ACADEMIC REGULATIONS (R20)

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 2020 - 2021)

&

(B.Tech. LES: Applicable for the batches admitted from 2021 - 2022)

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

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

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

All the faculty members, the parents and the students are requested to study all the rules and regulations carefully and approach the Principal to seek any clarifications, if needed, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the institution and for brightening the career prospects of engineering and management graduates.

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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 (ECE)

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 (R20)
B.Tech. - Regular Four Year Degree Programme
(For batches admitted from the academic year 2020 - 21)
&
B.Tech. - Lateral Entry Scheme
(For batches admitted from the academic year 2021 - 22)

PREAMBLE

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

All the specified rules are herein approved by the Academic Council. These rules will be in force and are applicable to students admitted from the Academic Year 2020-21 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. UNDERGRADUATE PROGRAMS 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
1	Civil Engineering (CE)
2	Mechanical Engineering (ME)
3	Electronics and Communication Engineering (ECE)
4	Computer Science and Engineering (CSE)
5	Computer Science and Engineering (AI & ML)
6	Computer Science and Engineering (Data Science)

2. ADMISSION CRITERIA AND MEDIUM OF INSTRUCTION

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

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

(i) Passed either Intermediate Public Examination (IPE) conducted by the Board of Intermediate Education, Telangana, with Mathematics, Physics and Chemistry as optional subjects or any equivalent examination recognized by Board of Intermediate Education, Telangana or a Diploma in Engineering conducted by the Board of Technical Education, Telangana or equivalent Diploma recognized by Board of Technical Education for admission as per guidelines defined by the Regulatory bodies of Telangana State Council for Higher Education (TSCHE) and AICTE.

(ii) Secured a rank in the TSEAMCET examination conducted by TSCHE for allotment of a seat by the Convenor, TSEAMCET.

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

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

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

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

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

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

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

3. B.Tech. PROGRAMME STRUCTURE

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

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

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

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

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

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

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

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

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

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

3.3.2 **Credit Courses:**

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

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

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

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

3.3.3 **Subject / Course Classification and Nomenclature:**

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

S. No.	Category	Breakup of Credits	
		(AICTE)	(CMRIT)
1	Humanities and Social Sciences including Management courses (HSMC)	12*	10
2	Basic Science Courses (BSC)	25*	25
3	Engineering Science courses including workshop, drawing, basics of Electrical / Mechanical / Computer etc. (ESC)	24*	24
4	Professional core courses (PCC)	48*	60
5	Professional Elective courses relevant to chosen specialization / branch (PEC)	18*	18
6	Open subjects – Electives from other technical and /or emerging subjects (OEC)	18*	09
7	Project work, seminar and internship in industry or appropriate work place / academic and research institutions in India / abroad (PRJ)	15*	14
8	Mandatory Courses: (Environmental Sciences, Induction program, Indian Constitution, Essence of Indian Traditional Knowledge, etc) (MC)	(non-credit)	(non-credit)
Total Credits		**160***	**160**

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

4. COURSE REGISTRATION

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

4.2 The academic section of the college invites 'registration forms' from students before the beginning of the semester through online submission, ensuring '**date** and **time stamping**'.

The online registration requests for any 'current semester' shall be completed **before the commencement of SEEs (Semester End Examinations) of the 'preceding semester'**.

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

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

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

4.6 Subject / course options exercised through **online** registration are final and **cannot** be changed or inter- changed; further, alternate choices will not be considered. However, if the subject / course that has already been listed for registration by Head of the Department in a semester could not be offered due to any unforeseen or unexpected reasons, then the student shall be allowed to have alternate choice - either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats), which may be considered. Such alternate arrangements will be made by Head of the Department, with due notification and time-framed schedule, within the **first week** from the commencement of class-work for that semester.

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

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

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

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

5. SUBJECTS / COURSES TO BE OFFERED

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

i) More than **one faculty member** may offer the **same subject** (lab / practical's may be included with the corresponding theory subject in the same semester) in any semester. However, selection choice for students will be based on '**first come first serve** basis and CGPA criterion' (i.e. the first focus shall be on early **on-line entry** from the student for registration in that semester, and the second focus, if needed, will be on CGPA of the student).

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

6. ATTENDANCE REQUIREMENTS

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

6.2 Condoning of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be granted by the college academic committee on genuine and valid grounds, based on the student's representation with supporting evidence.

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

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

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

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

7. ACADEMIC REQUIREMENTS

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

7.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course, if student secures not less than 35% marks (25 out of 70 marks) in the semester end examination (SEE), and a minimum of 40% of marks in the sum total of the Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) taken together; in terms of letter grades, this implies securing **C** grade or above in that subject / course.

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

7.3 Promotion Rules

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 19 credits out of 38 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 (21 credits out of 42 credits in case of 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 sixth semester. **(ii)** Must have secured at least 72 credits out of 120 credits (49 credits out of 82 credits in case of 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.

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

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

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

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

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

8. EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

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

8.2 Evaluation of Theory Subjects / Courses

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

- The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus.
- The subjective paper shall be conducted for duration of 90 minutes. Each subjective paper shall contain 2 parts (Part-A and Part-B). Part-A consists of one compulsory question with five sub questions carrying two marks each. Part-B consists of 3 essay questions carrying five marks each with internal choice; the student has to answer all 3 questions.
- First assignment should be submitted before the commencement of the first mid-term examinations, and the second assignment should be submitted before the commencement of the second mid-term examinations. The assignments shall be specified / given by the concerned subject teacher.

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

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

8.3 Evaluation of Practical / Design / Drawing Subjects /Courses:

In any semester, a student has to complete a minimum of 10 experiments / exercises in each laboratory course and get the record certified by the concerned Head of the Department to be eligible for Semester End Examination. For practical subjects, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 30 internal marks and 70 marks for Semester End Examination (SEE).

A) Continuous Internal Evaluation (CIE): For each practical subject, during the semester, there shall be 2 mid-term examinations of 30 marks each. Each mid-term examination consists of day-to-day work evaluation for 20 marks and internal test for 10 marks conducted by the concerned laboratory teacher for duration of 90 minutes. The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus. The final CIE marks (for total of 30) are calculated by taking 80% weightage from best of the two mid examinations and 20% weightage from the least scored mid examination marks in each practical subject.

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

8.4 Evaluation of Summer Internship:

The summer internship shall be registered by the students immediately after their IV semester course work in consultation with course coordinator and carried out in Industry/R&D organizations with a minimum duration of 4

weeks. The completed internship report will be assessed as SEE for 100 marks in V semester by a committee consisting of an external examiner; Head of the Department, supervisor of the Summer Internship and a senior faculty member of the department. There shall be no internal marks for Summer Internship.

8.5 **Evaluation of Industry Oriented Mini-Project:** The industry-oriented mini-project shall be registered by the students immediately after their VI semester course work in consultation with course coordinator and carried out in any Industry or R&D organization during the summer vacation for four weeks duration. The industry oriented mini-project shall be submitted in a report form and presented before the committee in VII semester. It shall be evaluated as SEE for 100 marks by the committee consisting of Head of the Department, concerned supervisor and two senior faculty members of the department. There shall be no internal marks for industry-oriented mini- project.

8.6 **Evaluation of Major Project:** The student shall enroll for the main project 15 days before commencement of VIII semester and should submit before II mid-test as per the guidelines issued by the respective Head of the Department. The main project will be evaluated for a total of 100 marks, of which 30 marks shall be for continuous internal evaluation and 70 marks for the end semester viva-voce examination. Out of 30 marks allocated for CIE, 15 marks shall be awarded by the project supervisor (based on the continuous evaluation of student's performance throughout the project work period), and the other 15 marks shall be awarded by a Departmental Committee consisting of Head of the Department and Project Supervisor, and two senior faculty members, based on the work carried out and the presentation made by the student during internal reviews (at least two internal reviews shall be conducted). The project viva-voce shall be conducted by a committee comprising an external examiner, Head of the Department and Project Supervisor.

8.7 **Evaluation of Mandatory Non-Credit Courses:** A student has to fulfill minimum attendance requirement for successful completion of all mandatory (non-credit) courses. Instead of letter grades, **'Satisfactory'** or "**Unsatisfactory'** shall be indicated and will not be counted for SGPA / CGPA computations for the award of the degree. Any student who fails to obtain the required attendance has to reregister and repeat the course as and when offered for award of the degree as per guidelines.

9. GRADING PROCEDURE

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

9.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following letter grades (UGC Guidelines) and corresponding percentage of marks shall be followed...

% of Marks Secured (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
90% and above (≥ 90% , ≤ 100%)	O (Outstanding)	10
Below 90% but not less than 80% (≥ 80% , < 90%)	A^+ (Excellent)	9
Below 80% but not less than 70% (≥ 70% , < 80%)	A (Very Good)	8
Below 70% but not less than 60% (≥ 60% , < 70%)	B^+ (Good)	7
Below 60% but not less than 50% (≥ 50% , < 60%)	B (Average)	6
Below 50% but not less than 40% (≥ 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 Semester End Examination (SEE),

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

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

9.5 In general, a student shall not be permitted to repeat any subject/course (s) only for the sake of '**grade improvement**' or 'SGPA / CGPA improvement'. However, student has to repeat all the subjects / courses pertaining to that semester, if detained.

9.6 A student earns grade point (GP) in each subject / course, on the basis of the letter grade obtained in that subject/course (excluding mandatory non-credit courses). Then the corresponding '**credit points**' (CP) are computed by multiplying the grade point with credits for that particular subject/course.

Credit Points (CP) = Grade Point (GP) x Credits

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

9.8 The Semester Grade Point Average (SGPA) is calculated by dividing the sum of credit points (ΣCP) secured from all subjects / courses registered in a semester, by the total number of credits registered during that semester. SGPA is rounded off to **two** decimal places. SGPA is thus computed as

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

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

9.9 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in **all** registered courses in **all** Semesters, and the total number of credits registered in **all** the semesters. CGPA is rounded off to **two** decimal places. CGPA is thus computed from the I year second semester onwards, at the end of each semester, as per the formula:

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

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

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

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

9.11 For calculations listed in Item 9.6–9.10, performance in failed subjects/courses (securing **F** grade) will also be taken into account, and the credits of such subjects/courses will also be included in the multiplications and summations. However, mandatory courses will not be taken into consideration.

10 PASSING STANDARDS

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

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

11. DECLARATION OF RESULTS

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

11.2 The conversion formula from CGPA to percentage of Marks:

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

12 AWARD OF DEGREE

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

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

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

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

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

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

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

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

12.5 **Transcripts:** After successful completion of prerequisite credits for the award of degree a transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued if required after the payment of requisite fee and also as per norms in vogue.

13 WITH HOLDING OF RESULTS

If the student has not paid the fees to the Institute at any stage, or has dues pending due to any reason whatsoever, or if any case of indiscipline is pending, the result of the student may be withheld, and the student will not be allowed to go into the next higher semester. The award or issue of the degree may also be withheld in such cases.

14 SUPPLEMENTARY EXAMINATIONS

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

15. TRANSITORY REGULATIONS

a) A student who has discontinued for any reason, or has been detained for want of attendance or lack of required credits as specified, or who has failed after having undergone the degree programme, may be considered eligible for readmission to the same subjects / courses (or equivalent subjects/ courses, as the case may be), and same professional electives / open electives (or from set / category of electives or equivalents suggested, as the case may be) as and when they are offered (within the time-frame of 8 years from the date of commencement of student's first year first semester).

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

c) The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including R20 Regulations. The performance evaluation of the student will be done as per the rules and regulations applicable at the time of admission(s) regarding award of grade and/or class as the case may be.

d) If a student readmitted to R20 Regulations, has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R20 Regulations will be substituted by another subject to be suggested by the CMRIT Academic Council.

e) **Promotion Rule:** Where the credits allotted to a semester/year under the regulations studied in are different from that under R20 regulations for the corresponding semester/year, the promotion rules of R20 vide section 7.3 shall be applied after normalization. Normalization is done by scaling down or up the number of credits of a semester/year under the previous regulations to equal the number of credits of the corresponding semester/year under R20 regulations and revising the secured credits also in the same proportion.

16 STUDENT TRANSFERS

There shall be no transfers from other colleges / streams.

17 RULES OF DISCIPLINE

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

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

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

18. MALPRACTICE

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

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

18.2 Malpractice Rules: Disciplinary Action for Improper Conduct in Examinations

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

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

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

19. SCOPE

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

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

iii) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.

20. REVISION AND AMENDMENTS TO REGULATIONS

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

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COURSE STRUCTURE

B.Tech. (ECE) – R20 COURSE STRUCTURE

(Applicable from the batch admitted during 2020-21 and onwards)

I – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	20-BSC-101	Linear Algebra & Calculus	1,2,12		3	1	-	4
2	20-BSC-103	Applied Physics	1,2,12		3	1	-	4
3	20-HSMC-101	English for Engineers	10,12		2	-	-	2
4	20-ESC-103	Problem Solving with C Programming	1,2,3,12		3	-	-	3
5	20-ESC-107	Computer Aided Engineering Graphics	1,5,10		-	-	3	1.5
6	20-BSC-104	Applied Physics Lab	4		-	-	3	1.5
7	20-HSMC-102	English Language and Communication Skills Lab	5,10		-	-	3	1.5
8	20-ESC-104	Problem Solving with C Programming Lab	4		-	-	3	1.5
9	20-MC-101	NSS / Physical Education / Yoga	3,6,8,9,12		-	-	2	-
TOTAL					**11**	**02**	**14**	**19**

II – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	20-BSC-102	Advanced Calculus	1,2,12		3	1	-	4
2	20-BSC-105	Engineering Chemistry	1,2,12		3	-	-	3
3	20-ESC-101	Basic Electrical & Electronics Engineering	1,2,3,12		3	-	-	3
4	20-ESC-105	Data Structures through C	1,2,3,12		3	-	-	3
5	20-BSC-106	Engineering Chemistry Lab	4		-	-	3	1.5
6	20-ESC-102	Basic Electrical & Electronics Engineering Lab	4		-	-	3	1.5
7	20-ESC-106	Data Structures through C Lab	4		-	-	3	1.5
8	20-ESC-108	IT & Engineering Workshop Practice	1,5,9,10		-	-	3	1.5
9	20-MC-102	Environmental Science	1,6,7,12		2	-	-	-
TOTAL					**14**	**01**	**12**	**19**

III – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	20-BSC-203	Numerical Methods and Complex Analysis	1,2,12		3	1	-	4
2	20-ESC-206	Networks and Measurements	1,2,3,12	1	3	-	-	3
3	20-ESC-207	Probability Theory & Stochastic Processes	1,2,12	1	3	-	-	3
4	20-EC-PC-211	Analog Electronics	1,2,3,12	1	3	-	-	3
5	20-EC-PC-212	Signals and Systems	1,2,12	1	3	-	-	3
6	20-EC-PC-213	Analog Electronics and Networks Lab	4,5	2	-	-	2	1
7	20-EC-PC-214	Simulation Lab	4,5	2	-	-	2	1
8	20-HSMC-201	Business Communication Skills Lab	9,10		-	-	3	1.5
9	20-BSC-205	Social Innovation Lab	1 to 12	1,2	-	-	3	1.5
10	20-MC-201	Gender Sensitization Lab	9,12		-	-	2	-
TOTAL					**15**	**01**	**12**	**21**

IV – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	20-EC-PC-221	Pulse & Digital Circuits	2,3,1	1	3	-	-	3
2	20-EC-PC-222	Linear & Digital IC Applications	2,3,12	1	3	-	-	3
3	20-EC-PC-223	Digital Design and Computer Organization	2,3,12	1	3	-	-	3
4	20-EC-PC-224	Electromagnetic Waves & Transmission Lines	1,2,12	1	3	-	-	3
5	20-EC-PC-225	Control Systems	1,2,12	1	3	-	-	3
6	20-EC-PC-226	Pulse & Digital Circuits Lab	4,5	2	-	-	3	1.5
7	20-EC-PC-227	Linear & Digital IC Applications Lab	4,5	2	-	-	3	1.5
8	20-EC-PC-228	Digital Design Lab through Verilog	4,5	2	-	-	3	1.5
9	20-BSC-204	Aptitude and critical thinking skills Lab	9,10		-	-	3	1.5
10	20-MC-202	Indian Culture and Constitution	8,12		2	-	-	-
TOTAL					**17**	**00**	**12**	**21**

Note: Summer Internship carried out during Summer Vacation between IV semester & V semester and evaluated in V semester.

V – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	20-EC-PC-311	Analog and Digital Communication	2,3,8,12	1	3	-	-	3
2	20-EC-PC-312	Antenna & Wave Propagation	2,3,12	1	3	-	-	3
3	20-EC-PC-313	Digital Signal Processing	2,3,6,12	1	3	-	-	3
4	20-EC-PC-314	Micro Processors & Micro Controllers	2,3,7,12	1	3	-	-	3
5	**Professional Elective – I**				3	-	-	3
	20-EC-PE-311	Data Communication & Computer Networks	2,12	1				
	20-EC-PE-312	Information Theory & Coding	2,3,8,12	1				
	20-EC-PE-313	Digital Marketing	2,3,5,6,8,12					
6	20-EC-PC-315	Analog and Digital Communication Lab	4,5	2	-	-	2	1
7	20-EC-PC-316	Digital Signal Processing Lab	4,5	2	-	-	2	1
8	20-EC-PC-317	Micro Processors & Micro Controllers Lab	4,5	2	-	-	3	1.5
9	20-ESC-311	Scripting Languages Lab	1,2,3,5		-	-	3	1.5
10	20-EC-PR-311	Summer Internship	1 to 12	1,2	-	-	-	1
11	20-MC-301	Coding Skills	2,3,4,5,12		1	-	2	-
TOTAL					**16**	**-**	**12**	**21**

VI – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	20-EC-PC-321	IoT with Cloud Computing	2,3,6,7,12	1	3	-	-	3
2	20-EC-PC-322	VLSI Design	2,3,7,12	1	3	-	-	3
3	20-EC-PC-323	Artificial Intelligence	1,2,3,6,12	1	3	-	-	3
4	**Professional Elective – II**				3	-	-	3
	20-EC-PE-321	Cellular and Mobile Communications	2,3,6,12	1				
	20-EC-PE-322	Embedded Systems	2,3,5,7,12	1				
	20-EC-PE-323	Data Mining and Data Analytics	1,2,3,5,12					
5	**Open Elective – I**				3	-	-	3
	20-OEC-321	CE: Disaster Management	2,7,8,12					
	20-OEC-322	ME: Robotics	1,2,5,12					
	20-OEC-323	ECE: Electronic Measurements and Instrumentation	1,2,12					
	20-OEC-324	CSE: Java Programming	1,2,3,5,12					
6	20-EC-PC-324	IoT with Cloud Computing Lab	4,5	2	-	-	3	1.5
7	20-EC-PC-325	VLSI Design Lab	4,5	2	-	-	3	1.5
8	20-EC-PC-326	Artificial Intelligence Lab	4,5	2	-	-	2	1
9	20-HSMC-301	Advanced English Communication Skills Lab	5,10		1	-	2	2
10	20-MC-302	Human Values and Professional Ethics	6,7,8,12		2	-	-	-
TOTAL					**18**	**-**	**10**	**21**

Note: Industry Oriented Mini-Project carried out during Summer Vacation between VI semester & VII semester and evaluated in VII semester.

VII – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	20-HSMC-411	Business Economics	11,12		3	-	-	3
2	20-EC-PC-411	Microwave Engineering	2,3,12	1	3	-	-	3
3	**Professional Elective – III**				3	-	-	3
	20-EC-PE-411	Digital Image Processing	2,5,12	1				
	20-EC-PE-413	IoT Architecture and Protocols	2,3,5,6,12	1				
	20-EC-PE-415	Machine Learning and Data Science	2,3,5,6,12					
4	**Professional Elective – IV**				3	-	-	3
	20-EC-PE-412	Radar and Satellite Communication Systems	2,3,7,12	1				
	20-EC-PE-414	Smart Sensors and Networking	2,3,5,6,12	1				
	20-EC-PE-416	Augmented and Virtual Reality	2,3,5,8,12	1				
5	**Open Elective – II**				3	-	-	3
	20-OEC-411	CE: Green Building Technologies	1,2,7,12					
	20-OEC-412	ME: Drones	1,2,3,5,7,12					
	20-OEC-413	ECE: 5G Technologies	1,2,3,5,7,12					
	20-OEC-414	CSE: Database Management Systems	1,2,3,5,12					
6	20-EC-PC-412	Microwave Engineering Lab	4,5	2	-	-	2	1
7	20-EC-PR-411	Industry Oriented Mini-Project	1 to 12	1,2	-	-	-	3
TOTAL					**15**	**-**	**02**	**19**

VIII – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	**Professional Elective – V**				3	-	-	3
	20-EC-PE-421	5G Communication Technologies	2,3,5,7,12	1				
	20-EC-PE-423	Software Defined Radio	2,3,5,7,12	1				
	20-EC-PE-425	Neural Networks and Deep Learning	2,3,5,6,12	1				
2	**Professional Elective – VI**				3	-	-	3
	20-EC-PE-422	Wireless Communications	2,3,5,8,12	1				
	20-EC-PE-424	Industry 4.0	2,3,5,7,12	1				
	20-EC-PE-426	Information and Cyber Security	2,3,6,8,12	1				
3	**Open Elective – III**				3	-	-	3
	20-OEC-421	CE: Intellectual Property Rights	1,6,8,12					
	20-OEC-422	ME: Principles of Entrepreneurship	7,8,9,11,12					
	20-OEC-423	ECE: Precision Agriculture	1,2,3,5,6,12					
	20-OEC-424	CSE: Web Technologies	2,3,5,6,12					
4	20-EC-PR-421	Major Project	1 to 12	1,2	-	-	20	10
TOTAL					**09**	**-**	**20**	**19**

B.TECH.-I-SEMESTER SYLLABUS

LINEAR ALGEBRA & CALCULUS

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-BSC-101	3	1	-	4

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

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

Syllabus

Unit	Title/Topics	Hours
I	**Matrices**	9
Matrices: Types of Matrices, Symmetric; Hermitian; Skew-symmetric; Skew-Hermitian; orthogonal matrices; Unitary Matrices; rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method; System of linear equations; solving system of Homogeneous and Non-Homogeneous equations. Gauss elimination method; Gauss Seidel Iteration Method.		
II	**Eigen values and Eigen vectors**	11
Linear Transformation and Orthogonal Transformation: Eigen values and Eigenvectors and their properties: Diagonalization of a matrix; Cayley-Hamilton Theorem (without proof); finding inverse and power of a matrix by Cayley-Hamilton Theorem; Quadratic forms and Nature of the Quadratic Forms; Reduction of Quadratic form to canonical forms by Orthogonal Transformation.		
III	**Sequences and Series**	4+6=10
Part A: Sequence: Definition of a Sequence, limit; Convergent, Divergent and Oscillatory sequences. Series: Convergent, Divergent and Oscillatory Series; Series of positive terms; Comparison test, p-test, D-Alembert's ratio test; Raabe's test.		
Part B: Cauchy's Integral test; Cauchy's root test Alternating series: Leibnitz test; Alternating Convergent series: Absolute and Conditionally Convergence.		
IV	**Calculus**	9
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 and Maclaurin's series (without proof). Definition of Improper Integral: Beta and Gamma functions and their applications.		
V	**Multivariable calculus (Partial Differentiation and applications)**	9
Definitions of Limit and continuity, Partial Differentiation; Euler's Theorem; Total derivative; Jacobian; Functional dependence & independence, Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.		
Textbooks:		
1. Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers, 36th Edition, 2010. 2. Advanced Engineering Mathematics by Erwin kreyszig, 9th Edition, John Wiley & Sons, 2006. 3. Calculus and Analytic Geometry by G.B.Thomas and R.L.Finney, 9th Edn., Pearson, Reprint, 2002.		
References:		
1. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2008. 2. Higher Engineering Mathematics, Ramana B.V., TMH, 11th Reprint.		

APPLIED PHYSICS

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-BSC-103	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 Mechanics	3	2	1
CO2	analyze various electron theories of conduction in solids	3	2	1
CO3	classify semiconductors and relate functioning of semiconductor devices	3	2	1
CO4	illustrate principles and applications of lasers and optical fibers	3	2	1
CO5	outline dielectric and magnetic properties of materials	3	2	1

Syllabus

Unit	Title/Topics	Hours
I	**Principles of Quantum Mechanics**	9
Waves and particles, de-Broglie hypothesis, matter waves, Davisson and Germer's experiment, Heisenberg's uncertainty principle, physical significance of the wave function , Schrödinger's time independent wave equation, particle in 1-dimensional potential box.		
II	**Introduction to Solids**	9
Quantum free electron theory, estimation of Fermi energy, dependence of Fermi level on temperature, density of states. Bloch's theorem, Kronig - Penny model, origin of energy bands, classification of materials on the basis of energy bands, effective mass of electron.		
III	**Semiconductor Physics and Devices**	6+5=11
Part-A: Introduction, types of semiconductors, calculation of carrier concentration in intrinsic semiconductor, Fermi level in intrinsic semiconductor, direct and indirect band gaps, Hall effect.		
Part-B: Formation of PN junction, open circuit PN junction, I-V characteristics of PN junction diode, solar cell, LED.		
IV	**Lasers and Fiber Optics**	9
Characteristics of Lasers, absorption, spontaneous and stimulated emission of radiation, Einstein's coefficients and relation between them, population inversion, lasing action, Ruby laser, Helium-Neon laser, applications of lasers. Principle of optical fiber, construction of fiber, acceptance angle and acceptance cone, numerical aperture, types of optical fibers: step index and graded index fibers, applications.		
V	**Dielectric and Magnetic Properties**	10
Introduction to dielectric properties, electronic, ionic and orientation polarizations and calculation of polarizabilities: ionic and electronic - internal fields in solids, Clausius - Mossotti equation. Introduction to magnetic properties, origin of magnetic moment, Bohr magneton, classification of Dia, Para and Ferro magnetic materials on the basis of magnetic moment, applications.		
Textbooks:		
1. Applied Physics by P.K.Mittal, I K International Publishers. 2. Engineering Physics by P.K.Palanisamy, Scitech Publishers.		
References:		
1. Principles of physics by Halliday, Resnick, Walker, Wiley India Pvt. Ltd, 9th Edition. 2. Introduction to solid state physics by Charles Kittel, Wiley India Pvt. Ltd, 7th Edition.		

ENGLISH FOR ENGINEERS

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-HSMC-101	2	-	-	2

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

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

Syllabus

Unit	Title/Topics	Hours
I	**The Raman Effect**	7
Vocabulary Building: The Concept of Word Formation -The Use of Prefixes and Suffixes. **Grammar:** Identifying Common Errors in Writing with Reference to Articles and Prepositions. **Reading:** Reading and Its Importance - Techniques for Effective Reading. **Basic Writing Skills:** Sentence Structures - Use of Phrases and Clauses in Sentences-Importance of Proper Punctuation-Techniques for writing precisely - **Paragraph writing** - Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.		
II	**Ancient Architecture in India**	11
Vocabulary: Synonyms and Antonyms. **Grammar:** Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement. **Reading:** Improving Comprehension Skills – Techniques for Good Comprehension. **Writing:** Format of a Formal Letter-**Writing Formal Letters** E.g.., Letter of Complaint, Letter of Requisition, Job Application with Resume.		
III	**Blue Jeans**	4+6=10
Part A: Vocabulary: Acquaintance with Prefixes and Suffixes from Foreign Languages in English to form Derivatives-Words from Foreign Languages and their Use in English. **Grammar:** Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.		
Part B: Reading: Sub-skills of Reading- Skimming and Scanning. **Writing**: Nature and Style of Sensible Writing- **Defining- Describing** Objects, Places and Events - **Classifying**- Providing Examples or Evidence.		
IV	**What Should You Be Eating**	9
Vocabulary: Standard Abbreviations in English. **Grammar:** Redundancies and Clichés in Oral and Written Communication. **Reading**: Comprehension- Intensive Reading and Extensive Reading. **Writing: Writing Practices** - Writing Introduction and Conclusion - Information Transfer - Essay Writing-Précis Writing.		
V	**How a Chinese Billionaire Built Her Fortune**	9
Vocabulary: Technical Vocabulary and their usage. **Grammar:** Common Errors in English. **Reading:** Reading Comprehension-Exercises for Practice. **Writing: Technical Reports** - Introduction – Characteristics of a Report – Categories of Reports; **Formats**- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.		
Textbooks:		
1. Sudarshana, N.P. and Savitha, C. (2018). English for Engineers. Cambridge University Press.		
References:		
1. Swan, M. (2016). Practical English Usage. Oxford University Press. 2. Zinsser, William. (2001). On Writing Well. Harper Resource Book. 3. Exercises in Spoken English. Parts I –III. CIEFL, Hyderabad. Oxford University Press.		

PROBLEM SOLVING WITH C PROGRAMMING

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-ESC-103	3	-	-	3

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

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

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Programming**	11
Introduction to components of a computer system: primary and secondary memory, processor, Input/output devices, operating system, compilers, creating, compiling and executing a program. **Introduction to Algorithms:** Representation of Algorithm/Pseudo code, Flowchart, Structure chart with examples, Program development steps. **Introduction to C Programming Language:** identifiers, data types, variables, constants, Operators, Expression evaluation, precedence, Preprocessor commands, Conditional Branching and Loops: Writing and evaluation of conditions and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do-while loops.		
II	**Arrays and Functions**	8
Arrays: Concepts, using arrays in C, One dimensional, two dimensional arrays, multidimensional arrays, array applications- linear search, binary search and bubble sort, C program examples. **Functions:** Designing Structured Programs, Functions, user defined functions, Standard functions, Parameter passing in functions, Storage classes-auto, register, static, extern, recursion- recursive functions, differences between recursion and iteration, Simple programs, such as Finding Factorial, GCD, Fibonacci series etc., Limitations of recursion, example C programs.		
III	**Pointers and Strings**	5+5=10
Part A: Pointers: Defining pointers, pointers to pointers, Pointer Arithmetic, accessing arrays using pointers, void pointer, Null pointer, Dangling Pointer, dynamic memory allocation functions.		
Part B: Strings: Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strcmp, strstr, etc.), arrays of strings.		
IV	**Structures and Unions**	10
Structures - Defining structures, initializing structures, accessing structures, operations on structures, Nested structures, structures containing arrays, arrays of structures, structures and functions, self-referential structures, enum, typedef, bit fields; **Unions** - Defining unions, initializing unions, accessing unions, differences between Structures and unions, C programming examples.		
V	**File handling in C**	9
Files - Concept of a file ,Text and Binary files, Differences between text and binary files, File opening modes , Opening and Closing files, file input / output functions, file status functions (error handling), Random access using fseek, ftell and rewind functions, C programming examples.		
Textbooks:		
1. Computer Science: A Structured Programming Approach Using C, B.A. Forouzan and R.F. Gilberg, 3rd Edition, Cengage Learning. 2. Programming in ANSI C, E. Balaguruswamy, TMH.		
References:		
1. The C Programming Language, B.W. Kernighan and Dennis M. Ritchie, 2nd Edition, Pearson. 2. C: The Complete Reference, Herbert Schildt, TMH, 4th Edition.		

COMPUTER AIDED ENGINEERING GRAPHICS

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-ESC-107	-	-	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	PO10
CO1	apply engineering drawing concepts in technical graphic communication	3	3	2
CO2	construct conic sections using various methods	3	3	2
CO3	draw orthographic projections of points, lines, planes and solids	3	3	2
CO4	draw development of solid surfaces	3	3	2
CO5	draw the conversions of orthographic to isometric projections & vice versa	3	3	2

List of Experiments

Week	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.
3	Construction of Hyperbola, Epicycloid.
4	Construction of hypocycloid, involutes.
5	Orthographic Projections: Principles of Orthographic projections, Projections of Points.
6	Projections of lines simple position, inclined to one plane.
7	Projections of Lines inclined to both the planes.
8	Projections of planes inclined to one plane and both the planes.
9	Projections of Solids simple position.
10	Projections of Solids inclined to one plane.
11	Projections of Solids inclined to 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).

Textbooks

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

References

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

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

APPLIED PHYSICS LAB

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-BSC-104	-	-	3	1.5

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

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

List of Experiments

(Minimum 10 experiments to be conducted)

Week	Title/Experiment
1	Determination of frequency of an Electronic Vibrator – Melde's Experiment.
2	Calculation of the rigidity modulus of a given wire - Torsional pendulum.
3	Newton's Rings-Radius of curvature of Plano convex lens.
4	Determination of Energy Gap of a Semiconductor.
5	Time constant of an R-C Circuit.
6	Stewart and Gee's method - Magnetic field along the axis of current carrying coil.
7	Bending Losses of Fibers & Evaluation of numerical aperture of given fiber.
8	Determination of Resonance frequency of an LCR circuit.
9	Determination of the characteristics of a Solar Cell.
10	Diffraction Grating-Determination of wavelengths of a LASER source.
11	Determination of the characteristics of a Light Emitting Diode.
12	Calculation of Hall Voltage across a semiconductor sample.

Reference

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

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

1. Design rechargeable torch.
2. Design temperature sensor.
3. Design radio receiver set employing LCR tank circuit.
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 AND COMMUNICATION SKILLS LAB

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-HSMC-102	-	-	3	1.5

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

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

List of Experiments

Week	Title/Experiment
PART – A: COMPUTER ASSISTED LANGUAGE LEARNING (CALL) LAB	
1 2	Introduction to Phonetics -Speech Sounds -Vowels and Consonants
5	Pronunciation I: Syllable Division, Accent & Stress, Stress Shift
8	Pronunciation II: Intonation and Rhythm – Situational Dialogue
11	Errors in pronunciation – the Interference of Mother Tongue (MTI)
14	Listening Comprehension (Specific & General)
PART – B: INTERACTIVE COMMUNICATION SKILLS (ICS) LAB	
3 4	JAMs
6 7	Role Play: Situational Dialogues
9	Introduction to a Structured Talk
10	Descriptions & Formal Presentations
12 13	Communication at Workplace and Interview Skills

References

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

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

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

PROBLEM SOLVING WITH C PROGRAMMING LAB

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-ESC-104	-	-	3	1.5

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

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

List of Experiments

Week	Title/Experiment
I	**Familiarization with programming environment**
	1. Write a program to print sample strings like "hello world", "Welcome to C Programming" with different formats using escape sequences. 2. Write a Program to print different data types in C and their ranges. 3. Write a Program to initialize, assign & print variables of different data types.
II	**Operators**
	1. Write a Program to demonstrate arithmetic operators. (+,-,*,/,%) 2. Write a Program to demonstrate relational operators.(<,>,<=,>=,==,!=) 3. Write a program to check equivalence of two numbers using conditional operator. 4. Write a Program to demonstrate pre increment and post increment. (++a, a++ where a is a value to be initialized)
III	**Simple C programs**
	1. Write a Program to read radius value from the keyboard and calculate the area of circle 2. Write a Program to calculate simple interest. 3. Write a Program to convert temperature. (Fahrenheit –Centigrade and vice-versa) 4. Write a program for computing the volume of sphere, cone and cylinder assume that dimensions are integers use type casting where ever necessary.
IV	**Decision Statements**
	1. Write program that declares Class awarded for a given percentage of marks, where mark <40%= Failed, 40% to <60% = Second class, 60% to <70%=First class, >= 70% = distinction. Read percentage from standard input. 2. Write a Program to calculate roots of quadratic equation (using if-else). 3. Write a Program to perform arithmetic operations using switch case. 4. Write a Program to display colors using switch case (VIBGYOR).
V	**Loops**
	1. Write a program to calculate sum of individual digits of a given number. 2. Write a program to print prime numbers in the given range. 3. Write a program to read 2 numbers x and n then compute the sum of the Geometric Progression. $1+x+x^2+x^3+ - - - - - - - +x^n$ 4. Write a C program to construct a pyramid of numbers as follows: . 1 / 1 2 / 1 2 3 / * / * * / * * * / 1 / 2 3 / 4 5 6 / 1 / 2 2 / 3 3 3 / 4 4 4 4 / * / * * / * * * / * * / *
VI	**1-D arrays**
	1. Write a program to store 10 elements in the 1-D array and print sum of the array. 2. Write a program to print minimum and maximum elements in the 1-D array. 3. Write a program to search the given element by using linear search and binary search. 4. Write a program to sort the given elements using bubble sort technique.

VII	2-D arrays
1. Write a program to perform matrix addition. 2. Write a program to perform matrix multiplication. 3. Write a program to print the transpose of a matrix.	
VIII	**Functions**
1. Write a program to find product of two numbers using functions without arguments, without return type. 2. Write a program to find difference of two numbers using functions without arguments, with return type. 3. Write a program to find sum of two numbers using functions with arguments &without return type. 4. Write a program to find product of two numbers using functions with arguments, with return type.	
IX	**Functions and Recursion**
1. Write a program to swap two numbers using a) Call by Value b) Call by Reference. (Using pointers) 2. Write a program to calculate factorial, GCD and Fibonacci series of n terms using recursion and non-recursion functions. 3. Write C program that reads two integers x and n and calls a recursive function to compute x^n 4. Write a C program that reads two integers and calls a recursive function to compute ${}^nC_r$	
X	**Strings**
1. Write a program to demonstrate various string manipulations using built-in functions. 2. Write a program to print the given strings in ascending order. 3. Write a program to verify the given string is palindrome or not (without using built-in functions and with using built-in functions). 4. Write a program to concatenate two strings using arrays without using strcat.	
XI	**Structures**
1. Write a program to find total marks of individual student and average marks for 10 students using structures. 2. Write a program to illustrate passing an entire structure to a function. 3. Write a C Program to perform addition and multiplication of two complex numbers using structures.	
XII	**File operations**
1. Write a C program to display the contents of a file to standard output device. 2. Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents. 3. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file). 4. Write a C program to count the number of times a character occurs in a text file.	
References	
1. Problem Solving with C Programming Lab Manual, FED, CMRIT, Hyd.	
Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.	
1. Pay roll management system. 2. Fee collection system. 3. Employee's Management System. 4. Library management. 5. Department store system. 6. Personal Dairy Management System. 7. Telecom Billing Management System. 8. Bank Management System. 9. Contacts Management. 10. Medical Store Management System.	

NATIONAL SERVICE SCHEME (NSS)/PHYSICAL EDUCATION/YOGA MANDATORY COURSE (NON-CRIDIT)

Course	B.Tech.-I-Sem.	L	T	P	C
Subject Code	20-MC-101	-	-	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	PO3	PO6	PO8	PO9	PO12
CO1	harness physical literacy and lifelong engagement	3	3	3	3	3
CO2	use aesthetic appreciation	2	1	2	3	3
CO3	build competence and confidence to face challenges	1	2	1	3	3
CO4	develop Sports related values and attitudes	3	3	2	2	3
CO5	follow appropriate etiquette and sports	1	1	2	3	3

List of Activities/Events

NATIONAL SERVICE SCHEME (N.S.S.)

The programme aims to inculcate social welfare in students, and to provide service to society without bias. NSS volunteers work to ensure that everyone who is needy gets help to enhance their standard of living and lead a life of dignity. In doing so, volunteers learn from people in villages how to lead a good life despite a scarcity of resources. It also provides help in natural and man-made disasters by providing food, clothing and first aid to the disaster victims.

S. No.	Name of the Activity	S. No.	Name of the Activity
1	First-aid	9	Anti-Ragging Awareness
2	Blood donation camp	10	Social Activities Awareness
3	Traffic awareness program	11	Cyber Crime
4	Environmental Awareness	12	Digital India
5	Swachh Bharat Abhiyan	13	Substance Abuse Awareness Program (SAAP)
6	Health awareness program	14	Fire Safety Awareness
7	Garments / Essential Education Material Collection and distribution	15	Telanganaku Haritha Haram (Sapling Plantation)
8	Non-formal education		

PHYSICAL EDUCATION / YOGA

The aim of course is to make Physical Education as an integral part of Educational System. Students studying in the colleges should have the benefit of Physical Education to improve their health during the course of college education. It is designed to ensure that on completion of this training they would attain the minimum prescribed standard.

Name of the Individual Event		Name of the Team Event	
S. No.	Event	S. No.	Event
1	Badminton	1	Basketball
2	Gymnastics	2	Football
3	Judo	3	Hockey
4	Swimming	4	Kabaddi
5	Table Tennis	5	Kho –Kho
6	Tennis	6	Volleyball
7	Weight Lifting and Power Lifting	7	Cricket
8	Wrestling	8	Hand ball
9	**Yoga**	9	Throw ball
10	Archery	10	Badminton
11	Body Building	11	Table Tennis
12	Carroms	12	Tennis
13	Chess	13	Swimming
14	Boxing	14	Carroms
15	Taekwondo	15	Taekwondo
16	Fencing	16	Fencing
17	Athletics	17	Athletics

B.TECH.-II-SEMESTER SYLLABUS

ADVANCED CALCULUS

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-BSC-102	3	1	-	4

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

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

Syllabus

Unit	Title/Topics	Hours
I	**Differential Equations**	11
Exact & Reducible to exact, Linear and Bernoulie's Differential Equations. Applications; Newton's law of cooling, law of natural growth and decay. Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type e^{ax}, Sin ax, cos ax, polynomials in x, $e^{ax}V(x)$, $xV(x)$,method of Variation of parameters.		
II	**Partial Differential Equations**	8
Formation of partial differential equations-by elimination of arbitrary constants and arbitrary functions–solutions of first order linear (Lagrange) equations and nonlinear equations (Four standard types) – Method of Separation of Variables.		
III	**Multiple Integration**	5+5=10
Part A: Double integrals (Cartesian &polar), change of order of integration in double integrals, Change of variables (Cartesian to polar).		
Part B: Applications: areas and volumes (Cartesian), Triple integrals (Cartesian).		
IV	**Vector Differentiation**	9
Vector Differentiation: Vector point functions and scalar point functions. Gradient, Divergence and Curl. Directional derivatives, Scalar potential functions. Solenoidal and Irrational vectors, Vector Identities.		
V	**Vector Integration**	10
Vector Integration: Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stokes (without proofs) and related Problems.		
Textbooks:		
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010 2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006 3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.		
References:		
1. Paras Ram, Engineering Mathematics, 2nd Edition, CBS Publishes. 2. S. L. Ross, Differential Equations, 3rd Edition, Wiley.		

ENGINEERING CHEMISTRY

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-BSC-105	3	-	-	3

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

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

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. 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 and impressed current cathodic methods.		
III	**Spectroscopic techniques and applications**	5+4=9
Part A: Introduction - Absorbance, Extinction coefficient - Principles of spectroscopy - UV - Visible spectroscopy: Beer's-Lamberts law - applications, IR spectroscopy.		
Part B: Basic concepts of nuclear magnetic resonance Spectroscopy- Spin-spin coupling, chemical shift. Introduction to Magnetic resonance imaging.		
IV	**Fuels, Polymers and Synthesis of drug molecules**	11
Fuels: 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. **Synthesis of drug molecules**: Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.		
V	**Engineering Materials**	9
Cement: Portland cement, its composition, setting and hardening of Portland cement. **Refractories:** Classification and characteristics of refractories, properties and applications of Refractories. **Lubricants:** Classification of lubricants with examples - characteristics of a good lubricants - properties of lubricants: viscosity, cloud point, pour point, flash point and fire point. **Nano materials:** Introduction to nanomaterials, preparation of CNT'S by CVD method, properties of CNT'S. General applications of nanomaterials.		
Textbooks:		
1. Engineering Chemistry by P.C. Jain and M.Jain, Dhanpatrai Publishing Company, New Delhi 2010. 2. Engineering Chemistry by Rama Devi, Ch. V. Ramana Reddy and Rath, Cengage learning, New Delhi 2016.		
References:		
1. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd., New Delhi 2011.		

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-ESC-101	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12
CO1	solve electrical circuits using circuit laws	3	3	2	1
CO2	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, line voltage, line current relations power equation in star and delta connections in Three Phase systems, 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.		
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 and synthesis) - A. Chakrabarti, Dhanpat Rai & Co Pvt Ltd. 7th Edition, 2015. 2. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006. 3. Electrical Technology- vol-II B L Theraja, S. Chand publications.		
References:		
1. Introduction to Electronic Devices and Circuits-Rober T. Paynter, Pearson Education. 2. Network Theory by Sudhakar, Shyam Mohan Palli, TMH. 3. Electronic Devices and Circuits – 2nd Edition by Muhammad H.Rashid, Cengage Learning.		

DATA STRUCTURES THROUGH C

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-ESC-105	3	-	-	3

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

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

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Data Structures, Searching and Sorting**	11
Basic concepts - Introduction to data structures, classification of data structures, operations on data structures, abstract data type, algorithms, different approaches to design an algorithm, recursive algorithms. **Searching and Sorting techniques -** Linear search and binary search, Bubble sort, selection sort, insertion sort, quick sort, merge sort, and comparison of sorting algorithms.		
II	**Linear Data Structures**	8
Stack - Primitive operations, implementation of stacks using Arrays, applications of stacks: arithmetic expression conversion and evaluation. **Queue -** Primitive operations; Implementation of queues using Array, Types of Queue: Simple queue, circular queue and priority queue, applications of linear queue.		
III	**Linked Lists**	5+5=10
Part A: Linked lists -Introduction, singly linked list, representation of a linked list in memory, operations on a single linked list: Traversing, searching, insertion, deletion. Applications of linked lists: Polynomial representation and sparse matrix manipulation.		
Part B: Types of linked lists - Doubly linked lists, Circular linked lists, linked list representation and operations of Stack, linked list representation and operations of queue.		
IV	**Non Linear Data Structures**	10
Trees - Basic Tree Terminologies, binary tree, binary tree representation, array and linked representations, binary tree traversal, Binary Search Tree: properties and operations, Balanced search trees: AVL tree, application of trees.		
V	**Graphs and Hashing**	9
Graphs- Basic terminologies and representations, graph implementation, graph search and traversal algorithms, Application of graphs. **Hashing and Collision-** Introduction, hash tables, hash functions, collisions, applications of hashing.		
Textbooks:		
1. Mark A. Weiss, "Data Structures and Algorithm Analysis in C", Pearson, 2nd Edition, 1996. 2. Ellis Horowitz, SatrajSahni, Susan Anderson Freed, "Fundamentals of Data Structures in C", Universities Press, 2nd Edition 2008.		
References:		
1. ReemaThareja, "Data Structures using C", Oxford University Press, 2nd Edition, 2014. 2. S. Lipschutz, "Data Structures", Tata McGraw Hill Education, 1st Edition, 2008. 3. Tanenbaum, Langsam, Augenstein, "Data Structures Using C", Pearson, 1st Edition, 2003.		

ENGINEERING CHEMISTRY LAB

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-BSC-106	-	-	3	1.5

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

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

List of Experiments: (Perform any 10 Experiments)

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 Acetic acid by Conductometric titrations.
5	Estimation of HCl by Potentiometric titrations.
6	Estimation of Fe^{2+} by Potentiometer using $KMnO_4$.
7	Estimation of copper by colorimetric method.
8	Estimation of amount of ferrous ion in Cement by colorimetric method.
	Preparations
9	Synthesis of Aspirin and paracetamol.
	Physical properties
10	Determination of viscosity of a liquid by using Ostwald's viscometer.
11	Verification of Freundlich adsorption isotherm-adsorption of acetic acid on charcoal.
12	Determination of partition coefficient of acetic acid between n-butanol and water.

References

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

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

1. Assessment of ground water quality of specified area.
2. Determination of Viscosity of castor oil and groundnut oil.
3. Preparation of petroleum jelly.
4. Preparation of soaps and liquid hand wash.
5. Recycling of waste water.
6. Drinking water purification.
7. Estimation of manganese in pyrolusite.
8. 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	20-ESC-102	-	-	3	1.5

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

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

List of Experiments

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 Theorem equivalent circuits.
6	Experimental determination of Norton's Theorem 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 must submit a report on one of the following Micro–Projects before commencement of second internal examination.

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

DATA STRUCTURES THROUGH C LAB

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-ESC-106	-	-	3	1.5

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

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

List of Experiments

Week	Title/Experiment
I	**Searching Techniques**
Write C programs for implementing the following searching techniques. a. Linear search. b. Binary search.	
II	**Sorting Techniques**
Write C programs for implementing the following sorting techniques to arrange a list of integers in ascending order. a. Bubble sort. b. Insertion sort. c. Selection sort.	
III	**Sorting Techniques**
Write C programs for implementing the following sorting techniques to arrange a list of integers in ascending order. a. Quick sort. b. Merge sort	
IV	**Implementation of Stack and Queue**
a. Write C programs to design and implement Stack and its operations using Arrays. b. Write C programs to design and implement Queue and its operations using Arrays.	
V	**Applications of Stack**
a. Write C program by using Stack operations to convert infix expression into postfix expression. b. Write C program by using Stack operations for evaluating the postfix expression.	
VI	**Implementation of Single Linked List**
Write a C program that uses functions to perform the following operations on single linked list. a. Creation b. insertion c. deletion d. traversal	
VII	**Implementation of Circular Single Linked List**
Write a C program that uses functions to perform the following operations on Circular linked list. a. Creation b. insertion c. deletion d. traversal	
VIII	**Implementation of Double Linked List**
Write a C program that uses functions to perform the following operations on double linked list. a. Creation b. insertion c. deletion d. traversal in both ways.	
IX	**Implementation of Stack Using Linked List**
Write a C program to implement stack using linked list.	
X	**Implementation of Queue Using Linked List**
Write a C program to implement queue using linked list.	
XI	**Graph Traversal Techniques**
Write C programs to implement the following graph traversal algorithms: a. Depth first search. b. Breadth first search.	
XII	**Implementation of Binary Search Tree**
Write a C program that uses functions to perform the following: a. Create a binary search tree. b. Traverse the above binary search tree recursively in pre-order, post-order and in-order.	
References	
1. Data Structures through C Lab Manual, FED, CMRIT, Hyd.	

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

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

IT & ENGINEERING WORKSHOP PRACTICE

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-ESC-108	-	-	3	1.5

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

COs	Upon completion of course the students will be able to	PO1	PO5	PO9	PO10
CO1	execute simple programs using Sci Lab	3	3	2	2
CO2	design programs using conditional statements and loops	3	3	2	2
CO3	apply safety norms while handling the workshop equipment	3	1	3	2
CO4	prepare required models using various engineering trades	3	1	3	2
CO5	make use of various power tools	3	1	3	2

List of Experiments

Week	Title/Experiment
	Part-A: IT Workshop (Sci Lab)
1	**Introduction:** Why Sci Lab?, History, Its strengths, Competitors, Starting Sci Lab, Using Sci Lab as a calculator, Quitting Sci Lab.
2	**Basics:** Familiar with Sci Lab windows, Basic Operations, Sci Lab - Data types, Rules about variable names, Predefined variables.
3	**Programming-I:** Vector, Matrix, Array Addressing, Built-in functions, Mathematical Operations, Dealing with strings (Array of characters), Array of array (cell) concept.
4	**Programming-II:** Script file, Input commands, Output commands, Structure of function file, Inline functions, Feval command, Comparison between script file and function file.
5	**Conditional statements and Loop:** Relational and Logical Operators, If-else statements, Switch-case statements, For loop, While loop, Special commands (Break and continue), Import data from large database, Export data to own file or database.
6	**Plotting-I:** In-built functions for plotting, Multiple plotting with special graphics.
7	**Plotting-II:** Curve fitting, Interpolation, Basic fitting interface.
	Part-B: Engineering Workshop
8	**House Wiring:** Power point, light fitting and switches.
9	**Carpentry:** Study of tools and joints; Practice in planning, chiseling, marking and sawing.
10	**Carpentry:** Joints: Cross joint, T joint, Dove tail joint.
11	**Fitting:** Study of tools, practice in filing, cutting, drilling and tapping.
12	**Fitting:** Male and female joints, stepped joints**.**
13	**Tin Smithy:** Preparation of Open scoop, Cylinder, square/rectangular tray.
14	**Demonstration of Power Tools:** Bench drilling machine, hand drilling machine, power hacksaw, grinding machine, lathe machine, wood cutting machine and welding machine.

References

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

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

1. Design a mathematical model to explain the functioning of Global positioning system (GPS)
2. Design a mathematical model for the construction of flyover.
3. Model any art craft using mathematical calculations (electrical / non-electrical).
4. 2-D plotting using SCI-lab.
5. 3-D plotting using SCI-lab.
6. Make Round tee pipe.
7. Design electrical wiring plan for a house.
8. Prepare decorative series lights / dim & bright lighting.
9. Preparation of door stoppers / hinges.
10. Preparation of tool handles.

ENVIRONMENTAL SCIENCE
MANDATORY COURSE (NON-CREDIT)

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-MC-102	2	-	-	-

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

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

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.		
II	**Natural Resources**	7
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.		
III	**Biodiversity**	3+2=5
Part A: Definition and levels of biodiversity, Values of biodiversity Bio– geographical classification of India; hot spots of biodiversity; India as a mega diversity nation; Threats to biodiversity; Endangered and endemic species of India.		
Part B: Conservation of biodiversity: In–situ and Ex–situ conservation; Case studies.		
IV	**Environmental Pollution & Control Technologies**	8
Types of environmental pollution; **Air pollution**: major air pollutants, sources, effects, control measures, National Air Quality Standards. Water pollution: sources, impacts & control technologies- ETP, watershed management, rain water harvesting, Water Quality standards. Soil pollution: sources, causes & impacts on modern agriculture. Noise pollution. Solid waste Management- causes, effects and control measures; E-waste. **Global Environmental Issues and Treaties**: Global warming, ozone layer depletion. International protocol, Kyoto and Montreal protocol. Population Explosion.		
V	**Environmental Acts, EIA & Sustainable Development**	6
Environment Protection Acts: Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act and Forest Conservation Act, Environment (Protection) Act, 1986. EIA: conceptual facts, base line data acquisition, EIS, EMP. **Sustainable development**-causes & threats, strategies for achieving sustainable development; CDM and concept of green building, life cycle assessment(LCA); Ecological foot print. **Role of Information Technology** in Environment - Remote Sensing, GIS.		
Textbooks:		
1. Environmental Science by Y. Anjaneyulu, B S Publications (2004). 2. Environmental studies by Rajagopalan R (2009), Oxford University Press, New Delhi.		
References:		
1. Environmental Science and Technology by M. Anji Reddy (2007), B.S Publications. 2. Environmental Studies by Anubha Kaushik (2006), 4th Edn, New age International Publications		

B.TECH.-III-SEMESTER SYLLABUS

NUMERICAL METHODS AND COMPLEX ANALYSIS

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-BSC-203	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 transcendental, linear and non-linear equations with numerical methods	3	2	1
CO2	find the numerical solutions for 1st order initial value problems and integrals	3	2	1
CO3	solve ODE by using Laplace transforms	3	2	1
CO4	analyze the complex functions with reference to their analyticity	3	2	1
CO5	expand complex functions using Taylor's, Laurent's and Residue theorems	3	2	1

Syllabus

Unit	Title/Topics	Hours
I	**Algebraic and transcendental Equations and Curve Fitting**	9
Algebraic and transcendental Equations: Introduction, Bisection Method, Method of False position, Iteration method and Newton Raphson method. **Curve Fitting**: Fitting a linear, second degree, exponential and power curve by method of least squares. ***Task:*** *Write a program to find the root of transcendental equation.*		
II	**Numerical Integration and Solution of Ordinary Differential Equations**	9
Numerical Integration: Trapezoidal rule, Simpson's 1/3rd and 3/8th rule. **Solution of Ordinary Differential equations:** Taylor's series, Picard's method of successive approximations, Euler's method, Runge - Kutta method (second and fourth order) ***Task:*** *Write a program to find the area by using Simpsons 1/3rd rule and 3/8th rule.*		
III	**Laplace Transforms and Inverse Laplace Transform**	6+4=10
Part-A: Laplace Transforms: Laplace Transform of standard functions; first shifting theorem; Laplace transforms of functions when they are multiplied and divided by 't'. Laplace transforms of derivatives and integrals of function; Evaluation of integrals by Laplace transforms; Laplace transforms of Special functions; Laplace transform of periodic functions. ***Task:*** *Write a program on Laplace transform of functions.*		
Part-B: Inverse Laplace Transform: Inverse Laplace transform by different methods. ***Task:*** *Write a program to find the inverse Laplace Transform by using convolution method.*		
IV	**Complex Variables (Differentiation)**	10
Complex Variables (Differentiation): Limit, continuity and differentiation of complex functions. Cauchy-Riemann equations (without proof), Milne-Thomson methods, analytic functions, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties. ***Task:*** *Write a program on mathematical functions for complex numbers.*		
V	**Complex Variables (Integration)**	10
Complex Variables (Integration): Line integrals, Cauchy's integral Theorem, Cauchy's integral formula and Generalized Cauchy's Integral formula. Zeros of analytic functions and singularities. Taylor's Series, Laurent's series (without proof), Residues and Cauchy's Residue theorem. ***Task:*** *Write a program to find the area by using Residue theorem.*		

Textbooks:

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

References:

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

NETWORKS AND MEASUREMENTS

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-ESC-206	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	design resonant circuits and magnetic circuits	3	3	2	2	3
CO4	analyze various filters and DC bridges	3	3	2	2	3
CO5	determine unknown parameters of AC bridges	3	3	2	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Two Port Networks**	10
Impedance Parameters, Admittance Parameters, Hybrid Parameters, Transmission (ABCD) Parameters, Interconnection of Two Port networks in Series, Parallel and Cascaded configurations, Illustrative problems.		
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.		
III	**Resonance & Magnetic circuits**	5+5=10
Part-A: Resonance: series and parallel resonance circuits, resonance frequency, quality factor and band width determination.		
Part-B: Magnetic circuits: Magnetic circuits-Faraday's laws of electromagnetic induction-concept of self and mutual inductance-coefficient of coupling.		
IV	**Filters and DC Bridges**	10
Filters: Classification of Filters, Constant-k -Low Pass Filter and High Pass Filters; Band Pass filter and Band Elimination filters, Illustrative Problems. **DC Bridges**: Method of measuring low, medium and high resistance – sensitivity of Wheat-stone's bridge, Kelvin's double bridge for measuring low resistance.		
V	**AC Bridges**	9
Measurement of inductance - Maxwell's bridge, Hay's bridge, Anderson's bridge. Measurement of capacitance and loss angle –De Sauty's Bridge – Schering Bridge.		

Textbooks:

1. Circuit Theory (Analysis and synthesis) -A. Chakrabarti, Dhanpat Rai & Co Pvt Ltd 7th Edition, 2015.
2. Electrical Measurements and Measuring Instruments - E.W. Golding and F.C. Widdis, 5th Edition, Wheeler Publishing.
3. Electrical & Electronic Measurement & Instruments - A.K.Sawhney, Dhanpat Rai & Co. Pvt. Ltd.

References:

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

PROBABILITY THEORY & STOCHASTIC PROCESSES

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-ESC-207	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO1	PO2	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, 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, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density functions, Statistical Independence, Sum of Random Variables, 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, 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 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 Spectrum and its Properties, Cross-Power Density Spectrum and its Properties, Linear System Response of Mean and Mean-squared Value, Autocorrelation Function, 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, 4^{th} Edition, 2001, TMH. 2. Probability and Random Processes - Scott Miller, Donald Childers, 2^{nd} Edition, Elsevier, 2012.		
References:		
1. Probability, Random Variables and Stochastic Processes - Thanasios Papoulis and S. Unnikrishna Pillai, 4^{th} Edition, TMH. 2. Theory of Probability and Stochastic Processes - Pradip Kumar Gosh, University Press.		

ANALOG ELECTRONICS

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-EC-PC-211	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12	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 usig 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	20-EC-PC-212	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO12	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 and Fourier Series**	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, Introduction to Hilbert Transform.		
IV	**Sampling and Z-Transforms**	10
Sampling: Sampling theorem –Types of Sampling - Impulse Sampling, Natural and Flat top Sampling, Aliasing**,** introduction to Band Pass Sampling. **Z–Transforms:** Concept of Z-Transform 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.		

ANALOG ELECTRONICS AND NETWORKS LAB

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-EC-PC-213	-	-	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	PSO2
CO1	design and analyze the transistor amplifier circuits	3	3	3
CO2	design and analyze the FET amplifiers, feedback amplifiers and Oscillators	3	3	3
CO3	design and analyze the large signal amplifiers	3	3	3
CO4	design two port network and analyze transients for series circuits	3	3	3
CO5	evaluate filters & draw its characteristics	3	3	3

List of Experiments

Week	Title/Experiment
Part-A: ANALOG ELECTRONICS LAB	
Note: Design any **Five** using hardware and any **Five** simulation using Multisim or P-spice or Equivalent Simulation Software.	
1	Common Emitter Amplifier
2	Common Base Amplifier
3	Common Collector Amplifier
4	Common Source amplifier
5	Two Stage RC Coupled Amplifier
6	Current Shunt and Voltage Series Feedback Amplifier
7	Cascode Amplifier
8	Wien Bridge Oscillator using Transistors
9	RC Phase Shift Oscillator using Transistors
10	Class A Power Amplifier (Transformer less)
11	Class B Complementary Symmetry Amplifier
12	Hartley and Colpitt's Oscillator
13	Single Tuned Voltage Amplifier
14	Darlington Pair
Part-B: NETWORKS LAB	
Note: Any 4 experiments to be performed.	
1	Two Port Network Parameters- Z and Y Parameters.
2	Two Port Network Parameters- h and ABCD Parameters.
3	Transient Response of Series RL, RC and RLC Circuits Using DC Excitation.
4	Series Resonance Circuits- Timing, Resonant Frequency, Band Width and Q-Factor Determination for RLC Network.
5	Parallel Resonance Circuits - Timing, Resonant Frequency, Bandwidth and Q-Factor determination for RLC Network.
6	Constant –K Low Pass and High Pass Filter - Design And Test.
References	
1. Analog Electronics and Networks Lab Manual, Department of ECE, CMRIT, Hyd	
Micro-Projects: Student must submit a report on one of the following Micro–Projects before commencement of second internal examination.	
1. Battery Charger 2. Water level alarm 3. Low cost fire alarm 4. Stop watch 5. Electronic watchdog	6. Mini audio amplifier 7. Street light automatic intensity controller 8. Smart burglar alarm 9. Clap based fan switching system 10. Design of Power Supply With Auto Switching

SIMULATION LAB

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-EC-PC-214	-	-	2	1

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

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	interpret various types of MATLAB tools	3	3	3
CO2	solve different signals and perform different operations on signals	3	3	3
CO3	analyze convolution, correlation between signals and sequences	3	3	3
CO4	examine the stability of the system using S-plane and Z-plane	3	3	3
CO5	apply the mathematical modelling to LTI systems	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 must submit a report on one of the following Micro–Projects before commencement of second internal examination.

1. Find the trigonometric Fourier series coefficients of a rectangular periodic signal. Reconstruct the signal by combining the Fourier series coefficients with appropriate weightings.
2. The signal x (t) is defined as below. The signal is sampled at a sampling rate of 1000 samples per second. Find the power content and power spectral density for this signal.
3. Find the magnitude and phase response of first order low pass and high pass filter. Plot the responses in logarithmic scale.
4. 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.

BUSINESS COMMUNICATION SKILLS LAB

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-HSMC-201	-	-	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	PO9	PO10
CO1	demonstrate verbal and written skills effectively	3	3
CO2	develop professional correspondence skills	3	3
CO3	make use of soft skills to become a professional team member	3	3
CO4	apply knowledge of decision making, leadership, motivation	3	3
CO5	exhibit confidence in facing the interview process	3	3

List of Experiments

Week	Title/Experiment
1	Introduction to Business English - Functional English.
2	Fundamentals of Grammar - Sentence Structure - Parts of Speech - Articles - Prepositions - Subject - Verb Agreement, Question Tags, Speeches, Voices, Tenses etc.
3	Synonyms and Antonyms. Homonyms and Homophones, Word Formation, Idioms and Phrases, Analogy, One-word Substitutes.
4	Spotting errors, Sentence Corrections using Grammar concept knowledge.
5	Verbal logics - Para jumbles.
6	Paragraph writing, Picture description, Text Completion, Essay writing.
7	Verbal Reasoning - Reading Comprehensions, Cloze passages etc.
8	Critical Reasoning: Statements - Arguments, Assumptions, Conclusions, Assertions & Reasons.
9	**Importance of soft skills in personal and professional spheres:** Introduction to Soft Skills**,** Self awareness and Self esteem, Discipline, Integrity, Attitude, Change and Adaptability.
10	**People Skills:** Relationships - Personal & Professional Relationships - Rapport Building - Personal Space; Definition of Motivation - Motivation - Self-motivation; Time Management - Stephen Covey's time management.
11	**Teamwork:** Definition of Team, Team Dynamics - Specialization and Teamwork - Rewards of Teamwork.
12	**Leadership:** Definition of Leadership, Leading a Team, Leadership Qualities - Leader vs Manager - Leadership Styles.
13	**Problem Solving and Decision Making:** Definitions - Problem Solving and Decision Making - Hurdles in Decision Making - Case studies.
14	**Preparation for Interviews:** Body Language - Posture - Dressing and Grooming - Researching the Industry and the Organization- Types of Interviews - First Impressions - Dos and Don'ts of an Interview.

Activities

1. Regular practice tests.
2. Quiz, crossword, word-search and related activities.
3. Picture description including description of photos/images/posters/advertisement analysis etc.
4. Five-minute presentations about concepts learnt
5. JAM and picture narration.
6. Mock interviews.

References

1. Business Communication Skills Lab Manual, FED, CMRIT, Hyd.

SOCIAL INNOVATION LAB

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-BSC-205	-	-	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 to PSO2
CO1	illustrate social innovation	3
CO2	identify the problems	3
CO3	choose suitable design processes	3
CO4	develop a prototype using suitable platform	3
CO5	prepare a report using project management techniques and ethics	3

List of Experiments

Week	Title/Experiment
1	**Introduction to Engineering and Social Innovation**
Introduction to engineering, difference between science, engineering and technology. History of social innovation, core definitions, core elements and common features of social innovation, a topology of social innovations, fields for social innovation.	
2	**Stages and Process of social innovation**
Different sectors for social innovation and stages of social innovation. Prompts - identifying needs, Proposals - generating ideas, Prototyping - testing the idea in practice, Sustaining-developing a business model.	
3	**Social and economic change**
The shape of the economy to come, understanding social change-individuals, movements and organizations.	
4	**Analysis and Prototyping**
Basic components and applications, data acquisition, examples for prototyping.	
5	**Design and Platform based development**
Engineering design process, multidisciplinary facet of design. Introduction to PCB design. Introduction to various platform based development programming and its essentials.	
6 - 8	**Choose any one of the following or other platform for implementation**
Arduino: Introduction to sensors, transducers and actuators and its interfacing with Arduino.	
Mobile App Development using android: Installation of android studio, setup of AVD, layouts, UI components, working with Firebase, simple authentication App.	
Mobile App Development using MIT App inventor: Create an account in MIT App inventor, working with UI components and blocks, App development using MIT App inventor, authentication using firebase, AI using MIT App inventor.	
Multi-platform Application: Installation of flutter, create widgets, layers and simple authentication app using flutter.	
Web Application: Install virtual environment for FLASK, create web app using FLASK with routing.	
9	**Project Management and Ethical Dilemmas**
Significance of team work, importance of communication in engineering profession. Identify and apply moral theories and codes of conduct for resolution of ethical dilemmas.	
10	**Case Studies**
Report writing and documentation, presentation of the case studies with a focus on impact and vision on society.	
References	
1. Social Innovation Lab Manual, Department of FED, CMRIT, Hyd.	

GENDER SENSITIZATION LAB
(MANDATORY COURSE- NON- CREDIT)

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-MC-201	-	-	2	-

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

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

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.		
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.		
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.		
Part-B: Fact and Fiction. Unrecognized and Unaccounted work. Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming.		
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".		
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.		
Textbooks:		
1. Towards a world of equals, A bilingual textbook on gender, Telugu Akademi, Hyderabad.		
Note: Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments. Apart from the above prescribed book, Teachers can make use of any authentic materials related to the topics given in the syllabus on "Gender".		

B.TECH.-IV-SEMESTER SYLLABUS

PULSE & DIGITAL CIRCUITS

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-EC-PC-221	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, 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	20-EC-PC-222	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO12	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.		

DIGITAL DESIGN AND COMPUTER ORGANIZATION

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-EC-PC-223	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	interpret number systems and codes	3	2	2	3
CO2	solve boolean expressions and analyze combinational circuits	3	3	3	3
CO3	design the sequential circuits	3	3	3	3
CO4	illustrate various micro operations	3	2	2	3
CO5	explain basics of various types of memories	3	2	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	9
Digital Systems, Binary Numbers, Number base conversions, Octal, Hexadecimal and other base numbers, complements, signed binary numbers, Floating point number representation, binary codes, Error detection and correction, binary storage and registers, binary logic, Boolean algebra and logic gates, Basic theorems and properties of Boolean Algebra, Boolean functions, canonical and standard forms, Digital Logic Gates.		
II	**Boolean Expressions and Combinational Circuits**	10
Gate–Level Minimization, The K-Map Method, Three-Variable Map, Four-Variable Map, sum of products, product of sums simplification, Don't care conditions, NAND and NOR implementation and other two level implementations, Exclusive-OR function. Combinational Circuits: Adders, Subtractors, comparators, Multiplexers, Demultiplexers, Decoders, Encoders and Code converters.		
III	**Sequential circuits and Registers and Counters**	5+5=10
Part-A: Sequential circuits: Introduction: Basic Architectural Distinctions between Combinational and Sequential circuits, The Binary Cell, Latches, Flip Flops: SR, JK, Race Around Condition in JK, JK Master Slave, D and T Type Flip Flops, Excitation Table of all Flip Flops, Design of a Clocked Flip-Flop, Timing and Triggering Consideration, Clock Skew, Conversion from one type of Flip-Flop to another.		
Part-B: Registers and Counters: Shift Registers, Data Transmission in Shift Registers, Operation of Shift Registers, Shift Register Configuration, Bidirectional Shift Registers, Applications of Shift Registers, Design and Operation of Ring and Twisted Ring Counter, Operation Of Asynchronous And Synchronous Counters.		
IV	**Register Transfer and Microoperations**	10
Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit.		
V	**Processor Organization**	9
Introduction to CPU, Register Transfers, Execution of Instructions, Multiple Bus Organization, Hardwired Control, Micro-programmed Control Memory Organization: Concept of Memory, RAM, ROM memories, memory hierarchy, cache memories, virtual memory, secondary storage, memory management requirements.		
Textbooks:		
1. Digital Design, M. Morris Mano, M.D.Ciletti, 5th Edition, Pearson. 2. Computer System Architecture, M. Morris Mano, 3rd Edition, Pearson.		
References:		
1. Switching and Finite Automata Theory, Z. Kohavi, Tata McGraw Hill. 2. Fundamentals of Logic Design, C. H. Roth, L. L. Kinney, 7th edition, Cengage Learning.		

ELECTROMAGNETIC WAVES & TRANSMISSION LINES

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-EC-PC-224	3	-	-	3

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

COs	Upon completion of course the students will be able to	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, Losslessness/Low Loss Characterization, Distortion - Condition for Distortionlessness and Minimum Attenuation, Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. UHF Lines as Circuit Elements; λ/4, λ/2, λ/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, Aisan 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.		

CONTROL SYSTEMS

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-EC-PC-225	3	-	-	3

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

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

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	10
Concepts of Control Systems: Basics of control systems, classifications and their differences with examples. Transfer function, modeling of electric systems, translational and rotational mechanical systems, block diagram reduction technique, signal flow graph, feedback characteristics-effects of feedback. ***Task:*** *Write a program to find the TF of the system when blocks are connected in series & parallel.*		
II	**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.*		
III	**Stability Analysis**	5+5=10
Part-A: 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.*		
Part-B: Root Locus Technique: The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci. **Frequency Response Analysis:** Introduction, Frequency domain specifications-Bode Diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain Margin-Stability Analysis from Bode Plots. ***Task:*** *Write a program for complete root locus system with open loop transfer function.*		
IV	**Stability Analysis in Frequency Domain**	9
Polar Plots, Nyquist Plots and applications of Nyquist criterion to find the stability - Effects of adding poles and zeros to G(s)H(s) on the shape of the Nyquist diagrams. Classical Control Design Techniques: Compensation techniques – Lag, Lead, and Lead Lag Controllers design in frequency Domain. ***Task:*** *Write a program to draw Polar plot for a given transfer function.*		
V	**State Space Analysis of Continuous Systems**	10
Concepts of state, state variables and state model, derivation of state models from block diagrams, Concepts of observability and controllability, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and its Properties. ***Task:*** *Write a program to find the state transition matrix of a given matrix.*		
Textbooks:		
1. Control Systems Engineering - I.J.Nagrath and M.Gopal, New Age International 5th Edn, 2009. 2. Automatic Control Systems - John Wiley and sons, 8th Edition, 2003.		
References:		
1. Control Systems- N. K. Sinha, New Age International (P) Limited Publishers, 3rd Edn, 1998. 2. Linear Control Systems- B.S Manke, Khanna Publications, 2nd Edition, 2019.		

PULSE & DIGITAL CIRCUITS LAB

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-EC-PC-226	-	-	3	1.5

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

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	design linear and non linear wave shaping circuits	3	3	3
CO2	analyze multivibrators and its applications	3	3	3
CO3	create oscillations and sweep signals using UJT and Boot strap circuits	3	3	3
CO4	illustrate the switching characteristics of transistor	3	3	3
CO5	demonstrate the operation of logic gates and sampling gates	3	3	3

List of Experiments

(Minimum 12 experiments to be conducted)

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

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

LINEAR & DIGITAL IC APPLICATIONS LAB

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-EC-PC-227	-	-	3	1.5

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

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	construct circuits for various applications using Op-Amp IC741	3	3	3
CO2	design various applications with specific ICs	3	3	3
CO3	model various sequential and combinational circuits using digital ICs	3	3	3
CO4	design and analyze synchronous and asynchronous counters using digital ICs	3	3	3
CO5	implement the sequential circuits	3	3	3

List of Experiments

(Minimum 12 experiments to be conducted)

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 must submit a report on one of the following Micro–Projects before commencement of second internal examination.	
1. Electronic fuse using op-amp 741. 2. Dark activated relay circuit using IC 741. 3. DIY Digital Thermometer using IC 741. 4. Shadow sensor Alarm using IC 741. 5. Temperature controlled DC fan using IC 741. 6. Break failure indicator using IC 555. 7. Panic Alarm circuit using IC 741 and IC 555. 8. Rain alarm circuit using IC 555 timer. 9. High power car voltage regulator using IC 741 and voltage regulators. 10. Digital Fan speed regulator using digital IC'S and voltage regulators.	

DIGITAL DESIGN LAB THROUGH VERILOG

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-EC-PC-228	-	-	3	1.5

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

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	examine basic logic gates	3	3	3
CO2	implement boolean functions using universal gates	3	3	3
CO3	construct various combinational logic circuits	3	3	3
CO4	analyze the operation of flip-flops	3	3	3
CO5	design registers and counters using flip-flops	3	3	3

List of Experiments

(Minimum of 12 experiments to be performed)

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.
17	Design of MOD-5 and MOD-8 counters.

References

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

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

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

APTITUDE AND CRITICAL THINKING SKILLS LAB

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-BSC-204	-	-	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	PO9	PO10
CO1	build proficiency in quantitative reasoning	3	3
CO2	improve critical thinking skills	3	3
CO3	enhance analytical skills	3	3
CO4	demonstrate quantitative aptitude concepts	3	3
CO5	adapt principles of quantitative aptitude to achieve qualitative results	3	3

List of Experiments

Week	Title/Experiment
1	Basic concepts, combined mean, average principles, wrong values taken, number added or deleted, average speed.
2	**Percentages** - Basic Concepts, conversions, finding percentages from given numbers, quantity increases or decreases by given percentage, population increase by given percentage, comparisons, consumption when a commodity price increase or decrease and applications.
3	**Data Interpretation -** Introduction to Data Interpretation, quantitative and qualitative data, Tabular Data, Line Graphs, Bar Chart, Pie Charts, X-Y Charts. **Gamification** - Deductive Logical Thinking.
4	Number Series, Letter Series, Series completion and correction, Coding and Decoding. Word analogy-Applied analogy, Classifications, verbal classification. **Gamification** - Inductive Logical Thinking.
5	**Reasoning Logical Diagrams -** Simple diagrammatic relationship, Multi diagrammatic relationship, Venn-diagrams, Analytical reasoning. **Gamification** - Grid Motion, Motion Challenge, Colour The Grid. **Reasoning Ability -** Blood Relations, Seating arrangements, Directions, Decision making.
6	**Number Systems:** Basic Concepts, Number Systems: Natural numbers, whole numbers, integers, fractions, Rational Numbers, Irrational Numbers, Real Numbers, Divisibility Rules, Logic Equations, Remainder theorem, Unit digit calculation. **Gamification** – Switch Challenge **Progressions & Inequalities:** Basic Concepts, Types: arithmetic, geometric, harmonic progression and applications.
7	**Profit and Loss:** Basic Concepts, discounts, marked price and list price, dishonest shopkeeper with manipulated weights, successive discounts etc. **Interest (Simple and Compound):** Basic Concepts, Yearly, Half-yearly, and quarterly calculations, multiples, differences between simple and compound interest. **Gamification** – Digit Challenge.
8	**Ratio and Proportion:** Basic Concepts of ratio and proportion, continued or equal proportions, mean proportions, invest proportion, alternative proportion, division proportion, compound proportion, duplication of ratio, finding values, coins and currencies, etc. **Gamification** – The Same Rule.
9	**Speed, Time and Distance:** Basic Concepts, Single train problems, two train problems: some point same side, some point opposite sides, relative speed, different points meeting at common points, different points same side (different timings vs. same timings), ratios, number of stoppages, average speed, etc.
10	**Time and Work:** Basic Concepts, comparative work, mixed work, alternative work, middle leave and middle join, ratio efficiency.
11	**Permutations and combinations:** Basic Concepts, differences between permutations and combinations, always together-never together, alternative arrangement, fixed positions,
12	

	double fixations, items drawing from a single group, items drawing from a multiple group, total ways of arrangement with repetitions and without repetitions, dictionary, handshakes or line joining between two points or number of matches , sides and diagonals, etc.
13	**Clocks and Calendars:** Basic Concepts, Angle between minute hand and hour hand, reflex angle, hours hand angle, time gap between minute hand and hour hand, relative time: coincide, opposite sides and right angle, mirror images, faulty clock (slow/fast), miscellaneous, calendar. **Gamification** - Overall Revision.
14	**Geometry and Mensuration:** Basic concepts, types of angles. **Plane figures:** rectangles, squares, triangles, quadrilateral, areas, perimeters, etc. **Solid figures:** cubes, cuboids, cylinders-area (total surface area and lateral surface area), volumes, perimeters. **Others:** Parallelogram, Rhombus, Trapezium, Circle, Sector, Segment, Cone, Sphere, Hemisphere, etc.
References	
1. Aptitude and critical thinking skills Lab Manual, FED, CMRIT, Hyd.	

INDIAN CULTURE AND CONSTITUTION
MANDATORY COURSE (NON-CREDIT)

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-MC-202	3	-	-	-

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

COs	Upon completion of course the students will be able to	PO8	PO12
CO1	identify paradigm shift in indian culture	3	3
CO2	explain features of languages, religions and holy books	3	3
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	3

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.		
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 – Prevedic, Vedic religion, Buddhism and Jainism.		
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.		
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.		
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.		
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.		
Reference:		
1. A Hand Book on Indian Culture and Constitution, FED, CMRIT, Hyderabad.		

B.TECH.-V-SEMESTER SYLLABUS

ANALOG AND DIGITAL COMMUNICATION

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-EC-PC-311	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	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	20-EC-PC-312	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO12	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.		

DIGITAL SIGNAL PROCESSING

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-EC-PC-313	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO6	PO12	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, 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.		

MICROPROCESSORS & MICROCONTROLLERS

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-EC-PC-314	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO7	PO12	PSO1
CO1	illustrate the internal architecture and organization of 8086	3	3	2	2	3
CO2	analyze 8086 ALPs and interfacing devices	3	3	2	2	3
CO3	explain the architecture of 8051 microcontroller	3	3	2	3	3
CO4	interface memory, I/O and advanced peripherals with 8051	3	3	2	3	3
CO5	adapt the architecture and instruction set of ARM processor	3	3	2	3	3

Syllabus

Unit	Title/Topics	Hours
I	**8086 Architecture**	9
Fundamentals of 8-bit and 16-bit microprocessor, 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Signal descriptions of 8086, - Minimum mode and maximum mode of operation, memory interfacing to 8086 (static RAM and EPROM). Interrupts of 8086.		
II	**ALP of 8086 and Programmable Interfacing Devices**	10
Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch, Call and String Manipulations Instructions. **Programmable Interfacing Devices:** 8255 PPI-various modes of operation and interfacing to 8086. Interfacing key board and display controller- 8279, stepper motor and D/A & A/D converter, Interrupt structure of 8086, Vector interrupt table. Interrupt service routines. 8259 PIC architecture.		
III	**Introduction to Microcontrollers and 8051 Real Time Control**	5+5=10
Part-A: Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051,comparison of microprocessor and microcontroller.		
Part-B: 8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters.		
IV	**I/O and Memory Interface and Serial Communication and Bus Interface**	9
I/O and Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051. **Serial Communication and Bus Interface:** Serial Communication Standards, Serial Data Transfer Scheme, UART; External Communication Interfaces-RS232, USB.		
V	**ARM Architecture**	10
ARM Processor fundamentals, ARM Architecture - Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set - Data processing, Branch, load and store instructions; Software interrupt instructions, Program status register instructions, loading constants, Conditional execution.		
Textbooks:		
1. Advanced Microprocessors and Peripherals - A. K. Ray and K.M. Bhurchandani, 2nd Edition, TMH. 2. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Edition.		
References:		
1. Microprocessors and Interfacing, D. V. Hall, TMGH, 2nd Edition 2006. 2. ARM System Developers guide, Andrew N Sloss, Dominic Symes, Chris Wright, Elsevier, 2012		

DATA COMMUNICATION & COMPUTER NETWORKS
(Professional Elective – I)

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-EC-PE-311	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.		

INFORMATION THEORY & CODING
(Professional Elective –I)

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-EC-PE-312	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO3	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		

DIGITAL MARKETING
(Professional Elective – I)

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-EC-PE-313	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO8	PO12
CO1	outline the importance of digital marketing	2	1	2	3	3	3
CO2	use search engine optimization to achieve business goals	3	2	3	3	3	3
CO3	adapt social media for business promotion	3	3	3	3	3	3
CO4	identify link building techniques for content consideration	3	2	3	3	3	3
CO5	apply digital marketing techniques in real time applications	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	9
Introduction: digital marketing, Digital vs. Real Marketing, Digital Marketing Channels, Creating initial digital marketing plan, Content management, SWOT analysis, Target group analysis, Web design, Optimization of Web sites. ***Task:*** *Create the Digital Webpage using CMS.*		
II	**Search Engine Optimization (SEO)**	11
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:*** *Configure a website on Google webmaster tools to check website optimization performance.*		
III	**Social media in business**	4+5=9
Part-A: Wikipedia, Facebook, Instagram, LinkedIn, Google – advertising, analytics, ads visibility, bulk emailing essentials, integration of social media buttons into business website. ***Task:*** *Create Networking admin panel and assess the performance.*		
Part-B: campaign budgeting, cost control, resource planning, strengthen your brand, Generate leads, Get more visibility online, Connect with your audience, link exchange, registering with directories, data visualization. ***Task:*** *Campaign and sponsor networking pages.*		
IV	**Link building and content consideration**	10
Precursors to link building, elements of link building, finding your competition, analyzing your competition, competitor tracking, becoming a resource, content duplication, content verticals, sitemaps. ***Task:*** *Optimizing SEO using content management.*		
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.		
References:		
1. SEO: Search Engine Optimization Bible Jerri L. Ledford; Wiley India; 2nd Edition.		

ANALOG AND DIGITAL COMMUNICATION LAB

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-EC-PC-315	-	-	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	PSO2
CO1	test analog modulation and demodulation techniques	3	3	3
CO2	demonstrate time and frequency division multiplexing	3	3	3
CO3	design the pulse modulation and demodulation techniques	3	3	3
CO4	compare PCM , DPCM and DM	3	3	3
CO5	classify digital modulation and demodulation waveforms	3	3	3

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

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

DIGITAL SIGNAL PROCESSING LAB

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-EC-PC-316	-	-	2	1

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

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	classify various types of signals and perform linear operations on the signals	3	3	3
CO2	compute linear and circular convolution	3	3	3
CO3	analyze the principles of DIT FFT and DIF FFT algorithms	3	3	3
CO4	design digital IIR and FIR filter using various techniques	3	3	3
CO5	apply Multirate concepts in sampling rate conversion applications	3	3	3

List of Experiments

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

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

MICROPROCESSORS & MICROCONTROLLERS LAB

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-EC-PC-317	-	-	3	1.5

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

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	interpret programs for various problems using 8086 microprocessor	3	3	3
CO2	develop interfacing between 8086 microprocessor and various peripherals	3	3	3
CO3	compile programs on Microcontroller based systems	3	3	3
CO4	interface 8051 ports with various peripherals	3	3	3
CO5	design Microprocessor and Microcontroller based systems	3	3	3

List of Experiments

(Minimum 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 must submit a report on one of the following Micro–Projects before commencement of second internal examination.

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

SCRIPTING LANGUAGES LAB

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-ESC-311	-	-	3	1.5

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO5
CO1	distinguish various scripting languages	3	3	3	3
CO2	develop programs using shell script	3	3	3	3
CO3	create applications using PHP	3	3	3	3
CO4	build applications using perl	3	3	3	3
CO5	construct programs using python	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 accepts a file name, starting and ending line numbers as arguments and display all the lines between the given line numbers.
	2. Write a shell script that deletes all lines containing a specified word in one or more files supplied as arguments to it.
	3. Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or directory and reports accordingly. Whenever the argument is a file, the number of lines on it is also reported.
	4. Write a shell script that accepts a file names as its arguments, counts and reports the occurrence of each word that is present in the file argument file in other argument files.
II	**Personal Home Page (PHP)**
	1. Write a PHP script to print prime numbers between 1 - 50.
	2. PHP script to a) Find the length of a string b) Count no of words in a string. c) Reverse a string. d) Search for a specific string.
	3. Write a PHP script to merge two arrays and sort them as numbers, in descending order.
	4. Write a PHP script that reads data from one file and write into another file.
	5. Write a PHP script to validate user login page (i.e. user name and password).
III	**Practical Extraction Reporting Language (PERL)**
	1. a) Write a Perl script to find the largest number among three numbers. b) Write a Perl script to print the multiplication tables from 1-10 using subroutines.
	2. Write a Perl program to implement the following list of manipulating functions a) Shift b) Unshift c) Push
	3. Write a Perl script to substitute a word, with another word in a string.
	4. Write a Perl script to validate IP address and email address.
	5. Write a Perl script to print the file in reverse order using command line arguments
IV	**Python**
	1. Write a python program to solve a quadratic equation.
	2. a) Write a python program to find the factorial of a number. b) Write a python program to generate Fibonacci series.
	3. Write a python program to make a simple calculator.
	4. Write a python program to sort words in alphabetical order.
	5. Write a python program to add two matrices.
References	
1. Scripting Languages Lab Manual, Department of ECE, CMRIT, Hyd.	

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

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

SUMMER INTERNSHIP

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-EC-PR-311	-	-	-	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 PSO2
CO1	utilize the domain knowledge with modern tools to solve real world problems	3
CO2	analyze the industrial processes that results in the end product / service	3
CO3	extend global needs for professional ethics, responsibility and communication	3
CO4	function well as an individual, member or leader in diverse teams	3
CO5	make use of engineering knowledge for societal sustenance	3

Guidelines

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

CODING SKILLS
MANDATORY COURSE (NON-CREDIT)

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-MC-301	1	-	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	PO2	PO3	PO4	PO5	PO12
CO1	solve real world problems using C & DS	3	3	3	3	3
CO2	solve real world problems using DBMS	3	3	3	3	3
CO3	solve real world problems using Python	3	3	3	3	3
CO4	solve real world problems using Java, HTML, JavaScript	3	3	3	3	3
CO5	solve real world problems using any one emerging technology	3	3	3	3	3

List of Experiments

Week	Title/Experiment
	PART-A (Mandatory)
1	**C&DS:** Loops statements, control structures, functions, arrays, structures and unions.
2	**C&DS:** Pointers, strings, linked lists, stacks and queues.
3	**C&DS:** Sorting, searching algorithms, trees and graphs.
4	**DBMS:** Database creation, normalization, transactions and triggers.
5	**Python:** OOP concepts, control statements, list, tuple, set and dictionary.
6	**Python:** Exception handling and regular expressions.
7	**Java:** OOP concepts.
8	**Java:** String manipulations, exception handling.
9	**HTML & JavaScript:** Tags, table, lists, XHTML, HTML5, form validation using JS.
10	**Node.JS:** Simple Programs using promise and async.
	ReactJS: Features, Environment setup and installation, components, Strings, State, Props and Validation, handling RestAPI's.
	PART-B (Either DevOps/.Net/Rust/Julia or any emerging technologies)
11	**DevOps:** Introduction, architecture, life cycle, DevOps Vs agile.
	.Net: Introduction to ASP.Net, control, architecture, framework.
	Rust: Introduction, environment setup, data types, variables, constant.
	Julia: Introduction, initialization and installation, OOPs, object reference, variables.
12	**DevOps:** Workflows, version control - GIT.
	.Net: Introduction to C#, OOPs concepts, exception handling.
	Rust: Strings, operators, decision making, loops.
	Julia: Introduction to REPL, tab completion, seeking help from Julia.
13	**DevOps:** Continuous integration & deployment - Jenkins. Build tool - Maven.
	.Net: Introduction to VB.Net, multi-threading. Introduction to ADO.Net.
	Rust: Function, tuple, array.
	Julia: Data types, type assignment.
14	**DevOps:** Containers and virtual development - Docker and Vagrant. Configuration management tools - Ansible, Puppet, Chef.
	.Net: Introduction to AJAX, routing, publishing and engine creation.
	Rust: Ownership, borrowing, slices, structure, enum, module, error handling.
	Julia: Representation of different number types, mathematical functions.
Reference	
1. Coding Skills Manual, Department of CSE, CMRIT, Hyd.	

B.TECH.-VI-SEMESTER SYLLABUS

IOT WITH CLOUD COMPUTING

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-EC-PC-321	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO3	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	20-EC-PC-322	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO7	PO12	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: Ids-Vds 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) - Adhoc testing, Scan design, Built in self-test (BIST).		
Textbooks:		
1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Dougles A. Pucknell, PHI, 2005. 2. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E Weste, David Harris, Ayan Banerjee, 3rd Edn, Pearson, 2009.		
References:		
1. CMOS logic circuit Design - John. P. Uyemura, Springer, 2007. 2. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.		

ARTIFICIAL INTELLIGENCE

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-EC-PC-323	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO6	PO12	PSO1
CO1	explain the concepts of artificial intelligence	3	3	3	3	2	3
CO2	illustrate various search algorithms	3	3	3	3	2	3
CO3	adapt various probabilistic reasoning approaches	3	3	2	3	3	3
CO4	elaborate Markov decision process	3	3	2	3	2	3
CO5	perceive various reinforcement learning approaches	3	3	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	8
Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree.		
II	**Search Algorithms**	10
Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.		
III	**Probabilistic Reasoning**	6+4=10
Part-A: Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference.		
Part-B: Temporal Model, Hidden Markov Model.		
IV	**Markov Decision Process**	10
MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.		
V	**Reinforcement Learning**	10
Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning.		
Textbooks:		
1. Elaine Rich & Kevin Knight, 'Artificial Intelligence', 3rd Edition, TMH, 2008. 2. Russel and Norvig, 'Artificial Intelligence', Pearson Education, PHI, 2003.		
References:		
1. Trivedi, M.C., "A Classical Approach to Artifical Intelligence", Khanna Publishing House, Delhi. 2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011. 3. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010.		

CELLULAR AND MOBILE COMMUNICATIONS
(Professional Elective – II)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-EC-PE-321	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO3	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.		

EMBEDDED SYSTEMS
(Professional Elective – II)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-EC-PC-322	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO7	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 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, 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. ***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, Servo Motor, DAC, 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
Embedded Programming Concepts: Software programming in assembly language and high level language, data types, structures, modifiers, loops and pointers, macros and functions, object oriented programming. **Programming Embedded Systems:** Reading switches introduction, basic techniques for reading from port pins, example: reading and writing bytes, adding structure to your code introduction, object-oriented programming concepts. ***Task:*** *Write a program for loop and function concept using java programming.*		
V	**Real -Time Operating Systems**	9
OS services, process and memory management, basic design using an RTOS, task scheduling models, interrupt latency, response of task as performance metrics. Types of RTOS: RT Linux, Micro C/OS-II, Vx works, Embedded Linux, tiny OS, and basic concepts of android OS. ***Task:*** *Write a program to develop an application by using real time operating system.*		
Textbooks:		
1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill. 2. Embedded Systems - Raj Kamal, TMH. 3. An Embedded Software Primer, David Simon, Addison Wesley, 2000		
References:		
1. An Embedded software premier-. David Simon, Pearson education, 2007 2. Embedded C by Michael J. Pont, A Pearson.		

DATA MINING AND DATA ANALYTICS
(Professional Elective –II)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-EC-PE-323	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12	PSO1
CO1	summarize fundamentals of data mining	3	2	2	2	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:*** *Write a program to perform data preprocessing.*		
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, Generating Association Rules from Frequent Itemsets, Improving the Efficiency of Apriori, From Association Analysis to Correlation Analysis. ***Task:*** *Write a program to implement 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 to implement Decision Tree Induction algorithm.*		
Part-B: Clustering: Cluster Analysis, Partitioning Methods: k-Means and k-Medoids, Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering. ***Task:*** *Write a program to implement k-Means clustering algorithm.*		
IV	**Data Definitions and Analysis Techniques**	9
Data Definitions and Analysis Techniques: Introduction to statistical learning and R-Programming, Elements, Variables, and Data categorization, Levels of Measurement, Data management and indexing. ***Task:*** *Write a program to implement Data categorization.*		
V	**Basic Analysis Techniques**	9
Basic Analysis Techniques: Statistical hypothesis generation and testing, Chi-Square test, t-Test, Analysis of variance, Maximum likelihood test, regression, Practice and analysis with R. ***Task:*** *Write a program to implement Chi-Square test.*		
Textbooks:		
1. Data Mining- Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006. 2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education. 3. An Introduction to Statistical Learning: with Applications in R, G James, D. Witten, T Hastie, and R. Tibshirani, Springer, 2013.		
References:		
1. Data mining Techniques and Applications, Hongbo Du Cengage India Publishing 2. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press. 3. Software for Data Analysis: Programming with R (Statistics and Computing), John M. Chambers, Springer.		

DISASTER MANAGEMENT
(Open Elective - I)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-OEC-321	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO7	PO8	PO12
CO1	analyze impact of disasters	3	2	3	3
CO2	choose suitable disaster management mechanism	3	3	3	3
CO3	make use of appropriate measures for capacity building to reduce risks	2	2	3	2
CO4	develop strategies to cope up with disasters	3	3	3	3
CO5	build disaster management plan	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Understanding Disaster, Hazards and Vulnerabilities**	10
Understanding Disaster: Concept of Disaster - Different approaches - Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional). **Hazards and Vulnerabilities:** Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment - Dimensions of vulnerability factors; Vulnerability and disaster risk. ***Task:*** *Identify various types of hazards in your area.*		
II	**Disaster Management Mechanism**	9
Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief. ***Task:*** *Prepare a hypothetical risk mitigation plan.*		
III	**Capacity Building**	5+5=10
Part-A: Concept - Structural and Nonstructural Measures Capacity Assessment. ***Task:*** *Prepare a capacity assessment of the disaster risk management system in your state.*		
Part-B: Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels. ***Task:*** *Prepare a case study on initiatives of NDRF and Legislative Support.*		
IV	**Coping with Disaster**	9
Coping Strategies; alternative adjustment processes – Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management. ***Task:*** *Prepare a case study on role of mass media in coping up with disaster.*		
V	**Planning for disaster management**	10
Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India Organizational structure for disaster management in India - Preparation of state and district, Disaster management plans. ***Task:*** *Prepare a case study on proactive and reactive disaster management plans.*		
Textbooks:		
1. Manual on Disaster Management, National Disaster Management, Agency Govt of India. 2. Disaster Management by Mrinalini Pandey Wiley 2014. 3. Disaster Science and Management by T. Bhattacharya, TMH, 2015		
References:		
1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BSP 2009. 2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)		

ROBOTICS
(Open Elective-I)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-OEC-322	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO5	PO12
CO1	illustrate principles and functioning of the robot	3	2	2	2
CO2	perform kinematic analysis for end-effector positioning	3	3	3	2
CO3	integrate sensors for robot	3	3	3	2
CO4	design control laws for a robot	3	3	2	2
CO5	develop robot programming for various applications	3	3	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Robotics**	10
Types and components of a robot, Classification of robots, classification with respect to geometrical configuration (anatomy), closed-loop and open- loop control systems. Social issues and safety. ***Task:*** *Study components and anatomy of a real robot system.*		
II	**Robot Kinematics**	9
Kinematics systems, Definition of mechanisms and manipulators, Kinematic Modeling: Translation and Rotation Representation, Coordinate transformation, Homogeneous Coordinate representation, DH parameters. ***Task:*** *Forward kinematics and validate using sodhana software.*		
III	**Sensors and Vision System**	5+5=10
Part-A: Sensors and Vision System: Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc. ***Task:*** *Positioning and orientation of robot arm.*		
Part-B: Introduction to Cameras, Camera calibration, Geometry of Image formation, Euclidean / Similarity / Affine / Projective transformations Vision applications in robotics. ***Task:*** *Image Processing using open CV.*		
IV	**Robot Control**	10
Basics of control: Transfer functions, Control laws: P, PD, PID. ***Task:*** *Control experiment using Robot arm for pick and place.*		
V	**Control Hardware and Interfacing**	9
Embedded systems: Architecture and integration with sensors, actuators, components, Programming for Robot Applications. ***Task:*** *Study the architecture of Robot via FLD.*		

Textbooks:

1. Niku Saeed B., "Introduction to Robotics: Analysis, Systems, Applications", PHI, New Delhi.
2. Mittal R.K. and Nagrath I.J., "Robotics and Control", Tata McGraw Hill.

References:

1. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, 2014.
2. Ghosal, A., "Robotics", Oxford, New Delhi, 2006.

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION
(Open Elective-I)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-OEC-323	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	apply the fundamental concepts of measuring instruments	3	2	2
CO2	distinguish signal generators and signal analyzers	3	3	2
CO3	make use of oscilloscopes	3	2	2
CO4	identify various transducers	3	3	2
CO5	develop bridges for various measuring parameters	3	2	2

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.		

JAVA PROGRAMMING
(Open Elective-I)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-OEC-324	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO5	PO12
CO1	write simple java programs using OOP concepts	3	2	2	3	2
CO2	develop programs using inheritance and polymorphism	3	2	3	3	2
CO3	create packages and interfaces	3	2	3	3	2
CO4	build efficient code using multithreading and exception handling	3	2	3	3	2
CO5	design real-time applications using applets	3	2	3	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Java Basics**	10
History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, OOP concepts, concepts of classes, objects, constructors, methods, this keyword, parameter passing, recursion. ***Task:*** *Write a Java program that creates a user interface to perform integer divisions.*		
II	**Inheritance and Polymorphism**	9
Types of inheritance, member access rules, super uses, using final with inheritance, the object class and its methods, method overloading and overriding, dynamic binding, abstract classes and methods. ***Task:*** *Write a Java program to implement overloading and overriding.*		
III	**Packages, Inner classes and Interfaces**	5+5=10
Part-A: Packages and Inner classes: Defining, creating and accessing a package, CLASSPATH, importing packages, inner classes – local, anonymous and static. ***Task:*** *Write a Java program to demonstrate the package.*		
Part-B: Interfaces: Defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces, differences between classes and interfaces. ***Task:*** *Write a Java program to implement interfaces.*		
IV	**Exception handling and Multithreading**	9
Exception handling: Concepts of exception handling, benefits of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. **Multithreading:** Differences between multi-threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication. ***Task:*** *Write a Java program that implements a multi-thread application that has three threads.*		
V	**Applets**	10
Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets. ***Task:*** *Develop an applet in Java that displays a simple message.*		
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.		

IOT WITH CLOUD COMPUTING LAB

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-EC-PC-324	-	-	3	1.5

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

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	identify various IoT devices	3	3	3
CO2	use IoT devices in various applications	3	3	3
CO3	develop automation work-flow in IoT enabled cloud environment	3	3	3
CO4	take part in practicing and monitoring remotely	3	3	3
CO5	make use of various IoT protocols in cloud	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 smart phone 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 cloud using Arduino and Raspberry Pi.
9	Write a program to create TCP server on cloud using Arduino and respond with humidity data to TCP client when requested.
10	Write a program to create UDP server on cloud using Arduino and respond with humidity data to UDP client when requested.

References

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

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

1. Air Pollution Meter.
2. Smart Garbage Collector.
3. 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	20-EC-PC-325	-	-	3	1.5

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

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	test logic gates	3	3	3
CO2	design combinational circuits	3	3	3
CO3	develop sequential circuits	3	3	3
CO4	analyze finite state machines	3	3	3
CO5	construct CMOS circuit schematics and their layouts	3	3	3

List of Experiments

(Any **six** experiments from each part are to be conducted)

Design and implementation of the following CMOS digital/analog circuits using **Cadence / Mentor Graphics / Synopsys / Equivalent** CAD tools:

E-CAD programs

Programming can be done using any complier. Down load the programs on FPGA/CPLD boards and performance testing may be done using pattern generator (32 channels) and logic analyzer apart from verification by simulation with any of the front end tools.

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

1. Design and Implementation of a Barrel Shifter.
2. Design of FIFO memory using Verilog.
3. Design of 7T SRAM cell.
4. Design 16 bit RISC processor.
5. Design Car parking system using Verilog.
6. Design a Ripple carry Adder.
7. Design a ring counter using Verilog.
8. Design a Alarm clock on FPGA using Verilog.
9. Design a multiplier using Carry look Ahead Adder
10. Design a 5 to 32 Decoder using Verilog.

ARTIFICIAL INTELLIGENCE LAB

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-EC-PC-326	-	-	2	1

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

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	illustrate various search techniques	3	3	3
CO2	solve real-time problems using graph theory	3	3	3
CO3	develop various games using AI techniques	3	3	3
CO4	adapt Bayesian probability model	3	3	3
CO5	design programs based on Markov decision process	3	3	3

List of Experiments

Week	Title/Experiment
1	Write a program to implement BFS Traversal.
2	Write a program to implement DFS Traversal.
3	Write a program to implement A* Search.
4	Write a program to implement Travelling Salesman Problem.
5	Write a program to implement Graph Coloring Problem.
6	Write a program to implement Missionaries and Cannibals Problem.
7	Write a program to implement Water Jug Problem.
8	Write a program to implement Hangman game.
9	Write a program to implement Tic-Tac-Toe game.
10	Write a program to implement 8 Queens Problem
11	Write a program to implement Bayesian Network.
12	Write a program to implement Hidden Markov Model.

References

1. Artificial Intelligence Lab Manual, Department of ECE, CMRIT, Hyd.

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

1. Intelligent vehicles using Artificial Intelligence.
2. Smart ICU Predictive detection of deterioration of seriously ill patients using Artificial Intelligence.
3. Artificial Intelligence Innovation.
4. Prevention against Cyber security Threats using Artificial Intelligence.
5. Efficient, Scalable Processing of Patient Data using Artificial Intelligence.
6. Smart Bike Share Programs using Artificial Intelligence.
7. Automatic Document Classification using Bayesian theorem.
8. Automated Geophysical Feature Detection using Artificial Intelligence.
9. Artificial Intelligence for Records Management.
10. Artificial Intelligence in e-Commerce.

ADVANCED ENGLISH COMMUNICATION SKILLS LAB

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-HSMC-301	1	-	2	2

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

COs	Upon completion of course the students will be able to	PO5	PO10
CO1	assess and utilize vocabulary in an effective way	3	3
CO2	interpret interpersonal relationships	3	3
CO3	elaborate academic reading and writing skills	3	3
CO4	formulate appropriate communication techniques in various contexts	3	3
CO5	adapt to different work-place and socio-cultural scenarios	3	3

List of Experiments

Week	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 - Inforgraphics - 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

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

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

1. Role Play / Debate
2. Office Communication
3. Presentation Skills
4. Public Speaking
5. Interview Skills
6. Telephone Skills
7. Article Writing
8. Workplace etiquette
9. Video Resume / resume writing
10. Group Discussion

HUMAN VALUES AND PROFESSIONAL ETHICS
MANDATORY COURSE (NON-CREDIT)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-MC-302	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	PO6	PO7	PO8	PO12
CO1	identify values and ethics and its relation to individual excellence	3	3	3	2
CO2	outline the ten commandments and try to apply in professional career	2	2	3	2
CO3	illustrate modern percepts of ethics, CSR and Corporate Governance	3	3	3	2
CO4	analyze the purpose of professional code of ethics and whistle blowing	3	3	3	2
CO5	practice student professional/technical societies/associations activities	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Human Values**	7
Concept of Human Values - Ethics & types – Morality – Beliefs - Professional and Engineering Ethics -Ethics in Corporate Sector - Bearing of Human Values on Ethics, Morals, integrity, Equity, Caring, Sharing, Honesty, Cooperation, Commitment, Empathy, Modesty, Self-Confidence, Self-Reliance, Character, and Spirituality - Role of Yoga and meditation towards human excellence.		
II	**Concept of Virtues, Character, and Fundamental Rights**	6
List & Theories of Virtues-Values & Virtues - Moral Unity and Integrity - Honesty - Eight Ways of Misusing the Truth - Civic Virtues - Courage - Generosity in Character - Fundamental Rights.		
III	**Senses of Responsibility and Engineering Ethics**	3+3=9
Part-A: Concept of Responsibility: Spirituality, Religion, Super naturality, and Faith - The Golden Rule in Religious Ethics. Corporate Governance and Corporate Social Responsibility.		
Part-B: Concept of Engineering Ethics: Ethics in Hindu Mythology - Dharma - Development of Modern Precepts of Ethics.		
IV	**Codes of Conduct**	6
Purpose of Professional Ethical Codes and Limitations -Internal Conflicts - Professional Societies and Codes of Ethics - Corporate Codes of Ethics- Moral Issues - International Moral Code - Confidentiality – Whistle blowing, the Seven Social Sins.		
V	**Role of Professional/Technical Society/Association**	7
Attributes of a Profession - Professional Engineer & Respective Professional Associations & Technical Societies (ISTE, FIE, CSI, ACT, IETE, IEEE, SAE, ACE, Etc.) - Characteristics of a Professional. Student Professional/Technical Society Activity through institutional student chapter.		
Textbooks:		
1. D R Kiran, Professional Ethics and Human Values, MGH Publishers,		
References:		
1. R.S. Naagaraazan, Human Values & Professional Ethics, NAIP 2. Subramanian R., Professional ethics, Oxford University press		

B.TECH.-VII-SEMESTER SYLLABUS

BUSINESS ECONOMICS

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-HSMC-411	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO11	PO12
CO1	outline the concepts of business management & economics	3	2
CO2	identify demand function to predict sales using linear regression	3	2
CO3	adapt production, price, market and cost analysis functions	3	2
CO4	estimate enterprise requirements under risky economic environment	2	3
CO5	assess the operational and financial performance of an enterprise	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Fundamentals of Business Management & Economics and Demand Analysis**	10
Concept of Management, Functions, Scope and Levels of management, Concept of Business/Managerial Economics, nature, characteristics and Scope, Law of Consumption, Demand and Supply. ***Task:*** *Derive a function for Law of Consumption, demand and supply using MS-Excel.*		
II	**Demand Analysis**	10
Factors influencing Demand and Types of Demand, Types of Demand Elasticity, Methods of Demand Forecasting. ***Task:*** *Fit a trend line for sales using MS-Excel.*		
III	**Production, Price, Markets & Cost Analysis**	4+4=8
Part A: Production Analysis: Types of Production functions, Economies of Scale, Pricing objectives & methods. ***Task:*** *Derive production function using MS-Excel.*		
Part-B: Cost Analysis: Price - Output decisions under perfect and monopoly competitions, Types Costs, CVP Analysis, Computation of BEP and its applications. ***Task:*** *Find BEP for a desired profit using MS-Excel.*		
IV	**Investment Analysis & Indian Economic Environment**	10
Types of Capital Requirements, factors influencing working capital, Techniques of Capital Budgeting, Comments on Union Budgets and Flow of Credit, Steps in IPOs & trading of shares. ***Task:*** *Determine IRR for a capital budgeting project using standard notations through MS-Excel.*		
V	**Financial Statement Analysis and Type of Undertakings**	10
Types, Uses and Limitations of various ratios, Features of Sole-Trader, Partnership, Joint Stock Companies and PSUs. ***Task:*** *Forecast overall performance for a decade with ratios using MS-Excel.*		
References:		
1. Managerial Economics& Financial Analysis A.R. Aryasri. Tata McGraw Hill. 2. Financial Institutions and Markets, LM Bhole, Kindle Edition. 3. Managerial Economics, RL Varshney & KL Maheshwari, Sultan Chand & Sons. 4. Industrial Engineering and Management, O. P. Khanna, Dhanpat Rai & Sons.		

MICROWAVE ENGINEERING

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-EC-PC-411	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	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	20-EC-PE-411	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO5	PO12	PSO1
CO1	explain image fundamentals and transforms	3	3	2	3
CO2	utilize image enhancement and color image processing techniques	3	3	2	3
CO3	make use of image restoration techniques and wavelets	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–neighborhood, 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 and Color Image Processing**	10
	Image Enhancements and Filtering: Gray level transformations, histogram equalization and Specifications; pixel-domain smoothing filters – linear and order-statistics; pixel-domain sharpening filters – first and second derivative; frequency domain filters – low-pass and high-pass. **Color Image Processing**: Color models–RGB, YUV, HSI; Color transformations– formulation, Color complements, color slicing, tone and color corrections; Color image smoothing and Sharpening; Color Segmentation. ***Task:*** *Write a program to describe image enhancement and color image processing.*	
III	**Image Restoration, Wavelets and Multi-resolution image processing**	5+5=10
	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: Wavelets and Multi-resolution image processing: Uncertainty principles of Fourier Transform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution Analysis, wavelets and Sub band filter banks, wavelet packets. ***Task:*** *Write a program to describe wavelet transforms.*	
IV	**Image Segmentation and Morphological Image Processing**	10
	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–inter-pixel and psycho-visual; Lossless compression –predictive, entropy; Lossy compression- predictive and transform coding; Still image compression standards – JPEG and JPEG-2000. ***Task:*** *Write a program to illustrate image compression techniques.*	
Textbooks:		
1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, 3rd Edn., 2008, Pearson Education.		
References:		
1. Anil Kumar Jain, Fundamentals of Digital Image Processing, 2nd edition 2004, PHI.		

IOT ARCHITECTURE AND PROTOCOLS
Professional Elective – III)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-EC-PC-413	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12	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.		

MACHINE LEARNING AND DATA SCIENCE
(Professional Elective - III)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-EC-PC-415	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO6	PO12
CO1	demonstrate the required mathematical foundations for ML& DS	3	3	3	3
CO2	outline the functionalities of machine learning	3	3	3	3
CO3	illustrate learning algorithms & data science basics	3	3	2	2
CO4	build data science applications using Python based toolkits	3	3	3	3
CO5	use recommender systems in real time applications	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Mathematical Foundations**	10
Linear Algebra: Vectors, Matrices, Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Correlation and Causation, Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem, Hypothesis and Inference: Statistical Hypothesis Testing, Confidence Intervals, Phacking, Bayesian Inference. ***Task:*** *Write a program to implement Bayes Theorem.*		
II	**Machine Learning**	10
Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning, Introduction to Bayes Theorem, Linear Regression- model assumptions, regularization (lasso, ridge, elastic net), Classification and Regression algorithms- Naïve Bayes, k-Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest, Classification Errors. ***Task:*** *Write a program to implement k-Nearest Neighbors.*		
III	**Advanced Machine Learning and Introduction to Data Science**	4+5=9
Part-A: Advanced Machine Learning: Find-S: finding a maximally specific hypothesis, Analysis of Time Series- Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks - Learning and Generalization, Overview of Deep Learning. ***Task:*** *Write a program to implement Find-S algorithm.*		
Part-B: Introduction to Data Science: Concept of Data Science, Traits of Big data, Web Scraping, Analysis vs reporting, Data Science in business. ***Task:*** *Perform a case study on Analysis vs reporting*		
IV	**Programming Tools for Data Science**	11
Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK, Visualizing Data: Bar Charts, Line Charts, Scatterplots, Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction. ***Task:*** *Write a program to visualize data on various plots using any dataset.*		
V	**Recommender Systems**	8
Recommender Systems: Introduction, Content-Based Filtering, Collaborative Filtering, Hybrid Recommenders. ***Task:*** *Perform a case study on Recommender Systems.*		

Textbooks:

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media(unit-1)
2. Jeeva Jose, "Machine Learning", Khanna Publishing House, Delhi. (unit-2&3)
3. Chopra Rajiv, "Machine Learning", Khanna Publishing House, Delhi. (unit2&4)
4. Introduction to data science by Igual, Laura & Seguí, Santi, Springer. (unit-5)

RADAR AND SATELLITE COMMUNICATION SYSTEMS
(Professional Elective – IV)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-EC-PE-412	3	-	-	3

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

COs	Upon completion of course the students will be able to	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, 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, 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 , 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",* 2/e, 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	20-EC-PE-414	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	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.		

AUGMENTED AND VIRTUAL REALITY
(Professional Elective - II)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-CS-PE-323	3	-	-	3

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

COs	Upon completion of course the students will be able to	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 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.		

GREEN BUILDING TECHNOLOGIES
(Open Elective-II)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-OEC-411	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO7	PO12
CO1	explain the fundamentals of energy use and processes in building	3	2	2	2
CO2	identify indoor environmental requirement and its management	3	3	3	2
CO3	assess the impact of solar radiation on buildings	3	3	3	2
CO4	evaluate end-use energy utilization and requirements	3	3	2	2
CO5	adapt audit procedures for energy management	3	3	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	10
Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications. ***Task:*** *Analyze the characteristics of energy use and its management of dwellings.*		
II	**Indoor environmental requirement and management**	9
Thermal comfort - Ventilation and air quality - Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement. ***Task:*** *Perform a case study on ventilation illumination and air quality in a building.*		
III	**Climate, solar radiation and their influences**	5+5=10
Part A: Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation. ***Task:*** *Conduct a case study on climate changes.*		
Part B: Temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings. ***Task:*** *Conduct a case study on solar radiation.*		
IV	**End-use, energy utilization and requirements**	10
Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building - Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope. ***Task:*** *Perform a case study on energy utilization in a building.*		
V	**Energy management options**	9
Energy audit and energy targeting - Technological options for energy management. ***Task:*** *Perform a case study on energy management.*		
Textbooks:		
1. Michael Bauer, Peter Mosle and Michael Schwarz, Green Building, Guidebook for Sustainable Architecture, Springer, Heidelberg, Germany. 2. Norbert Lechner, Heating, Cooling, Lighting - Sustainable Design Methods for Architects‖, Wiley, New York.		
References:		
1. James Kachadorian, The Passive Solar House: Using Solar Design to Heat and Cool Your Home‖, Chelsea Green Publishing Co., USA.		

DRONES
(Open Elective-II)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-OEC-412	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO5	PO7	PO12
CO1	explain concepts of creative industries	3	3	3	3	3	3
CO2	outline the needs of creative industries	3	3	3	3	3	3
CO3	illustrate deployment and deadly abilities of drones	3	3	3	3	3	3
CO4	adapt price based data routing in dynamic IoT	3	3	3	3	3	3
CO5	make use of security in UAV/Drone communications	3	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	9
The creative industries: Concepts, Measurement, economic impact of the creative industries: Scenarios and theoretical models - Scenarios, Theoretical models, Measuring the economic impact of the creative industries - Direct impact of the creative industries. ***Task:*** *Implementation methods for photography in creative industries.*		
II	**Creative Industries' Needs: A Latent Demand**	8
Introduction, creative industries and film, emerging technologies - creative industries, importance of emerging technologies for creative industries, challenges. ***Task:*** *Comply on VR, AR and Drones together for Creative industries.*		
III	**Deployment and Deadly Abilities**	7+7=14
Part-A: The Deployment of Drones: The private invasion, The media invasion, The agricultural invasion, The commercial invasion, The medical invasion, The transportation invasion, The communication invasion, The controlled invasion. ***Task:*** *Develop design thinking method for drone application in agriculture fields.*		
Part-B: The Deadly Abilities of Drones: Drones in the police force, Drones in the military force, Drones in the animal world, Drones in the insect world. ***Task:*** *Recognize Do's and Don'ts of drone flying*		
IV	**Price Based Data Routing in Dynamic IoT**	8
Introduction, Background, IoT system model – IoT model, IoT node – Residual energy and power model, Load and buffer space, Delay, Trust, Pricing model, Communication model, Adaptive routing approach, Use case and theoretical analysis. ***Task:*** *Design an IoT model for any Drone application.*		
V	**Security in UAV/Drone Communications**	9
Introduction - PLS for UAV Systems - UAV as a mobile relay (UAV Relay), UAV as a mobile transmitter BS (UAV-BS), UAV as mobile jammer (UAV-Jammer), UAV as a flying UE (UAV-UE), One UAV as a cooperative jammer and another as a transmitter, Additional common attacks in UAV Systems - Attacker classification, Attack-type classification. ***Task:*** *Jamming of UAV remote control systems using software defined radio.*		
Textbooks:		
1. Virginia Santamarina-Campos et.al., "Drones and the Creative Industry Innovative Strategies for European SMEs", Springer, 2018 2. Fadi Al-Turjman, "Drones in IoT-enabled Spaces", CRC Press, 2019 3. Billy Crone, "Drones, Artificial Intelligence, & the Coming Human Annihilation", Get A Life Ministries, 2018.		
References:		
1. Ryan Nagelhout, "The Modern Nerd's Guide to Drone Racing", Gareth Stevens, 2018.		

5G TECHNOLOGIES
(Open Elective-II)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-OEC-413	3	-	-	3

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

COs	Upon completion of course the students will be able to	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.		

DATABASE MANAGEMENT SYSTEMS
(Open Elective-II)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-OEC-414	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO5	PO12
CO1	design databases using E-R model	3	3	3	3	2
CO2	construct database using relational model	3	3	3	3	2
CO3	formulate SQL queries to interact with database	3	3	3	3	2
CO4	make use of transaction control commands	3	3	3	3	2
CO5	apply normalization on database to eliminate redundancy	3	3	3	3	2

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Database Systems and Database Design**	11
Introduction to Database Systems: Introduction and applications of DBMS, Purpose of data base, History of database, Database architecture - Abstraction Levels, Data Independence, Database Languages, Database users and DBA. **Introduction to Database Design:** Database Design Process, Data Models, ER Diagrams - Entities, Attributes, Relationships, Constraints, keys, Generalization, Specialization, Aggregation, Conceptual design with the E-R model for large Enterprise. ***Task:*** *Conceptual Designing using ER Diagrams.*		
II	**Relational Model**	9
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. ***Task:*** *Converting ER Model to Relational Model.*		
III	**SQL Basics and Functions**	4+4=8
Part-A: SQL Basics: DDL, DML, DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, in operator. ***Task:*** *Creation of Tables using SQL commands.*		
Part-B: Functions: Aggregate functions, Built-in functions - numeric, date, string functions, set operations. ***Task:*** *Practice Queries using Aggregate Operators.*		
IV	**Sub-queries and Transaction control commands**	10
Sub-queries: Introduction, correlated sub-queries, use of group by, having, order by, join and its types, Exist, Any, All, view and its types. **Transaction control commands:** ACID properties, concurrency control, Commit, Rollback, save point, cursors, stored procedures, Triggers. ***Task:*** *Practicing Sub queries and Joins.*		
V	**Normalization**	10
Introduction, Normal forms - 1NF, 2NF, 3NF, BCNF, 4NF and 5NF, concept of De-normalization and practical problems based on these forms. ***Task:*** *Implement normalization with an example.*		
Textbooks:		
1. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, TMH. 2. Abraham Silberschatz, Henry F.Korth, S.Sudarshan, Database System Concepts, 6th Edition, TMH.		

MICROWAVE ENGINEERING LAB

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-EC-PC-412	-	-	2	1

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

COs	Upon completion of course the students will be able to	PO4	PO5	PSO2
CO1	interpret the characteristics of microwave devices	3	3	3
CO2	determine scattering parameters of various microwave components	3	3	3
CO3	analyze various parameters of waveguide components	3	3	3
CO4	measure VSWR and antenna pattern	3	3	3
CO5	design a microwave communication link using microwave bench	3	3	3

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

1. Electronic tuning range of a Reflex Klystron
2. Directivity of a Directional Coupler
3. Transmission Coefficient of Various loads
4. Reflection Coefficient of a Matched Termination
5. Return loss of a SS Tuner
6. VSWR of a Horn antenna
7. Electronic tuning sensitivity of a Reflex klystron
8. Attenuation of a fixed attenuator
9. Properties of an E and H Plane TEE
10. Properties of a MAGIC TEE

INDUSTRY ORIENTED MINI-PROJECT

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-EC-PR-411	-	-	-	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 problem statement, assess the scope and develop a prototype	3
CO2	execute the project using modern tools and prepare the report	3
CO3	demonstrate leadership, management skills for project development with ethics	3
CO4	function effectively as individual / member / leader in project teams	3
CO5	make use of engineering knowledge for societal sustenance	3

Guidelines

S. No.	Title
The objective of the industry oriented mini-project work is to imbibe students with technical, analytical and innovative ideas to facilitate with theoretical and practical learning pertaining to relevant domain of interest. An individual or a peer of 2-5 students work under the guidance / mentorship of a departmental faculty and industry expert with the aim of addressing solution to real world / societal problems using various R&D/industrial techniques. The team work fosters the communication and leadership skills among peers to survive and exercise during their career.	
1	Survey and study of published literature on the approved / assigned topic.
2	Conduct preliminary Analysis / Modeling / Simulation / Experiment / Design / Feasibility / ethnographical study.
3	Prepare an abstract/synopsis on the opted topic and submit to the Guide/Supervisor for approval.
4	Prepare an Action Plan for conducting the investigation, including team work.
5	Apply suitable methodology for Designing / Modeling / Simulation / Experimentation.
6	Develop an end product/process along with conclusions, recommendations and future scope.
7	Prepare and submit the final dissertation in the prescribed format to the Department.
8	Present and execute the industry oriented mini-project before External Committee for viva-voce.

B.TECH.-VIII-SEMESTER SYLLABUS

5G COMMUNICATION TECHNOLOGIES
(Professional Elective –V)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-EC-PE-421	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	20-EC-PE-423	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.		

NEURAL NETWORKS AND DEEP LEARNING
(Professional Elective - V)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-EC-PE-425	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 and Learning process	3	3	2	3	3	3
CO2	analyze the single-layer and multi-layer perceptrons	3	3	3	3	3	3
CO3	interpret the deep feed forward networks along with regularization	3	3	3	3	3	3
CO4	demonstrate the 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.		

WIRELESS COMMUNICATIONS
(Professional Elective – VI)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-EC-PC-422	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 Adhoc 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	20-EC-PE-424	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.		

INFORMATION AND CYBER SECURITY
(Professional Elective – VI)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-EC-PE-426	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	identify various cyber offences	3	3	3	3	3	3
CO3	apply cryptography for security networks	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**	12
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, Reverse engineering, Cracking techniques, and financial frauds. ***Task:*** *Perform a case study on financial frauds.*		
II	**Cyber Offences**	6
Introduction, how criminals plan the attacks, social engineering, cyber stalking, cyber cafe and cybercrimes, Botnets: The fuel for cybercrime, attack vector, cloud security. ***Task:*** *Perform a case study on cloud security.*		
III	**Cryptography and Cryptanalysis**	6+6=12
Part-A: Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types of Firewalls, User Management, 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. ***Task:*** *Perform a case study Security at Network Layer.*		
Part-B: Open Source/ Free/ Trial Tools: Implementation of Cryptographic techniques, OpenSSL, Hash Values Calculations MD5, SHA1, SHA256, SHA 512, Steganography (Stools) ***Task:*** *Perform a case study on the efficiency of OpenSSL.*		
IV	**Cyber Security Audit & Standards**	9
Risk assessment and management, asset classification, crisis management plan, resources recovery strategy, security testing, international standards, analysis and logging, security certification. ***Task:*** *Perform cyber security audit for any organization.*		
V	**Security Policy & IT ACT**	9
Security policies, WWW policies, email security policies, policy review process- corporate policies, sample security policies, publishing and notification requirement of the policies. Information Security Standards-ISO, cyber laws in India; IT Act 2000 provisions, Intellectual Property Law: Copy right law, software license, semiconductor law and patent law. ***Task:*** *Write a security policy for any organization.*		
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.		
References:		
1. Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analyzing Computer Security", Pearson. 2. Schou, Shoemaker, "Information Assurance for the Enterprise", TMH. 3. Chander, Harish," Cyber Laws And It Protection " , PHI, New Delhi, India.		

INTELLECTUAL PROPERTY RIGHTS
(Open Elective-III)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-OEC-421	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO1	PO6	PO8	PO12
CO1	outline basics of intellectual property law	3	3	3	3
CO2	identify the various trademarks	3	3	3	3
CO3	analyze patent and copy rights law	3	3	3	3
CO4	differentiate trade secret and unfair practice	3	2	3	2
CO5	summarize new developments in Intellectual Property Rights	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Intellectual property**	10
Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights. ***Task:*** *Draw a flow chart for filing IPR.*		
II	**Trade Marks**	9
Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes. ***Task:*** *Perform a case study on grant of trade mark.*		
III	**Law of copy rights and patents**	5+4=9
Part-A: Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues. ***Task:*** *Draw a flow chart for a copy right.*		
Part-B: Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer. ***Task:*** *Draw a flow chart for filing a patent.*		
IV	**Trade Secrets and Unfair competition**	10
Trade Secrets: Trade secretes law; determination of trade secretes status and litigation. **Unfair competition:** Misappropriation right of publicity, false advertising. ***Task:*** *Perform a case study on geographical indications.*		
V	**New development of intellectual property**	10
Recent Trends in copy right law, patent law, intellectual property audits at national and international level. ***Task:*** *Perform a case study intellectual property audits.*		
Textbooks:		
1. Intellectual property right, Deborah, E. Bouchoux, Cengage Learning. 2. Intellectual property right - Unleashing the knowledge economy, Prabuddha Ganguli, TMH.		

PRINCIPLES OF ENTREPRENEURSHIP
(Open Elective – III)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-OEC-422	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO7	PO8	PO9	PO11	PO12
CO1	illustrate concept & types of entrepreneurship	3	3	2	3	2
CO2	distinguish individual and corporate entrepreneurship	3	3	3	3	2
CO3	identify the process of launching new ventures	3	3	3	3	3
CO4	assess legal challenges of entrepreneurship	3	3	3	3	3
CO5	build entrepreneurial strategies	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Entrepreneurship**	10
The revolution impact of entrepreneurship- The evolution of entrepreneurship - Approaches to entrepreneurship - Process approach - Twenty first centaury trends in entrepreneurship. ***Task:*** *Perform a case study on a successful women entrepreneur.*		
II	**Individual and corporate entrepreneurship**	9
The entrepreneurial journey - Stress and the entrepreneur- the entrepreneurial ego- Entrepreneurial motivations - Corporate Entrepreneurial Mindset the nature of corporate entrepreneur. ***Task:*** *Prepare a report on Mindset of the corporate entrepreneur.*		
III	**Launching Entrepreneurial Ventures**	5+5=10
Part-A: Opportunities identification - entrepreneurial Imagination and Creativity - the nature of the creativity Process - Innovation and Entrepreneurship - Methods to initiate Ventures. ***Task:*** *Prepare a report on initiation of a venture.*		
Part-B: Creating New Ventures - Acquiring an established entrepreneurial venture – Franchising - hybrid disadvantage of Franchising. ***Task:*** *Develop a startup plan.*		
IV	**Legal challenges of Entrepreneurship**	9
Intellectual Property Protection-Patents, Copyrights, Trademarks and Trade Secrets-Avoiding Pitfalls- Formulation of the entrepreneurial Plan- The challenges of new venture start-ups. ***Task:*** *Prepare a report on statutory compliances for IPR protection.*		
V	**Strategic perspectives in entrepreneurship**	10
Strategic Planning-Strategic actions-strategic positioning-Business stabilization-Building the adaptive firms-understanding the growth stage-unique managerial concern of growing ventures. ***Task:*** *Prepare a strategic plan for positioning and stabilization of an enterprise.*		
References:		
1. Arya Kumar "Entrepreneurship- creating and leading an entrepreneurial org" Pearson 2012. 2. 'Entrepreneurship: New Venture Creation' David H Holt PHI, 2013. 3. Entrepreneurship: Text and Cases P. Narayana Reddy, Cengage, 2010.		

PRECISION AGRICULTURE
(Open Elective – III)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-OEC-423	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	PSO2
CO1	explain the concepts of precision agriculture	3	3	3	3	3	3
CO2	outline the components of precision agriculture	3	3	3	3	3	3
CO3	illustrate about tools technologies and sampling	3	3	3	3	3	3
CO4	adapt recent advances in precision agriculture	3	3	3	3	3	3
CO5	make use of feasibility and evaluation of precision farming	3	3	3	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 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.		

WEB TECHNOLOGIES
(Open Elective – III)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-OEC-424	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO12
CO1	design web pages using HTML and JavaScript	3	3	3	3	3
CO2	develop web applications using PHP	3	3	3	2	3
CO3	make use of XML and DTD for web design	3	3	3	2	2
CO4	build web applications using servlets and session tracking	3	3	3	2	2
CO5	establish database connectivity using JSP and JDBC	3	3	3	2	2

Syllabus

Unit	Title/Topics	Hours
I	**Web, HTML and Java Script**	10
Web: Introduction, Internet and web, web browsers, web servers, protocols. **HTML:** Basics, elements, attributes, tags- list, tables, images, forms, frames, cascading style sheets. **Java Script**: Introduction to scripting, control structures, conditional statements, arrays, functions, objects. ***Task:*** *Develop static pages (using Only HTML) of an online Book store.*		
II	**PHP**	10
Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, Reading data from web form controls, handling file uploads, connecting to database, executing simple queries. ***Task:*** *A web application that takes name and age from an HTML page using PHP.*		
III	**XML, Parsing and Introduction to DTD**	4+4=8
Part-A: XML: Basics of XML, Elements, Attributes, Name space, **Parsing:** DOM and SAX Parsers. ***Task:*** *Create XML document to display student details.*		
Part-B: Introduction to DTD: internal and external DTD, Elements of DTD, DTD Limitations, XML Schema, Schema structure, XHTML. ***Task:*** *Write a program to demonstrate DTD.*		
IV	**Servlets and Session Tracking**	10
Servlets: Introduction, Lifecycle, Generic and HTTP servlet, passing parameters to servlet, HTTP servlet Request & Response interfaces, Deploying web Applications, **Session Tracking:** Hidden form fields, cookies, URL- Rewriting, session. ***Task:*** *Write a servlet program with an example.*		
V	**JSP and JDBC**	10
JSP: Introduction, Difference Between servlets & JSP, Anatomy of JSP page, JSP elements: Directives, comments, Expressions, scriptlets, Declaration, Implicit JSP objects using Action elements. **JDBC:** Introduction, JDBC Drivers, Loading Driver, establishing connection, Executing SQL statement in JSP pages, MVC architecture. ***Task:*** *Write a JSP program for user validation.*		
Textbooks:		
1. Web Technologies, Uttam K Roy, Oxford University Press. 2. The Complete Reference PHP- Steven Hozner, TMH.		
References:		
1. Java Server Pages-Hans Bergsten, SPD O'Reilly. 2. JavaScript, D. Flanagan O'Reilly, SPD.		

MAJOR PROJECT

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-EC-PR-421	-	-	20	10

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 problem statement, assess the scope and develop a prototype	3
CO2	execute the project using modern tools and prepare the report	3
CO3	demonstrate leadership, management skills for project development with ethics	3
CO4	function effectively as individual / member / leader in project teams	3
CO5	make use of engineering knowledge for societal sustenance	3

Guidelines

S. No.	Title
The objective of the project work is to imbibe students with technical, analytical and innovative ideas to facilitate with theoretical and practical learning pertaining to relevant domain of interest. An individual or a peer of 2-5 students work under the guidance / mentorship of a departmental faculty with the aim of addressing solution to real world / societal problems using various R & D techniques. The team work fosters the communication and leadership skills among peers to survive and exercise during their career.	
1	Survey and study of published literature on the approved / assigned topic.
2	Conduct preliminary Analysis / Modeling / Simulation / Experiment / Design / Feasibility / ethnographical study.
3	Prepare an abstract/synopsis on the opted topic and present before Departmental Review Committee (DRC).
4	Prepare an Action Plan for conducting the investigation, including team work.
5	Apply suitable methodology for Designing / Modeling / Simulation / Experimentation as needed.
6	Develop an end product or process along with conclusions, recommendations and future scope.
7	Present and execute the project before DRC for CIE.
8	Prepare and publish a paper in Conference / Journal, if possible.
9	Prepare and submit the final dissertation in the prescribed format to the Department.
10	Present and execute the project before External Committee for viva-voce.