV-B.TECH.-II-SEMESTER SYLLABUS

MANAGEMENT, ECONOMICS AND ACCOUNTANCY

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: HSMC-401 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO11	PO12
CO1	apply principles of management in professional career	3	2
CO2	make use of principles of economics for decision making	3	2
CO3	solve problems in the areas of production, cost and price	3	2
CO4	prepare balance sheet and maintain books of accounts	2	3
CO5	analyze financial performance of an enterprise	3	3

Unit-I: Management concepts **10 hours**

Introduction to Management and organization, Scientific management, Modern management – Functions, objectives and scope of functional areas of management, Levels of management.

Unit-II: Introduction to Managerial Economics **10 hours**

Fundamental concepts of Managerial Economics, Concept of Law of Demand, Factors influencing and limitations, Concept of Elasticity of Demand, types and methods, Demand forecasting methods and limitations.

Unit-III: Theory of Production, Cost and Market Structure **(4 + 4) 8 hours**

Part-A: Types of Production function, input output relationship and types of costs, cost output relationship.

Part-B: CVP Analysis-BEP analysis assumptions, limitations and uses. Different market structures-Perfect & Monopoly Competition.

Unit-IV: Introduction to Accounts **14 hours**

Accounting Objectives, Functions, GAAP – Basics of Accounting - Rules for preparation of Journal and Ledger. Process of Journalisation and Subsidiary books. Preparation of Trading, Profit & Loss Accounts and Balance Sheet (Simple Problems).

Unit- V: Financial Statement Analysis **6 hours**

Concept of Financial Statement Analysis uses and limitations – Liquidity, Leverage, Activity, Turnover, Profitability Ratios (Simple problems).

References:

1. L.M. Prasad, Principles and Practices of Management, Revised Edition, S. Chand Publishing.
2. IM Pandey, Financial Management, 12th Edition, Vikas, 2017.
3. Philip Kotler, Kevin Lane Keller, Abraham Koshy and Mithleshwar Jha: Marketing Management, 15/e, Pearson Education, 2012.
4. K. Aswathappa, “Human Resource Management, Text and Cases”, TMH, 2016.
5. Panneerselvam “Production and Operations Management” PHI, 2017.

WIRELESS COMMUNICATIONS
(Professional Elective – V)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PEC-404 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO8	PO12	PO13
CO1	explain the basic concepts of wireless sensor networks	3	2	2	2	2	3
CO2	illustrate various wireless sensor networks topologies	3	2	2	2	2	3
CO3	analyze routing and MAC protocols for WSN	3	3	3	3	2	3
CO4	outline transport layer protocols for Adhoc WSN	3	3	2	2	2	3
CO5	make use of security techniques, WSN platforms and tools	3	3	2	3	2	3

Unit-I **10 hours**

Overview of Wireless Sensor Networks (WSN): Introduction, types, advantages, unique constraints & challenges and applications; Mobile Ad-hoc Networks (MANETs) and WSN; Enabling technologies for WSN-Issues and challenges.

Unit-II **9 hours**

Networking Technologies: Physical Layer & Transceiver Design Considerations-hidden node and exposed node problem; Topologies of PANs, MANETs, WANETs.

Unit-III **(5 + 5) 10 hours**

Part-A: Routing Protocols: Introduction, designing techniques for Ad Hoc WSN, Routing Protocols- classification, driven, On – Demand, Hybrid; Routing Protocols with Efficient Flooding Mechanisms; Hierarchical Routing Protocols; Power-Aware Routing Protocols; Proactive Routing.

Part-B: MAC Protocols: Classification of MAC Protocols: S-MAC, B-MAC protocols; IEEE 802.15.4 standard and Zig Bee; dissemination protocol for large sensor network-data dissemination, data gathering and data fusion; quality of a sensor network, Real-time traffic support and security protocols.

Unit-IV **9 hours**

Transport Layer: Introduction, Designing a Transport Layer protocol for Ad Hoc WSN and goals; TCP over Ad-hoc Wireless Networks; other Transport Layer Protocols for Ad-hoc WSN.

Unit-V **10 hours**

Security in WSN: Network Security Requirements-issues and Challenges in Security Provisioning; Network security attacks-key management, secure routing.
Sensor Network Platforms and Tools: Sensor Node Hardware-Berkeley Motes; Programming Challenges; Node- level software platforms; Node-level Simulators; State-centric programming, Applications of WSN.

Textbooks:

1. Fundamentals of Wireless Sensor Networks Theory And Practice, Waltenegus Dargie, Christian Poellabauer, By John Wiley & Sons Publications, 2011.
2. Wireless Sensor Networks: Technology, Protocols and Applications, Kazem Sohrby, Daniel Minoli, Wiley-Inter science.
3. Ad-Hoc Wireless Networks: Architectures and Protocols, C. Siva Ram Murthy and B. S. Manoj, 2004, PHI.

References:

1. Ad-Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh ,1st Edition Pearson.
2. Wireless Sensor Networks, Feng Zhao, Leonidas Guibas Elsevier Publications, 2004.

VIRTUAL REALITY
(Professional Elective – V)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PEC-408 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO8	PO12	PO13
CO1	explain fundamental of virtual reality and 3D graphic systems	2	2	2	2	2	3
CO2	adapt geometric modeling in virtual reality environment	3	3	3	3	3	3
CO3	make use of virtual environment for animation and simulation	3	3	3	3	3	3
CO4	illustrate virtual reality hardware and software	3	2	3	3	2	3
CO5	develop virtual reality applications	3	3	3	3	3	3

Unit-I: Introduction to Virtual Reality **10 hours**

Virtual Reality and Virtual Environment: Introduction, computer graphics, real time computer graphics, flight simulation, virtual environment requirement, benefits of virtual reality, historical development of VR, scientific landmark.

3D Computer Graphics: Introduction, The virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, 3D clipping, colour theory, simple 3D modelling, illumination models, reflection models, Shading algorithms, radiosity, hidden surface removal, realism-stereographic image.

Unit-II: Geometric Modelling **10 hours**

Geometric Modelling: Introduction, from 2D to 3D, 3D space curves, 3D boundary representation. Geometrical Transformations: Introduction, frames of reference, modelling transformations, instances, picking, flying, scaling the VE, collision detection

Generic VR system: Introduction, Virtual environment, computer environment, VR technology, model of interaction, VR systems.

Unit-III: Virtual Environment **(4 + 5) 9 hours**

Part A: Animating the Virtual Environment: Introduction, The dynamics of numbers, linear and non- linear interpolation, the animation of objects, linear and non-linear translation, shape & object inbetweening, free from deformation, particle system.

Part B: Physical Simulation: Introduction, objects falling in a gravitational field, rotating wheels, elastic collisions, projectiles, simple pendulum, springs, flight dynamics of an aircraft.

Unit-IV: VR Hardware and Software **11 hours**

Human factors: Introduction, the eye, the ear, the somatic senses.

VR Hardware: Introduction, sensor hardware, head-coupled displays, acoustic hardware, integrated VR systems.

VR Software: Introduction, modelling virtual world, physical simulation, VR toolkits, introduction to VRML.

Unit-V: VR Applications **8 hours**

Introduction, engineering, entertainment, science, training; the future: virtual environment, modes of interaction.

Textbook:

2. John Vince, “Virtual Reality Systems”, Pearson Education Asia, 2007.

References:

1. Anand R., “Augmented and Virtual Reality”, Khanna Publishing House, New Delhi.
2. Adams, “Visualizations of Virtual Reality”, Tata McGraw Hill, 2000.

QUANTUM COMPUTING
(Professional Elective - V)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PEC-412 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO5	PO12	PO13
CO1	explain the concepts of quantum computing	3	2	2	2	2	3
CO2	make use of mathematical foundations for quantum computing	3	3	3	2	2	3
CO3	outline the architecture and programming models	3	2	2	2	3	3
CO4	utilize basic techniques of quantum computing	3	3	3	3	2	3
CO5	elaborate major algorithms and discuss about OSS toolkits	3	3	3	3	3	3

Unit-I: Introduction to Quantum Computing **6 hours**

Motivation for studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.), Origin of Quantum Computing, Overview of major concepts in Quantum Computing, Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement.

Unit-II: Mathematical Foundations **10 hours**

Math Foundation for Quantum Computing, Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors.

Unit-III: Building Blocks **(8 + 5) 13 hours**

Part-A: Architecture & Information Representation: Architecture of Quantum Computing platform, Details of q-bit system of information representation: Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from quantum algorithmic perceptive e.g. Bell State, Operation on qubits: Measuring and transforming using gates, Quantum Logic gates and Circuit: Pauli, Hadamard, phase shift, controlled gates, Ising, Deutsch, swap etc.

Part-B: Programming Model for Quantum Computing: Steps performed on classical computer, Steps performed on Quantum Computer, Moving data between bits and qubits.

Unit-IV: Basic Techniques **5 hours**

Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum Walks.

.

Unit-V: Major Algorithms & OSS Toolkits **14 hours**

Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch -Jozsa Algorithm, IBM quantum experience, Microsoft Q, Rigetti PyQuil (QPU/QVM).

Textbooks:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press.
2. David McMahon, "Quantum Computing Explained", Wiley.

Reference:

1. Phillip Kaye Raymond Laflamme Michele Mosca, An Introduction to Quantum Computing, Oxford University Press.

SOFTWARE DEFINED RADIO
(Professional Elective – V)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: EC-PEC-416 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO7	PO12	PO13
CO1	explain the architecture of SDR	2	2	3	2	3	3
CO2	illustrate various digital frequency converters and digital filters	2	3	3	2	3	3
CO3	summarize signal processing components for software radio	3	3	3	2	3	3
CO4	identify various smart antennas for software radio	3	3	3	2	3	3
CO5	outline various navigational systems	3	3	3	2	3	3

Unit-I **10 hours**

SDR Architecture: Software Defined Radio: A Traditional Hardware Radio Architecture, Signal Processing Hardware: Introduction to 2G Radio Architectures, Hybrid Radio Architecture, Basic Software Defined Radio Block Diagram, System Level Functioning Partitioning, Digital Frequency Conversion Partitioning, RF System Design: Noise and Channel Capacity, Receiver Requirement.

Unit-II **9 hours**

Digital Frequency Converters: Digital Conversion Fundamentals, Sample Rate, Band pass sampling, oversampling, Anti-alias Filtering, Frequency converter Fundamentals, Digital NCO, Digital Mixers, Digital Filters: Half band Filters, CIC Filters Decimation, Interpolation, and Multirate Processing, DUCs Cascading, Digital Converters and Digital Frequency Converters.

Unit-III **(5 + 5) 10 hours**

Part-A: Signal Processing Components: Introduction to SDR Requirements for Processing Power, DSP Devices, DSP Compilers, Reconfigurable Processors, Adaptive Computing Machine.

Part-B: Signal Processing Components: FPGAs Software Architecture and Components, Architecture Choices: Hardware, Specific Software Architecture.

Unit-IV **9 hours**

Smart Antennas for Software Radio: 3G smart Antenna Requirements, Phased Antenna Array, Software Radio Principles to Antenna Systems, Smart Antenna Architectures, Optimum combining, Adaptive Arrays, DOA Arrays, Beam Forming for CDMA.

Unit-V **10 hours**

Navigational Systems: Review of Navigational Systems: Aircraft navigational system. Geometry of the earth. Navigation equation. Navigation errors. Radio navigation system types and Performance parameters.ILS System, Hyperbolic navigation systems, Loran, Omega, Decca Radio direction finding, DME.TACAN and VORTAC.

Textbooks:

1. Software Defined Radio for 3G, Paul Burns Artech House, 2002.
2. RF and DSP for SDR, Tony J Rouphael, Elsevier Newnes Press, 2008.
3. Avionics Navigation Systems, Myron Kavton and Walter Friend, R, Wiley, 1997.

References:

1. Implementing Software Defined Radio, Eugene Grayver, Springer-Verlag New York, 2013.
2. RF and Baseband Techniques for Software Defined Radio, P Kenington, Artech House, 2005.

GREEN BUILDING TECHNOLOGIES
(Open Elective-III)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-402 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO7	PO12
CO1	explain the fundamentals of energy use and processes in building	3	2	2	2
CO2	identify indoor environmental requirement and its management	3	3	3	2
CO3	assess the impact of solar radiation on buildings	3	3	3	2
CO4	evaluate end-use energy utilization and requirements	3	3	2	2
CO5	adapt audit procedures for energy management	3	3	3	2

Unit-I **10 hours**

Overview of the significance of energy use and energy processes in building: Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

Unit-II **9 hours**

Indoor environmental requirement and management: Thermal comfort - Ventilation and air quality - Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement.

Unit-III **(5 + 5) 10 hours**

Part-A: Climate, solar radiation and their influences: Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation.

Part-B: Temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

Unit-IV **10 hours**

End-use, energy utilization and requirements: Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building - Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer.

Unit-V **9 hours**

Energy management options: Energy audit and energy targeting - Technological options for energy management.

Textbooks:

1. Michael Bauer, Peter Mosle and Michael Schwarz, Green Building, Guidebook for Sustainable Architecture, Springer, Heidelberg, Germany.
2. Norbert Lechner, Heating, Cooling, Lighting - Sustainable Design Methods for Architects‖, Wiley, New York.
3. James Kachadorian, The Passive Solar House: Using Solar Design to Heat and Cool Your Home‖, Chelsea Green Publishing Co., USA.

FUNDAMENTALS OF ROBOTICS
(Open Elective-III)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-404 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO5	PO12
CO1	illustrate principles and functioning of the robot	3	2	2	2
CO2	perform kinematic analysis for end-effector positioning	3	3	3	2
CO3	integrate mechanical and electrical hardware for robot with feedback control	3	3	3	2
CO4	design control laws for a robot	3	3	2	2
CO5	develop robot programming for various applications	3	3	3	2

Unit-I **10 hours**

Introduction to Robotics: Types and components of a robot, Classification of robots, classification with respect to geometrical configuration (anatomy), closed-loop and open- loop control systems. Social issues and safety.

Unit-II **9 hours**

Robot Kinematics: Kinematics systems, Definition of mechanisms and manipulators, Kinematic Modelling: Translation and Rotation Representation, Coordinate transformation, Homogeneous Coordinate representation, DH parameters.

Unit-III **(5 + 4) 9 hours**

Part-A: Sensors and Vision System: Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc., Introduction to Cameras, Camera calibration, Geometry of Image formation, Euclidean / Similarity / Affine / Projective transformations Vision applications in robotics.

Part-B: Robot Actuation Systems: Actuators: Electric, Hydraulic and Pneumatic; Transmission: Gears, Timing Belts and Bearings, Parameters for selection of actuators.

Unit –IV **10 hours**

Robot Control: Basics of control: Transfer functions, Control laws: P, PD, PID, Non-linear and advanced controls.

Unit-V **9 hours**

Control Hardware and Interfacing: Embedded systems: Architecture and integration with sensors, actuators, components, Programming for Robot Applications.

Textbooks:

1. Niku Saeed B., “Introduction to Robotics: Analysis, Systems, Applications”, PHI, New Delhi.
2. Mittal R.K. and Nagrath I.J., “Robotics and Control”, Tata McGraw Hill.

References:

1. Saha, S.K., “Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, 2014.
2. Ghosal, A., “Robotics”, Oxford, New Delhi, 2006.

FUNDAMENTALS OF EMBEDDED SYSTEMS
(Open Elective – III)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-406 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12
CO1	outline the basic concepts of embedded computing	3	3	2	2
CO2	illustrate the architecture of 8051 microcontroller	3	3	3	2
CO3	develop embedded programs using 8051 microcontroller	3	3	3	2
CO4	demonstrate 8051 microcontroller interface with peripherals	3	3	3	2
CO5	explain real time operating system concepts	3	3	3	3

Unit-I **9 hours**

Embedded computing: Introduction, complex systems and microprocessor, the embedded system design process, formalisms for system design, design examples.

Unit-II **10 hours**

The 8051 architecture: Introduction, 8051 micro controller hardware, input / output ports and circuits, external memory, counter and timers, serial data input / output, interrupts.

Unit-III **(5 + 5) 10 hours**

Part-A: Basic assembly language programming concepts: The assembly language programming process, programming tools and techniques, programming the 8051.

Part-B: Instructions set: Data transfer and logical instructions, arithmetic operations, decimal arithmetic. Jump and call instructions.

Unit – IV **9 hours**

Applications: Interfacing with keyboards, displays, D/A and A/D conversions, multiple interrupts, serial data communication.

Unit – V **10 hours**

Introduction to real - time operating systems: Tasks and task states, tasks and data, semaphores, and shared data; message queues, mailboxes and pipes, timer functions, events, memory management, interrupt routines in an RTOS environment.

Textbooks:

1. Computers as Components - Principles of Embedded Computer System Design, Wayne Wolf, Elseveir.
2. The 8051 Microcontroller, Third Edition, Kenneth J.Ayala, Thomson.

References:

1. Microcontrollers, Raj kamal, Pearson Education.
2. An Embedded Software Primer, David E. Simon, Pearson Education.

WEB TECHNOLOGIES
(Open Elective – III)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-408 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12
CO1	design web pages using HTML and JavaScript	3	3	3	3	3
CO2	develop web applications using PHP	3	3	3	2	3
CO3	make use of XML and DTD for web design	3	3	3	2	2
CO4	build web applications using servlets and session tracking	3	3	3	2	2
CO5	establish database connectivity using JSP and JDBC	3	3	3	2	2

Unit-I **10 Hours**

Web: Introduction, Internet and web, web browsers, web servers, protocols.
HTML: Basics, elements, attributes, tags- list, tables, images, forms, frames, cascading style sheets.
Java Script: Introduction to scripting, control structures, conditional statements, arrays, functions, objects.

Unit-II **10 Hours**

PHP: Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, Reading data from web form controls, handling file uploads, connecting to database, executing simple queries, handling sessions and cookies, file handling.

Unit-III **(4 + 4) 8 Hours**

Part-A: XML: Basics of XML, Elements, Attributes, Name space, **Parsing:** DOM and SAX Parsers.
Part-B: Introduction to DTD: internal and external DTD, Elements of DTD, DTD Limitations, XML Schema, Schema structure, XHTML.

Unit-IV **10 Hours**

Servlets: Introduction, Lifecycle, Generic and HTTP servlet, passing parameters to servlet, HTTP servlet Request & Response interfaces, Deploying web Applications,
Session Tracking: Hidden form fields, cookies, URL- Rewriting, session.

Unit-V **10 Hours**

JSP: Introduction, Difference Between servlets & JSP, Anatomy of JSP page, JSP elements: Directives, comments, Expressions, scriptlets, Declaration, Implicit JSP objects, using Action elements.
JDBC: Introduction, JDBC Drivers, Loading Driver, establishing connection, Executing SQL statement in JSP pages, MVC architecture.

Text Books:

1. Web Technologies, Uttam K Roy, Oxford University Press.
2. The Complete Reference PHP- Steven Hozner, TMH.

References:

1. Java Server Pages-Hans Bergsten, SPD O'Reilly.
2. JavaScript, D. Flanagan O'Reilly, SPD.
3. Beginning Web Programming-Jon Dckett WROX.

PRINCIPLES OF ENTREPRENEURSHIP
(Open Elective – III)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-410 **3 - - 3**

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO7	PO8	PO9	PO11	PO12
CO1	illustrate concept & types of entrepreneurship	3	3	2	3	2
CO2	distinguish individual and corporate entrepreneurship	3	3	3	3	2
CO3	identify the process of launching new ventures	3	3	3	3	3
CO4	assess legal challenges of entrepreneurship	3	3	3	3	3
CO5	build entrepreneurial strategies	3	3	3	3	3

Unit-I: Entrepreneurship **10 hours**

The revolution impact of entrepreneurship- The evolution of entrepreneurship - Approaches to entrepreneurship- Process approach- Twenty first centaury trends in entrepreneurship.
Case: From candle seller to CEO (Arya Kumar P.No. 48).

Unit-II: Individual and corporate entrepreneurship **9 hours**

The entrepreneurial journey - Stress and the entrepreneur- the entrepreneurial ego- Entrepreneurial motivations- Corporate Entrepreneurial Mindset the nature of corporate entrepreneur.
Case: Globalizing Local Talent, (B. Janakiram, M. Rizwana, page 228).

Unit-III: Launching Entrepreneurial Ventures **(5 + 5) 10 hours**

Part-A: Opportunities identification - entrepreneurial Imagination and Creativity - the nature of the creativity Process - Innovation and Entrepreneurship - Methods to initiate Ventures.

Part-B: Creating New Ventures - Acquiring an established entrepreneurial venture – Franchising - hybrid disadvantage of Franchising.
Case: creativity in start-ups (Arya Kumar Page 166).

Unit-IV: Legal challenges of Entrepreneurship **9 hours**

Intellectual Property Protection-Patents, Copyrights, Trademarks and Trade Secrets-Avoiding Pitfalls- Formulation of the entrepreneurial Plan- The challenges of new venture start-ups.
Case: Tata Motors – Nano (Arya Kumar P.No. 279).

Unit-V: Strategic perspectives in entrepreneurship **10 hours**

Strategic Planning-Strategic actions-strategic positioning-Business stabilization-Building the adaptive firms-understanding the growth stage-unique managerial concern of growing ventures.
Case: To Lease or Not: A Cash flow Question (David H.Holt, Page 452).

References:

1. Arya Kumar “Entrepreneurship- creating and leading an entrepreneurial org” Pearson 2012.
2. ‘Entrepreneurship: New Venture Creation’ David H Holt PHI, 2013.
3. Entrepreneurship: Text and Cases P. Narayana Reddy, Cengage, 2010.

PROJECT - II

IV-B.Tech.-II-Sem.	L	T	P	C
Subject Code: EC-PRJ-421	-	-	22	11

Course Outcomes (COs) & CO-PO Mapping (3-Strong; 2-Medium; 1-Weak Correlation)

COs	Upon completion of course the students will be able to	PO1 to PO14
CO1	identify the problem statement, assess the scope and develop a prototype	3
CO2	execute the project using modern tools and prepare the report	3
CO3	demonstrate leadership, management skills for project development with ethics	3
CO4	function effectively as individual / member / leader in project teams	3
CO5	make use of engineering knowledge for societal sustenance	3

Guidelines:

The objective of the project work is to imbibe students with technical, analytical and innovative ideas to facilitate with theoretical and practical learning pertaining to relevant domain of interest. An individual or a peer of 2-5 students work under the guidance / mentorship of a departmental faculty with the aim of addressing solution to real world / societal problems using various R & D techniques. The team work fosters the communication and leadership skills among peers to survive and exercise during their career.

The project work normally includes:

1. Survey and study of published literature on the approved / assigned topic.
2. Conduct preliminary Analysis / Modeling / Simulation / Experiment / Design / Feasibility / ethnographical study.
3. Prepare an abstract/synopsis on the opted topic and present before Departmental Review Committee (DRC).
4. Prepare an Action Plan for conducting the investigation, including team work.
5. Apply suitable methodology for Designing / Modelling / Simulation / Experimentation as needed.
6. Develop an end product or process along with conclusions, recommendations and future scope.
7. Present and execute the project before DRC for CIE.
8. Prepare and publish a paper in Conference / Journal, if possible.
9. Prepare and submit the final dissertation in the prescribed format to the Department.
10. Present and execute the project before External Committee for viva-voce.