ACADEMIC REGULATIONS (R22)

COURSE STRUCTURE AND DETAILED SYLLABUS

(CHOICE BASED CREDIT SYSTEM (CBCS))

B.Tech.

Electronics and Communication Engineering

(B.Tech. Regular: Applicable for the batches admitted from 2022 - 2023)

&

(B.Tech. LES: Applicable for the batches admitted from 2023 - 2024)

Department of Electronics and Communication Engineering

CMR INSTITUTE OF TECHNOLOGY

(UGC - Autonomous)

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

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FOREWORD

CMR Institute of Technology, established in the year 2005, Approved by AICTE, New Delhi, Permanently Affiliated to JNTUH, Accredited by NBA under Tier-I, Achieved UGC Autonomous Status and has been bestowed with NAAC 'A' Grade 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 2005 to attain the current academic excellence in improvement of the standards and ethics. Institutional Governance enriched by eminent personalities on many of its boards/councils such as the Governing Body, Academic Council, Boards of Studies, IQAC to frame the guidelines for curriculum design and development in the interest of the key-stakeholders.

The autonomous academic regulations, course structure and syllabi have been framed in accordance with the vision and mission of the institution on the valuable suggestions from various stakeholders from the diverse fields of academics, industry, R&D and society with a bird-eye-view to impart quality professional technical education to contribute the society with innovation and creativity.

All the staff members, parents and 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 embarrassments. The cooperation of all the stakeholders 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.

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CMR INSTITUTE OF TECHNOLOGY

Vision: To create world class technocrats for societal needs.

Mission: Achieve global quality technical education by assessing learning environment through

- Innovative Research & Development
- Eco-system for better Industry institute interaction
- Capacity building among stakeholders

Quality Policy: Strive for global professional excellence in pursuit of key-stakeholders.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Vision: To become pioneer in the field of electronics & communication engineering by providing creative and innovative solutions for societal needs.

Mission: The department of **Electronics and Communication Engineering** is committed to

- Provide excellence in education, research and extension services.
- Provide quality education and to make the students entrepreneurs and employable.
- Learn continuously the state-of-art technologies for global excellence.

I. Programme Educational Objectives (PEOs): Engineering Graduates will

1. Acquire core competence for a successful professional career in the field of ECE.
2. Pursue higher education with a focus on multidisciplinary research activities.
3. Adapt entrepreneurship by engaging in lifelong learning with innovation and ethics.

II. Programme Outcomes (POs): Engineering Graduates will be able to

1. Apply mathematics, science, engineering fundamentals to solve complex engineering problems.
2. Identify, formulate and analyze complex engineering problems to reach substantiated conclusions.
3. Design and develop a component/system/process to solve complex societal engineering problems.
4. Design and conduct experiments to analyze, interpret and synthesize data for valid conclusions.
5. Create, select and apply modern tools, skills, resources to solve complex engineering problems.
6. Apply contextual engineering knowledge to solve societal issues.
7. Adapt modern engineering practices with environmental safety and sustainable development.
8. Apply professional code of ethics, responsibilities and norms in engineering practices.
9. Compete as an individual and/or as a leader in collaborative cross cultural teams.
10. Communicate effectively through technical reports, designs, documentations and presentations.
11. Endorse cognitive management skills to prepare project report using modern tools and finance.
12. Engage in independent and life-long learning in the broad context of technological changes.

III. Programme Specific Outcomes (PSOs): Engineering Graduates will be able to

1. Identify the complex problems and develop solutions in the areas of communication, signal processing, VLSI, embedded systems, IoT and Cloud.
2. Demonstrate proficiency in utilization of software and hardware tools along with analytical skills to arrive at appropriate solutions.

Academic Regulations (R22)
B.Tech. - Regular Four Year Degree Programme
(For batches admitted from the academic year 2022 - 23)
&
B.Tech. - Lateral Entry Scheme
(For batches admitted from the academic year 2023 - 24)

PREAMBLE

For pursuing four year undergraduate 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 2022-23 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.

1.0 UNDERGRADUATE PROGRAMMES OFFERED (E&T)

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

S. No.	Branch	Code
1	Electronics and Communication Engineering (ECE)	04
2	Computer Science and Engineering (CSE)	05
3	Computer Science and Engineering (Cyber Security)	62
4	Computer Science and Engineering (AI & ML)	66
5	Computer Science and Engineering (Data Science)	67
6	Artificial Intelligence and Machine Learning (AI & ML)	73

2.0 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:

2.1.1.1 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.

2.1.1.2 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 the admission process.

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

3.0 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 undergraduate 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 ≥ 5) for the completion of the undergraduate 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 the B.Tech. III 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 the B.Tech. programme.

3.2.2 The student shall register and secure 120 credits (with CGPA ≥ 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 (≥ 90 Instructional days per semester) each and in each Semester - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)', Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) indicated by UGC, and curriculum/course structure 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 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 almost all the guidelines specified by AICTE/UGC/JNTUH. The subjects/courses offered in the B.Tech. programme are broadly classified as mentioned below.

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses (FnC)	BS - Basic Sciences	Includes Mathematics, Physics and Chemistry subjects
2		ES - Engineering Sciences	Includes Fundamental Engineering Subjects
3		HS - Humanities and Social Sciences	Includes subjects related to Humanities, Social Sciences and Management
4	Core Courses (CoC)	PC – Professional Core	Includes core subjects related to the parent discipline/ department/ branch of Engineering.
5	Elective Courses (EℓC)	PE - Professional Electives	Includes elective subjects related to the parent discipline/department/branch of Engineering.
6		OE - Open Electives	Elective subjects which includes inter-disciplinary subjects or subjects in an area outside the parent discipline/department/ branch of Engineering.
7	Core Courses	PR - Project Work/ Internship/ Industry Oriented Mini-Project/Skill Enhancement Courses	Real Time/Societal Research Project, Project Stage - I & Project Stage - II including Seminar, Internship/Industry Oriented Mini-Project/ Skill Enhancement Courses.
8	MC - Mandatory Courses		Mandatory Courses (non-credit)

4.0 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 student 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 maximum of two additional theory subject(s)/ course(s) limited to 6 credits (any 2 elective subjects), 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 Choice for '**additional subjects/courses**', not more than any 2 elective subjects in any Semester, must be clearly indicated, which needs the specific approval and signature of the Faculty Advisor/Mentor/HOD.

4.6 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.

4.7 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.

4.8 Dropping of additional registered subject/course 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.

4.9 **Open Electives**: The students have to choose three Open Electives (OE-I, II & III) from the list of Open Electives given by other departments. However, the student can opt for an Open Elective subject offered by his own (parent) department, if the student has not registered and not studied that subject under any category (Professional Core, Professional Electives, Mandatory Courses etc.) offered by the parent department in any semester. Open Elective subjects already studied should not repeat/should not match with any category (Professional Core, Professional Electives and Mandatory Courses etc.) of subjects even in the forthcoming semesters.

4.10 **Professional Electives**: The students have to choose six professional electives (PE-I to VI) from the list of professional electives given.

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

5.0 SUBJECTS/COURSES TO BE OFFERED

5.1 A subject/ course may be offered to the students, **only if** a minimum of 15 students opt for it.

5.2 More than **one faculty member** may offer the **same subject** (lab/practical 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).

5.3 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**.

5.4 In case of options coming from students of other departments/branches/disciplines (not considering **open electives**), first **priority** shall be given to the student of the '**parent department**'.

6.0 ATTENDANCE REQUIREMENTS

6.1 A student shall be eligible to appear for the semester end examinations, if the student acquires a minimum of 75% of attendance in aggregate of all the subjects/courses including attendance in all mandatory courses for that semester. **Two periods** of attendance for each theory subject shall be considered, if the student appears for the mid-term examination of that subject.

6.2 Shortage of attendance in aggregate upto 10% (65% and above, and below 75%) in each semester may be condoned 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,** including all academic credentials(internal marks etc.) of that semester**. They will not be promoted to the next semester.**They may seek re-registration for all those subjects registered in that semester, in which the student is detained, by seeking re-admission into that semester as and when offered; 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.

7.0 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% (14 marks out of 40 marks) in the Continuous Internal Evaluation (CIE), not less than 35% (21 marks out of 60 marks) in the semester end examinations (SEE), and a minimum of 40% (40 marks out of 100 marks) in the sum total of the CIE and 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 Real-time/Societal Research Project (or) Industry Oriented Mini Project/Internship, if the student secures not less than 40% marks (i.e. 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if the student (i) does not submit a report on Industry Oriented Mini Project/Internship, or (ii) not make a presentation of the same before the evaluation committee as per schedule, or (iii) secures less than 40% marks in Real-time/Societal Research Project (or) Industry Oriented Mini Project/Internship evaluations.

7.3 A student may reappear once for each of the above evaluations, when they are scheduled again; if the student fails in such 'one reappearance' evaluation also, the student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

7.4 Promotion Rules

S. No.	Promotion	Conditions to be fulfilled
1	I Semester to II Semester	Regular course of study of I Semester.
2	II Semester to III Semester	**(i)** Regular course of study of II Semester. **(ii)** Must have secured at least 20 credits out of 40 credits i.e., 50% credits up to second semester from all the relevant regular and supplementary examinations whether the student takes those examinations or not.
3	III Semester to IV Semester	Regular course of study of III Semester.

4	IV Semester to V Semester	**(i)** Regular course of study of IV Semester. **(ii)** Must have secured at least 48 credits out of 80 credits i.e., 60% credits up to fourth semester (20 credits out of 40 credits for LES) from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	V Semester to VI Semester	Regular course of study of V Semester.
6	VI Semester to VII Semester	**(i)** Regular course of study of VI Semester. **(ii)** Must have secured at least 72 credits out of 120 credits (48 credits out of 80 credits for LES) i.e., 60% credits up to sixth semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	VII Semester to VIII Semester	Regular course of study of VII Semester.

7.5 A student has to register for all subjects covering 160 credits (120 credits for 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 (120 credits for LES) securing a minimum of **'C'** grade or above in each subject, and 'earn all 160 credits (120 credits for LES) securing SGPA ≥ 5.0 (in each semester) and CGPA (at the end of each successive semester) ≥ 5.0, to successfully complete the undergraduate programme and shall be indicated in the grade card/marks memo of VIII semester.

7.6 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 (120 credits for 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 (120 credits for 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.

7.7 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.

7.8 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 the student has been detained.

7.9 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.

8.0 EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

8.1 The performance of a student in every subject/course (including practical and Project Stage- I & II) will be evaluated for 100 marks each, with 40 marks allotted for CIE and 60 marks SEE.

8.2 Evaluation of Theory Subjects/Courses

A) Continuous Internal Evaluation (CIE): In CIE, for theory subjects, during a semester, there shall be **Two** Mid-Term Examinations. The first Mid-Term Examination shall be conducted for the first 50% of the syllabus, and the Second Mid-Term for the remaining 50% of the syllabus. Each Mid-Term examination consists of two parts (i) **Part - A** for 5 marks, (ii) **Part - B** for 25 marks with a total duration of 2 hours as follows:

- Part-A consists of one compulsory question with five sub questions carrying one mark each and Part-B consists of 5 essay questions with internal choice carrying five marks each; the student has to answer all 5 questions. The First and Second Mid-Term question papers comprise of 2,2,1 questions from I, II, III(A) Units and 1,2,2 questions from III(B), IV, V Units respectively. The **average of two Mid Term Examinations** shall be taken as final marks for Mid-Term Examination (for 30 marks).
- The remaining 10 marks of CIE are distributed as follows:
  (i) Assignment for 5 marks. First assignment should be submitted before the commencement of the first mid-term examinations and the second assignment before the commencement of second mid-term examinations. The assignments shall be specified/given by the concerned subject teacher. The average of two assignments shall be taken as final marks for assignment (for 5 marks).
  (ii) Subject Viva-Voce/PPT/Poster Presentation/Case Study on a topic in the subject concerned for 5 marks before commencement of II Mid-Term Examination.
- *There is NO Computer Based Test (CBT) for R22 regulations.*

B) Semester End Examinations (SEE): 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 60 marks consisting of two parts viz. i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.
- Part-A is compulsory, which consists of ten questions (two from each unit) carrying 1 mark 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 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 SEE. For practical subjects, there shall be a CIE during the Semester for 40 internal marks and 60 marks for SEE.

A) Continuous Internal Evaluation (CIE): The distribution of CIE 40 marks for practical subjects is as follows:

- A write-up on day-to-day experiment(s) in the laboratory shall be evaluated for 15 marks. The breakup of marks would be (i) 3 marks for observation and record (ii) 4 marks for performance of experiment (iii) 3 marks for expected outcome and (iv) 5 marks for Viva-Voce. The average marks of day-to-day experiments shall be the final marks (for 15 marks).
- Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 15 marks. The breakup of marks are (i) 3 marks for write-up (ii) 4 marks for experiment/program (iii) 3 for evaluation of results and (iv) 5 marks for viva-voce on concerned laboratory course.
- The remaining 10 marks are for Laboratory Project, which consists of the Design (or) Software/Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before Semester End Practical Examination.

B) Semester End Examination (SEE): The Semester End Examination (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 for 60 marks. The allocation of marks is as given below

- (i) 10 marks for write-up (ii) 15 marks for experiment/program (iii) 15 marks for evaluation of results (iv) 10 marks for presentation on another experiment/program in the same lab course and (v) 10 marks for viva-voce on concerned laboratory course.

8.4 Condition for Passing CIE and SEE in Theory and Practical Subject(s)/Course(s): The Student, in each subject, shall have to earn 35% of marks (i.e. 14 marks out of 40 marks) in CIE, 35% of marks (i.e. 21 marks out of 60) in SEE and Overall 40% of marks (i.e. 40 marks out of 100 marks) both CIE and SEE marks put together.

- The student is eligible to write Semester End Examination of the concerned subject, if the student scores ≥ 35% (14 marks) of 40 CIE marks.
- In case, the student appears for SEE of the concerned subject but has not scored minimum 35% of CIE marks (14 marks out of 40 internal marks), the student performance in that subject in SEE shall stand cancelled in spite of appearing the SEE.

8.5 The Evaluation of Elements of CSE/CSE allied branches/ECE: There shall be only internal evaluation for 50 marks and NO external evaluation. Students have to earn 40%, i.e. 20 out of 50 marks. The student is deemed to have failed, if the student (i) is absent as per schedule, or (ii) secures less than 40% marks in this course.

- **CSE/CSE allied branches:** There shall be two Mid-Term examinations and it shall take place during I Mid-Term and II Mid-Term examinations. The Continuous Internal Evaluation (CIE) will be for 50 marks. Each Mid-Term examination consists of two parts (i) **Part - A** for 10 marks, (ii) **Part - B** for 30 marks with a total duration of 2 hours.
  - **Part-A** consists of one compulsory question with five sub questions carrying two marks each and **Part-B** consists of 5 essay questions with internal choice carrying six marks each; the student has to answer all 5 questions. The First and Second Mid-Term question papers comprise of 2,2,1 questions from I, II, III(A) Units and 1,2,2 questions from III(B), IV, V Units respectively. The average of two Mid-Term examinations marks is final for 40 marks.
  - The remaining 10 marks of Continuous Internal Evaluation are for Assignment (5 marks) and Subject Viva-Voce/PPT/Poster Presentation/Case Study (5 marks) and the evaluation pattern will remain same as for other theory subjects.
- **ECE branch**: The Continuous Internal Evaluation (CIE) will be for 50 marks. Out of the 50 marks for internal evaluation:
  - A write-up on day-to-day experiment(s) in the laboratory shall be evaluated for 15 marks. The breakup of marks would be (i) 3 marks for observation and record (ii) 4 marks for performance of experiment (iii) 3 marks for expected outcome and (iv) 5 marks for Viva-Voce. The average marks of day-to-day experiments shall be the final marks (for 15 marks).
  - Internal practical examination conducted by the laboratory teacher concerned shall be evaluated for 20 marks. The breakup of marks are (i) 5 marks for write-up (ii) 5 marks for experiment/program (iii) 5 for evaluation of results and (iv) 5 marks for viva-voce on concerned laboratory course.
  - The remaining 15 marks are for Laboratory Project, which consists of the Design (or) Software/Hardware Model Presentation (or) App Development (or) Prototype Presentation submission which shall be evaluated after completion of laboratory course and before Semester End Practical Examination.

8.6 The Evaluation of Real-Time/Societal Research Project: The project will be evaluated for a total of 100 marks (CIE 40 marks and SEE 60 marks). The CIE marks are awarded by the supervisor based on the student's performance during the project work. The SEE marks are awarded by a Departmental Review Committee consisting of Head of the Department, Supervisor and a Senior Faculty Member. The student is deemed to have failed, if student (i) does not submit a report on the Project, or (ii) does not make a presentation of the same before the internal committee as per schedule, or (ii) secures less than 40% marks in this course.

8.7 The Evaluation of Internship/Industry Oriented Mini-Project/Skill Enhancement Courses: There shall be Internship (or) Industry Oriented Mini-Project (or) Skill Enhancement Courses, Students shall register for this immediately after IV SEE and complete before VI SEE without effecting regular classwork. Internship at reputed organization (or) Industry

Oriented Mini Project (or) Skill Enhancement Courses shall be submitted in a report form and presented before the committee in VI semester before End Semester Examination. It shall be evaluated only for SEE 100 marks. The committee consists of an External Examiner, Head of the Department, Supervisor of the Industry Oriented Mini Project (or) Internship etc, Internal Supervisor and a Senior Faculty Member of the Department. There shall be NO internal marks for Internship (or) Industry Oriented Mini-Project (or) Skill Enhancement Courses.

8.8 **Main Project:** The topic and content of the project should be different from Real-Time/Societal Research Project (or) Industry Oriented Mini-Project (or) Internship. The Main Project Work shall be carried out in two stages. The Project Stage-I will be initiated and completed in the VII Semester and the Project Stage-II will be initiated and completed in the VIII Semester. The student must present reports of Project Stage - I and Project Stage - II before II Mid examinations of VII semester and VIII semester respectively. Each report of the project stages I and II shall be evaluated for 100 marks before commencement of SEE theory examinations. Only those students who get Project Stage - I approved by Departmental Review Committee evaluation are eligible to start Project Stage - II work. The Departmental Review Committee comprises of Head of the Department, Project Supervisor and one Senior Faculty Member. The External Evaluation Committee comprises of Head of the Department, Project Supervisor and one External Examiner appointed by the Principal.

8.9 **Project Stage - I:** During the Project Stage - I the student in consultation with the Supervisor, decides on the title, objectives and plan of action of the Project work and submits the report to the Head of the Department on approval of Supervisor for evaluation. The Project Work is evaluated for a total of 100 marks, of which CIE is for 40 marks awarded by Supervisor and SEE is for 60 marks awarded by Departmental Review Committee. The student is deemed to be not eligible to register for the Project Stage - II, if the student (i) does not submit a report on Project Stage - I or (ii) does not make a Presentation of the same before the Evaluation Committee as per schedule or (iii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

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

8.10 **Project Stage - II:** During the Project Stage - II the student executes the Project under the guidance of the Supervisor and submits the final Project Report to the Head of the Department for evaluation. The External Evaluation Committee shall evaluate the Project Stage - II work for 60 marks and the Internal Project Committee shall evaluate it for 40 marks. Out of 40 internal marks, the Departmental Review Committee shall evaluate the project work for 20 marks and Project Supervisor shall evaluate for 20 marks. The student is deemed to have failed, if the student (i) does not submit a Report on the Project, or (ii) does not make a Presentation of the same before the External Examiner as per schedule, or (iii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

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

8.11 **A student shall be given one time chance to re-register for a maximum of two subjects:**

- If the internal marks secured by a student in the Continuous Internal Evaluation marks for 40 (Sum of average of two mid-term examinations consisting of two parts, Part-A (Short Answer Questions) and Part-B (Descriptive Questions), Average of two Assignments & Subject Viva-Voce/PPT/Poster Presentation/Case Study on a topic in the concerned subject) are less than 35% (14 out of 40 marks) and failed in those subjects.
- A student must re-register for the failed subject(s) for 40 marks within four weeks of commencement of the classwork in the next academic year.
- In the event of the student taking this chance, the Continuous Internal Evaluation marks for 40 and Semester End Examination marks for 60 obtained in the previous attempt stands cancelled.

8.12 Evaluation of Mandatory Non-Credit Courses: There shall be only Continuous Internal Evaluation for all mandatory (non credit) courses. Instead of marks, a letter grade '**S'** for **Satisfactory** or '**U'** for **Unsatisfactory** shall be indicated and this will not be counted for the computation of SGPA/CGPA.

9.0 GRADING PROCEDURE

9.1 Grades will be awarded to indicate the performance of students in each Theory Subject, Laboratory/Practical's/Industry-Oriented Mini Project/Internship/Skill Enhancement Course and Project Stage. Based on the percentage of marks obtained (CIE+SEE) 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 (As per UGC/AICTE/JNTUH Guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
90% and above ($\geq$ 90% , $\leq$ 100%)	O (Outstanding)	10
Below 90% but not less than 80% ($\geq$ 80% , < 90%)	A^+ (Excellent)	9
Below 80% but not less than 70% ($\geq$ 70% , < 80%)	A (Very Good)	8
Below 70% but not less than 60% ($\geq$ 60% , < 70%)	B^+ (Good)	7
Below 60% but not less than 50% ($\geq$ 50% , < 60%)	B (Average)	6
Below 50% but not less than 40% ($\geq$ 40% , < 50%)	C (Pass)	5
Below 40% (< 40%)	F (Fail)	0
Absent	Ab	0

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 SEE, as and when offered. In such cases, CIE in those subject(s) will remain the same as those obtained earlier.

9.4 To a student who has not appeared for an examination in any subject, '**Ab'** grade will be allocated in that subject, and the student is deemed to have '**Failed'**. A student will be required to reappear as a '**supplementary student**' in the SEE, as and when offered next. In this case also, the internal marks in those subjects will remain the same as those obtained earlier.

9.5 A letter grade does not indicate any specific percentage of marks secured by the student, but it indicates only the range of percentage of marks.

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 $\geq$ 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. The SGPA is

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

Where C_i is the no. of credits of the i^{th} course and G_i is the GP scored 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 following formula:

$$CGPA = \sum (C_i \, X \, S_i) / \sum C_i$$

where S_i is the SGPA of the i^{th} semester and C_i is the total no. 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	20	7	20 x 7= 140
Course 2	4	O	10	4 x 10 = 40	Sem II	20	6	20 x 6= 120
Course 3	3	C	5	3 x 5 = 15	Sem III	20	6.5	20 x 6.5 =130
Course 4	3	B	6	3 x 6 = 18	Sem IV	20	6	20 x 6 = 120
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	**20**		**62**	**154.5**	**Total**	**160**		**1150**
SGPA = 154.5/20 = 7.70					**CGPA = 1150/160 = 7.19**			

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 SGPA and CGPA of a semester will be mentioned in the semester Memorandum of Grades if all subjects of that semester are passed in the first attempt. Otherwise the SGPA and CGPA shall be mentioned only on the Memorandum of Grades in which the student passed in the last exam in that semester. However, mandatory courses will not be taken into consideration.

10.0 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 undergraduate 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, number of credits, grade earned etc.), credits earned, SGPA, and CGPA. **There is NO exemption of credits in any case.**

11.0 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

12.0 AWARD OF DEGREE

12.1 After a student has satisfied the requirement prescribed for the completion of the programme 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 120 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.

12.6 Award of 2-Year B.Tech. Diploma Certificate

a) A student is awarded 2-Year UG Diploma Certificate in the concerned engineering branch on completion of all the academic requirements and has earned all the 80 credits (within 4 years from the date of admission) upto B.Tech. IV Semester, if the student wants to exit the 4-Year B.Tech. programme and *requests for the 2-Year* B.Tech. (*UG) Diploma Certificate.*

b) The student **once opted and awarded a 2-Year UG Diploma Certificate will be permitted to join** in B.Tech. V Semester and continue for completion of remaining years of study for 4-Year B. Tech. Degree ONLY in the next academic year along with next batch students. *However, if any student wishes to continue the study after opting for exit, student should register for the subjects/courses in V Semester before commencement of class work for that semester.*

c) *The students, who exit the 4-Year B. Tech. program after IV semester of study and wish to rejoin the B.Tech. program, must submit the 2 -Year* B. Tech. (*UG) Diploma Certificate awarded to him, subject to the eligibility for completion of Course/Degree.*

d) A student may be permitted to take one year break after completion of IV Semester or B. Tech. VI Semester (with university permission through the Principal of the college well in advance) and can re-enter the course in **next Academic Year in the same college** and complete the course on fulfilling all the academic credentials within a stipulated duration i.e. double the duration of the course (Ex. within 8 Years for 4-Year program).

13.0 WITHHOLDING OF RESULTS

13.1 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.

14.0 SUPPLEMENTARY EXAMINATIONS

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

15.0 TRANSITORY REGULATIONS

A. For students detained due to shortage of attendance:

a) A Student who has been detained in I year of R18/R20 Regulations due to lack of attendance, shall be permitted to join I year I Semester of R22 Regulations and the student is required to complete the study of B.Tech. programme within the stipulated period of eight academic years from the date of first admission in I Year.

b) A student, who has been detained in any semester of II, III and IV years of R18/R20 regulations for want of attendance, shall be permitted to join the corresponding semester of R22 Regulations and is required to complete the study of B.Tech. within the stipulated period of eight academic years from the date of first admission in I Year. The R22 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester. See rule (C) for further Transitory Regulations.

B. For students detained due to shortage of credits:

c) A student of R18/R20 Regulations, who has been detained due to lack of credits, shall be promoted to the next semester of R22 Regulations only after acquiring the required number of credits as per the corresponding regulations of their first admission. The total credits required are 160 including both R18/R20 & R22 regulations. The student is required to complete the study of B.Tech. within the stipulated period of eight academic years from the year of first admission. The R22 Academic Regulations are applicable to a student from the year of readmission. See rule (C) for further Transitory Regulations.

C. For readmitted students in R22 Regulations:

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

e) 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 their study including R22 Regulations. **There is NO exemption of credits in any case**.

f) If a student is readmitted to R22 Regulations and has any subject with 80% of syllabus common with their previous regulations, that particular subject in R22 Regulations will be substituted by another subject to be suggested by the University.

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

16.0 STUDENT TRANSFERS

There shall be no transfers from other colleges/streams.

17.0 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.

18.0 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, notebook, 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 the student 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, the student will be handed over to the police and a case is registered against them.
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 the 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 classwork and

		all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6	Refuses to obey the orders of the Addl. Controller of examinations / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the addl. Controller of examinations or any person on duty in or outside the examination hall of any injury to his person or to any of their 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 their 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 a 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 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.	

19.0 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 Academic Council is final.

iv) 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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INDUCTION PROGRAM

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	PO9	PO10	PO12
CO1	acquaint with new learning environment and inculcate ethos	3	3	3	3
CO2	explore professional comfort, sensitization and group dynamics	3	3	3	3
CO3	promote healthy bonding, professional advancement and excellence	3	3	3	3
CO4	build relationship among members of academic community	3	3	3	3
CO5	provide a panoramic view of art of living and build one's character	3	3	3	3

List of Activities

Schedule of 1st Week Induction Program (Each session may be of 2-3 hrs)		
Day	**Session**	**Events**
1	1	Orientation program (Institute policies, processes, practices, academic regulations, culture and values).
	2	Mentoring (group formation and introduction).
2	3	Diagnostic test (English, Mathematics and computer operation).
	4	Familiarization of Department and Institute (Visits to department, laboratory, Library, Examination cell, office, etc).
3	5	Physical Activity (Sports, Yoga and Meditation, Plantation).
	6	Universal human values session.
4	7	Proficiency Module (Short courses on Mathematics, English and computer operation)
	8	Physical Activity (Sports, Yoga and Meditation, Plantation).
5	9	Proficiency Module (Short courses on Mathematics, English and computer operation)
	10	Creative Arts, Cultural and Literary Activity.
Conduct a minimum 12 out of 20 sessions from 2nd week onwards to till end of the semester		
Session	**Event**	
11	Physical Activity (Sports, Yoga and Meditation, Plantation, etc.) - 1	
12	Extra-Curricular Activity - 1	
13	Physical Activity (Sports, Yoga and Meditation, Plantation, etc.) -2	
14	Extra-Curricular Activity - 2	
15	Physical Activity (Sports, Yoga and Meditation, Plantation, etc.) - 3	
16	Lectures/Workshops by Eminent People - 1	
17	Physical Activity (Sports, Yoga and Meditation, Plantation, etc.) - 4	
18	Lectures/Workshops by Eminent People - 2	
19	Creative Arts, Cultural and Literary Activity - 1	
20	Lectures/Workshops by Eminent People - 3	
21	Creative Arts, Cultural and Literary Activity - 2	
22	Universal Human Values - 1 (Group Discussion among students as per mentoring group on various aspects of life, values, ethics etc.)	
23	Creative Arts, Cultural and Literary Activity - 3	
24	Universal Human Values - 2 (Group Discussion among students as per mentoring group on various aspects of life, values, ethics etc.)	
25	Creative Arts, Cultural and Literary Activity - 4	
26	Universal Human Values - 3 (Group Discussion among students as per mentoring group on various aspects of life, values, ethics etc.)	
27	Creative Arts, Cultural and Literary Activity - 5	
28	Physical Activity (Sports, Yoga and Meditation, Plantation, etc.) - 5	
29	Feedback and Report on the Program - 1	
30	Feedback and Report on the Program - 2	

COURSE STRUCTURE

B.Tech. (ECE) – R22 COURSE STRUCTURE

(Applicable from the batch admitted during 2022-23 and onwards)

I – Semester								
S. No.	Course Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	22BS11	Matrices and Calculus	1,2,12		3	1	-	4
2	22BS12	Applied Physics	1,2,12		3	1	-	4
3	22HS11	English for Skill Enhancement	10,12		2	-	-	2
4	22ES12	Programming for Problem Solving	1,2,3,12		3	-	-	3
5	22ES14	Elements of Electronics & Communication Engineering	1,2,3,4,5,9,12		-	-	2	1
6	22BS13	Applied Physics Lab	4,9		-	-	3	1.5
7	22HS12	English Language Laboratory for Effective Communication	5,9,10		-	-	3	1.5
8	22ES16	Programming for Problem Solving Lab	4,5,9		-	-	2	1
9	22ES18	IT Workshop Practice	1,5,9,10		-	1	2	2
10	22MC11	Induction Program	8,9,10,12		-	-	-	-
TOTAL					**11**	**03**	**12**	**20**

II – Semester								
S. No.	Course Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	22BS21	Ordinary Differential Equations and Vector Calculus	1,2,12		3	1	-	4
2	22BS24	Engineering Chemistry	1,2,12		3	1	-	4
3	22ES21	Basic Electrical & Electronics Engineering	1,2,3,12		3	-	-	3
4	22ES22	Data Structures through Python	1,2,3,12		3	-	-	3
5	22BS25	Engineering Chemistry Lab	4,9		-	-	2	1
6	22ES23	Basic Electrical & Electronics Engineering Lab	4,9		-	-	3	1.5
7	22ES24	Data Structures through Python Lab	4,5,9		-	-	2	1
8	22ES25	Computer Aided Engineering Graphics Lab	1,5,9,10		-	-	3	1.5
9	22ES27	Design Thinking for Innovation and Startups	1 to 12	1,2	-	-	2	1
10	22MC21	Environmental Science & Disaster Management	1,6,7,12		2	-	-	-
TOTAL					**14**	**02**	**12**	**20**

III – Semester								
S. No.	Course Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	22BS32	Numerical Methods and Complex Variables	1,2,12		3	1	-	4
2	22ES31	Probability Theory & Stochastic Processes	1,2,12	1	3	-	-	3
3	22ECPC31	Digital Logic Design	1,2,3,12	1	3	-	-	3
4	22ECPC32	Analog Electronics	1,2,3,12	1	3	-	-	3
5	22ECPC33	Signals and Systems	1,2,12	1	3	-	-	3
6	22ECPC34	Digital Logic Design Lab through Verilog HDL	4,5,9	2	-	-	2	1
7	22ECPC35	Analog Electronics Lab	4,5,9	2	-	-	2	1
8	22ECPC36	Basic Simulation Lab	4,5,9	2	-	-	2	1
9	22ES33	Scripting Languages Lab	1,2,3,5,9		-	-	2	1
10	22MC31	Gender Sensitization	9,12		-	-	2	-
11	22MC32	Employability Skills - I	9,10		-	-	3	-
TOTAL					**15**	**01**	**13**	**20**

IV – Semester								
S. No.	Course Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	22ECPC41	Networks and Control Systems	1,2,3,12	1	3	-	-	3
2	22ECPC42	Pulse & Digital Circuits	2,3,12	1	3	-	-	3
3	22ECPC43	Linear & Digital IC Applications	2,3,12	1	3	-	-	3
4	22ECPC44	Electromagnetic Waves & Transmission Lines	1,2,12	1	3	-	-	3
5	22ECPC45	Database Management Systems	1,2,3,12		3	-	-	3
6	22ECPC46	Pulse & Digital Circuits Lab	4,5,9	2	-	-	2	1
7	22ECPC47	Linear & Digital IC Applications Lab	4,5,9	2	-	-	2	1
8	22ECPC48	Database Management Systems Lab	4,5,9		-	-	2	1
9	22ECPR41	Real-time/Societal Research Project	1 to 12	1,2	-	-	4	2
10	22MC41	Indian Culture and Constitution	8,12		2	-	-	-
11	22MC42	Employability Skills - II	9,10		-	-	3	-
TOTAL					**17**	**-**	**13**	**20**

V – Semester								
S. No.	Course Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	22ECPC51	Analog and Digital Communication	2,3,8,12	1	3	1	-	4
2	22ECPC52	Antenna & Wave Propagation	2,3,12	1	3	-	-	3
3	22ECPC53	Microprocessors & Microcontrollers	2,3,7,12	1	3	-	-	3
4	22ECPC54	OOP through Java	2,3,12		3	-	-	3
5	**Professional Elective – I**				3	-	-	3
	22ECPE51	Data Communication & Computer Networks	2,12	1				
	22ECPE52	Computer Organization & Operating Systems	2,3,12	1				
	22ECPE53	Electronic Measurements and Instrumentation	1,2,12					
	22ECPE54	Digital Marketing	2,3,5,6,8,12					
6	22ECPC55	Analog and Digital Communication Lab	4,5,9	2	-	-	2	1
7	22ECPC56	Microprocessors & Microcontrollers Lab	4,5,9	2	-	-	2	1
8	22ECPC57	OOP through Java Lab	4,5,9		-	-	2	1
9	22HS51	Advanced English Communication Skills Lab	5,9,10		-	-	2	1
10	22MC51*	Environmental Science & Disaster Management	1,6,7,12		2	-	-	-
TOTAL					**17**	**01**	**08**	**20**

* For Lateral Entry Students only

VI – Semester								
S. No.	Course Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	22ECPC61	IoT and Cloud Computing	2,3,6,7,12	1	3	-	-	3
2	22ECPC62	VLSI Design	2,3,7,12	1	3	-	-	3
3	22ECPC63	Digital Signal Processing	2,3,6,12	1	3	-	-	3
4	**Professional Elective – II**				3		-	3
	22ECPE61	Cellular and Mobile Communications	2,3,6,12	1				
	22ECPE62	Information Theory & Coding	2,3,5,8,12	1				
	22ECPE63	Embedded System Design	2,3,5,6,12	1				
	22ECPE64	Artificial Intelligence and Machine Learning	1,2,3,6,12	1				
5	**Open Elective – I**				3		-	3
	22OE61	E-Commerce	3,8,9,10,12					
	22OE62	Agile Methodologies	2,3,6,8,12					
	22OE63	Electronic Sensors	2,3,6,7,8,12					
6	22ECPC64	IoT and Cloud Computing Lab	4,5,9	2	-	-	2	1
7	22ECPC65	VLSI Design Lab	4,5,9	2	-	-	2	1
8	22ECPC66	Digital Signal Processing Lab	4,5,9	2	-	-	2	1
9	22ECPR61	Industry Oriented Mini Project/ Internship/Skill Enhancement Course - Robotic Process Automation	1 to 12	1,2	-	-	4	2
10	22MC61	Entrepreneurship and IPR	1,7,8,12		3	-	-	
TOTAL					**18**	**00**	**10**	**20**

VII – Semester								
S. No.	Course Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	22HS71	Management, Economics and Accountancy	11,12		3	-	-	3
2	22ECPC71	Microwave Engineering	2,3,12	1	3	-	-	3
3	**Professional Elective – III**				3	-	-	3
	22ECPE71	Digital Image Processing	2,5,12	1				
	22ECPE72	IoT Architecture and Protocols	2,3,5,6,12	1				
	22ECPE73	CMOS Analog IC Design	2,3,5,6,12	1				
	22ECPE74	Data Mining and Data Analytics	1,2,3,5,12	1				
4	**Professional Elective – IV**				3	-	-	3
	22ECPE75	Radar and Satellite Communication Systems	2,3,7,12	1				
	22ECPE76	Smart Sensors and Networking	2,3,5,6,12	1				
	22ECPE77	Application Specific Integrated Circuits	2,3,4,12	1				
	22ECPE78	Neural Networks and Deep Learning	2,3,5,6,12	1				
5	**Open Elective – II**				3	-	-	3
	22OE71	Chatbots	2,3,5,7,8,12					
	22OE72	Multimedia and Animation	2,3,5,6,8,12					
	22OE73	Embedded Systems	2,3,5,6,7,12					
6	22ECPC72	Microwave Engineering Lab	4,5,9	2	-	-	2	1
7	22HS71	Professional Practice, Law & Ethics Lab	6,7,8,10,12		-	-	2	1
8	22ECPR71	Project Stage - I	1 to 12	1,2	-	-	6	3
TOTAL					**15**	**-**	**10**	**20**

VIII – Semester								
S. No.	Course Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	**Professional Elective – V**				3	-	-	3
	22ECPE81	5G Communication Technologies	2,3,5,7,12	1				
	22ECPE82	Software Defined Radio	2,3,5,7,12	1				
	22ECPE83	Low Power VLSI Design	2,3,4,5,12	1				
	22ECPE84	Augmented and Virtual Reality	2,3,5,8,12	1				
2	**Professional Elective – VI**				3	-	-	3
	22ECPE85	Ad-hoc Wireless Sensor Networks	2,3,5,8,12	1				
	22ECPE86	Industry 4.0	2,3,5,7,12	1				
	22ECPE87	System on Chip Architecture	2,3,5,6,12	1				
	22ECPE88	Information and Cyber Security	2,3,5,6,8,12	1				
3	**Open Elective – III**				3	-	-	3
	22OE81	Game Development	2,4,5,8,12					
	22OE82	Precision Agriculture	2,5,7,8,12					
	22OE83	Electronics for Health Care	2,5,6,8,12					
4	22ECPR81	Project Stage – II including Seminar	1 to 12	1,2	-	-	22	11
TOTAL					**09**	**-**	**22**	**20**

I-SEM. SYLLABUS

MATRICES AND CALCULUS

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	22BS11	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	verify mean value theorems and evaluate improper integrals	3	2	1
CO4	find the extreme values of functions of several variables	3	2	1
CO5	evaluate multiple integrals and apply them to find areas and volumes	3	2	1

Syllabus

Unit	Title/Topics	Hours
I	**Matrices**	9
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.		
II	**Eigen values and Eigen vectors**	11
Linear Transformation and Orthogonal Transformation: Eigen values, Eigen vectors 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.		
III	**Calculus**	4+6=10
Part A: Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series.		
Part B: Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves (Only in Cartesian coordinates), Definition of Improper Integral, Beta and Gamma functions and their applications.		
IV	**Multivariable calculus (Partial Differentiation and applications)**	9
Definitions of Limit and continuity. Partial Differentiation: Euler's Theorem, Total derivative, Jacobian, Functional dependence & independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.		
V	**Multivariable Calculus (Integration)**	9
Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Evaluation of Triple Integrals, Change of variables (Cartesian to polar) for double integrals. Applications: Areas (by double integrals) and volumes (by double integrals and triple integrals).		
Textbooks		
1. Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers, 36th Edition, 2010. 2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 2016.		
References		
1. A text book of Engineering Mathematics, N.P. Bali and M. Goyal, Laxmi Publications, 2008. 2. Advanced Engineering Mathematics by Erwin kreyszig, 9th Edition, John Wiley & Sons, 2006.		

APPLIED PHYSICS

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	22BS12	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	explain the principles of Quantum Physics and band theory of solids	3	2	1
CO2	classify semiconductors and relate functioning of semiconductor devices	3	2	1
CO3	outline the concepts of dielectric, magnetic and energy materials	3	2	1
CO4	use fabrication and characterization techniques of nano-materials	3	2	1
CO5	illustrate principles and applications of lasers and optical fibers	3	2	1

Syllabus

Unit	Title/Topics	Hours
I	**Quantum Physics and Solids**	10
Quantum Mechanics: Introduction to quantum physics, blackbody radiation - Planck's radiation law - photoelectric effect, de-Broglie's hypothesis, Davisson and Germer's experiment - Heisenberg's uncertainty principle - Born interpretation of the wave function - time independent Schrodinger wave equation - particle in one dimensional potential box. **Solids:** Free electron theory (Drude & Lorentz, Sommerfeld) - Bloch's theorem, Kronig-Penney model - origin of energy bands- classification of solids.		
II	**Semiconductors and Devices**	10
Intrinsic and extrinsic semiconductors - Hall effect - direct and indirect band gap semiconductors - construction, principle of operation and characteristics of P-N Junction diode, Zener diode and bipolar junction transistor (BJT) – LED and solar cells, their structure, materials, working principle and characteristics.		
III	**Dielectric, Magnetic and Energy Materials**	4+6=10
Part-A: Dielectric Materials: Basic definitions- types of polarizations (qualitative) - ferroelectric, piezoelectric and pyroelectric materials - applications.		
Part-B: Magnetic Materials: Hysteresis - soft and hard magnetic materials – magnetostriction, magnetoresistance - applications - bubble memory devices, magnetic field sensors and multiferroics. **Energy Materials:** Conductivity of liquid and solid electrolytes- superionic conductors - materials and electrolytes for super capacitors - rechargeable ion batteries.		
IV	**Nanotechnology**	9
Nanoscale, quantum confinement, surface to volume ratio, bottom-up fabrication: Sol-gel, Precipitation methods – top-down fabrication: Ball milling, Chemical Vapor Deposition (CVD) - characterization techniques - XRD, SEM &TEM - applications of nanomaterials.		
V	**Laser and Fiber Optics**	9
Laser beam characteristics-three quantum processes-Einstein coefficients and their relations, lasing action - pumping methods- Nd:YAG laser, CO_2 laser, semiconductor laser-applications of laser. Introduction to optical fiber- advantages of optical Fibers - total internal reflection - construction of optical fiber - acceptance angle - numerical aperture- classification of optical fibers - optical fiber for communication system - applications.		
Textbooks		
1. A Text book of Engineering Physics by M.N.Avadhanulu, P.G.Kshirsagar - S. Chand Publications, 2017. 2. Essentials of Nanoscience & Nanotechnology by Narasimha Reddy Katta, Typical Creatives Nano Digest, 1st Edition, 2021.		
References		
1. Applied Physics – P.K. Palanisamy, Scitech Publications, 11th Edition, 2018. 2. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons, 11th Edn, 2018. 3. Energy Materials, Taylor and Francis Group, 1st Edition, 2022.		

ENGLISH FOR SKILL ENHANCEMENT

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	22HS11	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 LSRW skills	3	2
CO2	demonstrate the acquired language in written and spoken contexts	3	2
CO3	express, restate and respond appropriately by comprehending the given data	3	2
CO4	develop proficiency to succeed in academic activities, research and career	3	2
CO5	excel in professional and social etiquette	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Toasted English by R.K. Narayan**	7
Vocabulary Building: The Concept of Word Formation -The Use of Prefixes and Suffixes - Acquaintance withPrefixes and Suffixes from Foreign Languages to form Derivatives - Synonyms and Antonyms. **Grammar:** Identifying Common Errors in Writing with Reference to Articles and Prepositions. **Reading:** Reading and Its Importance- Techniques for Effective Reading. **Writing 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.		
II	**Appro JRD by Sudha Murthy**	11
Vocabulary: Words Often Misspelt - Homophones, Homonyms and Homographs. **Grammar:** Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement. **Reading:** Sub-Skills of Reading - Skimming and Scanning - Exercises for Practice. **Writing:** Nature and Style of Writing- Defining/Describing People, Objects, Places and Events - Classifying- Providing Examples or Evidence-Blog Writing.		
III	**Lessons from Online Learning by F. Haider Alvi, Deborah Hurst et al**	4+6=10
Part A: Vocabulary: Words often confused - words from Foreign Languages and their use in English. **Grammar:** Identifying common errors in writing with reference to misplaced modifiers and tenses.		
Part B: Reading: Sub-Skills of Reading - Intensive and Extensive Reading - Exercises for Practice. **Writing**: Format of a Formal Letter-Writing Formal Letters E.g., Letter of Complaint, Letter of Requisition, Email Etiquette, Job Application with CV/Resume.		
IV	**Art and Literature by Abdul Kalam**	9
Vocabulary: Standard Abbreviations in English. **Grammar:** Redundancies and Clichés in Oral and Written Communication. **Reading**: Survey, Question, Read, Recite and Review (SQ3R Method) - Exercises for Practice. **Writing:** Writing Practices- Essay Writing-Writing Introduction and Conclusion -Précis Writing.		
V	**Go, Kiss the World by Subroto Bagchi**	9
Vocabulary: Technical Vocabulary and their Usage. **Grammar:** Common Errors in Active & Passive Voice, Degrees of Comparison. **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.		
Textbooks		
1. English: Language, Context and Culture by Orient Black Swan Pvt. Ltd, Hyderabad. 2022.		
References		
1. Swan, M. Practical English Usage. Oxford University Press, 2016. 2. Richards, Jack C. Interchange Series. Introduction, 1,2,3. Cambridge University Press, 2022. 3. Wood, F.T. Remedial English Grammar. Macmillan, 2007.		

PROGRAMMING FOR PROBLEM SOLVING

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	22ES12	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 and file handling	3	3	2	2
CO5	implement various searching and sorting techniques in C programming	3	3	2	2

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Programming**	11
Program Development steps, algorithm, flow chart, creating, compiling and executing a program. **Introduction to C Programming**: - Structure of C Program, C Tokens- Identifiers, Keywords, Variables, Constants, Strings, Operators, Input / Output, Data Types, Expressions, Precedence and Associativity, Expression Evaluation, Type conversions, Statements - Selection Statements(making decisions) –if and switch statements, Repetition statements (loops)-while, for, do-while statements, Loop examples, other statements related to looping-break, continue, goto, Simple C Programs.		
II	**Arrays and Functions**	8
Arrays: Concepts, using arrays in C, Types of arrays, accessing and manipulating elements of arrays. Program examples. **Functions:** Designing structured programs, declaring a function, signature of a function, parameters and return type of a function, user defined functions, standard functions, four categories of functions, inter function communication-call by value, scope, storage classes-auto, register, static, extern, recursion-recursive functions, differences between recursion and iteration, limitations of recursion, example c programs, preprocessor commands.		
III	**Pointers and Strings**	5+5=10
Part A: Pointers: Idea of pointers, defining pointers, pointers for inter function communication-call by reference, pointers to pointers, compatibility, void pointer, NULL pointer, pointer applications- accessing arrays using pointers, pointer arithmetic, dynamic memory allocation.		
Part B: Strings: Concepts, string input / output, basic string functions available in C (strlen, strcat, strcpy, strcmp, strstr, etc.), arrays of strings, C program examples.		
IV	**Structures, Unions and Files**	11
Structures: Defining and initializing structures, accessing structures, operations on structures, Nested structures, structures containing arrays, arrays of structures, self-referential structures, enum, typedef, bit fields. **Unions**: Defining, initializing and accessing unions, differences between Structures and unions. **Files**: Concept of a file, Types of Files, Differences between text and binary files, Opening and closing files, File input / output functions (standard library input / output functions for files), file status functions, Random access using fseek, ftell and rewind functions, C program examples.		
V	**Searching and Sorting**	8
Basic searching in an array of elements (linear and binary search techniques), Basic algorithms to sort array of elements (Bubble, Selection, Insertion, Quick and Merge sort algorithms), comparison of sorting algorithms.		
Textbooks		
1. Jeri R. Hanly and B.Koffman, Problem solving and Program Design in C 7th Edn, Pearson. 2. B.A. Forouzan and Gilberg C Programming and Data Structures, Cengage Learning, 3rd Edn.		
References		
1. C: The Complete Reference, Herbert Schildt, TMH, 4th Edition. 2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, PHI.		

ELEMENTS OF ELECTRONICS & COMMUNICATION ENGINEERING

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	22ES14	-	-	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	PO1	PO2	PO3	PO4	PO5	PO9	PO12
CO1	identify various electronics components	3	3	3	3	3	3	3
CO2	measure various parameters using electronics equipments	3	3	3	3	3	3	3
CO3	identify various gate modules, ICs	3	3	3	3	3	3	3
CO4	distinguish analog and digital communications signals	3	3	3	3	3	3	3
CO5	explain software's used in the field of electronics	3	3	3	3	3	3	3

List of Experiments

Week	Title/Experiment
1	Understand the significance of electronics and communications subjects.
2	Identify the different passive and active components.
3	Color code of resistors, finding the types and values of capacitors.
4	Measure the voltage and current using voltmeter and ammeter.
5	Measure the voltage, current with multimeter and study the other measurements using multimeter.
6	Study the CRO and measure the frequency and phase of given signal.
7	Draw the various Lissajous figures using CRO.
8	Study the function generator for various signal generations.
9	Study of spectrum analyzer and measure the spectrum.
10	Operate regulated power supply for different supply voltages.
11	Study the various gates module and write down the truth table of them.
12	Identify various digital and analog ICs.
13	Observe the various types of modulated signals.
14	Know the available software's for electronics and communication applications.

References

1. Elements of Electronics & Communication Engineering Manual, FED, CMRIT, Hyd.

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab internal examination.

1. Prepare decorative series lights/dim and bright lighting.
2. Construct RC network to measure voltage at different points.
3. Construct RC network to measure current at different points.
4. Design a potentiometer to control the speed of a fan.
5. Prepare a user manual to operate a CRO.
6. Prepare a user manual to operate a Function Generator and RPS.
7. Prepare a report on various analog ICs.
8. Prepare a report on various digital ICs.
9. Prepare a report on various AM/FM signals.
10. Prepare a detailed report on available software's in ECE.

APPLIED PHYSICS LAB

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	22BS13	-	-	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	PO9
CO1	calculate the Planck's constant, Hall co-efficient and Energy gap of semiconductors	3	3
CO2	examine the working of semiconductor and optoelectronic devices	3	3
CO3	demonstrate the behavior of magnetic and dielectric materials	3	3
CO4	demonstrate the properties of laser and optical fiber	3	3
CO5	compare practical results with theoretical calculations in electrical circuits	3	3

List of Experiments

(Minimum 10 experiments to be conducted)

Week	Title/Experiment
1	Determination of work function and Planck's constant using photoelectric effect.
2	Determination of Hall co-efficient and carrier concentration of a given semiconductor.
3	Determination of Energy gap of a semiconductor.
4	V-I characteristics of a p-n junction diode and Zener diode.
5	a) V-I and L-I characteristics of light emitting diode (LED). b) V-I Characteristics of solar cell.
6	Input and output characteristics of BJT (CE, CB & CC configurations).
7	Determination of the resistivity of semiconductor by two probe method.
8	Study B-H curve of a magnetic material.
9	Determination of dielectric constant of a given material.
10	a) Determination of the beam divergence of the given LASER beam. b) Determination of Acceptance Angle and Numerical Aperture of an optical fiber.
11	Characteristics of series and parallel LCR circuits.
12	Stewart and Gee's method - Magnetic field along the axis of current carrying coil.

Reference

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

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab internal examination.

1. Design rechargeable torch.
2. Design temperature sensor.
3. Design a solar cooker.
4. Design a counter using photo cell.
5. Design smoke detector.
6. Design mechanical energy to light energy converter.
7. Design a mobile phone detector.
8. Design IR based obstacle detector.
9. Design security alarm.
10. Design a circuit to detect breakage in a conducting wire.

ENGLISH LANGUAGE LABORATORY FOR EFFECTIVE COMMUNICATION

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	22HS12	-	-	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	PO5	PO9	PO10
CO1	identify the nuances of the language through multimedia experience	3	3	3
CO2	express clearly with right accent, intonation to overcome MTI	3	3	3
CO3	demonstrate formal and informal English in real life scenarios	3	3	3
CO4	develop speaking and listening skills	3	3	3
CO5	appraise communication and correspond effectively	3	3	3

List of Experiments

Week	Title/Experiment
PART – A: COMPUTER ASSISTED LANGUAGE LEARNING (CALL) LAB	
1 2	Introduction to Phonetics - Speech Sounds - Vowels and Consonants - Minimal Pairs - Consonant Clusters - Past Tense Marker and Plural Marker.
4	Syllable Division, Accent & Stress, Stress Shift, Weak Forms and Strong Forms.
6	Intonation and Rhythm - Situational Dialogue.
9	Errors in Pronunciation - the Interference of Mother Tongue (MTI), Common Indian Variants in Pronunciation - Differences between British and American Pronunciation.
12	Listening Comprehension (Specific & General).
PART – B: INTERACTIVE COMMUNICATION SKILLS (ICS) LAB	
3	Spoken vs. Written Language - Formal and Informal English - Ice-Breaking Activity and JAM Session.
5	Role Play - Situational Dialogues - Greetings - Taking Leave - Introducing Oneself.
7	Expressions in Various Situations - Making Requests and Seeking Permissions - Telephone Etiquette.
8	Descriptions - Narrations - Giving Directions, Guidelines & Instructions - Seeking Clarifications - Thanking and Responding - Agreeing and Disagreeing - Seeking and Giving Advice - Making Suggestions.
10	Public Speaking - Exposure to Structured Talks - Non-Verbal Communication Presentation Skills - Making a Short Speech - Extempore - Making a Presentation.
11	Group Discussion.

References

1. English Language Laboratory for Effective Communication Manual, FED, CMRIT, Hyd.

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab 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

PROGRAMMING FOR PROBLEM SOLVING LAB

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	22ES16	-	-	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	PO9
CO1	execute simple programs using C compiler	3	3	3
CO2	apply control statements in designing programs	3	3	3
CO3	design programs using functions, arrays, strings and pointers	3	3	3
CO4	construct programs for heterogeneous data and file operations	3	3	3
CO5	implement various searching and sorting techniques in C programming	3	3	3

List of Experiments

Week	Title/Experiment
I	**Simple C programs**
a) Write a C program to Calculate Simple Interest b) Write a C program to Calculate the area of Circle c) The total distance travelled by vehicle in‘t’ seconds is given by distance = ut+1/2at^2 where ‘u’ and ‘a’ are the initial velocity (m/sec.) and acceleration (m/sec^2). Write C program to find the distance travelled at regular intervals of time given the values of ‘u’ and ‘a’. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of ‘u’ and ‘a’	
II	**Decision Statements**
a) Write a C program that declares class awarded for a given percentage of marks, where marks <40%=Failed,40% to <60%=Second class,60%<70%=First Class,>=70%=Distinction. Read percentage from standard input b) Write a C program to find the roots of a quadratic equation c) Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)	
III	**Loops**
a) Write a C program to find the sum of individual digits of a positive integer. b) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence. c) Write a C program to check whether the given number is prime or not d) Write a C program to read 2 numbers x and n then compute the sum of the Geometric Progression: 1+x+x^2+x^3+…….+x^n	
IV	**Arrays**
a) Write a C program to find the largest integer in a list of integers b) Write a C program to perform the following: i) Addition of Two Matrices ii) Multiplication of Two Matrices	
V	**Functions**
Write a C program to find a) product of two numbers using functions without arguments, without return value b) difference of two numbers using functions without arguments, with return value c) sum of two numbers using functions with arguments, without return value d) product of two numbers using functions with arguments, with return value	
VI	**Recursion**
Write C program that use both recursive and non-recursive function to find a) factorial of a given integer b) GCD (greatest common divisor) of two given integers	
VII	**Pointers**
a) Write a C program to swap two numbers using Call by Value b) Write a C program to swap two numbers using Call by Reference (Using pointers)	

VIII	Strings and Structures
a) Write a C Program to demonstrate various string manipulations using built in functions b) Write a C program to determine whether the given string is a palindrome or not c) Write a C program that perform the following operations: i) Addition of two complex numbers ii) Multiplication of two complex numbers (Note: represent complex number using a Structure)	
IX	**File operations**
a) Write a C program which copies one file to another b) Write a C program to display the contents of a file c) 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)	
X	**Searching**
Write a C program to implement: a) Linear Search b) Binary Search	
XI	**Sorting**
Write a C program to implement: a) Bubble Sort b) Selection Sort c) Insertion Sort	
XII	**Sorting**
Write a C program to implement: a) Quick Sort b) Merge Sort	
References	
1. Programming for Problem Solving Lab Manual, FED, CMRIT, Hyd.	
Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab 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.	

IT WORKSHOP PRACTICE

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	22ES18	-	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	PO1	PO5	PO9	PO10
CO1	classify hardware components and inter dependencies	3	3	2	2
CO2	install operating systems and MS office	3	3	2	2
CO3	configure IP and trouble shoot network connections	3	3	3	2
CO4	use internet and safeguard computer systems from viruses/worms	3	3	3	2
CO5	prepare documentation/presentation by using office tools	3	3	3	2

List of Experiments

Week	Title/Experiment
1	Block diagram of CPU, troubleshooting different parts of the computer peripherals, monitor, keyboard & CPU.
2	Disassemble & assemble the PC back to working condition.
3	Installation of various operating systems - Windows, Linux. Installation of MS office.
4	**Network Connections, Troubleshooting:** IP configurations and connecting to various network devices and troubleshooting.
5	**Internet &WWW:** Web browsers, surfing the web, search engines & netiquette. **Cyber Hygiene**: Introduction to virus, worms, threats. Install antivirus, personal firewall.
6	**Latex:** Handle different types of documents. Organize documents, formatting text and pages, mathematical formulae, tables and images, create presentations using Beamer.
7	**MS Word:** Accessing, overview of toolbars, saving files, using help and resources, rulers, format painter in word.
8	**MS Word:** Prepare the project document and resume. Creating a news letter.
9	**MS Excel:** Accessing, overview of toolbars, saving excel files, using help and resources. Spreadsheets, formatting, formulas.
10	**MS Excel:** Functions, sorting, filtering and charts.
11	**MS Power Point:** Basic power point utilities and tools which help to create basic power point presentations. Working with slides, add content, work with text, working with tables, graphics.
12	**MS Power Point:** Slide animation, reordering slides, adding sound to a presentation.

References

1. IT Workshop Practice Manual, FED, CMRIT, Hyd.

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab internal examination.

1. Develop a user manual for Disassemble & assemble the PC.
2. Develop a user manual for Installation of operating systems.
3. Develop a user manual for Installation of MS office and open office.
4. Develop an own dictionary for Network Connections, Troubleshooting.
5. Prepare a survey report/presentation on Virus, worms, threats and attacks.
6. Design monthly budget planner using Ms Excel.
7. Design a Photo album using Ms Power Point.
8. Design of various certificates/brochure using Ms Word.
9. Design a video presentation using open source tools.
10. Prepare a survey report/presentation on latest cyber-attacks.

II-SEM. SYLLABUS

ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	22BS21	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	identify whether the given differential equation of first order is exact or not	3	2	1
CO2	solve ordinary differential equations of higher order	3	2	1
CO3	use the Laplace transforms techniques for solving ODE's	3	2	1
CO4	find vector differentiation of vector & scalar field/gradient/divergence/curl	3	2	1
CO5	solve the line, surface and volume integrals by using vector integration	3	2	1

Syllabus

Unit	Title/Topics	Hours
I	**First Order ODE**	11
Exact differential equations, Equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling, Law of natural growth and decay.		
II	**Ordinary Differential Equations of Higher Order**	8
Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax}, sinax , cosax ,polynomials in x , e^{ax} V(x) and xV(x) ,method of variation of parameters, Equations reducible to linear ODE with constant coefficients: Legendre's equation, Cauchy-Euler equation. Applications: Electric Circuits.		
III	**Laplace transforms**	5+5=10
Part A: Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Second shifting theorem, Unit step function, Dirac delta function, 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 transform of periodic functions.		
Part B: Inverse Laplace transform: by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.		
IV	**Vector Differentiation**	9
Vector Differentiation: Vector point functions and scalar point functions. Gradient, Divergence and Curl, Directional derivatives, Tangent plane and normal line, Vector Identities, Scalar potential functions. Solenoidal and Irratational vectors.		
V	**Vector Integration**	10
Vector Integration: Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stokes (without proofs) and their applications.		
Textbooks		
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010 2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.		
References		
1. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2008. 2. Advanced Engineering Mathematics by Erwin kreyszig, 9th Edition, John Wiley & Sons, 2006.		

ENGINEERING CHEMISTRY

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	22BS24	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	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	3	2	1
CO5	analyze and understand the properties, applications of engineering materials	3	2	1

Syllabus

Unit	Title/Topics	Hours
I	**Water and its treatment**	9
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-Scales and sludges, 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 - Desalination of water - Reverse osmosis.		
II	**Electrochemistry and Corrosion**	10
Electrochemistry: Introduction, conductance - specific, equivalent and molar conductance, Electrode-Types of electrodes - Construction and functioning of calomel electrode and glass electrode, Nernst equation - electrochemical series and its applications. 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. Corrosion control methods- Cathodic protection - Sacrificial anode & impressed current cathodic methods-Electroplating.		
III	**Spectroscopic techniques and applications**	5+4=9
Part A: Introduction - UV-Visible spectroscopy: Absorbance, Extinction coefficient -Principle - Beer's-Lamberts law -applications, IR spectroscopy: Principle and applications.		
Part B: Basic concepts of nuclear magnetic resonance Spectroscopy- Spin-spin coupling, chemical shift. Introduction to Magnetic resonance imaging.		
IV	**Fuels and Polymers**	11
Fuels: Calorific value- HCV, LCV-Numerical Problems, Classification- Solid fuels - Coal – analysis of coal - proximate and ultimate analysis and their significance. Liquid fuels - Petroleum and its refining, Gaseous fuels - composition and uses of natural gas, LPG and CNG. **Polymers:** Definition - Classification of polymers with examples - Types of polymerization - addition and condensation polymerization with examples. Preparation, Properties, and engineering applications of PVC, Teflon and Nylon. Biodegradable Polymers: Poly lactic acid, Poly vinyl alcohol (synthesis & applications).		
V	**Engineering Materials**	9
Cement: Portland cement and its composition - setting and hardening of Portland cement. **Lubricants:** Classification of lubricants with examples - characteristics of a good lubricant - properties of lubricants: viscosity, cloud and pour point, flash and fire point. **Smart materials:** Engineering applications - Shape memory materials – Polyurathane - Thermo response materials - Poly acryl amide, Poly vinyl amide.		
Textbooks		
1. Engineering Chemistry by P.C. Jain and M.Jain, Dhanpatrai Publishing Co, New Delhi 2010. 2. Engineering Chemistry by Rama Devi, Ch. V. Ramana Reddy and Rath, Cengage learning, New Delhi 2016.		
References		
1. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Co. Pvt. Ltd., New Delhi 2011.		

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	22ES21	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	elaborate the concepts of network theorems & single phase AC circuits	3	3	2	1
CO3	explain three phase AC circuits and P-N Junction Diode	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

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Electrical Circuits**	11
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.		
II	**DC Theorems and Single Phase AC Circuits**	8
DC Theorems: Superposition, Reciprocity, Thevenin's, Norton's and Maximum power transfer Theorems for DC excitation. Simple problems. **Single Phase AC Circuits:** Introduction, Sinusoidal alternating quantities, RMS values, Average values, form factor and peak factor, AC through Series RL, RC & RLC circuits.		
III	**Three Phase AC circuits & P-N Junction Diode**	5+5=10
Part-A: Three Phase AC circuits: Introduction, relation between line and phase voltages & currents, power equation in three phase balanced star and delta connections, Advantages of Three phase systems.		
Part-B: P-N Junction Diode: PN Junction diode- V-I Characteristics, Ideal versus Practical, Temperature dependence.		
IV	**Rectifiers and Special Purpose Devices**	9
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 voltage regulator, principle of operation – SCR, solar cell, LED, schottky diode.		
V	**Bipolar Junction Transistor (BJT)**	10
Construction, Principle of Operation, Symbol, CE, CB, CC configurations. DC & AC load line, stability factor, Need for biasing & biasing techniques.		
Textbooks		
1. Circuit Theory (Analysis & synthesis) - A. Chakrabarti, Dhanpat Rai & Co, 7th Edn, 2015. 2. Electronic Devices and Circuits - R.L. Boylestad & Louis Nashelsky, PEI/PHI, 9th Edn, 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.		

DATA STRUCTURES THROUGH PYTHON

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	22ES22	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	explain the fundamentals of python programming	3	3	2	2
CO2	develop programs using collections, classes and build error-free codes	3	3	2	2
CO3	illustrate operations and applications of linear data structures	3	3	2	2
CO4	make use of various concepts of non-linear data structures	3	3	3	2
CO5	design data structures using graphs	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	10
Introduction to Python, Installing Python. Using Python, Comments, Variables, Data types, Input and Output, Operators, Type conversions, Expressions, Stings. Control Flow Statements - Decision Structures: if, if-else, if-elif-else. Repetition Structures: Introduction, while loop, for loop. Control statements-break, continue and pass. **Functions:** Defining and using functions, passing arguments to functions, value-returning functions.		
II	**Collections, Classes, Files and Exceptions**	10
Collections: Lists, introduction to lists, list slicing, list methods and useful built-in functions, two-dimensional lists, tuples, tuple methods, sets, operations on sets, dictionaries and its methods. **Design with Classes**: Classes and objects, constructors and methods, working with instances, inheritance and its types, polymorphism. **Files:** Access modes, writing data to a file, reading data from a file, additional file methods. **Exceptions:** Error versus exception, handling exception, try-except block, raising exception, user-defined exception.		
III	**Linear Data Structures**	4+5=9
Part-A: Data Structures: Definition, Linear versus Non-linear. Linear - Stack and its operations, Applications of Stack, Queue and its operations, Applications of Queue.		
Part-B: Linked Lists: Implementation of Singly Linked Lists, Doubly Linked Lists and Circular Linked Lists.		
IV	**Non-Linear Data Structures**	10
Trees: Definition, terminology, binary trees-definition, properties, ADT, implementation, traversals. **Types of Trees:** Binary Search Tree: properties and operations, implementation. Balanced search trees: AVL tree, M-Way search trees: B tree.		
V	**Graphs and Hashing**	9
Graphs: Definition, terminology, applications, properties, graph ADT, graph representations-adjacency matrix, adjacency lists, graph search methods - DFS and BFS. **Hashing and Collision:** Introduction, hash tables, hash functions, collisions, applications of hashing.		
Textbooks		
1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning. 2. Data structures and algorithms in python by Michael T. Goodrich, Wiley, 2013. 3. Data Structures and Algorithmic Thinking with Python by Narasimha Karumanchi, Careermonk Publications.		
References		
1. Introduction to Computation and Programming Using Python. John V. Guttag, The MIT Press. 2. D. Samanta, “Classic Data Structures”, PHI Learning, 2nd Edition, 2004.		

ENGINEERING CHEMISTRY LAB

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	22BS25	-	-	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	PO9
CO1	determine the hardness in water samples to solve societal problems	3	3
CO2	estimate the strength of the given solutions	3	3
CO3	determine surface tension, Acid value and viscosity of various fluids	3	3
CO4	analyze the rate of corrosion of mild steel in various conditions	3	3
CO5	verify and understand the distribution coefficient	3	3

List of Experiments

(Perform any 10 Experiments)

Week	Title/Experiment
	Volumetric Analysis
1	Determination of total hardness of water by complexometric method using EDTA.
2	Estimation of ferrous ion by dichrometry.
	Instrumentation
3	Estimation of HCl by Conductometric titrations.
4	Estimation of Fe^{2+} by Potentiometer using $KMnO_4$.
5	Estimation of copper by colorimetric method.
6	Determination of an acid concentration using P^H meter.
	Corrosion
7	Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.
	Physical properties
8	Determination of viscosity of a liquid by using Ostwald's viscometer.
9	Estimation of acid value of given lubricant oil.
10	Determination of partition coefficient of acetic acid between n-butanol and water.
11	Determination of surface tension of a given liquid.

References

1. Engineering Chemistry Lab Manual, FED, CMRIT, Hyd.

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab 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. Preparation of hand sanitizer.
9. Determination of P^H values of various soft drinks.
10. Studies on the effect of metal coupling on corrosion.

BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	22ES23	-	-	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	PO9
CO1	design electrical circuits to verify circuit laws	3	3
CO2	evaluate network theorems	3	3
CO3	verify the V-I characteristics of various electronic devices	3	3
CO4	determine the efficiency of various rectifiers	3	3
CO5	illustrate the configurations of Bi-polar junction transistor	3	3

List of Experiments

Week	Title/Experiment
	Part-A: Electrical lab
1	Verification of KVL & KCL.
2	Verification of Superposition theorem.
3	Verification of reciprocity theorem.
4	Verification of maximum power transfer theorem.
5	Experimental determination of Thevenin's equivalent circuits.
6	Experimental determination of Norton's equivalent circuits.
	Part-B: Electronics Lab
1	Forward and reverse bias characteristics of PN-Junction Diode.
2	Zener diode V-I characteristics and Zener diode as voltage regulator.
3	Efficiency of Half wave rectifier.
4	Efficiency of Full wave rectifier.
5	Input & output characteristics of Transistor in CB configuration.
6	Input & output characteristics of Transistor in CE configuration.

References

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

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab 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.

DATA STRUCTURES THROUGH PYTHON LAB

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	22ES24	-	-	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	PO9
CO1	write simple programs using python	3	3	3
CO2	develop programs using collections and classes	3	3	3
CO3	construct different linear data structures along with their operations	3	3	3
CO4	implement various search trees	3	3	3
CO5	design programs for traversing graphs	3	3	3

List of Experiments

Week	Title/Experiment
1	Write a Python program to a) compute the GCD of two numbers b) display first "N" prime numbers c) display first "N" Fibonacci sequence d) find the factorial value of a given number
2	Write a Python program to a) check whether the given string is palindrome or not b) simulate simple calculator c) count the characters in the string and store them in a dictionary data structure d) find the most frequent words in a text
3	Write a Python program to perform a) Linear Search. b) Binary Search.
4	Write a Python program to a) compute the matrix multiplication b) find mean, median, mode for the given set of numbers in a list c) create 2 functions dups and unique to find all duplicate and unique elements of a list
5	Write a Python function to a) compute "N"/0 and use try/except to catch the exceptions b) define a custom exception class which takes a string message as attribute
6	Write a Python program to implement the following sorting techniques: a) insertion sort b) merge sort
7	Write a Python program to implement a) stack ADT b) queue ADT.
8	Write a Python program to implement the following stack applications: a) infix to postfix b) postfix expression evaluation
9	Write a Python program that uses functions to perform the following operations on single linked list: a) creation b) insertion c) deletion d) traversal
10	Write a Python program that uses functions to perform the following operations on doubly linked list: a) creation b) insertion c) deletion d) traversal
11	Write a Python program to traverse the given binary search tree in a) pre-order b) in-order c) post-order
12	Write a Python Program to implement the following Graph Traversals: a) BFS b) DFS

References

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

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab internal examination.

1. Create a Student Record Management System.
2. Create a Digital Calculator.
3. Create an Employee Payroll Management System.
4. Create a class for ATM and implement its functions.
5. Create a Sales Management System.
6. Create a class for Library and Implement its Functions.
7. Create a Contact Management System.
8. Create a Hotel Booking System.
9. Create a Car Rental System.
10. Create any Game (tic-tac-toe, snake, etc.).

COMPUTER AIDED ENGINEERING GRAPHICS LAB

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	22ES25	-	-	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	apply engineering drawing concepts in technical graphic communication	3	3	3	3
CO2	construct conic sections using various methods	3	3	3	3
CO3	draw orthographic projections of points, lines, planes and solids	3	3	3	3
CO4	draw development of solid surfaces	3	3	3	3
CO5	draw the conversions of orthographic to isometric projections & vice versa	3	3	3	3

List of Experiments

Week	Title/Experiment
1	Introduction to engineering drawing and AutoCAD software, Lettering, dimensioning practice and Geometrical Constructions.
2	Conic sections: General method, Construction of Ellipse, Parabola and Hyperbola.
3	Construction of Cycloid, Epicycloid and Hypocycloid.
4	Construction of involutes.
5	Orthographic Projections: Principles of Orthographic projections, Projections of Points.
6	Projections of lines simple position and inclined to one plane.
7	Projections of Lines inclined to both the planes.
8	Projections of planes simple position and inclined to one plane.
9	Projections of planes inclined to both the planes.
10	Projections of Solids simple position.
11	Projections of Solids inclined to one plane and both the planes.
12	Development of surfaces: Development of Prisms and Cylinders, Pyramids and Cones.
13	Isometric projections: isometric views of lines, planes and solid figures; Conversion of Isometric to Orthographic views (3D to 2D).
14	Conversion of Orthographic to Isometric views (2D to 3D).

References

1. Computer Aided Engineering Graphics Lab Manual, FED, CMRIT, Hyd.

Micro-Projects: Student should submit a report on one of the following/any other Micro–Projects using AutoCAD approved by the lab faculty before commencement of lab internal examination.

1. Draw the orthographic projections of knuckle joint.
2. Draw the orthographic projections of Socket and spigot cotter joint.
3. Draw the orthographic projections of glass bottle.
4. Draw the orthographic Projections of Connecting rod of IC Engine.
5. Draw the isometric projections of Horse chess coin.
6. Draw the Pipe truss design.
7. Draw a 3-D bolt and nut with Threads.
8. Draw a 3-D Cross head pattern.
9. Draw the pipe vice.
10. Draw the satellite dish and Antenna.

DESIGN THINKING FOR INNOVATION AND STARTUPS

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	22ES27	-	-	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	PO1 to PO12	PSO1	PSO2
CO1	illustrate the design thinking practices for value based innovation	3	3	3
CO2	analyze stakeholder behaviour and empathy in ideation	3	3	3
CO3	develop and test prototype for its scalability	3	3	3
CO4	identify and standardize business process	3	3	3
CO5	prepare a startup pitch	3	3	3

List of Experiments

Week	Title/Experiment
1	**Introduction to Design Thinking** - Understanding the mindsets-empathy, optimism, learn from failure, iterate, create confidence, creativity convergent & divergent thinking. **Activity**: Take LRI: Launch Readiness Index assessment.
2	**Design Thinking Methodology** - The Five stages of the Design Thinking Process: Empathize, Define, Ideate, Prototype, and Test. **Activity:** Debate on innovation and creativity, Debate on value-based innovation.
3	**Empathize** - Understand customer needs, Empathy maps, customer Journey Maps **Activity**: Reframe problems from various perspectives, Personas.
4	**Define** - Analysis & drawing inferences from Empathy. **Activity:** Create a brief design for all stakeholders (use chart and sticky notes).
5	**Ideation** - Ideation tools & exercises. Sample design challenge, Introduction to the design challenge themes, storytelling and tools for innovation. **Activity:** Filed Visit to explore customer needs.
6	**Prototype** - Experimentation, Rapid Iteration: Choosing a wire-framing/UX prototyping tool. **Activity**: Hold Inspirational Rapid-Sketch Sessions or Design Sprints.
7	**Test** - Finding ways to test fast and collaboratively with consumers, preparing questions. **Activity**: Get fast, productive feedback from human beings.
8	**Design Thinking in Business Processes** - Design thinking applied in business and strategic innovation, design thinking principles that redefine business. **Activity**: Business Canvas Model
9	**Extreme competition** - Standardization, Design Thinking to meet corporate needs. **Activity:** External presentation of innovation on National or International terms.
10	**Design thinking for Startups** - Defining and testing business models and business cases. **Activity:** How to market own product, maintenance, reliability and plan for startup.
11	**Startup Capital Requirements and Legal Environment** - Identifying startup capital resource, develop financial assertions, approval for new ventures and taxes. **Activity:** Identifying your Startup capital Resources.
12	**Startup up Financial Issues, Survival and Growth** - Feasibility analysis: the cost and process of raising capital, stages of growth in a new venture: growing with the market, growing within the industry, venture life patterns. **Activity:** Feasibility analysis chart.
Reference	
1. Design Thinking for Innovation and Startups Manual, FED, CMRIT, Hyd.	

ENVIRONMENTAL SCIENCE & DISASTER MANAGEMENT
MANDATORY COURSE (NON-CREDIT)

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	22MC21	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	explain the role of ecosystem for livelihood	3	3	3	2
CO2	interpret methods to sustain environmental resources	3	3	3	2
CO3	identify solutions for sustainable development and pollution control	3	3	3	2
CO4	analyze various types of disasters	3	3	3	3
CO5	develop strategies for preparedness measures against disasters	3	3	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Ecosystem**	6
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. ***Task:*** *Perform a case study on Biogeochemical cycles (Carbon/Nitrogen Cycles).*		
II	**Natural Resources**	6
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. ***Task:*** *Perform a case study on any one of renewable energy resources.*		
III	**Pollution control & Sustainable Development**	4+4=8
Part A: Environmental Pollution Control Technologies: Air, water & soil pollution control technologies; MSW & E. Waste Management, EIA concept, Environmental Audit; EPA Acts. ***Task:*** *Perform a case study on environmental audit.*		
Part B: Sustainable Development: Climate Change**: c**auses, effects, global warming, carbon footprint and environmental protection: brief idea on sustainable development: sustainable development concept, Sustainable Development Goal (SDGs), steps taken towards sustainable development: management of plastics, automobile scrapping policy and promotion of electrical vehicles. ***Task:*** *Perform a case study on sustainable development goals.*		
IV	**Disaster Management**	6
Types of Disasters: Natural and Man-made and their cause and effect, Vulnerability Assessment and Risk Analysis: Vulnerability to various disasters (Flood, Cyclone, Earthquake, Heat waves and Lightning). Institutional Framework: Institutional arrangements for disaster management - National Disaster Management Authority (NDMA), State Disaster Management Authority (SDMA), District Disaster Management Authority (DDMA) and National Disaster Response Force (NDRF). ***Task:*** *Perform a case study on any one of the institutional arrangements for disaster management.*		
V	**Preparedness Measure**	6
Disaster Management Cycle, Early Warning System, Pre-Disaster and Post-Disaster Preparedness, Strengthening of SDMA and DDMA, Community Preparedness, Stakeholder Participation, Corporate Social Responsibility (CSR), Survival Skills: Survival skills adopted during and after disaster Flood, Cyclone, Earthquake, Heat waves and Lightning. ***Task:*** *Prepare a case study on proactive and reactive disaster management plans.*		
Textbooks		
1. Environmental Science by Y. Anjaneyulu, B S Publications, 2004. 2. Climate Change Society & Sustainable Development, Jain Indu, Times Group, 2010. 3. Manual on Disaster Management, National Disaster Management Agency, Govt. of India.		

III-SEM. SYLLABUS

NUMERICAL METHODS AND COMPLEX VARIABLES

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	22BS32	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	express any periodic function in terms of sine and cosine terms	3	2	1
CO2	estimate the value for the given data using interpolation	3	2	1
CO3	find the numerical solutions for a given first order ODE's	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

Syllabus

Unit	Title/Topics	Hours
I	**Fourier Series & Fourier Transforms**	8
Fourier series - Dirichlet's Conditions - Half-range Fourier series - Fourier Transforms: Fourier Sine and cosine transforms. ***Task:*** *Write a program to find Fourier sine and cosines transform for a given function.*		
II	**Solution of algebraic and transcendental equations & Interpolation**	12
Solution of algebraic and transcendental equations: Bisection method, Iteration Method, Newton Raphson method and Regula-Falsi method. **Finite differences:** Forward differences, backward differences, central differences, symbolic relations and separation of symbols, Interpolation using Newton's forward and backward difference formulae. **Central difference interpolation:** Gauss's forward and backward formulae, Lagrange's method of interpolation. ***Task:*** *Write a program to find the root of transcendental equation.*		
III	**Numerical differentiation and Integration**	4+4=8
Part A: Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8th rules. ***Task:*** *Write a program to find the area by using Trapezoidal and Simpsons rules.*		
Part B: Ordinary differential equations: Taylor's series, Picard's method, Euler and modified Euler's methods, Runge-Kutta method of fourth order for first order ODE. ***Task:*** *Write a program to solve first order DE using R-K methods.*		
IV	**Complex Differentiation**	10
Limit, Continuity and Differentiation of Complex functions. Cauchy-Riemann equations (without proof), Milne- Thomson methods, analytic functions, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties. (All theorems without Proofs). ***Task:*** *Write a program on mathematical functions for complex numbers.*		
V	**Complex Integration**	10
Line integrals, Cauchy's theorem, Cauchy's Integral formula, zeros of analytic functions, singularities, Taylor's series, Laurent's series, Residues, Cauchy Residue theorem. and their properties. (All theorems without Proofs) ***Task:*** *Write a program to find the area by using Residue theorem.*		
Textbooks		
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010. 2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.		
References		
1. M. K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical methods for Scientific and Engineering Computations, New Age International publishers. 2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006. 3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Edn, MGH, 2004.		

PROBABILITY THEORY & STOCHASTIC PROCESSES

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	22ES31	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	PSO1
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

Syllabus

Unit	Title/Topics	Hours
I	**Probability and Random Variable**	10
Probability: Probability introduced through sets and relative frequency, experiments and sample spaces, discrete and continuous sample spaces, events, probability definitions and axioms, probability as a relative frequency, joint probability, conditional probability, total probability, Bayes theorem and independent events. **Random Variable:** Definition of a random variable, conditions for a function to be a random variable, discrete, continuous and mixed random variables.		
II	**Single Random Variables and Operations**	9
Distribution & Density Functions: Distribution and density functions and their properties - binomial, Poisson, uniform, Gaussian, exponential and Rayleigh distribution. **Operation on Single 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, monotonic and non-monotonic transformations for a continuous and discrete random variable.		
III	**Multiple Random Variables and Operations**	5+5=10
Part A: Multiple Random Variables: Vector random variables, joint distribution function and its properties, marginal distribution functions, conditional distribution and density functions, statistical independence, sum of random variables and central limit theorem (without Proof).		
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 and jointly Gaussian random variables: Two random variables case, N random variable case, properties, transformations of multiple random variables.		
IV	**Stochastic Processes - Temporal Characteristics**	10
The random process concept, classification of processes, distribution and density functions, concept of stationarity and statistical independence, first-order, second-order, wide-sense and n^{th} order and strict-sense stationarity, time averages and ergodicity, mean and correlation-ergodic processes, autocorrelation, cross-correlation, covariance and their properties.		
V	**Stochastic Processes - Spectral Characteristics**	9
Power density spectrum and its properties, cross-power density spectrum and its properties, linear system response - Mean, mean-squared value, autocorrelation function and cross-correlation functions. Power density spectrum and cross-power spectral density of input and output.		

Textbooks

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.

DIGITAL LOGIC DESIGN

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	22ECPC31	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	PSO1
CO1	interpret number systems and boolean algebra	3	3	2	2	2
CO2	use Karnaugh Map for minimization of boolean functions	3	3	2	2	3
CO3	construct combinational circuits & sequential logic circuits	3	3	2	2	2
CO4	design sequential circuits for registers and counters	3	3	2	2	3
CO5	illustrate finite state machine	3	3	2	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Number Systems and Boolean algebra**	10
Number Systems: Number systems, Complements of Numbers, Codes - Weighted and Non-weightedcodes and its Properties, Parity check code and Hamming code. **Boolean algebra:** Basic Theorems and Properties, Switching Functions - Canonical and Standard Form, Algebraic Simplification, Digital Logic Gates, EX-OR gates, Universal Gates, Multilevel NAND/NOR realizations.		
II	**Minimization of Boolean functions**	10
Minimization of Boolean functions: Karnaugh Map Method - Up to five Variables, Don't Care Map Entries, Tabular Method.		
III	**Combinational and Sequential Logic Circuits**	4+5=9
Part-A: Combinational Logic Circuits: Adders, Subtractors, Comparators, Multiplexers, Demultiplexers,Encoders, Decoders and Code converters, Hazards and Hazard Free Relations.		
Part-B: Sequential Logic Circuits: Basic Architectural Distinctions between Combinational and Sequential circuits, SR Latch, Flip Flops: SR, JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Timing and Triggering Consideration, Conversion from one type of Flip-Flop to another.		
IV	**Registers, Counters and Sequential Machines**	10
Registers and Counters: Shift Registers - Left, Right and Bidirectional Shift Registers, Applications of Shift Registers - Design and Operation of Ring and Twisted Ring Counter, Operation of Asynchronous and Synchronous Counters. **Sequential Machines:** Finite State Machines, Synthesis of Synchronous Sequential Circuits- Serial Binary Adder, Sequence Detector, Parity-bit Generator, Synchronous Modulo N –Counters		
V	**Finite state machine**	9
Capabilities and limitations, Mealy and Moore models, State equivalence and machine minimization, simplification of incompletely specified machines, Merger graphs. Introduction to ASM Charts.		
Textbooks		
1. Zvi Kohavi &Niraj K. Jha, - Switching and Finite Automata Theory, 3rd Ed., Cambridge, 2010. 2. R. P. Jain - Modern Digital Electronics, 3rd Edition, 2007- Tata McGraw-Hill		
References		
1. Morris Mano, Fredriac J. Hill, Gerald R. Peterson - Introduction to Switching Theory and LogicDesign –3rd Ed., John Wiley & Sons Inc. 2. Charles H. Roth - Fundamentals of Logic Design, 5th ED., Cengage Learning, 2004.		

ANALOG ELECTRONICS

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	22ECPC32	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	PSO1
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

Syllabus

Unit	Title/Topics	Hours
I	**Small Signal Low Frequency BJT Amplifiers**	10
CE, CB and CC amplifiers, BJT Hybrid model, Analysis of CE, CC, and CB Amplifiers using exact and simplified h-parameter model and CE Amplifier with emitter resistance using simplified CE Hybrid model, miller's theorem and its dual, Design of single stage RC coupled amplifier.		
II	**Small Signal High Frequency BJT Amplifiers**	9
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.		
III	**Feedback Amplifiers and Oscillators**	5+5=10
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 using BJT.		
IV	**Large Signal Amplifiers**	11
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.		
V	**FET Amplifiers**	8
JFET Characteristics, 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.		
Textbooks		
1. Integrated Electronics - Jacob Millman, Christos C Halkias, TMH. 2. Electronic Devices and Circuits - David A. Bell – 5th 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

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	22ECPC33	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	PSO1
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 signals using Fourier series and transforms	3	3	3	3
CO4	analyze sampling theorem and Z-transform	3	3	2	3
CO5	apply the mathematical modelling to LTI systems	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Signal Analysis**	9
Signal Analysis: Classification of 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.		
II	**Convolution, Correlation of Signals**	10
Convolution, Correlation of Signals: Convolution and their properties, Correlation of signals, Cross Correlation and auto correlation of signals and properties, relation between convolution and correlation.		
III	**Fourier Series and Fourier Transforms**	5+5=10
Part-A: Fourier Series: Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.		
Part-B: Fourier Transforms: Deriving Fourier Transform from Fourier series**,** Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform and introduction to Hilbert Transform.		
IV	**Sampling and Z-Transforms**	10
Sampling: Sampling theorem –Types of Sampling - Impulse Sampling, Natural and Flat top Sampling, Aliasing and introduction to Band Pass Sampling. **Z-Transforms:** Concept of Z-Transform and its properties, Region of Convergence, Inverse Z-transform.		
V	**Signal Transmission through Linear Systems**	9
Classification of systems, 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.		
Textbooks		
1. Signals, Systems & Communications - B.P. Lathi, 2013, BSP. 2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, 2nd Edition, PHI.		
References		
1. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2nd Edition. 2. Signals and Systems - A.Rama Krishna Rao – 2008, TMH.		

DIGITAL LOGIC DESIGN LAB THROUGH VERILOG HDL

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	22ECPC34	-	-	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	PO9	PSO2
CO1	examine basic logic gates	3	3	3	3
CO2	implement boolean functions using universal gates	3	3	3	3
CO3	construct various combinational logic circuits	3	3	3	3
CO4	analyze the operation of flip-flops	3	3	3	3
CO5	design registers and counters using flip-flops	3	3	3	3

List of Experiments

(Minimum of 12 experiments to be performed)

Week	Title/Experiment
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.

References

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

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab 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

ANALOG ELECTRONICS LAB

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	22ECPC35	-	-	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	PO9	PSO2
CO1	design and analyze the transistor amplifier circuits	3	3	3	3
CO2	design and analyze the FET amplifiers	3	3	3	3
CO3	design and analyze the feedback amplifiers	3	3	3	3
CO4	design and analyze the Oscillators	3	3	3	3
CO5	design and analyze the large signal amplifiers	3	3	3	3

List of Experiments

Note: Design any **six** using hardware and any **ten** using Multisim or equivalent Software.

Week	Title/Experiment
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

References

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

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab internal examination.

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

SIMULATION LAB

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	22ECPC36	-	-	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	PO9	PSO2
CO1	interpret various types of MATLAB tools	3	3	3	3
CO2	solve different signals and perform different operations on signals	3	3	3	3
CO3	analyze convolution, correlation between signals and sequences	3	3	3	3
CO4	examine the stability of the system using S-plane and Z-plane	3	3	3	3
CO5	apply the mathematical modelling to LTI systems	3	3	3	3

List of Experiments

(Minimum of 10 experiments to be performed)

Note: Software/Tools to be Used: MATLAB

Week	Title/Experiment
1	Introduction to MATLAB and Basic Operations.
2	Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit Impulse, Unit Step, Square, Sawtooth, Triangular, Sinusoidal, Ramp, Sinc.
3	Operations on Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
4	Finding the Even and Odd parts of Signal/Sequence and Real and Imaginary parts of Signal.
5	Convolution for Signals and sequences.
6	Auto Correlation and Cross Correlation for Signals and Sequences.
7	Verification of Linearity and Time Invariance Properties.
8	Computation of Unit sample, Unit step and Sinusoidal responses of the given LTI system and verifying its physical realiazability and stability properties.
9	Finding the Laplace Transform of continuous signals.
10	Locating the Zeros and Poles and plotting the Pole-Zero maps in S-plane and Z-Plane for the given transfer function.
11	Generation of Gaussian noise (Real and Complex), Computation of its mean, M.S. Value and its Skew, Kurtosis, and PSD, Probability Distribution Function.
12	Sampling Theorem Verification.
13	Removal of noise by Autocorrelation / Cross correlation.
14	Extraction of Periodic Signal masked by noise using Correlation.

References

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

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab 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. What is orthogonality concept with respect to vectors and signals.
5. Importance of wave-Symmetry in finding Fourier series of a given signals.
6. Fourier and Hilbert Transform of cosine and sinusoidal signals.
7. Demonstrate LTI System properties.
8. Study of convolution and correlation of signals.
9. Distribution and Density Functions of Standard Random Variables.
10. Checking a random process for Stationary in wide sense.

SCRIPTING LANGUAGES LAB

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	22ES33	-	-	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	PO1	PO2	PO3	PO5	PO9
CO1	distinguish various scripting languages	3	3	3	3	3
CO2	develop programs using shell script	3	3	3	3	3
CO3	create applications using PHP	3	3	3	3	3
CO4	build applications using Perl	3	3	3	3	3
CO5	construct programs using JavaScript	3	3	3	3	3

List of Experiments

(Minimum 3 experiments to be conducted from each part)

S.No.	Title/Experiment
I	**Shell Script**
	1. Write a shell script that displays range of lines within a file.
	2. Write a shell script that deletes all lines containing a specified word within a file.
	3. Write a shell script to check whether the given input is a file or directory.
	4. Write a shell script to count the word frequency within a file.
II	**Personal Home Page (PHP)**
	1. Write a PHP script to print prime numbers between 1 - 50.
	2. Write a PHP script to find length, count of words, reverse, sub-string within strings.
	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. Write a Perl script to print the multiplication tables from 1-10 using subroutines.
	2. Write a Perl program to implement Shift, Unshift and Push functions
	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	**JavaScript**
	1. Validate user registration and user login using JavaScript.
	2. Validate user profile and payment by credit card pages using JavaScript.
	3. Validate the number entered by the user in text field within a range using JavaScript.
	4. Validate various inputs entered by the user using JavaScript.
References	
1. Scripting Languages Lab Manual, Department of ECE, CMRIT, Hyd.	
Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab internal examination.	
1. Create a Phone Directory using shell script with various operations in it. 2. Create a File Management System using shell script with various operations in it. 3. Design and develop an ERP System for Student Management using PHP. 4. Develop Hospital Management System using PHP. 5. Develop Hotel Management System using PHP. 6. Write a Perl script to perform various operations on matrices. 7. Write a Perl script to create a package & add modules to it and use them. 8. Develop online banking system with all necessary validations using JavaScript. 9. Develop online library management system with all necessary validations using JavaScript. 10. Develop online booking system with all necessary validations using JavaScript.	

GENDER SENSITIZATION
(MANDATORY COURSE - NON-CREDIT)

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	22MC31	-	-	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

Syllabus

Unit	Title/Topics	Hours
I	**Understanding Gender**	6
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. ***Task:*** *Perform a case study on routes for gender sensitization.*		
II	**Gender Roles and Relations**	6
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. ***Task:*** *Perform a case study on gender discrimination in any one state in India.*		
III	**Gender and Labour**	4+4=8
Part-A: Division and valuation of labour-housework: the invisible labor - "my mother doesn't work." "Share the load."- Work: its politics and economics. ***Task:*** *Perform a case study on gender exploitation in unorganized sector.*		
Part-B: Fact and fiction. Unrecognized and unaccounted work. Gender development issues - gender, governance and sustainable development-gender and human rights - gender and mainstreaming. ***Task:*** *Perform a case study on implementation of human rights in its right-sense.*		
IV	**Gender - Based Violence**	6
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 out: Is home a safe place? - when women unite [film]. Rebuilding lives. Thinking about sexual violence blaming the victim - "I fought for my life". ***Task:*** *Perform a case study on domestic violence.*		
V	**Gender and Culture**	6
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. ***Task:*** *Perform a case study on cross gender and cross cultural awareness.*		
Textbooks		
1. Towards a world of equals: A bilingual textbook on gender, Telugu Akademi, Hyderabad, 2015		

EMPLOYABILITY SKILLS – I
MANDATORY COURSE (NON-CREDIT)

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	22MC32	-	-	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

List of Experiments

Week	Title/Experiment
1	**Verbal Ability:** Introduction to Business English - Functional English.
	Quantitative Aptitude: Basic concepts, combined mean, average principles.
2	**Verbal Ability:** Fundamentals of Grammar-Sentence Structure-Parts of Speech.
	Quantitative Aptitude: Wrong values taken, number added or deleted, average speed.
3	**Verbal Ability:** Articles and Prepositions.
	Quantitative Aptitude: **Percentages** - Basic Concepts, conversions, finding percentages from given numbers, quantity increases or decreases by given percentage.
4	**Verbal Ability:** Question Tags, Speeches and Voices.
	Quantitative Aptitude: **Percentages** - population increase by given percentage, comparisons, consumption when a commodity price increase or decrease and applications.
5	**Verbal Ability:** Subject-Verb Agreement and Tenses.
	Quantitative Aptitude: **Data Interpretation** - Introduction to Data Interpretation, quantitative and qualitative data.
6	**Verbal Ability:** Synonyms & Antonyms, Homonyms & Homophones, Word Formation.
	Quantitative Aptitude: **Data Interpretation** - Tabular Data, Line Graphs, Bar Chart, Pie Charts, X-Y Charts.
7	**Verbal Ability:** Idioms & Phrases, Word Analogy & One-Word Substitutes.
	Quantitative Aptitude: Number Series, Letter Series, Series completion and correction Coding and Decoding. Word analogy-Applied analogy.
8	**Verbal Ability:** Spotting Errors, Correction of Sentences.
	Quantitative Aptitude: **Reasoning Logical Diagrams** - Simple diagrammatic relationship, Multi diagrammatic relationship, Venn-diagrams, Analytical reasoning.
9	**Verbal Ability:** Verbal Logics & Jumbled Sentences.
	Quantitative Aptitude: **Number Systems:** Basic Concepts, Number Systems: Natural numbers, whole numbers, integers, fractions, Rational Numbers, Irrational Numbers, Real Numbers, Divisibility Rules.
10	**Verbal Ability:** Paragraph Writing, Picture Description.
	Quantitative Aptitude: **Number Systems:** Logic Equations, Remainder theorem, Unit digit calculation. **Gamification** - Deductive Logical Thinking.
11	**Verbal Ability:** Text Completion & Essay Writing
	Quantitative Aptitude: **Reasoning Ability** - Blood Relations, Seating arrangements, Directions, Decision making. **Gamification**- Inductive Logical Thinking.
12	**Verbal Ability:** Verbal Reasoning, Reading Comprehension & Cloze Passages.
	Quantitative Aptitude: **Progressions** - Basic Concepts, Types: arithmetic, geometric progression, Harmonic progression and applications. **Gamification**- Grid Motion, Motion Challenge, Colour The Grid.

13	**Verbal Ability:** Critical Reasoning - Statements, Arguments, Assumptions.
	Quantitative Aptitude: Profit and Loss: Basic Concepts, discounts, marked price and list price, dishonest shopkeeper with manipulated weights, successive discounts etc., **Gamification** - Switch Challenge.
14	**Verbal Ability:** Critical Reasoning - Conclusions, Assertions & Reasons.
	Quantitative Aptitude: Interest (Simple and Compound): Basic Concepts, Yearly, Half-yearly, and quarterly calculations, multiples, differences between simple and compound interest. **Gamification** – Digit Challenge.
Activities	
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 - I Manual, FED, CMRIT, Hyd.	

IV-SEM. SYLLABUS

NETWORKS AND CONTROL SYSTEMS

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	22ECPC41	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	PSO1
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	analyze the transfer function and stability using R-H criterion	3	3	2	2	3
CO4	determine transient and steady state analysis of a control system	3	3	2	2	3
CO5	examine the stability analysis in frequency domain	3	3	2	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Two Port Networks & Resonance**	10
Impedance Parameters, Admittance Parameters, Hybrid Parameters, Transmission (ABCD) Parameters. Series and parallel resonance circuits, resonance frequency, quality factor and band width determination. ***Task:*** *Write a program to find Two Port network h and ABCD Parameters.*		
II	**Transient Analysis (First and Second Order Circuits)**	9
Transient Response of RL, RC and RLC Circuits for DC excitations, Initial Conditions with source, Solution using Differential Equations approach and Laplace Transform Method. ***Task:*** *Write a program to find the step response of second order system for different zeta values.*		
III	**Introduction to Control Systems and Stability**	5+5=10
Part-A: Concepts of Control Systems: Basics of control systems, classifications and their differences with examples. Transfer function, modeling of electric systems, block diagram reduction technique, and signal flow graph, feedback characteristics-effects of feedback. ***Task:*** *Write a program to find the TF of the system when blocks are connected in series & parallel.*		
Part-B: The concept of stability: Routh stability criterion – qualitative stability and conditional stability. ***Task:*** *Write a program to determine the stability of a system for a given characteristic equation.*		
IV	**Time Response Analysis**	9
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. ***Task:*** *Write a program to find the step response of second order system for different zeta values.*		
V	**Root Locus and Stability Analysis in Frequency Domain**	10
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. ***Task:*** *Write a program for complete root locus system with open loop transfer function.*		
Textbooks		
1. Circuit Theory (Analysis & synthesis)-A. Chakrabarti, Dhanpat Rai & Co Pvt Ltd 7th Edn, 2015 2. Control Systems Engineering - I.J.Nagrath and M.Gopal, New Age International 5th Edn, 2009.		
References		
1. Network Theory - Sudhakar and Shyam Mohan, TMH. 2. Control Systems- N. K. Sinha, New Age International (P) Limited Publishers, 3rd Edn, 1998.		

PULSE & DIGITAL CIRCUITS

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	22ECPC42	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	PSO1
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

Syllabus

Unit	Title/Topics	Hours
I	**Linear Wave Shaping**	9
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.		
II	**Non-Linear Wave Shaping**	10
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.		
III	**Steady State Switching Characteristics of Devices**	5+5=10
Part-A: Diode as a switch, Piece Wise Linear Diode Characteristics, Diode Switching Times and Transistor Acts as a Switch.		
Part-B: Breakdown Voltages, transistor in saturation, temperature variation of saturation parameters, transistor-switching times.		
IV	**Multivibrators and Time Base Generators**	10
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.		
V	**Sampling Gates and Realization of Logic Gates**	9
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 & DIGITAL IC APPLICATIONS

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	22ECPC43	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	PSO1
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

Syllabus

Unit	Title/Topics	Hours
I	**Operational Amplifier**	9
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.		
II	**OP-AMP, IC-555 & IC 565 Applications**	10
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.		
III	**Data Converters**	5+5=10
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.		
IV	**Digital Integrated Circuits**	10
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.		
V	**Sequential Logic IC'S**	9
Familiarity with commonly available 74XX & CMOS 40XX Series ICs- RS, JK, JK Master - Slave, D and T Type Flip-Flops & their Conversions, IC74LS93 4-bit Asynchronous Counter, IC74LS90 4-bit Asynchronous Decade Counter, IC74HC163 4-bit Synchronous Counter, IC74HC190 UP/DOWN Decade Counter, IC74HC194 4-bit Bi-directional Universal Shift Register & Applications.		
Textbooks		
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 WAVES & TRANSMISSION LINES

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	22ECPC44	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	PSO1
CO1	illustrate the concepts of electric fields	3	2	2	3
CO2	interpret the concepts of magnetic fields	3	2	2	3
CO3	outline the characteristics of electromagnetic fields	3	3	2	3
CO4	explain electromagnetic field concepts	3	3	2	3
CO5	summarize the fundamental concepts of transmission line theory	3	3	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Electrostatics**	10
Coulomb's Law, Electric Field Intensity and Applications, 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. ***Task:*** *Write a program to calculate electric filed intensity & Flux density.*		
II	**Magnetostatics**	9
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, 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. ***Task:*** *Write a program to calculate Magnetic Flux Density.*		
III	**EM Wave Characteristics-I**	5+5=10
Part-A: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves - Definition, all relations between E & H. ***Task:*** *Write a program to generate time harmonic 3D electromagnetic wave.*		
Part-B: Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics - Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization, Illustrative Problems. ***Task:*** *Write a program to identify given material based on its loss tangent.*		
IV	**EM Wave Characteristics-II**	8
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. ***Task:*** *Write a program to measure propagation characteristics of an EM wave.*		
V	**Transmission Lines**	11
Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Infinite Line Concepts, Lossless/Low Loss Characterization, Distortion - Condition for Distortionless and Minimum Attenuation, 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 Z_{min} and Z_{max}, Smith Chart. ***Task:*** *Write a program to measure the impedance of EM wave Transmission line.*		
Textbooks		
1. Principles of Electromagnetics – Matthew N.O. Sadiku and S.V. Kulkarni, 6th Edition, Oxford University Press, Asian Edition, 2015. 2. Electromagnetic Waves and Radiating Systems-E.C.Jordan & K.G.Balmain, 2nd Edn. 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 Edn, 2006, TMH. 2. Networks, Lines and Fields – John D. Ryder, 2nd Edition, 1999, PHI.		

DATABASE MANAGEMENT SYSTEMS

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	22ECPC45	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	design simple databases using database architectures	3	3	3	2
CO2	construct databases using ER Modelling	3	3	3	2
CO3	formulate SQL queries to interact with database	3	3	3	2
CO4	apply normalization on database to eliminate redundancy	3	3	3	2
CO5	explain transaction processing and concurrency control	3	3	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Database Systems**	10
Introduction: Introduction and applications of DBMS, Purpose of database, database architecture and structure - 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.		
II	**Relational Model, Algebra and Calculus**	9
The 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. **Relational Algebra and Calculus:** Relational algebra operators, relational calculus - tuple and domain relational calculus.		
III	**SQL**	5+5=10
Part-A: Basics of SQL, DDL, DML, DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, in operator, Functions - aggregate functions, built-in functions – numeric, date, string functions, set operations.		
Part-B: Sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, exist, any, all, view and its types. Transaction control commands – commit, rollback, save point, cursors, stored procedures, Triggers.		
IV	**Schema Refinement and Normal Forms**	10
Schema Refinement and Normal Forms: Introduction to schema refinement, functional dependencies, reasoning about FDs. Normalization, normal forms: 1NF, 2NF, 3NF, BCNF, multi valued dependency-fourth normal form-join dependency-fifth normal form, properties of decomposition, dependency preservation.		
V	**Transactions Management, Concurrency Control and Recovery System**	9
Transactions Management: Transaction concept and ACID properties, transaction state, implementation of atomicity and durability, concurrent executions, Serializability, testing for Serializability, recoverability, implementation of isolation. **Concurrency Control and Recovery System:** Concurrency control, lock based protocols, time-stamp protocols, validation protocols, crash recovery, remote backup system.		
Textbooks		
1. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, 3rd Edn, TMH. 2. Abraham Silberschatz, Henry F.Korth, S.Sudarshan, Database System Concepts, 5th Edn, TMH.		
References		
1. Elmasri Navate, Fundamentals of Database Systems, Pearson Education, India. 2. Database Management System Oracle SQL, P. K. Das Guptha and P Radha Krishna PHI.		

PULSE & DIGITAL CIRCUITS LAB

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	22ECPC46	-	-	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	PO9	PSO2
CO1	design linear and non linear wave shaping circuits	3	3	3	3
CO2	analyze multivibrators and its applications	3	3	3	3
CO3	create oscillations and sweep signals using UJT and Boot strap circuits	3	3	3	3
CO4	illustrate the switching characteristics of transistor	3	3	3	3
CO5	demonstrate the operation of logic gates and sampling gates	3	3	3	3

List of Experiments

(Minimum 12 experiments to be conducted)

Week	Title/Experiment
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

References

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

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab 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.

LINEAR & DIGITAL IC APPLICATIONS LAB

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	22ECPC47	-	-	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	PO9	PSO2
CO1	construct circuits for various applications using Op-Amp IC741	3	3	3	3
CO2	design various applications with specific ICs	3	3	3	3
CO3	model various sequential and combinational circuits using digital ICs	3	3	3	3
CO4	design and analyze synchronous and asynchronous counters using digital ICs	3	3	3	3
CO5	implement the sequential circuits	3	3	3	3

List of Experiments

(Minimum 12 experiments to be conducted)

Week	Title/Experiment
Design and Implementation of	
Part-I: Linear IC Experiments (Any 6 Experiments to be conducted)	
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 to be conducted)	
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.
References	
1. Linear & Digital IC Applications Lab Manual, Department of ECE, CMRIT, Hyd.	
Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab 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.	

DATABASE MANAGEMENT SYSTEMS LAB

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	22ECPC48	-	-	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	PO9
CO1	construct databases using SQL commands	3	3	3
CO2	apply normalization techniques to eliminate redundancy	3	3	3
CO3	design a database schema for a given domain	3	3	3
CO4	solve queries based on joins, nested queries and aggregate functions	3	3	3
CO5	execute PL/SQL programs for a given application	3	3	3

List of Experiments

Note: Take any database application and conduct experiments to get expertise on various case studies

Week	Title/Experiment
1	Student should decide on a case study, analyze and then formulate the problem Statement by populating objects (entities) and their role.
2	**Conceptual Designing using ER Diagrams** (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.) **Note:** Student is required to submit a document by drawing an ER Diagram.
3	**Converting ER Model to Relational Model** (Represent entities and relationships in Tabular form, represent attributes as columns, identifying keys). **Note:** Student is required to submit a document showing the database tables created from the ER Model.
4	**Creation of Tables using SQL**- Overview of using SQL tool, Data types in SQL, **Practicing DDL Commands**-Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables.
5	**Practicing DML commands** - Insert, Select, Update, Delete of Tables.
6	**Practicing Queries** using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, EXCEPT, CONSTRAINTS etc.
7	**Practicing Sub queries** (Nested, Correlated) and Joins (Inner, Outer and Equi).
8	**Practice Queries** using Aggregate Operators - COUNT, SUM, AVG, MAX, MIN. GROUP BY, HAVING, VIEWS Creation and Dropping.
9	**Practicing on** Triggers - creation of trigger, Insertion using trigger, Deletion using trigger, Updating using trigger
10	**Procedures**- Creation of Stored Procedures, Execution of Procedure, and Modification of Procedure.
11	**Cursors** - Declaring Cursor, Opening Cursor, Fetching the data, closing the cursor.
12	**Normalization** -To remove the redundancies and anomalies in the above relational tables, Normalize up to Third Normal Form.

References

1. Database Management Systems Lab Manual, Department of ECE, CMRIT, Hyd.

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab internal examination.

1. Design and implement University Database for External examination schedule.
2. Construct an E-R diagram for a motor-vehicle sales company.
3. Design and implement a relational database for University Registrar's office.
4. Take any schema and convert it into 1st Normal Form and 2nd Normal Form.
5. Design and implement a schema for Life Insurance Company.
6. Design an E-R diagram for the Library Management system.
7. Demonstrate various built-in functions of SQL with suitable examples.
8. Demonstrate various operators in SQL with suitable examples.
9. Perform sub-queries, nested Queries and join concepts in SQL with suitable examples.
10. Analyze tuple relational calculus and domain relational calculus for suitable queries.

REAL TIME/SOCIETAL RESEARCH PROJECT

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	22ECPR41	-	-	4	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 PSO2
CO1	identify relevant problem and design & develop a prototype	3
CO2	execute project using modern tools and prepare the report	3
CO3	exhibit leadership and managerial skills in project development	3
CO4	function effectively as individual, member and/or leader in project teams	3
CO5	apply engineering knowledge for societal sustenance	3

Guidelines

The main aim of the project is to expose the students to solve societal/real-time issues as an individual or as a group of 3-4 students and work under the guidance of faculty/industry supervisor.

S. No.	Title
1	Prepare an abstract on the approved topic and submit to the Guide/Supervisor.
2	Conduct literature survey on the approved project title.
3	Analyze collected data, model, simulation, experiment, design and test project feasibility.
4	Prepare a Gantt chart for project schedule to conduct investigations with team.
5	Design and develop a prototype, simulate and test-facility by using modern tools.
6	Document end-to-end project/product process.
7	Submit a report in the prescribed format through the Guide to Head of the Department.
8	Demonstrate Project work before the Evaluation Committee.

Evaluation Procedure

CIE: 40 Marks		SEE: 60 Marks	
Internal Guide Evaluation		**Department Review Committee Evaluation**	
Item	**Marks**	**Item**	**Marks**
Societal Problem Identification	05	Problem Justification	05
Objectives	05	Content and Innovation	05
Literature Survey	05	Execution	15
Design and Execution	10	Technical Presentation	15
Viva-Voce (Q & A)	05	Viva-Voce (Q & A)	10
Project Report	10	Project Report	10
Total	**40**	**Total**	**60**

INDIAN CULTURE AND CONSTITUTION
MANDATORY COURSE (NON-CREDIT)

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	22MC41	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	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

Syllabus

Unit	Title/Topics	Hours
I	**Indian Culture**	10
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. ***Task:*** *Perform a case study on cultural migration.*		
II	**Indian Languages, Religions and Literature**	9
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 - Pre-Vedic, Vedic religion, Buddhism and Jainism. ***Task:*** *Perform a case study on any unscripted languages in India.*		
III	**Indian Constitution and Union Administration**	5+5=10
Part A: Indian Constitution: Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Fundamental Rights and Duties. ***Task:*** *Perform a case study on implementation of Fundamental Rights.*		
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. ***Task:*** *Perform a case study on Federalism and red-tape.*		
IV	**State and District Administration**	10
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. ***Task:*** *Perform a case study on limitations of democratic chair/position.*		
V	**Local Administration and Election Commission**	9
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. ***Task:*** *Perform a case study on functional difference between state & central Election Commission.*		
Reference		
1. A Hand Book on Indian Culture and Constitution, FED, CMRIT, Hyderabad.		

EMPLOYABILITY SKILLS – II
MANDATORY COURSE (NON-CREDIT)

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	22MC42	-	-	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

List of Experiments

Week	Title/Experiment
1	**Soft skills:** Introduction to Soft Skills and Their Importance.
	Aptitude: Statements - Arguments, Assumptions, Conclusions. **Ratio and Proportion:** Basic concepts of ratio and proportion, continued or equal proportions, mean proportions, invest proportion, alternative proportion.
2	**Soft skills:** Self awareness and Self esteem Assertions & Reasons.
	Aptitude: Ratio and Proportion: Division proportion, compound proportion, duplication of ratio, finding values, coins and currencies, etc.
3	**Soft skills:** Discipline, Integrity, Attitude, Change and Adaptability. **People Skills** - Relationships - Personal & Professional Relationships - Rapport Building - Personal Space.
	Aptitude: Speed, Time and Distance: Basic Concepts, Single train problems, two train problems: some point on the same side.
4	**Soft skills:** Definition of Motivation - Motivation - Self-motivation; Time Management - Stephen Covey's Time Management.
	Aptitude: Speed, Time and Distance: Some point opposite sides, relative speed, different points meeting at common points, different points same side (different timings vs. same timings).
5	**Soft skills: Teamwork** - Definition of Team, Team Dynamics - Specialization and Teamwork - Rewards of Teamwork.
	Aptitude: Speed, Time and Distance: Ratios, number of stoppages, average speed, etc.
6	**Soft skills: Leadership** - Definition of Leadership, Leading a Team, Leadership Qualities - Leader vs. Manager - Leadership Styles.
	Aptitude: Time and Work: Basic Concepts, comparative work, mixed work, alternative work, middle leave and middle join ratio efficiency. **Gamification** - The Same Rule.
7	**Soft skills: Problem Solving and Decision Making** - Definitions - Problem Solving and Decision Making - Case Studies.
	Aptitude: Permutations and combinations: Basic concepts, differences between permutations and combinations, always together-never together, alternative arrangement, fixed positions, double fixations.
8	**Soft skills: Conflict Management** - Definitions - Strategies - Styles - Case Studies.
	Aptitude: Permutations and combinations: items drawing from a single group, items drawing from a multiple group, total ways of arrangement with repetitions and without repetitions.
9	**Soft skills: Preparation for Interviews** - Self Introduction - Professional Context, Pre-Interview Preparation Techniques, Analyzing Skills & Achievements**,** Researching the Industry and the Organization.
	Aptitude: Permutations and combinations: Dictionary, handshakes or line joining between two points or number of matches , sides and diagonals, etc.

10	**Soft skills:** **Develop the Interview File** - Resume Building -Types of Interviews.
	Aptitude: **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.
11	**Soft skills:** First Impressions - Body Language - Posture - Dressing and Grooming- Dos and Don'ts of an Interview.
	Aptitude: **Clocks and Calendars:** Basic opposite sides and right angle, mirror images, faulty clock (slow/fast), miscellaneous, calendar.
12	**Soft skills:** Interview Practice/Mock Interviews - FAQ's
	Aptitude: **Geometry and Mensuration:** Basic concepts, types of angles.
13	**Soft skills:** **Presentation** - Oral Presentation - Individual - Group - Poster.
	Aptitude: **Plane figures:** rectangles, squares, triangles, quadrilateral, areas, perimeters, etc. **Solid figures:** cubes, cuboids, cylinders-area (total surface area and lateral surface area). **Gamification** - Overall Revision.
14	**Soft skills:** **Presentation Skills** - How to Present a Project Effectively - PowerPoint Presentations.
	Aptitude: **Solid figures:** Volumes, perimeters. **Others:** Parallelogram, Rhombus, Trapezium, Circle, Sector, Segment, Cone, Sphere, Hemisphere, etc.

Activities

1. Regular cumulative practice tests.
2. Quiz, Crossword, Word-search and related activities.
3. Five - minute presentations about concepts learnt.
4. JAM and Picture Narration.
5. Mock Interviews.

Reference

1. Employability Skills - II Manual, FED, CMRIT, Hyd.

V-SEM. SYLLABUS

ANALOG AND DIGITAL COMMUNICATION

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	22ECPC51	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	PSO1
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

Syllabus

Unit	Title/Topics	Hours
I	**Amplitude Modulation**	11
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.		
II	**Angle Modulation**	8
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.		
III	**Transmitters, Noise sources and Receivers**	5+5=10
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.		
IV	**Information Theory and Pulse Modulation**	10
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.		
V	**Digital Modulation Techniques**	9
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, 5thEdn, 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

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	22ECPC52	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	PSO1
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

Syllabus

Unit	Title/Topics	Hours
I	**Antenna Fundamentals**	10
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, introduction to loop antennas. ***Task:*** *Write a program to measure radiation efficiency of isotropic antenna.*		
II	**Antenna arrays**	9
Two element arrays - different cases, principle of pattern multiplication, N-element uniform linear arrays: broadside, end fire arrays and binomial arrays. ***Task:*** *Write a program to measure directivity for broadside, end fire array and 8 element arrays.*		
III	**HF and VHF Antennas**	5+5=10
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. ***Task:*** *Write a program to measure directivity of 20 turn helix for a given circumference.*		
Part-B: VHF Antennas: Yagi-Uda antenna, folded dipole antenna and its characteristics, helical antennas: significance, geometry and basic properties. ***Task:*** *Write a program to measure input impedance of two wire folded half wave length antenna.*		
IV	**UHF, Microwave antennas and Measurements**	9
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. Fundamentals of Micro strip antennas. **Antenna Measurements:** Sources of errors, Patterns, directivity and gain (comparison, absolute and 3-antenna methods) measurements. ***Task:*** *Write a program to measure directivity of Pyramidal horn.*		
V	**Wave Propagation**	10
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. ***Task:*** *Write a program to measure the Skip distance of a flat earth for a given MUF*		
Textbooks		
1. Antennas for all applications – John D. Kraus and Ronald J. Marhefka, TMH, 2003, 3rd Edn. 2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2000.		
References		
1. Antenna Theory, C.A. Balanis, John Wiley & Sons, 2001, 2nd Edn. 2. Antennas and Wave Propagation, K.D. Prasad, Satya Prakashan, Tech India Pub., 2001.		

MICROPROCESSORS & MICROCONTROLLERS

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	22ECPC53	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	PSO1
CO1	illustrate the architecture and ALP of 8086 processor	3	3	2	2	3
CO2	explain the architecture of 8051 microcontroller	3	3	2	2	3
CO3	interface memory, I/O and advanced peripherals with 8051	3	3	2	3	3
CO4	adapt the architecture and instruction set of ARM processor	3	3	2	3	3
CO5	demonstrate advanced ARM processors	3	3	2	3	3

Syllabus

Unit	Title/Topics	Hours
I	**8086 Architecture and Programming**	10
8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086. **Instruction Set and Assembly Language Programming of 8086**: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branchand Call Instructions, Sorting, String Manipulations.		
II	**Introduction to Microcontrollers and 8051 Real Time Control**	8
Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, MemoryOrganization, Addressing Modes and Instruction set of 8051. **8051 Real Time Control:** Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters.		
III	**I/O and Memory Interface and Serial Communication and Bus Interface**	6+6=12
Part-A: I/O And Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.		
Part-B: Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232,USB.		
IV	**ARM Architecture**	10
ARM Processor fundamentals, ARM Architecture - Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set - Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.		
V	**Advanced ARM Processors**	8
Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture, Introduction to PIC and AVR.		
Textbooks		
1. Advanced Microprocessors and Peripherals – A. K. Ray and K. M. Bhurchandani, TMH, 2nd Edition 2006. 2. ARM System Developers guide, Andrew N Sloss, Dominic Symes, Chris Wright, Elsevier, 2012.		
References		
1. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed, 2004. 2. Microprocessors and Interfacing, D. V. Hall, TMGH, 2nd Edition 2006. 3. Digital Signal Processing and Applications with the OMAP- L138 Experimenter, Donald Reay,Wiley 2012.		

OOP THROUGH JAVA

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	22ECPC54	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 java programs using OOP concepts	3	3	2	2
CO2	interpret programs using OOP concepts	3	3	2	2
CO3	build efficient codes using multithreading and exception handling	3	3	3	3
CO4	design GUI programs using AWT and event handling	3	3	3	2
CO5	develop real-time applications using applets and swings	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Java Basics**	10
Java Basics: History of Java, Java buzzwords, data types, variables, scope and lifetime of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java programs, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods, parameter passing, recursion, exploring String class.		
II	**Inheritance, Polymorphism, Packages and Interfaces**	9
Inheritance and Polymorphism: Types of inheritance, member access rules, super uses, using final with inheritance, the object class and its methods, Method overriding, dynamic binding, abstract classes and methods. **Packages and Interfaces**: Defining, Creating and Accessing a Package, understanding CLASSPATH, importing packages, exploring java.util. Differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.		
III	**Exception handling and Multithreading**	5+5=10
Part-A: 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 subclasses.		
Part-B: Multithreading: Differences between multithreading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication.		
IV	**Event handling and AWT**	9
Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. **AWT:** class hierarchy, user interface components- labels, buttons, scrollbars, text components, checkbox, checkbox groups, choices, lists panels – scroll pane, dialogs, menu bar, Layout Managers- Flow Layout, Border Layout, Grid Layout, Card Layout, Grid Bag Layout.		
V	**Applets and Swings**	10
Applets: Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets. **Swings:** Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, ImageIcon, JLabel, JTextfield, JButton, JCheckbox, JList, JRadiobutton, JComboBox, JTabbedPane, JScrollPane.		
Textbooks		
1. Java the complete reference, 8th Edition, Herbert Schildt, TMH.		
References		
1. Java How to Program, H. M. Dietel and P. J. Dietel, 6th Edition, Pearson Education/PHI. 2. Introduction to Java programming, Y. Daniel Liang, Pearson Education.		

DATA COMMUNICATION & COMPUTER NETWORKS
(Professional Elective – I)

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	22ECPE51	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	PSO1
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

Syllabus

Unit	Title/Topics	Hours
I	**Basics of Networking and Physical layer**	9
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. ***Task:*** *Configure a network topology by establishing peer to peer N/W connection using 2 systems.*		
II	**Data link layer**	11
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 ***Task:*** *Write a program to generate CRC code for checking error.*		
III	**Network Layer**	4+5=9
Part-A: Basics of Network Layer - Logical Addressing, Internetworking, Tunneling, Address mapping. ***Task:*** *Implement an IP Addressing Scheme.*		
Part-B: Communication Protocols - ICMP, IGMP, Forwarding, Unicast Routing Protocols, Multicast Routing Protocols. ***Task:*** *Configure a Network using Distance Vector Routing algorithm.*		
IV	**Transport Layer**	10
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. ***Task:*** *Implement UDP protocol.*		
V	**Application layer**	9
DNS - Domain name space, DNS in internet, Electronic mail. **Protocols and Network Security -** FTP, WWW, HTTP, SNMP, Network Security, Cryptography. ***Task:*** *configure DNS, Web, DHCP, FTP servers.*		
Textbooks		
1. Behrouz A. Forouzan, "Data Communications and Networking", 4th Edition, 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.		

COMPUTER ORGANIZATION & OPERATING SYSTEMS
(Professional Elective – I)

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	22ECPE52	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	PSO1
CO1	outline the basic structure of computer and its micro operations	3	2	2	3
CO2	explain the concepts of micro programmed control and memory system	3	2	3	3
CO3	make use of input-output organization and operating systems	3	3	3	3
CO4	illustrate Process and Memory Management of operating systems	3	3	3	3
CO5	adapt various deadlock handling and file management system	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Basic Computer Organization and Micro Operations**	10
Basic Structure of Computers: Computer Types, Functional Unit, Basic Operational Concepts, Bus Structures, Software, Performance, Multiprocessors and Multi Computers, Data Representation, Fixed Point Representation, Floating - Point Representation. **Register Transfer Language and Micro Operations:** Register Transfer Language, Register Transfer Bus and Memory Transfers, Arithmetic, Logic and Shift Micro Operations, Arithmetic Logic Shift Unit, Instruction Codes, Computer Registers Computer Instructions - Instruction Cycle, Memory - Reference Instructions, I/O unit and Interrupt, STACK Organization, Instruction Formats, Addressing Modes, DATA Transfer and Manipulation, Program Control. ***Task:*** *Prepare a comparative report on computer architectures.*		
II	**Micro Programmed Control and Memory System**	9
Micro Programmed Control: Control Memory, Address Sequencing, Micro-program Examples, Design of Control Unit, Hard Wired Control, Micro-programmed Control. **The Memory System:** Basic Concepts of Semiconductor RAM Memories, Read-Only Memories, Cache Memories Performance Considerations, Virtual Memories Secondary Storage. ***Task:*** *Prepare a report on Micro-programmed control.*		
III	**Input-Output Organization and Operating Systems**	5+5=10
Part-A: Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data TransferModes, Priority Interrupt, DMA, I/O Processor (IOP), Serial Communication. ***Task:*** *Prepare a summary report on I/O Organization.*		
Part-B: Operating Systems Overview: Overview, Functions, Protection and Security, Distributed Systems, Special Purpose Systems, Operating Systems Structures, Services and Systems Calls, System Programs, Operating Systems Generations. ***Task:*** *Prepare a report on operating systems.*		
IV	**Process and Memory Management**	9
Process Management: Process concepts, process states, process control block, scheduling queues, process scheduling, Threads Overview, Threading issues. **Memory Management:** Swapping, Contiguous Memory Allocation, Paging, Structure of The Page Table, Segmentation, Virtual Memory, Page-Replacement Algorithms, Allocation of Frames. ***Task:*** *Prepare a report on process and memory management.*		
V	**Deadlocks and File System**	10
Principles of Deadlock: System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock. **File System Interface:** The Concept of a File, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection. ***Task:*** *Prepare a report on file management system.*		
Textbooks		
1. Computer System Architecture, M. Moris Mano, Third Edition, Pearson. 2. Andrew S. Tanenbaum, Modern Operating Systems, 2nd Edition, 2007, PHI, India.		

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION
(Professional Elective – I)

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	22ECPE53	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	PSO1
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

Syllabus

Unit	Title/Topics	Hours
I	**Block Schematics of Measurement**	10
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. ***Task:*** *Study the effects of measuring instruments.*		
II	**Signal Analyzers**	9
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. ***Task:*** *Design an Attenuator.*		
III	**Oscilloscopes**	5+5=10
Part-A: Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, CRO Probes. Applications-measurement of Time period and frequency specifications. ***Task:*** *Simulate Electronic Multi-meter.*		
Part-B: Special Purpose Oscilloscopes: introduction to dual trace, dual beam CROs, sampling oscilloscopes, storage oscilloscopes, digital storage CROs. ***Task:*** *Simulate DSO.*		
IV	**Transducers**	10
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. ***Task:*** *Design DAC and ADC.*		
V	**Bridges**	9
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. ***Task:*** *Design Wheatstone Bridge Measurement.*		
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.		

DIGITAL MARKETING
(Professional Elective – I)

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	22ECPE54	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 and register a domain	3	2	3	3	3	3
CO5	apply digital marketing techniques in real time applications	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	8
Introduction to Digital Marketing, Start with the Customer and Work Backward, 3i Principles, Search Engine Optimization - An Introduction, Search Engine Result Pages: Positioning, Search Behavior, Goals, On-Page Optimization, Off-Page Optimization, Analyze. ***Task:*** *Perform a case study on digital marketing.*		
II	**Search Engine Optimization (SEO)**	8
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. ***Task:*** *Make a SEO friendly website design.*		
III	**Advertising & Marketing**	8+5=13
Part-A: Paid and Digital Advertising: Goals, Setup, Manage, Analyze, Digital display advertising - An Industry Overview - Define, Format, Configure, Analyze, Email Marketing, An Introduction - Data-Email Marketing Process, Design and Content, Delivery, Discovery. ***Task:*** *Perform a case study on email marketing.*		
Part-B: Social-Media and Mobile Marketing: Goals, Channels, Implementation, Analyze, Laws and Guidelines, Mobile marketing – Opportunity, Optimize, Advertise, Analyze. ***Task:*** *Implement social media marketing.*		
IV	**Website Essentials**	10
Domain Name Options, Domain Name Namespaces, Generic top-level domains, Country code top-level domains, Country code second-level domains, Buying Domain Names, Domain name size, Keyword-rich domain names, Nonsensical domain names, Domain registration period, Tapping into expired domain names, Buying existing domains, Utilizing the unsolicited approach, Domain name resellers. ***Task:*** *Perform a case study of Godaddy website.*		
V	**Applications**	9
Travel portal –Makemytrip, Yatra, IRCTC; E-commerce – Amazon, flipkart; Song portals – Wynk. ***Task:*** *Case study of travel / music / E-commerce based on website performance.*		
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, 2023.		
References		
1. SEO: Search Engine Optimization Bible Jerri L. Ledford; Wiley India; 2nd Edition, 2007.		

ANALOG AND DIGITAL COMMUNICATION LAB

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	22ECPC55	-	-	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	PO9	PSO2
CO1	test analog modulation and demodulation techniques	3	3	3	3
CO2	demonstrate time and frequency division multiplexing	3	3	3	3
CO3	design the pulse modulation and demodulation techniques	3	3	3	3
CO4	compare PCM , DPCM and DM	3	3	3	3
CO5	classify digital modulation and demodulation waveforms	3	3	3	3

List of Experiments

(Minimum 12 experiments should be conducted)

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

Week	Title/Experiment
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.

References

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

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab 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

MICROPROCESSORS & MICROCONTROLLERS LAB

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	22ECPC56	-	-	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	PO9	PSO2
CO1	interpret programs for various problems using 8086 microprocessor	3	3	3	3
CO2	develop interfacing between 8086 microprocessor and various peripherals	3	3	3	3
CO3	compile programs on Microcontroller based systems	3	3	3	3
CO4	interface 8051 ports with various peripherals	3	3	3	3
CO5	design Microprocessor and Microcontroller based systems	3	3	3	3

List of Experiments

(Minimum 12 experiments to be conducted)

Week	Title/Experiment
1	Programs for 16 bit arithmetic operations using 8086 (using Various Addressing Modes).
2	Program for sorting an array using 8086.
3	Program for searching for a number or character in a string using 8086
4	Program for string manipulations using 8086.
5	Program for digital clock design using 8086.
6	Interfacing ADC and DAC to 8086.
7	Parallel communication between two microprocessors using 8255.
8	Serial communication between two microprocessor kits using 8251.
9	Interfacing to 8086 and programming to control stepper motor.
10	Programming using arithmetic, logical and bit manipulation instructions of 8051.
11	Program and verify Timer/Counter in 8051.
12	Program and verify Interrupt handling in 8051.
13	UART Operation in 8051.
14	Communication between 8051 kit and PC.
15	Interfacing LCD to 8051.
16	Interfacing Matrix/Keyboard to 8051.

References

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

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab 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

OOP THROUGH JAVA LAB

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	22ECPC47	-	-	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	PO9
CO1	write, compile and execute simple java programs	3	3	3
CO2	develop programs using inheritance, polymorphism, packages and Interfaces	3	3	3
CO3	demonstrate multithreading and exception handling mechanisms	3	3	3
CO4	design GUI using the concepts of AWT and event handling	3	3	3
CO5	build real-time applications using applets and swings	3	3	3

List of Experiments

Note: Use Eclipse or NetBeans platform and get acquainted with the various menus.

Week	Title/Experiment
1	Write a Java program to a) find the roots of quadratic equation $ax^2+bx+c = 0$ b) print all prime numbers up to a given integer (use Scanner class to read input)
2	Write a Java program to a) check whether a given string is a palindrome or not b) sort given list of strings. Read input from command line
3	Write a Java program to demonstrate a) method overloading and method overriding b) implement multiple inheritance
4	Write a Java program to a) demonstrate packages b) demonstrate abstract usage
5	Write a java program to a) demonstrate exception handling mechanism b) create user defined exception.
6	Write a Java program that implements the producer - consumer problem.
7	Write a Java program to handle a) mouse events b) key events.
8	Write an applet program to a) displays a simple message b) compute factorial value.
9	Write a Java program that creates a user interface to perform integer divisions.
10	Write a Java program that simulates a traffic light.
11	Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for thedigits and for the +, -,*, % operations.
12	Write Java programs to develop swing application using JList, JTree, and JTable.
13	Write Java programs to develop swing application using JTabbedPane and JScrollPane.

References

1. OOP through JAVA Lab Manual, Department of ECE, CMRIT, Hyd.

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab internal examination.

1. Design job application form using swing/applet
2. Develop Attendance Management System
3. Implement Social Media System
4. Implement Library Management System.
5. Design New Patient Registry Management System
6. Develop Scientific Calculator
7. Demonstrate login validation using rich GUIcomponents
8. Create a package which has classes and methods to read Student Admission details.
9. Event handler to display cut/copy/paste events using swings
10. Demonstrate Graphics class

ADVANCED ENGLISH COMMUNICATION SKILLS LAB

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	22HS51	-	-	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	PO9	PO10
CO1	assess and utilize vocabulary in an effective way	3	3	3
CO2	interpret interpersonal relationships	3	3	3
CO3	elaborate academic reading and writing skills	3	3	3
CO4	formulate appropriate communication techniques in various contexts	3	3	3
CO5	adapt to different work-place and socio-cultural scenarios	3	3	3

List of Experiments

Week	Title/Experiment
1	Self-Introduction, Role Play, Simple Exercises on Personality Development, Vocabulary Test.
2	Non-Verbal Communication & Personality-Development - Self Assessment- Attitude - Self-Esteem.
3	Synonyms and Antonyms, One-word Substitutes, Prefixes and Suffixes, Idioms, Phrases, Collocations, Technical Vocabulary.
4	Reading Skills - General Vs Local Comprehension - Reading for Facts & Details - Understanding Pictures, Figures and Graphs - Guessing Meaning from Context - Skimming, Scanning, Inferring Meaning.
5	Unseen Passages on Various Topics for Reading Comprehension.
6	Different Types of Writing - Formal Letter Writing - Cover Letter - Resume - Email - Memos - SOP.
7	Technical Reports, Research Proposals, Thesis Writing (Abstract, Synopsis, Thesis Statement, Conclusion, etc.) - Editing - Understanding Plagiarism and its Tools.
8	Presentations - Styles (Oral and Written) - Tools - Info-graphics - Cross-Cultural Communication.
9	Oral Presentations (Audience-Centered, JAMs, Seminars, etc.) Written Presentations (Posters, PPTs, Pictures, etc.)
10	Dynamics of Group Discussion - Organization of Ideas - Rubrics of Evaluation.
11	GD Sessions for Practice.
12	Interview Skills - Do's & Don'ts pre, during & post Interview Techniques - Research about Job Profile and Mock Interviews.

References

i. Advanced English Communication Skills Lab Manual, FED, CMRIT, Hyd.

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab 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

ENVIRONMENTAL SCIENCE & DISASTER MANAGEMENT
MANDATORY COURSE (NON-CREDIT)

Course	B.Tech.-V-Sem.	L	T	P	C
Course Code	22MC51*	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	explain the role of ecosystem for livelihood	3	3	3	2
CO2	interpret methods to sustain environmental resources	3	3	3	2
CO3	identify solutions for sustainable development and pollution control	3	3	3	2
CO4	analyze various types of disasters	3	3	3	3
CO5	develop strategies for preparedness measures against disasters	3	3	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Ecosystem**	6
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. ***Task:*** *Perform a case study on Biogeochemical cycles (Carbon/Nitrogen Cycles).*		
II	**Natural Resources**	6
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. ***Task:*** *Perform a case study on any one of renewable energy resources.*		
III	**Pollution control & Sustainable Development**	4+4=8
Part A: Environmental Pollution Control Technologies: Air, water & soil pollution control technologies; MSW & E. Waste Management, EIA concept, Environmental Audit; EPA Acts. ***Task:*** *Perform a case study on environmental audit.*		
Part B: Sustainable Development: Climate Change**: c**auses, effects, global warming, carbon footprint and environmental protection: brief idea on sustainable development: sustainable development concept, Sustainable Development Goal (SDGs), steps taken towards sustainable development: management of plastics, automobile scrapping policy and promotion of electrical vehicles. ***Task:*** *Perform a case study on sustainable development goals.*		
IV	**Disaster Management**	6
Types of Disasters: Natural and Man-made and their cause and effect, Vulnerability Assessment and Risk Analysis: Vulnerability to various disasters (Flood, Cyclone, Earthquake, Heat waves and Lightning). Institutional Framework: Institutional arrangements for disaster management - National Disaster Management Authority (NDMA), State Disaster Management Authority (SDMA), District Disaster Management Authority (DDMA) and National Disaster Response Force (NDRF). ***Task:*** *Perform a case study on any one of the institutional arrangements for disaster management.*		
V	**Preparedness Measure**	6
Disaster Management Cycle, Early Warning System, Pre-Disaster and Post-Disaster Preparedness, Strengthening of SDMA and DDMA, Community Preparedness, Stakeholder Participation, Corporate Social Responsibility (CSR), Survival Skills: Survival skills adopted during and after disaster Flood, Cyclone, Earthquake, Heat waves and Lightning. ***Task:*** *Prepare a case study on proactive and reactive disaster management plans.*		
Textbooks		
1. Environmental Science by Y. Anjaneyulu, B S Publications, 2004. 2. Climate Change Society & Sustainable Development, Jain Indu, Times Group, 2010. 3. Manual on Disaster Management, National Disaster Management Agency, Govt. of India.		

VI-SEM. SYLLABUS

IOT AND CLOUD COMPUTING

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	22ECPC61	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	PSO1
CO1	explain the concepts of IoT	3	2	3	3	3	3
CO2	illustrate the foundations of IoT	3	2	3	3	3	3
CO3	adapt protocol and standards of IoT	3	3	3	3	3	3
CO4	outline the importance of cloud in IoT	3	3	3	3	3	3
CO5	make use of cloud in IoT enabled spaces	3	2	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	10
Introduction to Internet of Things, IoT Kaleidoscope, Ubiquitous IoT Applications**,** A Panoramic View of IoT Applications, Telematics and Intelligent Transport Systems, Smart Grid and Electric Vehicles, Smarter Planet and Smart Buildings.		
II	**Pillars and DNA of IoT**	10
Four Pillars of IoT, M2M: The Internet of Devices, RFID: The Internet of Objects, WSN: The Internet of Transducers, SCADA: The Internet of Controllers, The DNA of IoT - DCM: Device - Things that Talk. Connect - Via Pervasive Networks, Wired Networks, Wireless Networks. Manage - To Create New Business Value.		
III	**Smart Home Scheduling and Cloud Computing**	4+5=9
Part-A: Protocol Standards for IoT: TCP and UDP, M2M and WSN Protocols, SCADA and RFID Protocols, Issues with IoT Standardization.		
Part-B: Architecture Standardization for WoT: Platform Middleware for WoT, Standards for M2M, Frameworks for WSN, Standards for SCADA, Extensions on RFID Standards, Unified Multitier WoT Architecture, OSGi: The Universal Middleware, WoT Framework Based on Data Standards.		
IV	**The Cloud of Things**	10
Introduction to Cloud Computing, Cloud Middleware, NIST's SPI Architecture and Cloud Standards, Cloud Providers and Systems, The Cloud of Things, The Internet of Things and Cloud Computing, Mobile Cloud Computing, MAI versus XaaS: The Long Tail and the Big Switch, The Cloud of Things Architecture, Four Deployment Models, Vertical Applications.		
V	**Cloud in IoT Enabled Spaces**	9
Medium Access, Data Caching, Smart Parking, Indecision Service Delivery, Home, Learning in Cities', Data Delivery Pricing, Planting & Farming.		
Textbooks		
1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012. 2. Maheswaran, Muthucumaru et.al., "The Cloud in IoT-enabled Spaces", CRC Press, 2019.		
References		
1. HwaiyuGeng, "Internet of Things and Data Analytics Handbook", Wiley, 2016. 2. Al-Turjman, Fadi, "Trends in Cloud-based IoT", Springer, 2020.		

VLSI DESIGN

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	22ECPC62	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	PSO1
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

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	9
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.		
II	**Basic Electrical properties of MOS circuits**	10
Basic Electrical Properties of MOS and BiCMOS Circuits: I_{ds}-V_{ds} relationships, MOS transistor threshold Voltage. CMOS Inverter analysis and design, Bi-CMOS Inverters. 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.		
III	**VLSI Circuit Design Processes**	5+5=10
Part-A: 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 Compound Gates.		
IV	**Basic concepts of MOS Circuits**	9
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.		
V	**Scaling of MOS Circuits and CMOS Testing**	10
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) - Ad-hoc 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 Edition, Pearson, 2009.		
References		
1. CMOS logic circuit Design - John. P. Uyemura, Springer, 2007. 2. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.		

DIGITAL SIGNAL PROCESSING

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	22ECPC63	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	PSO1
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

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Digital Signal Processing**	10
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 and Realization of Digital Filters - Direct, Canonic, Cascade and Parallel Forms, Transposed structures.		
II	**Fourier Transforms**	9
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.		
III	**IIR Digital Filters**	5+5=10
Part-A: Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques,		
Part-B: Bilinear Transformation Method, Spectral Transformations.		
IV	**FIR Digital Filters**	9
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.		
V	**Multirate Digital Signal Processing**	10
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.		

CELLULAR AND MOBILE COMMUNICATIONS
(Professional Elective – II)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	22ECPE61	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	PSO1
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

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Cellular systems**	9
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. ***Task:*** *Write a program to generate hexagonal cell shape.*		
II	**Interference and frequency planning**	10
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. ***Task:*** *Write a program to print pattern for a short and any dipole antenna*		
III	**Cell Coverage for Signal and Traffic & Cell Site and Mobile Antennas**	5+5=10
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. ***Task:*** *Write a program to plot 3D pattern of rectangular aperture.*		
Part-B: Cell Site and Mobile Antennas: Space Diversity Antennas, Umbrella Pattern Antennas, Minimum Separation of Cell Site Antennas, Mobile Antennas. ***Task:*** *Perform a case study on space diversity antennas*		
IV	**Frequency Management and Channel Assignment**	9
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. ***Task:*** *Perform a case study on frequency management and channel assignment.*		
V	**Multiple Access Techniques and Spread Spectrum Techniques**	10
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. ***Task:*** *Write a program for CDMA code generation.*		
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 Edition, 2001. 2. Modern Wireless Communications-Simon Haykin, Michael Moher,Pearson Education, 2005.		

INFORMATION THEORY & CODING
(Professional Elective – II)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	22ECPE62	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	PSO1
CO1	apply the concepts of information theory and entropy	3	3	2	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	2	2	3
CO5	develop error control codes	3	3	2	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Information Entropy Fundamentals**	9
Uncertainty, Information theory, Information rate, entropy for discrete ensembles, Source coding Theorem, Huffman coding, Shannon-Fano coding, Encoding of discrete sources, Markov sources. ***Task:*** *Write a program to demonstrate Huffman Coding and decoding.*		
II	**Information Channels**	10
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. ***Task:*** *Write a program to find entropy and mutual information of a given channel.*		
III	**Block and Cyclic Codes**	5+7=12
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. ***Task:*** *Write a Program for coding & decoding of Linear block codes.*		
Part-B: Cyclic Codes: Properties of cyclic codes, Syndrome calculation and error detection, Encoding and decoding of cyclic codes. ***Task:*** *Write a Program for coding & decoding of Cyclic codes.*		
IV	**BCH Codes**	8
Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials and examples. ***Task:*** *Write a program for coding and decoding of BCH and RS codes.*		
V	**Error Control Coding**	9
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. ***Task:*** *Write a program for coding and decoding of convolutional codes.*		
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, 3rd Edition, Elsevier 2006 2. Introduction to Error Control Codes, S Gravano, Oxford University Press 2007 3. Digital Communication, Amitabha Bhattacharya, TMH 2006		

EMBEDDED SYSTEM DESIGN
(Professional Elective – II)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	22ECPE63	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	PSO1
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 embedded firmware approaches	3	3	3	2	3	3
CO4	explain the various real time operating system concepts	3	3	3	2	3	3
CO5	apply task communication and synchronization techniques	3	2	3	2	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Embedded Systems**	9
Definition of embedded system, embedded systems Vs general computing systems, history of embedded systems, classification, major application areas and purpose of embedded systems, characteristics and quality attributes of embedded systems. ***Task:*** *Perform a case study of various embedded system processors and their applications.*		
II	**Typical Embedded System**	10
Core of the Embedded System: General purpose and domain specific processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of interface, memory shadowing, memory selection for embedded systems, sensors and actuators, communication interface: Onboard and external communication interfaces. ***Task:*** *Perform a case study to compare the performance of different Embedded Systems.*		
III	**Embedded Firmware**	5+5=10
Part-A: Reset circuit, brown-out protection circuit, oscillator unit, real time clock, watchdog timer. ***Task:*** *Write a program for real time clock.*		
Part-B: Embedded firmware design approaches and development languages. ***Task:*** *Perform a case study on Embedded firmware.*		
IV	**RTOS Based Embedded System Design**	9
Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling. ***Task:*** *Perform a case study on process and threads using real time operating system.*		
V	**Task Communication and Synchronization**	10
Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, **Task Synchronization:** Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, Methods to Choose an RTOS. ***Task:*** *Perform a case study on Task Synchronization Techniques.*		
Textbooks		
1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.		
References		
1. Embedded Systems - Raj Kamal, TMH. 2. An Embedded Software Primer - David E. Simon, Pearson Education. 3. Embedded C by Michael J. Pont, A Pearson.		

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
(Professional Elective – II)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	22ECPE64	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	PSO1
CO1	illustrate the concepts of AI and various search algorithms	3	3	3	3	3	3
CO2	adapt knowledge representation and probabilistic reasoning	3	3	3	3	2	3
CO3	explain expert systems and concepts of machine learning	3	3	2	3	3	3
CO4	classify various supervised learning algorithms	3	3	2	3	2	3
CO5	demonstrate the various unsupervised learning algorithms	3	3	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	8
Introduction: Artificial Intelligence, AI Problems, AI Techniques, the Level of the Model, Criteria for Success. Defining the Problem as a State Space Search, Problem Characteristics, Production Systems, Search: Issues in the Design of Search Programs, Un-Informed Search, BFS, and DFS. **Heuristic Search Techniques:** Generate- And- Test, Hill Climbing, Best-First Search, A* Algorithm, Problem Reduction, AO* Algorithm, Constraint Satisfaction, Means- Ends Analysis. ***Task:*** *Write a program to implement A* algorithm.*		
II	**Knowledge Representation and Probabilistic Reasoning**	10
Knowledge Representation and Reasoning: Logical systems Knowledge Based systems, Propositional Logic Constraints, Predicate Logic First Order Logic, Inference in First Order Logic, Ontological Representations and applications. **Uncertainty and knowledge Reasoning:** Overview Definition of uncertainty, Bayes Rule Inference, Belief Network, Utility Based System, Decision Network. ***Task:*** *Perform a case study on knowledge reasoning.*		
III	**Expert Systems and Machine Learning**	6+4=10
Part-A: Expert Systems: Architecture of expert systems, Roles of expert systems - Knowledge Acquisition - Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells. ***Task:*** *Perform a case study on expert systems.*		
Part-B: Machine Learning: Introduction of machine learning concepts, examples of various learning paradigms over fitting and train/set splits, types of machine learning, supervised, unsupervised, reinforcement learning, perspectives and issues, version spaces, finite and infinite hypothesis spaces. ***Task:*** *Perform a case study on Finite Hypothesis Spaces.*		
IV	**Supervised Learning**	10
Supervised Learning: Learning a class from examples, linear, non-linear, multi-class and multi-label classification, generalization error bounds: VC Dimension, Decision Trees: ID3. Linear Regression - model assumptions, regularization (lasso, ridge, elastic net), Classification and Regression Algorithms - Naïve Bayes, K-Nearest Neighbors, logistic regression, SVM, decision trees and random forest. ***Task:*** *Write a program for SVM.*		
V	**Unsupervised Learning**	10
Unsupervised Learning: Introduction to clustering, Hierarchical: AGNES, DIANA, Partitional: K-means clustering, K-Mode Clustering, Self-Organizing Map, Expectation Maximization, Gaussian Mixture Models, Principal components analysis (PCA), Subclass Discriminant Analysis (SDA), Factor Analysis. ***Task:*** *Perform a case study on PCA.*		
Textbooks		
1. Riche, Elaine., Knight, 2009. Artificial Intelligence, 3rd edition, TMH. 2. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, 3rd Edition, PHI, 2014.		
References		
1. Russell, S. and Norvig, P. Artificial Intelligence - A Modern Approach, 3rd Edition, PHI, 2015. 2. Tom Mitchell, Machine Learning, McGraw Hill, 3rd Edition, 1997.		

E-COMMERCE
(Open Elective - I)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	22OE61	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	PO3	PO8	PO9	PO10	PO12
CO1	outline the concepts of E-Commerce	3	2	2	3	3
CO2	develop supporting environment for E-Commerce	3	2	3	3	3
CO3	make use of technology in E-Commerce	3	3	3	3	3
CO4	adapt payment technologies in E-Commerce	3	3	3	3	3
CO5	implement security in E-Commerce	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	7
The origin and development of e-commerce influence of mathematics on e-commerce, impact of computer science, communication science and management science on e-commerce, categories of e-commerce - B2B, B2C, B2G, G2G, C2C. ***Task:*** *Outline the importance of management in e-commerce.*		
II	**Constitution, Supporting Environment and M-Commerce**	10
Portal of the network, customer relationship management, supply chain management, logistic management, decision support, technical environment, legal environment, credit environment, financial environment. Origin of M-Commerce, M-Commerce components, development and applications of M-Commerce. ***Task:*** *Perform a case study on the supporting environment of E-commerce.*		
III	**Technology**	7+7=14
Part-A: E-commerce supporting technologies: E-Commerce fundamental technology - Web technology, HTML, XML, Java, Computer communication technology - TCP/IP protocols, HTTP Communication protocol, EDI Communication protocol, WAP Communication protocol, WLAN protocol, Bluetooth protocol. ***Task:*** *Perform a case study of e-commerce supporting technologies.*		
Part-B: Information processing technologies in E-Commerce - Global positioning system, Geographical information system, Decision supporting system, Group decision supporting system, Intelligent decision supporting system. ***Task:*** *Perform a case study on a global positioning system.*		
IV	**Payment Technologies in E-Commerce**	9
Online bank - Development of online banks, Function of online bank, Online banking technologies, E-Payment tools - E-Payment system, Intelligent card, E-Check, E-Wallet, E-Cash. ***Task:*** *Make a list of payment technologies in E-commerce.*		
V	**Security Technologies in E-Commerce**	8
Security problems in e-commerce, Reliability of e-commerce systems, Data encryption technology, - Symmetric encryption system, public key encryption algorithm, Mixed encryption technology, Digital signature - Sign the document with public key algorithm, Signature with one way hash function and public key system. ***Task:*** *Sign the document with a public key algorithm.*		
Textbooks		
1. Zheng Qin, Introduction to E-commerce, Springer. 2. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison Wesley.		
References		
1. Pete Lohsin , John Vacca "Electronic Commerce", New Age International. 2. Goel, Ritendra "E-commerce", New Age International. 3. Laudon, "E-Commerce: Business, Technology, Society", Pearson Education.		

AGILE METHODOLOGIES
(Open Elective - I)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	22OE62	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	PO8	PO12
CO1	explain the concepts of agile methodology	3	2	3	3	3
CO2	make use of agile process	3	3	3	3	3
CO3	illustrate agility and knowledge management	3	3	3	3	3
CO4	adapt agility and requirements engineering	3	3	3	3	3
CO5	outline the importance agility and quality assurance	3	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Agile Methodology**	8
Theories for agile management - agile software development - traditional model vs. agile model-classification of agile methods - agile manifesto and principles - agile project management - agile team interactions - ethics in agile teams - agility in design, testing - agile documentations - agile drivers, capabilities and values. ***Task:*** *Perform a case study on agile project management.*		
II	**Agile Processes**	8
Lean production SCRUM, crystal, feature driven development, adaptive software development, extreme programming: method overview, lifecycle, work products, roles and practices. ***Task:*** *Perform a case study on Extreme programming.*		
III	**Agility and Knowledge Management**	8+6=14
Part-A: Agile information systems - agile decision making – Earl_S schools of KM - Institutional knowledge evolution cycle - development, acquisition, refinement, distribution, deployment. ***Task:*** *Perform a case study on institutional knowledge evaluation cycle.*		
Part-B: Leveraging - KM in software engineering - managing software knowledge - challenges of migrating to agile methodologies - agile knowledge sharing - role of story-cards - Story-card Maturity Model (SMM). ***Task:*** *Perform a case study on challenges of migrating to agile methodologies.*		
IV	**Agility and Requirements Engineering**	9
Impact of agile processes in RE - current agile practices - variance - overview of RE using agile - managing unstable requirements - requirements elicitation - agile requirements abstraction model - requirements management in agile environment, agile requirements prioritization - agile requirements modeling and generation - concurrency in agile requirements generation. ***Task:*** *Perform a case study on agile requirements modeling and generation.*		
V	**Agility and Quality Assurance**	9
Agile product development - agile metrics - Feature Driven Development (FDD) - Financial and Production Metrics in FDD - agile approach to quality assurance - test driven development agile approach in global software development. ***Task:*** *Perform a case study on FDD.*		

Textbooks

1. David J. Anderson and Eli Schragenheim, - Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003. https://www.amazon.com/Agile-Management-Software-Engineering-Constraints/dp/0131424602
2. Hazza and Dubinsky, - Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.

References

1. Craig Larman - Agile and Iterative Development: A Manager_s Guide, Addison-Wesley, 2004.
2. Kevin C. Desouza - Agile Information Systems: Conceptualization, Construction and Management, Butterworth-Heinemann, 2007.

ELECTRONIC SENSORS
(Open Elective-I)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	22OE63	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	PO8	PO12
CO1	analyze the characterization of sensors	3	3	2	2	3	3
CO2	illustrate thermal embedded system	3	2	3	3	3	3
CO3	adapt magnetic sensors	3	3	3	2	3	3
CO4	make use of radiation sensors	3	3	3	2	3	3
CO5	design a system with sensors	3	2	3	2	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Sensors**	9
Sensors/Transducers: Principles, classification, parameters, characteristics, environmental parameters (ep), characterization. **Electromechanical Sensors:** Introduction, resistive potentiometer, strain gauge, resistance strain gauge, semiconductor strain gauges -inductive sensors: sensitivity and linearity of the sensors, types of capacitive sensors: electrostatic transducer, force/stress sensors using quartz resonators, ultrasonic sensors. ***Task:*** *Perform a case study on linear variable differential transformer (LVDT).*		
II	**Thermal Sensors**	10
Thermal Sensors: Introduction, gas thermometric sensors, thermal expansion type thermometric sensors, acoustic temperature sensor, dielectric constant and refractive index thermo sensors, helium low temperature thermometer, nuclear thermometer, magnetic thermometer, resistance change type thermometric sensors, thermo EMF sensors, junction semiconductor types, thermal radiation sensors, quartz crystal thermoelectric sensors, heat flux sensors. ***Task:*** *Perform a case on thermocouple sensors.*		
III	**Magnetic sensors**	5+5=10
Part-A: Magnetic sensors: Introduction, principles, magneto-resistive sensors, anisotropic magneto resistive sensing. ***Task:*** *Perform a case on magnetic variable reluctance.*		
Part-B: Semiconductor magneto resistors, hall effect,inductance and eddy current sensors, angular/ rotary movement transducers, synchros. ***Task:*** *Perform a case on hall device applications.*		
IV	**Radiation and Electro analytical Sensors**	10
Radiation Sensors: Introduction, characteristics, types of photoresistors/photodetectors, X-ray and nuclear radiation sensors, fiber optic sensors. **Electro analytical Sensors:** The electrochemical cell, the cell potential - standard hydrogen electrode (SHE), liquid junction and other potentials, polarization, concentration polarization, reference electrodes, sensor electrodes, electro ceramics in gas media. ***Task:*** *Prepare a report on electrochemical sensors.*		
V	**Smart Sensors**	9
Smart Sensors: Introduction, primary sensors, excitation, amplification, filters, converters, standards for smart sensorinterface, the automation sensors - applications: on-board automobile sensors (Automotive Sensors), home appliance sensors, aerospace sensors, sensors for manufacturing and environmental monitoring. ***Task:*** *Draft a report on getting sensor information into the microcontroller.*		
Textbooks		
1. "Sensors and Transducers - D. Patranabis" - PHI Learning Private Limited., 2003. 2. Introduction to sensors - John Vetelino, Aravind Raghu, CRC press, 2011.		
References		
1. Sensors and Actuators, D. Patranabis, 2nd Edition, PHI, 2013. 2. Make Sensors: Terokarvinen, Kemo, Karvinen and Villey Valtokari, 1st Ed, Makermedia, 2014.		

IOT AND CLOUD COMPUTING LAB

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	22ECPC64	-	-	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	PO9	PSO2
CO1	identify various IoT devices	3	3	3	3
CO2	use IoT devices in various applications	3	3	3	3
CO3	develop automation work-flow in IoT enabled cloud environment	3	3	3	3
CO4	take part in practicing and monitoring remotely	3	3	3	3
CO5	make use of various IoT protocols in cloud	3	3	3	3

List of Experiments

Week	Title/Experiment
1	Install necessary software for Arduino and Raspberry Pi.
2	Familiarization with Arduino and Raspberry Pi board.
3	Write a program to transfer sensor data to a smartphone using Bluetooth on Arduino.
4	Write a program to implement RFID using Arduino.
5	Write a Program to monitor temperature and humidity using Arduino and Raspberry Pi.
6	Write a Program to interface IR sensors with Arduino using IoT Cloud Application.
7	Write a Program to upload temperature and humidity data to the cloud using an Arduino or Raspberry Pi.
8	Write a program to retrieve temperature and humidity data from the cloud using Arduino and Raspberry Pi.
9	Write a program to create a TCP server on cloud using Arduino and respond with humidity data to the TCP client when requested.
10	Write a program to create a UDP server on cloud using Arduino and respond with humidity data to the UDP client when requested.

References

1. IoT and Cloud Computing Lab Manual, Department of ECE, CMRIT, Hyd.

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab internal examination.

1. Air Pollution Meter.
2. Smart Garbage Collector.
3. Weather monitoring system.
4. Baggage Tracker.
5. Circuit Breakage Detection.
6. Anti-Theft Flooring System.
7. IoT Based Smart Street Light.
8. IoT based Gas Leakage Monitoring system.
9. IoT Based Smart Irrigation System.
10. IoT Based Water Level Monitoring System.

VLSI DESIGN LAB

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	22ECPC65	-	-	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	PO9	PSO2
CO1	test logic gates	3	3	3	3
CO2	design combinational circuits	3	3	3	3
CO3	develop sequential circuits	3	3	3	3
CO4	analyze finite state machines	3	3	3	3
CO5	construct CMOS circuit schematics and their layouts	3	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.

S. No.	Experiment	S. No.	Experiment
1	Design of 16 to 1 Multiplexer	6	Design of Carry Select Adder
2	Design of Ripple Carry Adder	7	BCD Adder Realization
3	Pattern Detection using Moore Machine	8	Design of flip flops: SR,D,JK,T
4	Design of Full Adder using 3 modeling styles	9	Design of 4 Bit Arithmetic Logic Unit (ALU)
5	Design of N bit comparator	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:

S. No.	Experiment	S. No.	Experiment
1	CMOS inverter.	6	Static/Dynamic logic circuit (register cell)
2	CMOS NOR / NAND gates.	7	Latch.
3	CMOS XOR gates.	8	Pass transistor.
4	CMOS MUX gates.	9	Layout of any combinational circuit (complex CMOS logic gate)
5	CMOS half / full adder.	10	Analog Circuit simulation (AC analysis) – CS and CD amplifier.

References

1. VLSI Design Lab Manual, Department of ECE, CMRIT, Hyd.

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab 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.

DIGITAL SIGNAL PROCESSING LAB

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	22ECPC66	-	-	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	PO9	PSO2
CO1	classify various types of signals and perform linear operations on the signals	3	3	3	3
CO2	compute linear and circular convolution	3	3	3	3
CO3	analyze the principles of DIT FFT and DIF FFT algorithms	3	3	3	3
CO4	design digital IIR and FIR filter using various techniques	3	3	3	3
CO5	apply Multirate concepts in sampling rate conversion applications	3	3	3	3

List of Experiments

Week	Title/Experiment
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.

References

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

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab 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

INDUSTRY ORIENTED MINI PROJECT/INTERNSHIP/SKILL ENHANCEMENT COURSE – ROBOTIC PROCESS AUTOMATION

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	22ECPR61	-	-	4	2

Note:

1. A student can choose any one of the following courses: (i) Industry Oriented Mini Project (ii) Internship (iii) Skill Enhancement Course. However, the process of evaluation would be different for Skill Enhancement Course.
2. Evaluation guideline for (i) Industry Oriented Mini Project or (ii) Internship is as given below.
3. There shall be no separate evaluation by the institution for Skill Enhancement Course and the marks/grade would be the replica of Grade-Certificate issued by the respective organization.

INDUSTRY ORIENTED MINI PROJECT/INTERNSHIP

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 PSO1
CO1	apply domain knowledge to solve identified industrial problem	3
CO2	use industrial processes involved in end product/service	3
CO3	exhibit communication skills, professional ethics and social responsibility	3
CO4	manage and lead project in coordination with functional team-members	3
CO5	execute the project that meets industry requirements	3

Guidelines

S. No.	Title
1	Students should start the project/Internship under approved internal guide immediately after B.Tech. IV Semester End Examinations and complete before B.Tech. VI Semester End Examinations in any reputed organization without effecting regular classwork.
2	The students have to obtain NOC from both HOD and internship organization and submit the same to the guide for commencement of project/internship.
3	Upon commencement of work, the guide visits the internship organization periodically to monitor the performance of the student.
4	The students have to report the guide periodically on progress of work and seek advice.
5	On completion of internship, the students should submit the project report to the guide along with Certificate of Completion.
6	The project work is evaluated before commencement of VI-Semester End Examinations.
7	The student should give presentation before the Evaluation Committee for 10-15 minutes.
8	The Evaluation Committee awards the marks based on the student's performance.

Evaluation Procedure

External Committee Evaluation (SEE for 100 Marks)

S. No.	Item	Marks
1	Problem Justification/Observation	05
2	Content and Innovation	10
3	Use of Modern tools	15
4	Execution	15
5	Technical Presentation	30
6	Viva-Voce (Q & A)	10
7	Technical Report	15
Total		**100**

SKILLS ENHANCEMENT COURSE- ROBOTIC PROCESS AUTOMATION

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	22ECPR61	-	-	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	PO9	PSO2
CO1	install RPA packages	3	3	3	3
CO2	apply variables, data types, control statements in designing RPA	3	3	3	3
CO3	make use of data manipulation, recording and scrapping techniques	3	3	3	3
CO4	use selectors, data tables in excel for automation	3	3	3	3
CO5	develop email and PDF automation	3	3	3	3

List of Experiments

Week	Title/Experiment
1	Introduction to RPA and installation of RPA packages.
2	Perform automation for variables and data types.
3	Design a process for control flow: a) Conditional Statements b) Iteration
4	Create a process for data manipulation - scalar variables, collections, tables, text manipulation.
5	Design a process for recording-basic, desktop and web.
6	Design a process for scrapping: a) Screen scrapping b) Data scrapping
7	Perform automation for customizing the Selectors.
8	Create a process for image and text automation.
9	Design a process for automating Data tables in Excel.
10	Perform email automation.
11	Design a process to read all PDF files from a folder and then close them all.
12	Create an automation to change the background color of excel cell/range in Ui Path.
13	Design a process to Generate Covid-19 report and send this report to required recipient.
14	Create a Process which reminds a user to take his medicine after every 4Hr.

References

1. Robotic Process Automation Lab Manual, Department of CSE, CMRIT, Hyd.

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab internal examination.

1. Web Scraping.
2. Data Migration.
3. CRM Upgrading.
4. Call Center Operations.
5. On-boarding Employees.
6. Payroll Processing.
7. Legal Process.
8. Data Wiring for Healthcare.
9. Claims Processing.
10. Support Sales and Marketing Process.

ENTREPRENEURSHIP AND IPR
MANDATORY COURSE (NON-CREDIT)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	22MC61	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	PO7	PO8	PO12
CO1	illustrate entrepreneurship principles	3	3	3	3
CO2	analyze entrepreneurs' mindset	3	3	3	3
CO3	develop Business Plan and incubate innovative ideas	3	3	3	3
CO4	identify entrepreneurs' challenges in light of legal environment	3	2	3	2
CO5	demonstrate various types of IPRs applicable	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Fundamentals of Entrepreneurship**	10
Introduction - development - evolution - entrepreneurship value creation-traits-role models - business model - entrepreneurial mind set-big companies vs. startups-misconceptions and myths about entrepreneurship. ***Task:*** *Perform a case study on a successful men and women entrepreneur.*		
II	**Entrepreneurship Development in Emerging Markets**	10
Types of startups - entrepreneurship - entrepreneurship as career option-youth and female entrepreneurship - small business enterprises - international entrepreneurship - role of educational institutions in entrepreneurship - mistakes startups make - leadership components and trends in entrepreneurship. ***Task:*** *Perform a case study on a child, youth and rural entrepreneur.*		
III	**Creativity in Business Ideas & Idea to Opportunity and Business Plan**	4+4=8
Part-A: Creativity & entrepreneurship - characteristics of creative people - blocks to creativity - creativity at work & sources of new ideas - techniques of generating ideas - idea not enough. ***Task:*** *Identify creativity in ideas among select Entrepreneurs.*		
Part-B: Opportunity recognition, process and sources of opportunities - steps involved in assessing business idea and tapping opportunity. Entrepreneurial opportunities & business plan, concept of business plan, steps, drivers and limitations. Reasons for business failures. ***Task:*** *Develop a format of Business Plan for any proto type.*		
IV	**Legal Aspects of Entrepreneurship**	10
Introduction - formation of business entity - different types of business entities (sole trader, partnership & types, limited companies, psus - promotion, registration, formation of different entities-governance & administration of various forms of enterprises. ***Task:*** *Prepare a model Memorandum and Articles of Association for private limited company.*		
V	**Entrepreneurship and Intellectual Property Rights (IPR)**	10
Intellectual Property Protection: Patents - Types of Patent Applications, Copyrights Trademarks and Trade Secrets-Avoiding Trademark Pitfalls. Formulation of the entrepreneurial Plan - The challenges of new venture startups, Critical factors for new venture development - Evaluation Process - Feasibility Criteria Approach. ***Task:*** *Draw a flow chart for filing of different IPRs under Indian patents act.*		
Textbooks		
1. Arya Kumar "Entrepreneurship - Creating and Leading an Entrepreneurial Organization" Pearson 2016. 2. D F Kuratko and T V Rao "Entrepreneurship - A South-Asian Perspective "Cengage Learning, 2nd Edition, 2015. 3. Robert Hisrich et al "Entrepreneurship" 7th Edition, TMH, 2016. 4. Intellectual Property Rights - Deborah E. Bouchoux, 4th Edition, Cengage Learning, 2013.		

B.TECH.-VII-SEMESTER SYLLABUS

MANAGEMENT, ECONOMICS AND ACCOUNTANCY

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	22HS71	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

Syllabus

Unit	Title/Topics	Hours
I	**Management concepts**	10
Introduction to Management and organization, Scientific management, Modern management – Functions, objectives and scope of functional areas of management, Levels of management. ***Task:*** *Perform a case study on various managerial positions & functions of any MNC.*		
II	**Introduction to Managerial Economics**	10
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. ***Task:*** *Fit a trend line for sales using MS-Excel.*		
III	**Theory of Production, Cost and Market Structure**	4+4=8
Part A: Types of Production function, input output relationship and types of costs, cost output relationship. ***Task:*** *Derive production function using MS-Excel.*		
Part-B: CVP Analysis-BEP analysis assumptions, limitations and uses. Different market structures-Perfect & Monopoly Competition. ***Task:*** *Find BEP for a desired profit using MS-Excel.*		
IV	**Introduction to Accounts**	10
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). ***Task:*** *Prepare horizontal final accounts from vertical statements using www.moneycontrol.com.*		
V	**Financial Statement Analysis**	10
Concept of Financial Statement Analysis uses and limitations – Liquidity, Leverage, Activity, Turnover, Profitability Ratios (Simple problems). ***Task:*** *Compute Liquidity, Leverage and Profitability Ratios using www.moneycontrol.com.*		

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 Mithileshwar 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.

MICROWAVE ENGINEERING

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	22ECPC71	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	PSO1
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

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Microwaves and Model of Microwave Transmission**	9
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.		
II	**Analysis of Microwave Transmission Lines and Passive Microwave Devices**	10
Analysis of Microwave Transmission Lines: Rectangular Waveguides– solution of wave equations in rectangular coordinates, TE/TM mode analysis, expressions for fields, characteristic equation. **Passive Microwave Devices:** Cavity Resonators, E plane, H plane &, Magic Tee, Directional Couplers and Attenuators; Ferrite Components – Faraday rotation, Gyrator, Isolator and Circulator.		
III	**Active Microwave Devices and M-Type Tubes**	5+5=10
Part-A: Active Microwave Devices: Limitations & losses of conventional tubes, Microwave tubes: 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.		
IV	**Scattering Matrix and Microwave Measurements**	10
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.		
V	**Microwave systems and Modern Trends in Microwaves Engineering**	9
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.		
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.		

DIGITAL IMAGE PROCESSING
(Professional Elective – III)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	22ECPE71	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	PSO1
CO1	explain image fundamentals and transforms	3	3	2	3
CO2	utilize image enhancement and filtering techniques	3	3	2	3
CO3	make use of image restoration techniques and color image processing	3	3	2	3
CO4	apply image segmentation and morphological image processing	3	3	2	3
CO5	analyze image compression techniques	3	3	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Digital Image Fundamentals and Image Transforms**	9
Digital Image Fundamentals: Elements of visual perception, image sensing and acquisition, image Sampling and quantization; basic relationships between pixels-neighbors of a pixel, adjacency, Connectivity, distance measures. **Image Transforms:** 2-D FFT, Walsh, Hadamard, Discrete Cosine, Haar, Slant and Hotelling Transforms, properties. ***Task:*** *Write a program to describe pixel information in a digital image.*		
II	**Image Enhancements, Filtering**	9
Image Enhancements and Filtering: Gray level transformations, histogram equalization and Specifications; smoothing spatial filters - linear and order-statistics; sharpening spatial filters - first and second derivative; frequency domain filters - low-pass and high-pass. ***Task:*** *Write a program to demonstrate image enhancement and filtering.*		
III	**Image Restoration and Color Image Processing**	6+6=12
Part-A: Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, LMS Filters, Constrained Least Squares Restoration, Interactive Restoration. ***Task:*** *Write a program to demonstrate LMS filter for digital images.*		
Part-B: Color Image Processing: Color models - RGB, CMY and CMYK, HSI; Color transformations - formulation, Color complements, color slicing, tone and color corrections; Color image smoothing and Sharpening; Color Segmentation. ***Task:*** *Write a program to demonstrate color image processing.*		
IV	**Image Segmentation and Morphological Image Processing**	9
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. ***Task:*** *Write a program to demonstrate region based image segmentation.*		
V	**Image Compression**	9
Redundancy, fidelity criteria, image compression models, compression methods: Huffman coding, Arithmetic coding, Run-length coding; Lossy compression, Lossy and Lossless predictive coding, transform based compression, JPEG-2000 standards. ***Task:*** *Write a program to illustrate image compression techniques.*		
Textbooks		
1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, 3rd Ed., 2008, Pearson Education.		
References		
1. Anil Kumar Jain, Fundamentals of Digital Image Processing, 2nd Ed., 2004, PHI.		

IOT ARCHITECTURE AND PROTOCOLS
(Professional Elective – III)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	22ECPE72	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	PSO1
CO1	outline the fundamentals of IoT architecture and smart objects	3	3	2	3	3	3
CO2	make use of smart objects in IoT	3	3	3	3	3	3
CO3	illustrate IoT reference architecture and ARM	3	2	3	3	3	3
CO4	demonstrate application protocols for IoT	3	3	3	3	3	3
CO5	apply IoT architecture and protocols for public safety	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	10
Introduction to IOT - IoT Network Architecture and Design, Applications of IOT, Engineering IoT Networks - Smart Objects: The "Things" in IoT, Connecting Smart Objects, IP as the IoT Network Layer, Data and Analytics for IoT, IoT in Industry – Oil, Gas, Manufacturing, Smart cities, Transportation, Mining, Public Safety. ***Task:*** *Perform a case study on IoT Network Architecture and Design.*		
II	**Smart Objects: The "Things" in IoT**	9
Sensors, Actuators, Micro-Electro-Mechanical Systems (MEMS),Smart Objects, A Definition, Trends in Smart Objects, Sensor Networks, Wireless Sensor Networks, IoT Access Technologies - IEEE 802.15.4, Standardization and Alliances, Physical Layer, MAC Layer, Topology. ***Task:*** *Create a checklist for basic standards in IoT.*		
III	**IoT Reference Architecture and ARM**	5+5=10
Part-A: IoT Reference Architecture: Architecture, Functional, information, deployment and operation views; SOA based Architecture, API-based Architecture, OPENIoT Architecture for IoT/Cloud Convergence. ***Task:*** *Perform a case study in SOA based architecture.*		
Part-B: A Guidance to the Architecture Reference Model (ARM): Overview, IoT Reference Model: Domain, information, functional and communication models, IoT Reference Architecture. ***Task:*** *Perform a case study on Architecture Reference Model.*		
IV	**Application Protocols for IoT**	9
UPnP, CoAP, MQTT, XMPP. SCADA, WebSocket; IP-based protocols: 6LoWPAN, RPL; Authentication Protocols; IEEE 802.15.4. ***Task:*** *Perform a comparative analysis between CoAP & SCADA.*		
V	**Public Safety**	10
Overview of Public Safety - Public Safety Objects and Exchanges, Public and Private Partnership for Public Safety IoT, Public Safety Adoption of Technology and the IoT, Emergency Response IoT Architecture, Mobile Command Center, Network and Security Services. ***Task:*** *Perform a case study on Public and Private Partnership for Public Safety IoT.*		
Textbooks		
1. Bassi, Alessandro, et al, "Enabling things to talk", Springer-Verlag Berlin An, 2016. 2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.		
References		
1. Hersent, Olivier, David Boswarthick, and Omar Elloumi. The internet of things: Key applications and protocols. John Wiley & Sons, 2011. 2. Buyya, Rajkumar, and Amir Vahid Dastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016.		

CMOS ANALOG IC DESIGN
Professional Elective – III)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	22ECPE73	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	PSO1
CO1	design basic building blocks of CMOS analog ICs	3	3	2	3	3	3
CO2	explain various analog CMOS Sub-Circuits	3	3	3	3	3	3
CO3	illustrate functions of MOS amplifiers	3	2	3	3	3	3
CO4	adapt various measurement techniques for Op Amps	3	3	3	3	3	3
CO5	outline various comparators	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**MOS Devices and Modeling**	10
The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small- Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model. ***Task:*** *Perform a case study on Computer Simulation Models.*		
II	**Analog CMOS Sub-Circuits**	9
MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors- Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror,Current and Voltage References, Band gap Reference. ***Task:*** *Create a mirror circuit and analyze results.*		
III	**CMOS Amplifiers**	5+5=10
Part-A: Inverters, Differential Amplifiers, Cascode Amplifiers. ***Task:*** *Perform a case study on Differential Amplifiers.*		
Part-B: Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures. ***Task:*** *Perform a case study on High Gain Amplifiers Architectures.*		
IV	**CMOS Operational Amplifiers**	9
Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power-Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp. ***Task:*** *Design Two-Stage Op Amps and validate results.*		
V	**Comparators**	10
Characterization of comparator, two-stage, open-loop comparators, other open-loop comparators, improving the performance of open-loop comparators, discrete-time comparators. ***Task:*** *Perform a case study on comparative analysis of various comparators.*		
Textbooks		
1. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International 2nd Edition/Indian Edition, 2010. 2. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition, 2010.		
References		
1. Analog Integrated Circuit Design- David A. Johns, Ken Martin, Wiley Student Edn, 2013. 2. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition. 3. CMOS: Circuit Design, Layout and Simulation- Baker, Li and Boyce, PHI.		

DATA MINING AND DATA ANALYTICS
(Professional Elective - III)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	22ECPE74	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	PSO1
CO1	summarize fundamentals of data mining	3	2	3	3	2
CO2	illustrate various mining association rules	3	3	2	2	3
CO3	make use of classification and clustering techniques	3	3	3	2	3
CO4	outline various data analytics techniques	3	2	2	2	3
CO5	solve statistical problems using R programming	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Data Mining**	8
Introduction to Data Mining: Kinds of Data, Data mining Functionalities – Interesting Patterns Task Primitives, Issues in Data Mining, Data Preprocessing. ***Task:*** *Perform a case study on kinds of Data.*		
II	**Mining Frequent, Associations and Correlations**	10
Mining Frequent, Associations and Correlations: Basic Concepts, Frequent Itemset Mining Methods: Apriori Algorithm, Finding Frequent Itemsets by Confined Candidate Generation, FP-Growth, Generating Association Rules from Frequent Itemsets, Improving the Efficiency of Apriori, From Association Analysis to Correlation Analysis. ***Task:*** *Perform a case study on the Efficiency of Apriori algorithm.*		
III	**Classification and Clustering**	6+6=12
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. ***Task:*** *Write a program showing Bayes Classification Methods.*		
Part-B: Clustering: Cluster Analysis, Partitioning Methods: k-Means and k-Medoids, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering. ***Task:*** *Perform cluster analysis on a given dataset.*		
IV	**Data Definitions and Analysis Techniques**	10
Data Definitions: Introduction to statistical learning and R-Programming, Elements, Variables, Data structures, Data categorization, Levels of Measurement, Data management and indexing. **Analysis Techniques:** Introduction to statistical hypothesis generation and its types. ***Task:*** *Setup a R-Programming environment.*		
V	**Testing Techniques**	8
Testing: Chi-Square test, t-Test, Z-test, Analysis of variance, Maximum likelihood test, regression, Practice and analysis with R. ***Task:*** *Perform a case study on data analysis in R.*		

Textbooks

1. Data Mining- Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2nd 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.

RADAR AND SATELLITE COMMUNICATION SYSTEMS
(Professional Elective – IV)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	22ECPE75	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	PSO1
CO1	explain the basic principles of radar system	3	2	2	2	3
CO2	illustrate the various types of radar systems	3	2	2	2	3
CO3	analyze radar signals and explain the principles of satellites	3	2	2	2	3
CO4	compare satellite subsystems with earth station technology	3	2	2	2	3
CO5	design the power budget for satellite links	3	2	2	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Radar**	9
Introduction to radar, Radar block diagram and operation, Radar frequencies, Applications of radar, Prediction of range performance, Minimum detectable signal, Receiver noise, Probability density function, SNR, Integration of radar pulses, Radar cross-section of targets, PRF and range ambiguities, Transmitter power, System losses. ***Task:*** *Draw a flow chart of velocity determination process of moving objects using Radar range.*		
II	**Radar Technology**	10
Doppler Effect, CW radar, FM CW radar, Multiple frequency CW radar. MTI radar, Delay line canceller, Range gated MTI radar, Blind speeds, Staggered PRF, Limitations to the performance of MTI radar, Non-coherent MTI radar. Tracking radar: sequential lobing, conical scan, Monopulse: amplitude comparison and phase comparison methods, Radar antennas. Radar displays. ***Task:*** *Study the use of Doppler Radar to detect the maximum range.*		
III	**Radar Signals and Satellite Communications**	5+5=10
Part-A: Detection of Radar Signals: Detection of Radar Signals in Noise Matched Filter Receiver - Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Filter with Non-white Noise. ***Task:*** *Study the use of RADAR system to measure the distance travelled by any object.*		
Part-B: Introduction to Satellite Communication: Orbital aspects of Satellite Communication: Introduction to geo-synchronous and geo-stationary satellites, Kepler's laws, Locating the satellite with respect to the earth, Sub-satellite point, Look angles, Mechanics of launching a synchronous satellite, Orbital effects and Indian scenario in communication satellites. ***Task:*** *Study the various Kepler's law.*		
IV	**Spacecraft and Earth station**	10
Satellite sub-systems: Attitude and Orbit control systems, Telemetry, Tracking and command control system, Power supply system, Space craft antennas and Multiple access techniques, comparison of FDMA, TDMA, and CDMA. Earth station equipment's, tracking systems. ***Task:*** *Study the various multiple access techniques such as FDMA, TDMA and CDMA.*		
V	**Satellite Link Design**	9
Introduction to satellite link design, basic transmission theory, system noise temperature and G/T ratio, design of down link and uplink, design of satellite links for specified C/N, satellite data communication protocols. ***Task:*** *Study of change in uplink and downlink of frequencies of satellite.*		
Textbooks		
1. Merril. I. Skolnik, *"Introduction to Radar Systems",* 2nd Edition, MGH, 1981. 2. Timothy Pratt and Charles Bostian, *"Satellite Communications",* John Wiley, 1986.		
References		
1. Mark A. Richards, James A. Scheer and William A. Holm, *"Principles of Modern Radar: Basic Principles,"* YesDee Publishing Pvt. Ltd., India, 2012. 2. Byron Edde, *"Radar: Principles, Technology, Applications",* Pearson, 2008. 3. Dennis Roddy, *"Satellite Communications",* MGraw Hill, Millan, 4th edition, 2013.		

SMART SENSORS AND NETWORKING
(Professional Elective - IV)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	22ECPE76	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	PSO1
CO1	explain the concepts of smart sensors	3	2	2	2	3	3
CO2	illustrate communication process	3	3	2	3	3	3
CO3	make use of various sensor nodes	3	3	3	3	3	3
CO4	adapt the standards of smart sensing	3	3	3	3	3	3
CO5	outline the implications of smart sensor standards	3	2	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	6
Smart sensor basics – Introduction, Mechanical Electronic transition in sensing, Nature of sensors, Integration of micromachining and microelectronics. ***Task:*** *Perform a case study on microelectronics.*		
II	**Communication of Smart Sensors**	10
Definitions and background, Organizations and standards, Automotive protocols, CAN protocol, Industrial networks, Industrial usage of CAN, LonTalk™ protocol, Office/building automation, CEBus, MI-Bus**,** Transition between protocols, Transition between systems. ***Task:*** *Perform a case study on Communication of Smart Sensors.*		
III	**Transceivers, Transponders, Telemetry, Packaging, Testing and Reliability**	8+8=16
Part-A: Transceivers, Transponders, and Telemetry: Introduction, The RF spectrum, Spread spectrum, Wireless data and communications, Wireless local area networks, FAX/Modems, Wireless zone sensing, Radar, GPS, Remote emissions sensing, Remote keyless entry, Intelligent transportation system. ***Task:*** *Perform a case study on Communication of Smart Sensors.*		
Part-B: Packaging, Testing and Reliability: Semiconductor packaging, Increased pin count, Hybrid packaging, Ceramic packaging and substrates, Multichip modules, Dual-chip packaging, Ball-grid array packaging, Testing smart sensors. ***Task:*** *Perform a case study on Reliability.*		
IV	**Standards of Smart Sensing**	10
Introduction, Setting the standards, IEEE 1451.1, Network capable application processor, Network communication models, IEEE 1451.1 example, IEEE 1451.2, STIM. ***Task:*** *Perform a comparative analysis on Standards of Smart Sensing.*		
V	**The Implications of Smart Sensor Standards**	10
Sensor Plug-and-Play, communicating sensor data via existing wiring, Ethernet, Sensing by modem, Automated/Remote sensing and the web, Wireless protocol, Remote diagnosis, Airplane networks. ***Task:*** *Perform a comparative analysis on Wireless protocols.*		
Textbooks		
1. Randy Frank, 'Understanding Smart Sensors', 3rd Edition, Artech House, 2013. 2. Gerard Meijer, 'Smart Sensor Systems', WILEY, 2008.		
References		
1. Nikolay V. Kirianaki, Sergey Y. Yurish, Nestor O. Shpak, Vadim P. Deynega "Data Acquisition and Signal Processing for Smart Sensors", WILEY, 2002. 2. Ibrahiem M. M. El Emary, "S.Wireless Sensor Networks: From Theory to Applications", CRC Press, 2013.		

APPLICATION SPECIFIC INTEGRATED CIRCUITS
(Professional Elective - IV)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	22ECPE77	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	PSO1
CO1	explain various types of ASICs and its libraries	3	2	2	3	3
CO2	illustrate programmable ASICs and logic cells	3	3	2	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	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to ASICs**	10
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. ***Task:*** *Perform a case study on ASIC design.*		
II	**Programmable ASICs and Logic Cells**	9
The Anti-fuse, Static Ram, EPROM and EEPROM Technology, Practical Issues, Specifications, PREDP Benchmarks, FPGA Economics, Actel ACT, Xilinx LCA, Altera Flex, Altera Max. ***Task:*** *Perform a comparative analysis of Actel and Altera.*		
III	**ASIC Design and Interconnects**	5+5=10
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. ***Task:*** *Perform a case study on I/O blocks.*		
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. ***Task:*** *Perform a case study on logic synthesis.*		
IV	**Low Level Design Entry and Logic Synthesis**	9
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. ***Task:*** *Perform a case study on Finite State Machine.*		
V	**Simulation, Test and ASIC Construction**	10
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. ***Task:*** *Perform Built in Self-Test for D-FF.*		
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.		

NEURAL NETWORKS AND DEEP LEARNING
(Professional Elective – IV)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	22ECPE78	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	PSO1
CO1	illustrate the functionalities of neural networks	3	3	2	3	3	3
CO2	analyze the single-layer and multi-layer perceptrons	3	3	3	3	3	3
CO3	interpret deep feed forward networks with regularization	3	3	3	3	3	3
CO4	demonstrate convolutional neural networks in deep learning	3	3	3	3	3	3
CO5	outline the importance of autoencoders	3	2	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	10
Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks. **Learning Process:** Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive Learning, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process. ***Task:*** *Write a program in Python to Calculate the output of a simple neuron.*		
II	**Single and Multilayer Layer Perceptrons**	10
Single Layer Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptrons, Convergence Theorem. **Multilayer Perceptrons:** Back Propagation Algorithm, XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection. ***Task:*** *Write a program to implement back propagation learning algorithm.*		
III	**Deep Feed forward Networks and Regularization for Deep Learning**	4+6=10
Part-A: Deep Feed forward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Back-Propagation and Other Differentiation Algorithms. ***Task:*** *Implement gradient-based learning algorithm.*		
Part-B: Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Early Stopping, Parameter Tying and Parameter Sharing, Dropout. ***Task:*** *Improve the Deep learning model by tuning hyper parameters.*		
IV	**Convolutional Neural Networks**	10
The Convolution Operation, Pooling, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Recurrent Neural Networks. ***Task:*** *Object detection using Convolution Neural Network.*		
V	**Autoencoders**	8
Under complete Autoencoders, Regularized Autoencoders, Representational Power, Layer Size and Depth, Stochastic Encoders and Decoders, Denoising Autoencoders. ***Task:*** *Perform comparative analysis on various Autoencoders.*		
Textbooks		
1. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI Edition. 2. Deep Learning, Goodfellow, I., Bengio,Y., and Courville, A., MIT Press, 2016		
References		
1. Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009. 2. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education, 2004.		

CHATBOTS
(Open Elective-II)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	22OE71	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	PO8	PO12
CO1	summarize chatbots and growth of internet	3	3	3	3	3	3
CO2	explain basics of bot building	3	3	3	3	3	3
CO3	articulate easy and hard ways of bot building	3	2	3	3	3	3
CO4	take part in deploying chatbot on apps	3	2	3	3	3	3
CO5	plan the deployment of chatbot	3	2	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	9
Introduction to Chatbots - Journey, Rise - Growth of internet users, Advancement in Technology, Developer ecosystem, messaging platforms, Setting Up the Developer Environment - Bot framework, Local installation – Installation NodeJS, Following the development pipeline, Storing messaging in database. ***Task:*** *Install NodeJS.*		
II	**Basics of Bot Building**	8
Intents, Entities, Design principles - keep it short and precise, make use of rich elements, Respect the source, use human handover, Common elements, showing product results - Integrating location lookup intent, saving messages - getting Mongoose, building the message model, adding the model file, Integrating the model into app, Building your own intent classifier. ***Task:*** *Build message model in Mongoose.*		
III	**Easy & Hard Way**	7+7=14
Part-A: Introduction to dialog flow, building a food ordering chatbot, building a food ordering chatbot, deploying dialog flow chatbot on the web, Integrate dialog flow chatbot on Facebook messenger, Fulfilment. ***Task:*** *Build a chatbot.*		
Part-B: Introduction to Rasa NLU, training and building a chatbot from scratch, dialog management using rasa core, writing custom actions of chatbot, data preparing for training the bot. ***Task:*** *Deploy chatbot on Facebook.*		
IV	**Deploying Chatbot on Apps**	8
First steps, Rasa's credential management, Deploying the chatbot on Facebook – Creating an app on Heroku, setting up Heroku on your local system, Creating and setting an app at Facebook, Creating and deploying Rasa actions server app on Heroku. ***Task:*** *Deploy chatbot in the local system.*		
V	**Deploying Chatbot on Slack**	9
Creating a standalone script for Slack chatbot, editing your Profile, Final deployment on SlackBot to Heroku, Subscribe to Slack events, Subscribe to Bot events, Post deployment verification: Slack Bot, Deploying the chatbot on slack, Deploying the chatbot on your own. ***Task:*** *Deploy chatbot on Slack.*		
Textbooks		
1. Rashid Khan, Anik Das "Build Better Chatbots", Apress, 2018. 2. Sumit Raj "Building Chatbots with Python", Apress, 2019.		
References		
1. Conversational AI: Chatbots that work By Andrew Freed, 2021.		

MULTIMEDIA AND ANIMATION
(Open Elective – II)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	22OE72	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	explain the concepts of multimedia	3	3	3	3	3	3
CO2	outline the concepts of animation	3	3	3	3	3	3
CO3	make use of 2D and 3D animation concepts	3	2	3	3	3	2
CO4	develop motion caption using animation techniques	3	2	3	3	3	2
CO5	build concept development using animation techniques	3	2	3	3	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Multimedia**	8
Introduction to Multimedia PCs, Components of Multimedia, Multimedia Tools, digital sound, interactive and non-interactive Graphics, digital image concepts. ***Task:*** *Make a list of components used in Interactive and Non-Interactive Graphics.*		
II	**Introduction to Animation**	9
Introduction, history of animation, uses of animation, types of animation, principles of animation, various techniques of animation, animation on the WEB, 3D animation, special effects, creating animation, creating animation in flash. ***Task:*** *Perform a case study on 3D animation.*		
III	**2D and 3D Animation**	7+7=14
Part-A: 2D animation, 3D animation & its concepts, types of 3D animation, skeleton & kinetic 3D animation. ***Task:*** *Perform a comparative analysis between 2D and 3D animation.*		
Part-B: Texturing and lighting of 3D animation, 3D camera tracking, applications & software of 3D animation. ***Task:*** *Perform a case study of Texturing & Lighting of 3D Animation.*		
IV	**Motion Caption**	8
Motion caption, formats, methods, usages, expression, motion capture software's, script animation usage, different language of script animation among the software. ***Task:*** *Create a motion caption using Script Animation.*		
V	**Concept Development**	9
Concept development, story development, audio & video, color model, device independent color model, gamma and gamma correction, production budgets, 3D animated movies. ***Task:*** *Perform a case study of Production Budgets.*		
Textbooks		
1. Principles of Multimedia, Ranjan Parekh, 2007, TMH. 2. Animation Techniques, Steve Roberts, 2021, Crowood Press.		
References		
1. Multimedia Technologies, Ashok Banerji, Ananda Mohan Ghosh, MGH. 2. TayVaughan, Multimedia Making it Work, TMH, 8th Edn, 2011.		

EMBEDDED SYSTEMS
(Open Elective-II)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	22OE73	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	PO7	PO12
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

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Embedded Systems**	9
Definition of Embedded System, embedded systems vs general computing systems, history of embedded systems, classification, major application areas and purpose of embedded systems, characteristics and quality attributes of embedded systems. ***Task:*** *Perform a case study of various embedded system processors and their applications.*		
II	**Typical Embedded System**	10
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. ***Task:*** *Perform a case study to compare the performance of different Embedded Systems.*		
III	**Interfacing**	5+5=10
Part-A: LCD, LED, Relay, DC Motor, Stepper Motor, DAC and ADC. ***Task:*** *Write a program for DC Motor, ADC and DAC.*		
Part-B: PID controller, communication interface: onboard and external communication interfaces. ***Task:*** *Write a program for Communication Interface.*		
IV	**Embedded Programming**	10
Software programming in assembly language and high level language, data types, structures, modifiers, loops and pointers, macros and functions, object oriented programming concepts. Reading switches introduction, basic techniques for reading from port pins, example: reading and writing bytes. ***Task:*** *Write a program for loop and function concept using a java programming.*		
V	**Real-Time Operating Systems**	9
OS services, process and memory management, basic design using an RTOS, task scheduling models, interrupt latency. Types of RTOS: RT Linux, Micro C/OS-II, VX works, tiny OS, and basic concepts of android OS. ***Task:*** *Write a program to develop an application by using real time operating system.*		
Textbooks		
1. Introduction to Embedded Systems - Shibu K.V., TMH. 2. Embedded Systems - Raj Kamal, TMH.		
References		
1. An Embedded software premier, David Simon, Pearson education, 2007. 2. Embedded C by Michael J. Pont, A Pearson.		

MICROWAVE ENGINEERING LAB

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	22ECPC72	-	-	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	PO9	PSO2
CO1	interpret the characteristics of microwave devices	3	3	3	3
CO2	determine scattering parameters of various microwave components	3	3	3	3
CO3	analyze various parameters of waveguide components	3	3	3	3
CO4	measure VSWR and antenna pattern	3	3	3	3
CO5	design a microwave communication link using microwave bench	3	3	3	3

List of Experiments

(Minimum 10 experiments to be conducted)

Week	Title/Experiment
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.

References

1. Microwave Engineering Lab Manual, Department of ECE, CMRIT, Hyd.

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab 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

PROFESSIONAL PRACTICE, LAW & ETHICS LAB

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	22HS71	-	-	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	PO6	PO7	PO8	PO10	PO12
CO1	identify code of ethics and professional responsibilities	3	3	3	3	3
CO2	illustrate law of contract and legality of object	3	3	3	3	3
CO3	outline salient features of sale of goods act and agency law	3	3	3	3	3
CO4	assess the process for arbitration, adjudication and conciliation	3	3	3	3	3
CO5	apply legal provisions for cyber & environmental protection laws	3	3	3	3	3

List of Exercises

Week	Title/Experiment
1	Definition of Ethics, Professional Ethics - Engineering Ethics, Personal Ethics; Code of Ethics - Profession, Professionalism, Professional Responsibility.
2	Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures.
3	Introduction to GST- salient features and classes of goods.
4	Law of Contract: Nature of Contract, Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object.
5	Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract.
6	Indemnity and guarantee, Contract of Agency, Sale of goods General Principles, Conditions for guarantee and warranty.
7	Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types.
8	Arbitration and expert determination; Extent of judicial intervention; Arbitration agreements – essential and kinds, validity, and reference.
9	Arbitration tribunal appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality.
10	Provisions under Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923.
11	Introduction & meaning of intellectual property, forms of IP, Copyright, Trademarks, Patents and Designs, Secrets.
12	Salient features of Laws relating to Copyright in India, computer programs, Ownership of copyrights and assignment, Piracy in Internet - Remedies and procedures in India; Law relating to Patents under Patents Act, 1970.

References

1. Professional Practice, Law & Ethics Lab Manual, FED, CMRIT, Hyd.

Micro-Projects: Student should submit a report on one of the following/any other micro-project(s) approved by the lab faculty before commencement of lab internal examination.

1. Whistle blowing, Corporate Governance and disclosure requirements.
2. Salient features of GST.
3. Unlawful & illegal agreements Performance discharge and remedies.
4. Indemnity, sale of goods, agency law and conditions for guarantee and warranty.
5. Arbitration, Conciliation and adjudication.
6. Appellate on Arbitration, adjudication and conciliation.
7. Legal provisions of industrial disputes act; collective bargaining; workmen's compensation act.
8. Trends in IPR, forms of IP, Copyright, Trademarks, Patents, Designs and Trade Secrets.
9. Salient features of Copyright Laws regarding intelligence protection.
10. Statutory provisions against Piracy, Cyber Crimes and Hacking.

PROJECT STAGE – I

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	22ECPR71	-	-	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 PSO2
CO1	identify the real-world complex problems and set of objectives	3
CO2	review relevant literature from various sources	3
CO3	compile data and propose suitable tools and techniques	3
CO4	prepare an abstract of the proposed project	3
CO5	apply core competence to propose economically feasible solutions	3

Guidelines

The main aim of the Project Stage - I is to prepare the students to identify the real-world complex problems and submit a project proposal in report-form with set of objectives and proposed methodology to solve the problem as an individual or as a group of 3-4 to the approved faculty supervisor. **No student is allowed to change from one group to another group** till the completion of Project Stage - II.

S. No.	Title
1	Define a problem and identify the set of objectives.
2	Collect relevant literature from various sources.
3	Propose data collection methodology, design, modelling, and simulation.
4	Prepare and submit an abstract of proposed project with approval of Guide.
5	Present the abstract of the proposed project before the Evaluation Committee.
6	Evaluation Committee awards marks and gives approval to proceed for project stage-II.
7	If committee not satisfied with the student performance then the student has to reappear.
8	If the students fail even in reappearance then, they should appear as and when offered.

Evaluation Procedure

CIE: 40 Marks		SEE: 60 Marks	
Internal Guide Evaluation		**Department Review Committee Evaluation**	
Item	**Marks**	**Item**	**Marks**
Problem Identification	05	Title Justification	05
Abstract	05	Abstract	05
Objectives	05	Objectives	05
Literature Survey	10	Literature Review	10
Proposed Methodology	05	Proposed Methodology	10
Report Submission	05	Report Presentation	15
Viva-Voce (Q & A)	05	Viva-Voce (Q & A)	10
Total	**40**	**Total**	**60**

B.TECH.-VIII-SEMESTER SYLLABUS

5G COMMUNICATION TECHNOLOGIES
(Professional Elective –V)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	22ECPE81	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	PO7	PO12	PSO1
CO1	explain basic principles of 5G communication	3	3	2	2	3	3	3
CO2	identify the 5G new radio, core network, mobile networks	3	3	2	2	3	3	3
CO3	analyze the physical architecture of 5G and its challenges	3	3	2	2	3	3	3
CO4	design the modulation and multiple access technique for 5G	3	3	2	2	3	3	3
CO5	evaluate the various channels, layers and links used in 5G	3	3	2	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to 5G Wireless Communications**	9
Introduction, Usage Scenario, Specifications and Use Cases, Performance - Speed, Latency, Standards, NR, Spectrum, Unlicensed Spectrum, Technology, Concerns, Interference Issues, Surveillance Concerns, Health Concerns. ***Task:*** *Write a program on SSBSC Modulation and Demodulation using SDR.*		
II	**5G Wireless Networks**	10
Cellular Systems Overview, Basics of New Radio (NR), Next Generation Core Network, Mobile Network Technologies, Network Softwarization and Slicing, Cell Clustering, Physical Infrastructure Improvements, Enabling Technologies, Multi-Tenancy Support. ***Task:*** *Write a program on Sampling and Quantization.*		
III	**Wireless Systems, Standards and architecture for 5G**	5+7=12
Part-A: Systems and Standards: Technology, Challenges, Requirement, High Speed, High Capacity, Massive Connected Devices, Ultra-low Latency and Ultra-High Reliability, Energy Saving, Cost Saving, Radio Technology, Utilization of High Frequency Bands, Massive Element Antenna Technologies. ***Task:*** *Write a program on Digital Quadrative Amplitude Modulation and Demodulation.*		
Part-B: Architecture, Generalized Physical Architecture, Radio Access Network, Evolved Packet Core, IP Multimedia Subsystem, Architecture of 5G, Security Architecture. ***Task:*** *Write a program on Bit Error Rate measurement of DQAM.*		
IV	**Modulation and Multiple Access Techniques for 5G**	8
Multiple Access Schemes, Basic Concept of OFDM, The Principles of OFDM, OFDM Technology, Requirements, Cyclic Prefix OFDM, Multipath Signal Transmission, CP Design in 5G NR, DFT-s-OFDM, DFT-S-OFDM and OFDMA, Modulation Considerations. ***Task:*** *Write a program on OFDM Transmitter and Receiver.*		
V	**Channels for 5G Wireless Communications**	9
Logical Channels for NR, Transport Channel, Logical, Transport and Physical Channel Mapping, Propagation Channel Model, Channel Models, Channel Hierarchy, Communications System Channel Mapping, NR Physical Layer Data Channels. ***Task:*** *Write a program on Bit Error Rate Measurement of M-ARYPSK.*		
Textbooks		
1. Fundamentals of 5G Wireless Communications: V. K. Sachan, Jay Devi Sachan, MPH. 2. Index Modulation for 5G Wireless Communications: Miaowen Wen, Xiang Cheng, Springer.		
References		
1. 5G Mobile and Wireless Communications Technology: AFIF OSSEIRAN Ericsson JOSE F. MONSERRAT, and PATRICK MARSCH, Cambridge University Press.		

SOFTWARE DEFINED RADIO
(Professional Elective – V)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	22ECPE82	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	PSO1
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

Syllabus

Unit	Title/Topics	Hours
I	**SDR Architecture**	10
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. ***Task:*** *Write a program to simulate OFDM transceiver.*		
II	**Digital Frequency Converters**	9
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. ***Task:*** *Write a program to simulate band pass sampling.*		
III	**Signal Processing Components**	5+5=10
Part-A: Introduction to SDR Requirements for Processing Power, DSP Devices, DSP Compilers, Reconfigurable Processors, Adaptive Computing Machine. ***Task:*** *Perform a case study on DSP compiler.*		
Part-B: FPGAs Software Architecture and Components, Architecture Choices: Hardware, Specific Software Architecture. ***Task:*** *Write a program to simulate FPGA transmitter.*		
IV	**Smart Antennas for Software Radio**	9
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. ***Task:*** *Write a program to simulate 3G smart Antenna array.*		
V	**Navigational Systems**	10
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. ***Task:*** *Write a program to simulate Aircraft navigational system.*		
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.		

LOW POWER VLSI DESIGN
(Professional Elective – V)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	22ECPE83	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	PO5	PO12	PSO1
CO1	explain the concepts of low-power design	2	2	3	2	3	3
CO2	design low-voltage and low-power circuits	2	3	3	2	3	3
CO3	apply low power design techniques	3	3	3	2	3	3
CO4	develop low-voltage low power adders and multipliers	3	3	3	2	3	3
CO5	evaluate low-voltage low-power memories	3	3	3	2	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Fundamentals**	10
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. ***Task:*** *Perform a case study on Short Channel Effects.*		
II	**Low-Power Design Approaches**	9
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. ***Task:*** *Perform a case study on Parallel Processing Approaches.*		
III	**Low-Voltage Low-Power Adders**	5+5=10
Part-A: Introduction and Standard Adder Cells, CMOS Adder Architectures-Ripple carry, Carry Select, Carry Save and Carry Look-Ahead Adders. ***Task:*** *Perform a case study on any one of CMOS Adder Architectures.*		
Part-B: Low-Voltage, Low-Power Design Techniques - Latest Trends and Power Supply Voltage, Low Voltage Low-Power Logic Styles. ***Task:*** *Perform a case study on Low-Power Design Techniques.*		
IV	**Low-Voltage Low-Power Multipliers**	9
Introduction to multiplication, types of multiplier Architectures-Braun, Baugh-Wooley, Booth multiplier, Introduction to Wallace Tree multiplier. ***Task:*** *Perform a case study on any one of Multiplier Architectures.*		
V	**Low-Voltage Low-Power Memories**	10
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. ***Task:*** *Perform a comparative analysis of various memories.*		
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.		

AUGMENTED AND VIRTUAL REALITY
(Professional Elective - V)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	22ECPE84	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	PSO1
CO1	illustrate taxonomy and features of AR systems	2	2	2	2	2	3
CO2	explain fundamentals of virtual reality	3	3	3	3	3	3
CO3	adapt geometric modeling in virtual reality environment	3	3	3	3	3	3
CO4	make use of virtual environment for animation	3	2	3	3	2	3
CO5	develop VR and AR applications	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Augmented Reality**	7
Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for AR, enhancing interactivity in AR environments, evaluating AR systems. ***Task:*** *Explore human anatomy using AR and VR.*		
II	**Introduction to Virtual Reality**	9
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. ***Task:*** *Developing architecture of Flight Simulation using Virtual Reality.*		
III	**Computer Graphics And Geometric Modelling**	8+6=14
Part A: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Colour theory, Conversion From 2D to 3D, 3D space curves, 3D boundary representation, Simple 3D modelling, 3D clipping, Illumination models, Reflection models, Shading algorithms. ***Task:*** *Perform 2D/3D based experiment using Virtual world space.*		
Part B: Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection. ***Task:*** *Perform a case study on collision detection.*		
IV	**Virtual Environment**	9
Input: Tracker, Sensor, Digital Gloves, Movement Capture, Video-based Input, 3D Menus & 3D Scanner etc.; Output: Visual/Auditory/Haptic Devices. Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems. ***Task:*** *Perform movement capture using a virtual environment.*		
V	**Development Tools and Frameworks**	9
Human factors: Introduction, the eye, the ear, the somatic senses. Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML. ***Task:*** *Developing concept of Virtual class room with multiplayer.*		
Textbooks		
1. Grigore C. Burdea, Philippe Coiffet, Virtual Reality Technology, Wiley 2016. 2. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.		
References		
1. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.		

AD-HOC WIRELESS SENSOR NETWORKS
(Professional Elective – VI)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	22ECPC85	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	PSO1
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 Ad-hoc WSN	3	3	2	2	2	3
CO5	make use of security techniques, WSN platforms and tools	3	3	2	3	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Overview of Wireless Sensor Networks (WSN)**	10
Introduction, types, advantages, unique constraints & challenges and applications; Mobile Ad-hoc Networks (MANETs) and WSN; Enabling technologies for WSN-Issues and challenges. ***Task:*** *Simulate a wireless sensor network.*		
II	**Networking Technologies**	9
Physical Layer & Transceiver Design Considerations-hidden node and exposed node problem; Topologies of PANs, MANETs, WANETs. ***Task:*** *Simulate a Mobile adhoc network (MANET).*		
III	**Routing and MAC Protocols**	5+5=10
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. ***Task:*** *Simulate Transport Control Protocol in sensor network.*		
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. ***Task:*** *Simulate MAC Protocol in sensor network.*		
IV	**Transport Layer**	9
Introduction, Designing a Transport Layer protocol for Adhoc WSN and goals; TCP over Adhoc Wireless Networks; other Transport Layer Protocols for Adhoc WSN. ***Task:*** *Simulate Adhoc-WSN in sensor network.*		
V	**Security in WSN, Sensor Network Platforms and Tools**	10
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. ***Task:*** *Implement Node level platform in sensor network using simulator.*		
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.		

INDUSTRY 4.0
(Professional Elective - VI)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	22ECPE86	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	PSO1
CO1	explain concepts of Industry 4.0	3	3	2	3	3	3
CO2	outline the architecture of Industry 4.0	3	3	2	3	3	3
CO3	make use of Industry 4.0 resources	3	3	3	3	3	3
CO4	illustrate the use of data rationalization	3	3	3	3	3	3
CO5	adapt secure Industry 4.0 in all the sectors	3	3	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	9
Introduction, RAMI 4.0, Product Service-System (PSS), SMARTness and pervasive Computing - Pervasive computing, Problems, Proposed infrastructure for pervasive (Ubiquitous) computing: Ubi-Cloud, Applications – Healthcare, Two Stages of pervasive Computing Development. ***Task:*** *Perform a case study on Standards of Smart Sensing.*		
II	**The Industry 4.0 architecture and Cyber Physical Systems**	10
Cyber-Physical Systems (CPS) - Implementation, Adaptive clustering for self-aware machine analytics, Classic applications, Classification, Operational and information technology, convergence, Data and optimization across the value chain: Benefits, Principles: Horizontal and vertical integration, Basic functions and uses of CPS. ***Task:*** *Perform a case study on Cyber-Physical Systems.*		
III	**Resources of Industry 4.0**	5+4=9
Part-A: Cloud computing, data sources and data centres: IT vs OT, CMMS, ERP, MES, EMS, PLM and other actors, Cloud computing taxonomies, Cloud services, Data repositories and data centres. ***Task:*** *Create a checklist of resources of Industry 4.0.*		
Part-B: Big Data Analytics as Service Provider: Connection: sensors and networks, Content or context, Data sharing and collaboration, Big data analytics. ***Task:*** *Perform a case study on Big data analytics.*		
IV	**IoT and the Need for Data Rationalization**	14
Enablers of IoT – Importance, Types of services of IoT, Internet of things (IoT) applications, The internet of things today, The internet of things tomorrow, Internet of things (IoT) ecosystem. ***Task:*** *Perform a case study on Internet of things (IoT) ecosystem.*		
V	**Cyber Security and Industry 4.0 across the Sectors**	6
Cyber security - OT level, IT level, IT-OT cyber security convergence, Risks and threats of sharing data, Blockchains in cyber security, Transportation 4.0: multimodal transportation systems, Rail 4.0, Digital transformation of railways, Logistics 4.0 (Implications). ***Task:*** *Perform a case study on cyber security for Industry 4.0.*		
Textbooks		
1. Diego Galar Pascual et.al, "Handbook of Industry 4.0 and SMART Systems", CRC Press, 2019. 2. Ustundag, Alp., "TIndustry 4.0: Managing The Digital Transformation", Springer, 2018		
References		
1. Carl Endorf, Eugene Schultz, Jim Mellander, Jack Kozio;"Industry 4.0 2. Gilchrist, Alasdair, "The Industrial Internet of Things" APress, 2016.		

SYSTEM ON CHIP ARCHITECTURE
(Professional Elective - VI)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	22ECPE87	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	PSO1
CO1	explain the concepts of SOC Architectural features	3	2	2	2	3	3
CO2	illustrate processor selection criteria and limitations	3	3	2	3	3	3
CO3	make use of memory architectures on SOC	3	3	3	3	3	3
CO4	adapt the interconnection strategies on SOC	3	3	3	3	3	3
CO5	outline the customization on SOC	3	2	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to the System Approach**	6
	System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity. ***Task:*** *Perform a case study on SOC Design approaches.*	
II	**Processors**	10
	Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors. ***Task:*** *Perform a case study on Superscalar Processors.*	
III	**Memory Design for SOC**	8+8=16
	Part-A: Overview of SOC external memory, internal memory, size, scratchpads and cache memory, cache organization, cache data, write policies, strategies for line replacement at miss time. ***Task:*** *Perform a case study on cache memory.*	
	Part-B: Types of cache, Split - I, and D - caches, multilevel caches, virtual to real translation, SOC memory system, models of simple processor – memory interaction. ***Task:*** *Perform a case study on models of simple processor.*	
IV	**Interconnect Customization**	10
	Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. ***Task:*** *Perform a comparative analysis on SOC Standard Buses.*	
V	**Configuration**	10
	SOC Customization: An overview, customizing instruction processor, reconfiguration technologies, mapping design onto reconfigurable devices, instance- specific design, customizable soft processor, reconfiguration - overhead analysis and trade-off analysis on reconfigurable parallelism. ***Task:*** *Perform a case study on reconfigurable devices.*	
Textbooks		
1. Computer System Design System-on-Chip by Michael J. Flynn and Wayne Luk, Wiely India Pvt.Ltd. 2. ARM System on Chip Architecture - Steve Furber –2nd Ed., 2000, Addison Wesley Professional.		
References		
1. Design of System on a Chip: Devices and Components – Ricardo Reis, 1st Ed., 2004, Springer. 2. Co-Verification of Hardware and Software for ARM System on Chip Design (Embedded Technology) – Jason Andrews – Newnes, BK and CDROM. 3. System on Chip Verification – Methodologies and Techniques –Prakash Rashinkar, Peter Paterson and Leena Singh L, 2001, Kluwer Academic Publishers.		

INFORMATION AND CYBER SECURITY
(Professional Elective – VI)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	22ECPE88	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	PO8	PO12	PSO1
CO1	explain information and cyber security terminologies	2	2	2	3	2	3
CO2	apply cryptography for security networks	3	3	3	3	3	3
CO3	identify various cyber offences	3	3	3	3	3	3
CO4	use standards and cyber laws to enhance cyber security	3	3	3	3	3	3
CO5	illustrate the importance of security policies & IT Act	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	7
Essential Terminologies: Information security - Principles, Mechanisms, Network security models, NIA, Risks, Breaches, Threats, Attacks, Exploits. Information gathering. Incident response team, Reporting crime, Operating System attacks, Application attacks, cracking techniques, and financial frauds.		
II	**Cryptography**	10
Introduction to Cryptography, Message Authentication, Digital Signatures. Overview of Firewalls-Types of Firewalls, VPN Security, Security Protocols - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec.		
III	**Cryptanalysis and Cyber Offences**	7+7=14
Part-A: Open Source Tools: Implementation of Cryptographic techniques, OpenSSL, Hash Values Calculations MD5, SHA1, SHA256, SHA 512, introduction to Steganography.		
Part-B: Introduction to cyber offences, how criminals plan the attacks, social engineering, cyber stalking, cyber cafe and cybercrimes, Botnets, introduction to cloud security.		
IV	**Cyber Security Audit & Standards**	8
Risk assessment and management, asset classification, crisis management plan, resources recovery strategy, security testing, international standards, analysis and logging, security certification.		
V	**Security Policy & IT ACT**	9
Security policies, WWW policies, email security policies, policy review process- corporate policies, sample security policies, publishing and notification requirements of the policies. Cyber laws in India; IT Act 2000 provisions, Intellectual Property Law: Copyright law, software license and patent law.		
Textbooks		
1. William Stallings, "Cryptography and Network Security", Pearson Education/PHI, 2006. 2. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA. 3. Chander, Harish, "Cyber Laws and IT Protection", PHI, New Delhi, India.		
References		
1. Charles P. Pfleeger, Shari Lawrence Pfleeger, "Analyzing Computer Security", Pearson. 2. Schou, Shoemaker, "Information Assurance for the Enterprise", TMH.		

GAME DEVELOPMENT
(Open Elective – III)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	22OE81	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	PO8	PO12
CO1	summarize game design concepts	3	3	2	3	2
CO2	explain basics of game & play	3	3	3	3	2
CO3	articulate game mechanics and experiences	3	3	3	3	3
CO4	take part in game structure development	3	3	3	3	3
CO5	plan aesthetics of game development	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	9
Introduction, Magic words, Skills needed, most important skill, five kinds of listening, secret of the gifted, designer creates an experience, three practical approaches to chasing rainbows, Introspection: powers, perils, and practice dissect your feelings defeating Heisenberg. ***Task:*** *Perform a case study on the need of gaming.*		
II	**Game & Player**	9
A Short history of software engineering, risk assessment and prototyping, eight tips for productive prototyping, closing the loop, Einstein's violin, project yourself, demographics, the medium is the misogynist, psychographics, modelling, focus, empathy, imagination, motivation, judgment. ***Task:*** *Project yourself as a player in any game.*		
III	**Game Mechanics, Balancing, Players & Experiences**	6+7=13
Part A: Twelve Most Common Types of Game, Game Balancing Methodologies, Balancing Game Economies, Dynamic Game Balancing, The Big Picture, The Puzzle of Puzzles, Aren't Puzzles Dead, A Final Piece ***Task:*** *Compare between puzzles and games.*		
Part B: Breaking it Down: The Loop of Interaction, Channels of Information, My First Lens, Interest Curves, Patterns Inside Patterns, What Comprises Interest, Interest Factor Examples, Putting It All Together. ***Task:*** *Make a list of interesting factors in the game.*		
IV	**Experience and Game Structure**	8
Story/Game Duality, The Myth of Passive Entertainment, The Dream, The Reality, The Problems, The Dream Reborn, Story Tips for Game Designers, The Feeling of Freedom, Indirect Control Method - Constraints, Goals, Interface, Visual Design, Characters, Music. ***Task:*** *Experience visual design of NFS3.*		
V	**Characters, Spaces & Aesthetics**	9
The Nature of Game Characters, Avatars, Creating Compelling Game Characters, The Purpose of Architecture, organizing your Game Space, Christopher Alexander is a Genius, Real vs. Virtual Architecture. ***Task:*** *Perform a case study of Real vs. Virtual Architecture.*		
Textbooks		
1. Jesse Schell, the Art of Game Design, Morgan Kaufmann Publishers, 2008. 2. George Skaff Elias, Richard Garfield, and K. Robert Gutschera, "Characteristics of Games", the MIT Press.		
References		
1. Jeremy Gibson, "Introduction to Game Design, Prototyping, and Development: From Concept to Playable Game with Unity and C#", Addison-Wesley Professional, 2nd Edition, 2016.		

PRECISION AGRICULTURE
(Open Elective – III)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	22OE82	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	PO7	PO8	PO12
CO1	explain the concepts of precision agriculture	3	3	3	3	3
CO2	outline the components of precision agriculture	3	3	3	3	3
CO3	illustrate about tools technologies and sampling	3	3	3	3	3
CO4	adapt recent advances in precision agriculture	2	2	3	3	3
CO5	make use of feasibility and evaluation of precision farming	2	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	9
Accuracy and precision, Comparison chart, Target comparison, Number of measurements, Quality, Bias, Degree of accuracy, A brief history of precision agriculture, Defining precision agriculture, Variability and the production system, Need for precision agriculture. ***Task:*** *Write a program on finding the precision in agricultural dataset.*		
II	**Components of Precision Agriculture**	9
Components of Precision Agriculture, Spatial Data Management, Geographical Positioning, Geographical Information System, Remote Sensing, Soil Sampling and Mapping, Yield Monitoring and Mapping, Components of a Yield Monitor. ***Task:*** *Perform a case study on Yield Monitoring.*		
III	**Tool, Technologies and Sampling**	6+6=12
Part-A: Tool and Technologies in Precision Agriculture: Global Positioning System (GPS), Sensor Technologies, Geographic Information System (GIS), Grid Soil Sampling and Variable Rate Fertilizer (VRT), Online Resources for Precision Agriculture. ***Task:*** *Perform a case study on Tool and Technologies in Precision Agriculture.*		
Part-B: Precision Soil Sampling: Introduction, Soil Sampling, Sampling Procedures – Depth, Pattern, Soil Sampling Instructions and Pattern Options, Grid Soil Sampling - Advantages and Disadvantages, Zone Sampling - Method, Advantages and Disadvantages, Prescription Maps. ***Task:*** *Perform a comparative analysis on soil sampling procedures.*		
IV	**Recent Advances in Precision Agriculture**	9
Internet of Things in Precision Agriculture, Prerequisites of IoT Applications in Agriculture, Structure of IOT for Agriculture, Drones or Unmanned Aerial Vehicles (UAVs). ***Task:*** *Perform a case study on the design concept of UAVs.*		
V	**Feasibility and Evaluation of Precision Farming in India**	9
Present Scenario, Economic Feasibility of Precision Farming, Constraints in the Adoption of Precision Agriculture, Capital Expenditures in Precision Agriculture, Farm Size and Technology Adoption, Profitability, Environmental Benefits. ***Task:*** *Perform the profitability analysis in Precision Agriculture.*		
Textbooks		
1. Latief Ahmad and Syed Sheraz Mahdi, 'Satellite Farming - An Information and Technology Based Agriculture' Springer, 2018. 2. Pedersen, Søren Marcus, 'Precision Agriculture: Technology and Economic Perspectives' Springer, 2018.		
References		
1. Ryan Nagelhout, 'The Modern Nerd's Guide to Drone Racing', Gareth Stevens, 2018. 2. Oerke, E.C et.al., 'Precision Crop Protection - the Challenge and Use of Heterogeneity' Springer, 2010.		

ELECTRONICS FOR HEALTH CARE
(Open Elective – III)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	22OE83	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	PO6	PO8	PO12
CO1	explain the various methods of recording of biopotentials	3	3	3	3	3
CO2	measure biochemical and various physiological information	2	3	2	3	3
CO3	make use of assist devices and biotelemetry	3	3	3	3	3
CO4	use of radiation for diagnostic and therapy	3	3	3	3	3
CO5	adapt techniques of electrical safety in hospitals	3	3	2	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Electro-Physiology and Biopotential Recording**	8
The origin of Biopotential; Biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, EOG, lead systems and recording methods, typical waveforms and signal characteristics. ***Task:*** *Write a technical report on biometrics.*		
II	**Bio-Chemical and Non Electrical Parameter Measurement**	9
PH, PO2, PCO2, PHCO3, Electrophoresis, colorimeter, photometer, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse, Blood cell counters. ***Task:*** *Write a technical report on transducers for medical electronics.*		
III	**Assist Devices and Biotelemetry**	7+7=14
Part-A: Assist Devices: Cardiac pacemakers, DC Defibrillator. ***Task:*** *Write a technical report on measurement of heart sounds.*		
Part-B: Biotelemetry: Telemetry principles, frequency selection, Biotelemetry, radio-pill and Tele-stimulation. ***Task:*** *Write a technical report on remote SCADA.*		
IV	**Radiological Equipments**	8
Ionizing radiation, diagnostic X-Ray equipments, use of radioisotope in diagnosis, radiation therapy. ***Task:*** *Write a technical report on digital x-ray systems.*		
V	**Recent Trends In Medical Instrumentation**	9
Thermograph, endoscopy unit, Laser in medicine, Diathermy units, Electrical safety in medical equipment. ***Task:*** *Write a technical report on digital health care.*		
Textbooks		
1. Leislie Cromwell, "Biomedical instrumentation and measurement", PHI, New Delhi, 2002.		
References		
1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", TMH, New Delhi, 1997. 2. Joseph J.Carr and John M.Brown, "Introduction to Biomedical equipment Technology", John Wiley and Sons, New York, 1997.		

PROJECT STAGE – II INCLUDING SEMINAR

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	22ECPR81	-	-	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 PSO2
CO1	design and develop a prototype/process/simulation for identified problem	3
CO2	execute project using modern tools and prepare the report	3
CO3	exhibit leadership and managerial skills in project development	3
CO4	function effectively as individual and member or leader in project teams	3
CO5	apply engineering knowledge for societal sustenance	3

Guidelines

The Project Stage-II is an extension of Project Stage-I, subject to its successful completion. The main aim of the Project Stage-II is to give solution to the problem defined in the Project Stage-I.

S. No.	Title
1	Conduct detailed literature survey on the approved project title.
2	Prepare a Gantt chart for project schedule to conduct investigations with team.
3	Compile data and develop a model/simulation/prototype of the product/services.
4	Document end-to-end project/product process.
5	Organize a test-run, deploy the resources and prepare the user manual.
6	Submit a report in the prescribed format through the Guide to Head of the Department.
7	Demonstrate Project work before Evaluation Committee.
8	The Evaluation Committee awards the marks based on the student's performance.

Evaluation Procedure

CIE: 40 Marks				SEE: 60 Marks	
Internal Guide: 20 Marks		DRC: 20 Marks		External Committee Evaluation	
Item	Marks	Item	Marks	Item	Marks
Review - I		***Seminar-I***		Problem Justification	05
Abstract	05	Abstract	05	Content and Innovation	05
Design	05	Design	05	Execution	15
Review - I		***Seminar-II***		Technical Presentation	15
Execution	05	Execution	05	Viva-Voce (Q & A)	10
Report	05	Report	05	Project Report	10
Total	**20**	**Total**	**20**	**Total**	**60**

CMR INSTITUTE OF TECHNOLOGY

UGC Autonomous

(Approved by AICTE, Affiliated to JNTUH, Accredited by NBA & NAAC with 'A' Grade)
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UNDERTAKING BY STUDENT/PARENT REGARDING R22 REGULATIONS

ACADEMIC YEAR: 20___ - 20___

College Code	**R0**										Affix recent Stamp Size Photograph
Course	I - B.Tech.										
Branch	Electronics and Communication Engineering (ECE)										
Roll No.	2		R	0		A	0	4			
Student Name											
Fathers' Name											

Declaration

1. I am completely aware of academic regulations prescribed by CMR Institute of Technology from the Academic Year 2022-23 onwards under which I was admitted.
2. I am aware of course registration before commencement of each semester with help of faculty mentor/advisor/Head of the Department.
3. I am aware of attendance detention procedure/system and minimum attendance requirement, of 75% without condonation, to be promoted to the next academic semester/year.
4. I am aware of credit detention regulations and minimum credits to be earned by me to promote to next academic year.
5. Guidelines for Internship/Industry Oriented Mini-Project/Skill Enhancement course, Project Stage-I and Project Stage-II as per R22 Regulations.
6. I am aware that minimum marks required in Continuous Internal Evaluation (CIE) are 35% of 40 CIE i.e. 14 marks out of 40, minimum 35% of Semester End examination (SEE) for 60 marks i.e. 21 marks out of 60 and minimum 40% of total marks of 100 i.e. 40 marks out of 100 marks both CIE & SEE marks taken together.
7. Re-registration of course if marks in CIE are less than 35% of 40 marks to improve CIE marks. When this option is exercised, I will forego the marks of SEE if any.
8. Guidelines for re-admission from one regulation to readmitted year regulations.
9. Malpractice rules and punishment.
10. Punishment of ragging, if involved in ragging of any student(s).

Date		**Signature of the Student**		**Signature of the Parent**	

Endorsement by the Head of the concerned Department and Principal

Date		**Name of the Dept. Head**		**Signature**	
Date		**Name of the Principal**		**Signature**	
College Stamp					