ACADEMIC REGULATIONS (R20)

COURSE STRUCTURE AND DETAILED SYLLABUS

(CHOICE BASED CREDIT SYSTEM (CBCS))

B.Tech.
Mechanical Engineering

(B.Tech. Regular: Applicable for the batches admitted from 2020 - 2021)

&

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

CMR GROUP OF INSTITUTIONS
EXPLORE TO INVENT

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

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

DEPARTMENT OF MECHANICAL ENGINEERING (ME)

Vision: To be a centre of excellence committed to provide quality education and research for nurturing technically competent and socially responsible mechanical engineering professionals

Mission: Provide state-of-art technical knowledge, research and consultancy in collaboration with industries and R&D organizations to meet the global and societal challenges in the field of mechanical engineering.

I. PROGRAMME EDUCATIONAL OBJECTIVES (PEO's)

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

PEO2: Graduate will be able to pursue higher education and research and/or become an entrepreneur / innovator to design and develop mechanical systems to address technical, business and global challenges.

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

II. PROGRAMME OUTCOMES (PO's)

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

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
13. **PSO1:** Apply Geometric modeling, Analysis and Simulation tools to design and develop mechanical engineering systems.
14. **PSO2:** Apply advanced techniques in manufacturing, thermal engineering and automobile engineering to solve industry and societal problems.

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. UNDER GRADUATE PROGRAMS OFFERED (E&T)

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

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. (ME) – 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-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-103	Problem Solving with C Programming	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-104	Problem Solving with C Programming Lab	4		-	-	3	1.5
8	20-ESC-108	IT & Engineering Workshop Practice	1,5,9,10		-	-	3	1.5
9	20-MC-101	NSS / Physical Education / Yoga	3,6,8,9,12		-	-	2	-
TOTAL					**12**	**01**	**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-107	Engineering Physics	1,2,12		3	1	-	4
3	20-HSMC-101	English for Engineers	10,12		2	-	-	2
4	20-ESC-105	Data Structures through C	1,2,3,12		3	-	-	3
5	20-ESC-107	Computer Aided Engineering Graphics	1,5,10		-	-	3	1.5
6	20-BSC-108	Engineering Physics Lab	4		-	-	3	1.5
7	20-HSMC-102	English Language and Communication Skills Lab	5,10		-	-	3	1.5
8	20-ESC-106	Data Structures through C Lab	4		-	-	3	1.5
9	20-MC-102	Environmental Science	1,6,7,12		2	-	-	-
TOTAL					**13**	**02**	**12**	**19**

III – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	20-ESC-203	Engineering Mechanics	1,2,12	1	3	-	-	3
2	20-ESC-204	Materials Engineering	1,2,12		3	-	-	3
3	20-ME-PC-211	Thermodynamics	1,2,12	2	3	-	-	3
4	20-ME-PC-212	Manufacturing Processes	1,2,12	2	3	-	-	3
5	20-ME-PC-213	Kinematics of Machinery	1,2,3,12		3	-	-	3
6	20-ESC-205	Materials Engineering Lab	3,4,5		-	-	3	1.5
7	20-ME-PC-214	Manufacturing Processes Lab	3,4,14	2	-	-	3	1.5
8	20-HSMC-201	Business Communication Skills Lab	9,10		-	-	3	1.5
9	20- BSC-205	Social Innovation Lab	1 to 14	1,2	-	-	3	1.5
10	20-MC-201	Gender Sensitization Lab	9,12		-	-	2	-
TOTAL					**15**	**-**	**14**	**21**

IV – Semester								
S. No.	Subject Code	Subject	POs	PSOs	Hours Per Week			Credits
					L	T	P	
1	20-BSC-202	Numerical and Statistical Methods	1,2,12		3	1	-	4
2	20-ME-PC-221	Solid Mechanics	1,2,3,12	1	3	-	-	3
3	20-ME-PC-222	Fluid Mechanics & Hydraulic Machinery	1,2,3,12	1	3	-	-	3
4	20-ME-PC-223	Dynamics of Machinery	1,2,3,12	1	3	-	-	3
5	20-ME-PC-224	Applied Thermodynamics – I	2,3,12	2	3	-	-	3
6	20-ME-PC-225	Solid Mechanics Lab	3,4	1	-	-	2	1
7	20-ME-PC-226	Fluid Mechanics & Hydraulic Machinery Lab	3,4	2	-	-	3	1.5
8	20-ME-PC-227	Kinematics & Dynamics Lab	3,4	1	-	-	2	1
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**	**01**	**10**	**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-ME-PC-311	Instrumentation & Control systems	1,2,12	1	3	-	-	3
2	20-ME-PC-312	Machine Tools & Metrology	1,2,3,12	2	3	-	-	3
3	20-ME-PC-313	Design of Machine Elements	2,3,8,12	1	3	-	-	3
4	20-ME-PC-314	Applied Thermodynamics – II	2,6,12	2	3	-	-	3
5	**Professional Elective – I**				3	-	-	3
	20-ME-PE-311	Automobile engineering	6,7,12	2				
	20-ME-PE-312	Industrial Engineering	1,2,8,11,12					
	20-ME-PE-313	Electric & Hybrid Vehicles	2,3,7,12	2				
6	20-ME-PC-315	Instrumentation & Control systems Lab	3,4,5		-	-	2	1
7	20-ME-PC-316	Mechanical Drawing Lab using CAD	4,5,6,10	1,2	-	-	2	1
8	20-ME-PC-317	Applied Thermodynamics Lab	3,4,7	2	-	-	3	1.5
9	20-ME-PC-318	Machine Tools & Metrology Lab	3,4,6	2	-	-	3	1.5
10	20-ME-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-ME-PC-321	Heat Transfer	1,2,3,12	2	3	-	-	3
2	20-ME-PC-322	CAD/CAM	2,3,12	1	3	-	-	3
3	20-ME-PC-323	Operations Research	1,2,3,12	2	3	-	-	3
4	**Professional Elective – II**				3	-	-	3
	20-ME-PE-321	Refrigeration and air conditioning	2,3,7,12	2				
	20-ME-PE-322	Unconventional machining processes	2,3,5,12	2				
	20-ME-PE-323	Finite Element Analysis	2,3,4,12	1				
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-ME-PC-324	Heat Transfer Lab	4,6,7	2	-	-	3	1.5
7	20-ME-PC-325	Computer Aided Engineering Lab	4,5,10	2	-	-	2	1
8	20-ME-PC-326	Computer Aided Manufacturing Lab	4,5,10	1,2	-	-	3	1.5
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-ME-PC-411	Artificial Intelligence and Robotics	1,2,12	1	3	-	-	3
3	**Professional Elective – III**				3	-	-	3
	20-ME-PE-411	Advanced IC Engines	2,6,7,12	2				
	20-ME-PE-413	Flexible manufacturing systems	2,3,12	2				
	20-ME-PE-415	Production Planning & Control	2,3,11,12	2				
4	**Professional Elective – IV**				3	-	-	3
	20-ME-PE-412	Renewable Energy Sources	2,6,7,12	2				
	20-ME-PE-414	Plant Layout & Material Handling	2,6,7,12	2				
	20-ME-PE-416	Design of Transmission Systems	2,3,4,12	2				
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-ME-PC-412	Artificial Intelligence and Robotics Lab	4,5	2	-	-	2	1
7	20-ME-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-ME-PE-421	Power Plant Engineering	2,3,6,12	2				
	20-ME-PE-423	Product Life Cycle Management	2,3,6,12	1,2				
	20-ME-PE-425	Tribology	2,3,6,12	1				
2	**Professional Elective – VI**				3	-	-	3
	20-ME-PE-422	Computational Fluid Dynamics	2,3,12	2				
	20-ME-PE-424	Optimization Techniques	2,3,12	2				
	20-ME-PE-426	Additive Manufacturing	2,3,12	1,2				
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-ME-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.		

ENGINEERING CHEMISTRY

Course	B.Tech.-I-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.-I-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 Ed, 2015. 2. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, PEI/PHI, 9th Ed, 2006. 3. Electrical Technology- vol-II B L Theraja, S. Chand publications.		
References:		
1. Introduction to Electronic Devices and Circuits-Rober T. Paynter, Pearson Education. 2. Network Theory by Sudhakar, Shyam Mohan Palli, TMH. 3. Electronic Devices and Circuits – 2nd Edition by Muhammad H.Rashid, Cengage Learning.		

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.		

ENGINEERING CHEMISTRY LAB

Course	B.Tech.-I-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.-I-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.

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.	

IT & ENGINEERING WORKSHOP PRACTICE

Course	B.Tech.-I-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.

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 PHYSICS

Course	B.Tech.-II-Sem.	L	T	P	C
Subject Code	20-BSC-107	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	illustrate the interference and diffraction phenomena of light	3	2	1
CO2	compare various crystal systems and characterization techniques	3	2	1
CO3	examine the mechanism of various lasers and holography	3	2	1
CO4	demonstrate the propagation of light in optical fiber	3	2	1
CO5	analyze the properties of nanomaterials	3	2	1

Syllabus

Unit	Title/Topics	Hours
I	**Interference & Diffraction**	9
Interference of light - Principle of Superposition, Interference of light, Conditions for sustained Interference, Young's double slit experiment, Interference in thin films (reflected geometry), Newton's Rings. Diffraction – Fresnel & Fraunhofer Diffraction, Fraunhofer Diffraction due to Single slit, Double slit (qualitative), Diffraction Grating – Grating spectrum.		
II	**Crystallography & X-Ray Diffraction**	9
Unit Cell, Space Lattice**,** Lattice Parameters, Crystal Systems, Bravais Lattices, Atomic Radius, Co-ordination Number and Packing Factor of SC, BCC, FCC, Miller Indices, Crystal Planes and Directions, Inter Planar Spacing of Orthogonal Crystal Systems. Bragg's Law, X-Ray diffraction methods: Laue Method, Powder Method.		
III	**Lasers**	5+5=10
Part - A: 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.		
Part - B: Semiconductor Diode Laser: Homo-junction and Hetero-junction laser, Applications of Lasers; Holography: recording and reconstruction of hologram.		
IV	**Fiber Optics**	9
Principle of Optical Fiber, Construction of Fiber, Acceptance Angle and Acceptance Cone, Numerical Aperture, Types of Optical Fibers: Step Index and Graded Index Fibers. Attenuation in Optical Fibers, Application of Optical Fiber in Communication Systems, Optical fiber endoscope, Optical fiber temperature sensor.		
V	**Nano - Science & Technology**	9
Introduction, surface to volume ratio, quantum confinement, density of states in 2-D, 1-D and 0-D (qualitatively), fabrication: bottom–up (Sol-Gel, Precipitation), Top-down (Ball milling, CVD). Characterization techniques of nanomaterials (XRD, SEM & TEM) and their applications.		
Textbooks:		
1. "A Text book of Engineering Physics" by M.N. Avadhanulu, P.G.Kshirsagar - S.Chand Publications, 2017. 2. "Engineering Physics" by R.K Gaur. and S.L Gupta., - Dhanpat Rai publishers, 2012.		
References:		
1. "Optics" by Ajoy Ghatak, 6th Edition McGraw Hill Education, 2017. 2. "Solid State Physics" by A. J. Dekker, Mc Millan Publishers, 2011.		

ENGLISH FOR ENGINEERS

Course	B.Tech.-II-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.		

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.		

COMPUTER AIDED ENGINEERING GRAPHICS

Course	B.Tech.-II-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.

ENGINEERING PHYSICS LAB

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

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

Course	B.Tech.-II-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

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.

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), 4thedn, New age International Publications		

B.TECH.-III-SEMESTER SYLLABUS

ENGINEERING MECHANICS

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-ESC-203	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	analyze the resultant of a system of forces using principles of mechanics	3	2	1
CO2	apply the conditions of static equilibrium to particles and rigid bodies	3	2	1
CO3	determine mechanical efficiency of simple lifting machines, centroid and centre of gravity of simple sections	3	2	1
CO4	compute the second moment of inertia of various laminas and bodies	3	2	1
CO5	solve the problems involving kinetics and virtual work of particles	3	2	1

SYLLABUS

Unit	Title/Topics	Hours
I	**Introduction to Engineering Mechanics**	10
Introduction to Engineering Mechanics – Basic Concepts, Force-types, characteristics- Principle of transmissibility. Classification of force system, Resultant of Coplanar Concurrent forces and concurrent force system in space. Lami's theorem, Triangle law of Forces-Polygon law of Forces-Parallelogram Law of Forces .Resolution and composition of Forces, Moment of Force and its Application – Varignon's theorem, Couples. Resultant of coplanar Parallel force system.		
II	**Equilibrium of Systems of Forces and Friction**	9
Equilibrium of Systems of Forces: Equilibrium of system of Forces: Free body diagrams, Equations of Equilibrium of coplanar concurrent, parallel force Systems and concurrent force system in space. **Friction:** Definitions-Types of Friction – Limiting Friction – laws of Static and Dynamic Frictions – Angle of friction- Angle of Repose- Cone of Friction-Equilibrium of rigid body on an Inclined plane Application of Friction – Ladder, Wedge and Screw friction.		
III	**Simple Lifting Machines and Center of Gravity**	5+4=9
Part A: Simple Lifting Machines: Basic definitions: effort, Load, mechanical advantage, velocity ratio, efficiency. Simple screw jack, Differential Screw jack.		
Part B: Center of Gravity: Centre of gravity of simple solids (from basic principles), centre of gravity of composite solids.		
IV	**Area and Mass Moment of Inertia**	10
Area Moment of Inertia: Definition –Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections. **Mass Moment of Inertia**: Mass Moment of Inertia of circular plate, cylinder, cone and sphere.		
V	**Kinetics of Rigid Bodies and Virtual Work**	10
Kinetics of Rigid Bodies: Types of motion, D'Alemberts principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; kinetic of rigid body rotation. **Virtual Work:** Virtual displacements, Principle of virtual work for particle and ideal system of rigid bodies.		
Textbooks:		
1. Singer's Engineering Mechanics Statics and Dynamics, K.Vijaya Kumar Reddy, et al, BSP. 2. Engineering Mechanics, Irving Shames, G. Krishna Mohan Rao, Prentice Hall.		
References:		
1. A Text of Engineering Mechanics, YVD Rao, K. Govinda Rajulu, M. Manzoor Hussain, Academic Publishing Company.		

MATERIALS ENGINEERING

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-ESC-204	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	explain the concepts of structure of metals and constitution of alloys	3	2	1
CO2	construct and interpret equilibrium phase diagrams	3	2	1
CO3	analyze the material properties of ferrous and non-ferrous alloys	3	2	1
CO4	apply various heat treatment methods to steels	3	2	1
CO5	outline the properties, applications of ceramic and composite materials	3	2	1

Syllabus

Unit	Title/Topics	Hours
I		9
Structure of Metals: Bonds in Solids - Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal/alloys - determination of grain size. Constitution of Alloys: Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.		
II		10
Equilibrium of Diagrams: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni, Al-Cu and Fe-Fe_3C.		
III		5+4=9
Part-A: Cast Irons and Steels: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, Alloy cast irons.		
Part-B: Classification of steels, structure and properties of plan carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.		
IV		10
Heat treatment of Alloys: Effect of alloying elements on Fe-Fe3C system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys. Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.		
V		10
Ceramic materials: Crystalline ceramics, glasses, cermets, abrasive materials, nonomaterials – definition, properties and applications of the above. **Composite materials:** Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal – matrix composites.		
Textbooks:		
1. Introduction to Physical Metallurgy, Sidney H. Avener. 2. Material science & Metallurgy, Kodgire		
References:		
1. Science of Engineering Materials, Agarwal 2. Elements of Material science, V. Rahghavan 3. Callister's Materials Science and Engineering adopted by R. Balasubramaniam.		

THERMODYNAMICS

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-ME-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	PO12	PSO2
CO1	explain various thermodynamic systems and processes	3	3	2	3
CO2	apply the basic laws of thermodynamics	3	3	2	3
CO3	evaluate the performance of energy conversion devices	3	3	2	3
CO4	find property values during process using mixture of gasses concepts	3	3	2	3
CO5	assess performance parameters of thermodynamic cycles	3	3	2	3

Syllabus

Unit	Title/Topics	Hours
I		10
Introduction: Basic Concepts: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle - Reversibility - Quasi - static Process, Irreversible Process, Causes of Irreversibility - Energy in State and in Transition, Types, Displacement & Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics - Concept of Temperature - Principles of Thermometry - Reference Points - Const. Volume gas Thermometer - Scales of Temperature, Ideal Gas Scale.		
II		9
PMM I - Joule's Experiments - First law of Thermodynamics - Corollaries - First law applied to a Process - applied to a flow system - Steady Flow Energy Equation. Limitations of the First Law - Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase - Energy Equation, Availability and Irreversibility.		
III		5+5=10
Part-A: Pure Substances, p-V-T-surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations - Triple point at critical state properties during change of phase, Dryness Fraction - Clausius - Clapeyron Equation Property tables. Mollier charts.		
Part B: Perfect Gas Laws - Equation of State, specific and Universal Gas constants - various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy - Throttling and Free Expansion Processes - Flow processes.		
IV		10
Deviations from perfect Gas Model - Vader Waals Equation of State - Compressibility charts - Mixtures of perfect Gases - Mole Fraction, Mass friction Gravimetric and volumetric Analysis - Dalton's Law of partial pressure, Avogadro's Laws of additive volumes - Mole fraction, Volume fraction and partial pressure, Equivalent Gas const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air - Psychrometric Properties - DBT, WBT, DPT, TWBT, Specific Humidity, RH, saturated Air, Vapour pressure, Degree of saturation - Adiabatic Saturation , Carrier's Equation - Psychrometric chart.		
V		9
Power Cycles : Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle - Description and representation on P-V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.		
Textbooks:		
1. Engineering Thermodynamics, P.K. Nag, TMH, 3rd Edition. 2. Thermodynamics, C.P.Arora. 3. Tables/Codes: Steam Tables and Mollier Chart		

MANUFACTURING PROCESSES

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-ME-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	PSO2
CO1	explain concepts of various casting techniques	3	3	2	3
CO2	differentiate various welded joints	3	3	2	3
CO3	distinguish the process details of soldering, brazing and welding	3	3	3	3
CO4	illustrate various techniques of metal working	3	3	2	3
CO5	distinguish various extrusion and forging techniques	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
Casting: Steps involved in making a casting – Advantage of casting and its applications; Patterns – Pattern making, Types, Materials used for patterns, pattern allowances and their construction; Properties of moulding sands. Methods of Melting – Crucible melting and cupola operation – Defects in castings; Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding; Principles of Gating – Requirements – Types of gates, Design of gating systems – Riser – Function, types of Riser and Riser design. Solidification of casting – Solidification of pure metal – Nucleation and grain growth, casting design considerations.		
II		9
Welding: Classification – Types of welds and welded joints; Gas welding – Types, oxy-fuel gas cutting – standard time and cost calculations. Arc welding, forge welding, submerged arc welding, Resistance welding, Thermit welding.		
III		5+5=10
Part A: Inert Gas Welding: TIG Welding, MIG welding, Friction welding, induction welding, explosive welding, Laser Welding.		
Part B: Soldering and Brazing; Heat affected zone in welding - Welding defects – causes and remedies; destructive and non- destructive testing of welds.		
IV		9
Hot and Cold Working: Strain hardening, recovery, recrystallisation and grain growth. Rolling fundamentals – theory of rolling, types of Rolling mills and products Forces in rolling and power requirements Stamping, forming and other cold working processes. Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning - Types of presses and press tools. Forces and power requirement in the above operations.		
V		10
Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion – Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion and pipe making, Hydrostatic extrusion. Forces in extrusion Forging Processes: Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.		
Textbooks:		
1. Manufacturing Technology, P.N. Rao Vol.1 & 2, TMH. 2. Manufacturing Engineering & Technology, SeropeKalpakjian, Steven R. Schmid, Pearson.		
References:		
1. Metal Casting, T.V RamanaRao, New Age. 2. Production Technology, G. Thirupathi Reddy, Scitech.		

KINEMATICS OF MACHINERY

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-ME-PC-213	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	illustrate concepts of kinematics and mechanisms of machines	3	3	2	2
CO2	evaluate velocity and acceleration of simple mechanisms	3	3	3	2
CO3	explain working principle of various straight line mechanisms	3	3	2	2
CO4	develop cam profiles based on follower motion	3	3	3	2
CO5	solve problems related to gears and gear trains	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
Mechanisms: Elements or links – classification – rigid link, flexible and fluid link –types of kinematics pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully and incompletely constrained. **Mechanism and Machines:** Mobility of mechanisms - grubler's criterion, classification of machines – kinematics chain – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, mechanical advantage.		
II		9
Kinematics: Velocity and acceleration – Motion of link in machine – Determination ofVelocity and acceleration – Graphical method – Application of relative velocity method. **Plane motion of body:** Instantaneous center of rotation- centrodes and axodes – Threecenters in line theorem – Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method; Kliens construction - Coriolis acceleration - determination of Coriolis component of acceleration. **Analysis of Mechanisms:** Analysis of slider crank chain for displacement- velocity and acceleration of slider – Acceleration diagram for a given mechanism.		
III		5+5=10
Part-A: Straight-line motion mechanisms: Exact and approximate copied and generated types - Peaucellier-Hart-Scott Russel-Grasshopper-Watt-Tchebicheff's and Robert Mechanism-Pantographs.		
Part-B: Steering gears: Conditions for correct steering - Davis Steering gear, Ackerman's steering gear.		
IV		9
Cams: Definitions of cam and followers – their uses – Types of followers and cams –Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases. **Analysis of motion of followers:** Tangent cam with Roller follower – circular arc cam withstraight, concave and convex flanks.		
V		10
Higher pair: Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding forms of teeth, cycloidal and involutes profiles – phenomena of interferences – Methods of interference Condition for minimum number of teeth to avoid interference – expressions for arc of contact and path of contact of Pinion & Gear and Pinion & Rack Arrangements– Introduction to Helical – Bevel and worm gearing. **Gear Trains:** Introduction – Types – Simple – compound and reverted gear trains –Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Selection of gear box - Differential gear for an automobile		
Textbooks:		
1. Theory of Machines and Mechanisms, Joseph E. Shigley, Oxford. 2. Theory of Machines, S.S.Rattan, TMH.		
References:		
1. Theory of Machines, Sadhu Singh, Pearson.		

MATERIALS ENGINEERING LAB

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-ESC-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	PO3	PO4	PO5
CO1	interpret crystal structure and necessity of alloying	3	3	3
CO2	perform metallographic characterization of metals and metal alloys	3	3	3
CO3	plot the hardness variations of heat treated and non-heat treated steels	3	3	3
CO4	select materials for various engineering applications	3	3	3
CO5	apply the skills and modern techniques for latest materials	3	3	3

List of Experiments

Week	Title/Experiment
1	Preparation and study of crystal models
2	Study of specimen cutting machine, Specimen mounting press, Grinding and polishing equipment and microscope.
3	Study of micro structures of cast irons
4	Study of micro structures of mild steels
5	Study of micro structures of low carbon steels
6	Study of micro structures of High carbon steels
7	Study of micro structures of non ferrous alloys
8	Hardenabilty of steels by Jominy End Quench test
9	Study heat treatment process (Hardening and Tempering) of steel specimen
10	Find out the hardness of various treated and untreated steels.

References

1. Materials Engineering Lab Manual, Department of ME, CMRIT, Hyd.

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

1. Mechanical and microstructure evaluation of Inconel.
2. Mechanical and microstructure evaluation of Titanium.
3. Mechanical and microstructure evaluation of Haynes alloy.
4. Effect of heat treatment on weld joints (Arc welding) of MS.
5. Effect of heat treatment on weld joints (TIG welding) of MS
6. Microstructure evaluations of Friction weld joints.
7. Study of microstructure of Non-ferrous metals.
8. Theoretical study of Ferrite and cementite for Ni alloys
9. Comparative analysis of Martensite and Austenite strength for cast Iron
10. Theoretical study of allotropic change for Ferrous materials

MANUFACTURING PROCESSES LAB

Course	B.Tech.-III-Sem.	L	T	P	C
Subject Code	20-ME-PC-214	-	-	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	PO3	PO4	PSO2
CO1	perform the casting process in manufacturing of different types products	3	3	3
CO2	determine the properties of different types of moulding sands	3	3	3
CO3	illustrate different welding processes required for fabrication	3	3	3
CO4	test the various metal forming processes	3	3	3
CO5	make use of blow and injection moulding equipment	3	3	3

List of Experiments

(Minimum of 12 Exercises needs to be performed)

Week	Title/Experiment
I	**Metal Casting** 1. Pattern Design and making - for one castingdrawing. 2. Sand properties testing - Exercise -for strengths, and permeability –1 3. Moulding Melting and Casting - 1Exercise
II	**Welding** 1. ARC Welding Lap & Butt Joint - 2Exercises 2. Spot Welding - 1Exercise 3. TIG Welding - 1Exercise 4. Plasma welding and Brazing - 2 Exercises (Water PlasmaDevice)
III	**Mechanical Pressworking** 1. Blanking & Piercing operation and study of simple, compound and progressive presstool. 2. Hydraulic Press: Deep drawing and extrusionoperation. 3. Bending and otheroperations
IV	**Processing of Plastics** 1. InjectionMoulding 2. Blow Moulding 3. Reference: Manufacturing process manual of CMRIT.

References

1. Manufacturing Processes Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd.

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

1. Fabricate split patterns for gear casting process. And also cast the gear
2. Fabricate an automobile frame using different welding techniques.
3. Weld two dissimilar metals and study the mechanical properties.
4. Create a 3D models (using auto cad) and fabricate the following components using wood. (i) Cone (ii) Prism (iii) Pyramid (pentagonal and hexagonal).
5. Fabrication of a mini cupola furnace.
6. Design and fabricate wooden box (patterns) for making paraffin apple.
7. Fabrication of a mini hand operated sand Muller (mixture)for the preparation of moulding sand.
8. Theoretical study and analysis of the force required in shearing operations like punching and blanking.
9. Fabrication of adjustable metallic cupboard.
10. Preparation of machineable wax.

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:		
2. 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

NUMERICAL AND STATISTICAL METHODS

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-BSC-202	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 system of equations	3	2	1
CO2	find the solutions using numerical integrals and ODE	3	2	1
CO3	differentiate among random variables involved in the probability models	3	2	1
CO4	test hypothesis for small and large samples along with significance level	3	2	1
CO5	fit correlation, regression coefficients and association of attributes	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.		
II	**Numerical Integration and Solution of Ordinary Differential Equations**	9
Numerical Integration: Trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rule. **Solution of Ordinary Differential equations:** Taylor's series, Picard's method of successive approximations, Euler's method, Runge - Kutta method (second and fourth order)		
III	**Probability, Random variables and Distributions**	6+4=10
Part A: Probability & Random variables: Random variables, discrete and continuous random variables, probability distribution function, probability density function and mathematical expectations.		
Part B: Distributions: Binomial, Poisson and Normal distributions.		
IV	**Sampling Theory and Test of Hypothesis for Large Samples**	12
Sampling Theory: Introduction, Population and samples, Sampling distribution of means and variances **Test of Hypothesis For Large Samples** : Introduction, Hypothesis, Null and Alternative Hypothesis, Type I and Type II errors, Level of significance, One tail and two-tail tests, Tests concerning one mean and proportion, two means-proportions and their differences. Point estimation, Maximum error of estimate and Interval estimation.		
V	**Test of Hypothesis for Small Samples**	8
Test of Hypothesis for Small Samples: t - Test, F-Test and χ^2- Test for goodness of fit and independence of attribute. Point estimation, maximum error of estimate and Interval estimation. Correlation and regression-Rank Correlation.		
Textbooks:		
1. Introductory Methods of Numerical Analysis by S. S. Sastry, PHI Learning Pvt. Ltd. 2. Fundamentals of Mathematical Statistics by S. C. Gupta & V. K. Kapoor, S. Chand Publishers.		
References:		
1. Numerical Methods for Scientific and Engineering Computation by M.K.Jain, S.R.K.Iyengar and R.K.Jain, New Age International Publishers. 2. Probability and Statistics for Engineers and Sciences by Jay L. Devore, Cengage Learning. 3. Mathematics for engineers and scientists by Alan Jeffrey, 6^{th} Edition, CRC press.		

SOLID MECHANICS

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-ME-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	PO1	PO2	PO3	PO12	PSO1
CO1	determine the stress and strain of various materials	3	3	2	2	3
CO2	sketch the shear force and bending moment diagrams for beams of various supports and loads	3	3	2	3	3
CO3	analyze flexural and shear stresses in a beam	3	3	3	2	3
CO4	evaluate principal stresses, strains and various theories of failure	3	3	3	3	3
CO5	determine stresses and deformations in shafts and thin cylinders	3	3	2	2	3

Syllabus

Unit	Title/Topics	Hours
I		10
Simple Stresses And Strains : Elasticity and plasticity – Types of stresses and strains –Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety –Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Barsof varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual,sudden, impact loadings.		
II		9
Shear Force And Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilver, simply supported and overhanging beams subjected to point loads , u.d.l, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.		
III		5+5=10
Part A: Flexural Stresses: Theory of simple bending – Assumptions Derivation of bending equation: MM/I=f/y=E/R Neutral axis – Determination bending stresses – section modules of rectangular and circular sections (Solid and Hollow), I,T,Angle and Channel sections – Design of simple beam sections.		
Part B: Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.		
IV		10
Principal Stresses and Strains: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear –Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions. **Theories of Failure**: Introduction - Various theories of failure - Maximum Principal Stress Theory, Maximum Principal Strain Theory, Strain Energy & Shear Strain Energy Theory(Von-Mises Theory).		
V		9
Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations: T/J = q/r = Nθ/L – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure. **Thin Cylinders:** Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells.		
Textbooks:		
1. Strength of Materials by R.K.Bansal, Lakshmi Publications House Pvt. Ltd. 2. Strength of Materials by S. Ramamrutham, Dhanpath Rai Publishing Company, Pvt., Ltd.		
References:		
1. Strenght of Mateirals by S. Tumoshenko 2. Strength of Materials by R.S. Khurmi; S. Chand & Co. 2005		

FLUID MECHANICS & HYDRAULIC MACHINERY

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-MC-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	PO1	PO2	PO3	PO12
CO1	explain the concepts of fluid statics	3	3	2	2
CO2	describe the concepts of fluid kinematics and dynamics	3	3	3	3
CO3	analyze flow through different pipes and boundary layer theory	3	3	3	3
CO4	select suitable turbine for given heads	3	3	3	2
CO5	estimate performance parameters of hydraulic machines	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I		9
Fluid Statics: Dimensions and Units: physical properties of fluids-specific gravity, viscosity, surface tension, capillarity- vapour pressure-atmospheric, gauge and vacuum pressure-measurement of pressure- piezometer, U-Tube and Differential Manometers.		
II		10
Fluid kinematics: stream line, path line and steak line and stream line, classification of flows steady &un steady, uniform & non uniform, laminar & turbulent, rotational &irrotational flows-equation of continuity for one dimensional flow and three dimensional flow. **Fluid dynamics:** Surface & body forces, Euler's &Bernouli's equations for flow along a stream line, moment equation and its applications on force on pipe bend. Measurement of flow: pitot tube, venture meter and orifice meter, flow nozzle.		
III		5+5=10
Part-A: Closed conduit flow: Reynolds's experiment, Darcy Weisbach equation, minor losses in pipes, pipes in series and pipes in parallel, total energy line-hydraulic gradient line.		
Part-B: Boundary layer concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivations) boundary layer in transition, separation of boundary layers submerged objects-drag and lift.		
IV		10
Basics and hydraulic turbine turbo machinery: Hydro dynamic force on jets on stationary and moving plate, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency , flow over radial vanes. Classification of turbines, heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine, and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design-draft tube theory-functions and efficiency.		
V		9
Performance of hydraulic turbines and pumps: Geometric similarity, unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbines, cavitation, surge tank, water hammer. **Centrifugal pumps:** Classification, working, work done-barometric head-losses and efficiencies specific speed-performance characteristic curves, NPSH. **Reciprocating pumps:** Working, discharge, slip, indicator diagrams.		
Textbooks:		
1. Fluid mechanics and hydraulic machines by R.K.Bansal. 2. Hydraulics, Fluid mechanics and hydraulic machinery by MODI and SETH.		
References:		
1. Fluid mechanics and fluid power engineering by D.S.Kunar, Kotaria and sons. 2. Fluid mechanics and machinery by D. Rama Durgaiah, New age international. 3. Hydraulic machines by Banga and Sharma, Khanna publishers.		

DYNAMICS OF MACHINERY

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-ME-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	PO1	PO2	PO3	PO12
CO1	explain the concepts of Gyroscopes, static and dynamic force analysis	3	3	2	3
CO2	illustrate turning moment diagrams and design of fly wheels	3	3	2	3
CO3	outline the concepts of friction-clutches, brakes and dynamometers	3	3	2	3
CO4	analyze balancing of rotating masses and characterisctics of governors	3	3	2	3
CO5	summarize free and forced vibrations	3	3	2	3

Syllabus

Unit	Title/Topics	Hours
I		10
Precession: Gyroscopes – effect of precession – motion on the stability of moving vehicles such as motorcycle – motorcar – aeroplanes and ships. **Static and Dynamic Force Analysis:** Static force analysis of planar mechanisms – Analytical Method - Dynamic Force Analysis – D'Alembert's principle, Dynamic Analysis of 4-link mechanism, Slider Crank Mechanism.		
II		9
Dynamic force analysis in Reciprocating Engines: Engine Force Analysis – Piston Effort, Crank Effort, etc., Inertia Force in Reciprocating Engine – Graphical Method. **Turning moment diagram** – fluctuation of energy – flywheels and their design - Inertia of connecting rod- inertia force in reciprocating engines – crank effort and torque diagrams.		
III		5+5=10
Part-A: Friction: pivots and collars – uniform pressure, uniform wear – friction circle and friction axis: lubricated surfaces – boundary friction – film lubrication. Clutches – Types – Single plate, multi-plate and cone clutches.		
Part-B: Brakes and Dynamometers: Types of brakes: Simple block brake, band and block brake-internal expanding shoe brake-effect of braking of a vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.		
IV		10
Governors: Types of governors - Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronisms and hunting – stability – effort and power of the governors. **Balancing:** Balancing of rotating masses- Primary, Secondary, and higher balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples.		
V		9
Vibrations: Free Vibration of mass attached to vertical spring – Transverse loads – vibrations of beams with concentrated and distributed loads. Dunkerly's method – Raleigh's method. Whirling of shafts – critical speed – torsional vibrations – one, two and three rotor systems.		
Textbooks:		
1. Theory of Machines, S.S.Rattan. 2. Theory of Machines, R.S.Khurmi		
References:		
1. Theory of Machines, Shigley, TMH. 2. Theory of Machines, R.K.Bansal, Lakshmi publications.		

APPLIED THERMODYNAMICS-I

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-MC-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	PO2	PO3	PO12	PSO2
CO1	explain functioning of various IC engines	2	2	2	3
CO2	illustrate combustion phenomena in IC Engines	3	2	3	3
CO3	evaluate the effect of various operating variables on engine performance	3	2	3	3
CO4	analyze operating principles of different types of compressors	3	2	2	3
CO5	determine the efficiency of axial flow compressors	3	2	2	3

Syllabus

Unit	Title/Topics	Hours
I		9
I.C. Engines: Classification - Working principles of Four & Two stroke engine, SI & CI engines, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles - Engine systems – Carburetor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system, engine emmissions.		
II		10
Normal Combustion and abnormal combustion in SI engines- Importance of flame speed and effect of engine variables- Abnormal combustion, pre-ignition and knocking in SI Engines - Fuel requirements and fuel rating, anti knock additives - combustion chamber - requirements, types of SI engines. Four stages of combustion in CI engines - Delay period and its importance - Effect of engine variables – Diesel Knock- Need for air movement, suction, compression and combustion induced turbulence in Diesel engine - open and divided combustion chambers and fuel injection - fuel rating.		
III		5+5=10
Part-A: Testing and Performance: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart Classification of compressors – Fans, blowers and compressors – positive displacement and dynamic types – reciprocating and rotary types		
Part-B: Reciprocating Compressors: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance volume, staged compression, under cooling, saving of work, minimum work condition for staged compression.		
IV		10
Rotary Compressor (Positive displacement type): Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations. **Dynamic Compressors:** Centrifugal compressors - Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.		
V		9
Axial Flow Compressors: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency- pressure rise calculations – Polytropic efficiency.		
Textbooks:		
1. I.C. Engines, V. Ganesan, TMH. 2. Thermal Engineering, Rajput, Lakshmi Publications. 3. Thermal Engineering, P.K.Nag.		
References:		
1. IC Engines – Mathur & Sharma – Dhanpath Rai & Sons. 2. Engineering fundamentals of IC Engines – Pulkrabek, Pearson, PHI.		

SOLID MECHANICS LAB

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-ME-PC-225	-	-	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	PO3	PO4	PSO1
CO1	analyze stress-strain relationship for given material	2	3	3
CO2	assess the flexural strength for given member	2	3	3
CO3	determine shear modulus of shaft and stiffness of spring	2	3	3
CO4	find the hardness and compressive strength of given material	2	3	3
CO5	measure toughness using Charpy and Izod tests	2	3	3

List of Experiments

(A Minimum of 10 experiments is to be conducted)

Week	Title/Experiment
1	Direct tension test
2	Deflection test on Simple supported beam
3	Deflection test on Cantilever beam
4	Torsion test
5	Brinell hardness test
6	Rockwell hardness test
7	Test on springs
8	Compression test on cube
9	Izod Impact test
10	Charpy Impact test
11	Punch shear test

References

1. Solid Mechanics Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd.

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

1. Evaluation of hardness of super alloys.
2. Effect of heat treatment on hardness of weld joints (Arc welding) of MS.
3. Effect of heat treatment on hardness of weld joints (TIG welding) of MS
4. Evaluation of hardness of Friction weld joints.
5. Effect of surface modification (carburization) on hardness.
6. Study of rigidity modulus of friction weld joints.
7. Evaluation of mechanical properties of TIG-Weld joints.
8. Theoretical Analysis of a cantilever beam for hollow cross section
9. A Methodology to predict deflections in a triangle cross section simply supported beam
10. Theoretical Study of stress vs strain for strength on high heat resisting materials.

FLUID MECHANICS & HYDRAULIC MACHINERY LAB

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-ME-PC-226	-	-	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	PO3	PO4	PSO2
CO1	find co-efficient of discharge for the venturimeter and orifice meter	2	3	2
CO2	determine minor losses and friction factor for a given pipeline	2	3	2
CO3	verify Bernoulli's equation	2	3	2
CO4	calculate impact of force of Jet on different types of Vanes	2	3	2
CO5	analyze the performance of various turbines and pumps	2	3	2

List of Experiments

Week	Title/Experiment
1	Verify Berboulli'sTheorm.
2	Calibration ofVenturimeter.
3	Calibration of Orificemeter.
4	Determination of friction factor for a given pipeline.
5	Determination of loss of head due to sudden contraction in apipeline.
6	Impact of Jets.
7	Performance Test on PeltonWheel.
8	Performance Test on FrancisTurbine.
9	Performance Test on KaplanTurbine.
10	Performance Test on Single Stage CentrifugalPump.
11	Performance Test on Multi Stage CentrifugalPump.
12	Performance Test on ReciprocatingPump.

References

1. Fluid Mechanics and Hydraulic Machinery Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd.

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

1. Determination of co-efficient of discharge for Pitot tube.
2. Determine the loss of head at the entrance and exit of the pipe.
3. Draw the hydraulic gradient line and total energy line for an inclined pipe.
4. Calibration of Rotameter.
5. Determine the metacentric height of a floating body.
6. Calibration of simple U-tube and inverted U-tube manometer.
7. Fabricate a Pelton wheel proto type model.
8. Fabricate a centrifugal pump proto type model.
9. Fabricate a Francis turbine proto type model.
10. Fabrication of a orifice meter suitable for a given pipe to determine the discharge

KINEMATICS & DYNAMICS LAB

Course	B.Tech.-IV-Sem.	L	T	P	C
Subject Code	20-ME-PC-227	-	-	2	1

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

COs	Upon completion of course the students will be able to	PO3	PO4	PSO1
CO1	estimate primary & secondary forces for dynamic balancing of rotary masses	3	3	3
CO2	analyse the response of different vibrating systems	3	3	3
CO3	test the performance of governors	3	3	3
CO4	determine the effect of gyroscope for different motions	3	3	3
CO5	analyze cam profile	3	3	3

List of Experiments

(A Minimum of 10 experiments is to be conducted)

Week	Title/Experiment
1	To determine the state of balance of machines for primary and secondary forces
2	To determine the frequency of torsional vibration of a given rod
3	Determine the effect of varying mass on the centre of sleeve in porter and proell governor
4	Find the motion of the follower if the given profile of the cam
5	The balance masses statically and dynamically for single rotating mass systems
6	Determine the critical speed of a given shaft for different n-conditions
7	For a simple pendulum determine time period and its natural frequency
8	For a compound pendulum determine time period and its natural frequency
9	Determine the effect of gyroscope for different motions
10	Determine time period, amplitude and frequency of undamped free longitudinal vibration of single degree spring mass systems.
11	Determine the pressure distribution of lubricating oil at various load and speed of a Journal bearing.
12	Determine time period, amplitude and frequency of damped free longitudinal vibration of single degree spring mass systems.

References

2. Kinematics and Dynamics Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd.

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

1. Geneva mechanism for automatic punching
2. Gear linear translating motion mechanism
3. cam linear translating motion mechanism
4. Simple gear train mechanism
5. Compound gear train mechanism
6. Peaucellier straight line linkage mechanism
7. Whitworth Quick return mechanism
8. Reciprocating motion with Quick return mechanism
9. Slotted lever Quick return mechanism
10. Slider crank mechanism

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

INSTRUMENTATION & CONTROL SYSTEMS

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-ME-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	PO1	PO2	PO12
CO1	explain dynamic performance characteristics and sources of error	3	2	2
CO2	use various displacement, temperature and pressure measuring instruments	3	2	2
CO3	choose various speed, flow, acceleration & vibration measuring instruments	3	3	2
CO4	select strain, humidity, force, torque and power measuring instruments	3	3	2
CO5	outline various control systems and position controller applications	3	3	2

Syllabus

Unit	Title/Topics	Hours
I		10
Definition-Basic principles of measurement-measurement systems, generalized configuration and functional descriptions of measuring instruments- examples Dynamic performance characteristics-sources of error, classification and elimination of error.		
II		9
Measurement of Displacement: Theory and construction of various transducers to measure displacement- piezo electric, inductive, capacitance, resistance, ionization, and photo electric transducers, calibration procedures. **Measurement of Temperature:** Classification-Ranges- Various Principles of measurement-Expansion, Electrical Resistance- Thermistor- Thermocouple- Pyrometers- Temperature Indicators. **Measurement of Pressure:** Units- Classification- different principles used. Manometers Piston, Bourdon Pressure Gauges, Bellows-Diaphragm gauges, Low Pressure Measurement- Thermal Conductivity Gauges- ionization Pressure Gauges, Mcleod pressure Gauge.		
III		5+5=10
Part-A: Measurement of Level: Direct Method- Indirect Methods- capacitative, ultrasonic, magnetic, Cryogenic fuel level Indicators- Bubbler level indicators. **Flow Measurement:** Rota meter, Magnetic, Ultrasonic, Turbine flow meter, Hot- Wire Anemometer, Laser Doppler Anemometer (LDA).		
Part-B: Measurement of Speed: Mechanical Tachometers- Electrical Tachometers- Stroboscope, Non-contact type of Tachometers. **Measurement of Acceleration and Vibration:** Different Simple instruments – Principles of Seismic instruments- Vibrometer and accelerometer using the principle.		
IV		10
Stress Strain Measurements: Various Types of stress and Strain Measurements – electrical Strain Gauge- Gauge factor –Method of Usage of resistance strain Gauge for bending compressive and tensile strains- Usage for Measuring Torque, Strain gauge Rosettes. **Measurement of Force, Torque and Power:** Elastic Force Meters, Load Cells, Torque meters, Dynamometers.		
V		9
Elements of Control systems: Introduction, Importance-Classification- Open and closed systems servomechanisms- Examples With Block Diagrams- Temperature, Speed and Position Control systems.		
Textbooks:		
1. Measurement Systems: Applications and Design by D.S kumar, Anuradha Agencies. 2. Instrumentation, measurement and Analysis by B.C nakra and K.K Choudhary,TMH		
References:		
1. Instruments and Control systems, S.bhaskar, Anuradha Agencies. 2. Mechanical and Industrial Instruments, R.K Jain, Khanna Publishers.		

MACHINE TOOLS & METROLOGY

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-ME-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	PO1	PO2	PO3	PO12	PSO2
CO1	explain cutting tool geometry, types of lathes and chip formation	3	3	3	3	3
CO2	illustrate operations of drilling, and boring machines	3	3	2	3	3
CO3	make use of the operations of milling and grinding machines	3	3	2	3	3
CO4	analyze the limits and tolerances for engineering components	3	3	3	3	3
CO5	test surface roughness of part and tool alignment	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
Metal cutting: Introduction, elements of cutting process – Geometry of single point tools. Chip formation and types of chips. Engine lathe – Principle of working, types of lathe, specifications. Taper turning – Lathe attachments. Capstan and Turret lathe – Single spindle and multi-spindle automatic lathes – tool layouts.		
II		9
Drilling and Boring Machines: Principles of working, specifications, types, operations performed; twist drill. Types of Boring machines and applications. Shaping, slotting and planing machines – Principles of working – machining time calculations.		
III		5+5=10
Part-A: Milling machines – Principles of working – Types of milling machines – Geometry of milling cutters methods of indexing.		
Part-B: Grinding – theory of grinding – classification of grinding machines. Types of abrasives, bonds. Selection of a grinding wheel. Lapping, honing and broaching machines, comparison and Constructional features, machining time calculations.		
IV		10
Limits, fits and tolerances- Unilateral and bilateral tolerance system, hole and shaft basis system. Interchangeability and selective assembly. Limit Gauges: Taylor's principle, Design of GO and NO GO gauges Measurement of angles, Bevel protractor, and Sine bar. Measurement of flat surfaces, straight edges, surface plates, optical flat and auto collimator.		
V		9
Surface Roughness Measurement: Roughness, Waviness. CLA, RMS, Rz Values. Methods of measurement of surface finish, Talysurf. Screw thread measurement, Gear measurement; Machine Tool Alignment Tests on lathe, milling and drilling machines.		
Textbooks:		
1. Machine Tool Practices, Kibbe, Johne. Neely, T. White, Rolando O. Meyer, Pearson. 2. Fundamentals of Metal Machining and Machine Tools, Geoffrey Boothroyd, TMH.		
References:		
1. Principles of Machine Tools, Bhattacharyya A and Sen.G.C, New Central Book Agency. 2. Fundamentals of Dimensional Metrology, Connie Dotson, Thomson.		

DESIGN OF MACHINE ELEMENTS

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-ME-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	PO8	PO12	PSO1
CO1	design machine elements under static loads	3	3	2	3	3
CO2	design machine elements under cyclic loads	3	3	2	3	3
CO3	design different fasteners like riveted, welded and bolted joints	3	3	3	3	3
CO4	design bearings for specific applications	3	3	3	3	3
CO5	design shafts, couplings and gears for particular applications	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Design for Static Strength**	10
Introduction: General considerations in the design of Engineering Materials and their properties – selection –Manufacturing consideration in design. **Design for Static Strength:** Simple stresses – Combined stresses – Torsional and Bending stresses – Impact stresses – Stress strain relation – Theories of failure – Factor of safety – Design for strength and rigidity – preferred numbers.		
II	**Design for Fatigue Strength**	9
Stress concentration–Theoretical stress Concentration factor –Fatigue stress concentration factor-Notch Sensitivity. Design for fluctuating stresses – S-N Diagram - Endurance limit – Estimation of Endurance strength – Gerber's curve – Goodman Method– Soderberg Method.		
III	**Riveted, Welded and Bolted Joints**	5+5=10
Part A: Riveted joints- methods of failure of riveted joints - strength equations - efficiency of riveted joints, eccentrically loaded riveted joints.		
Part B: Welded joints-Design of fillet welds-axial loads-circular fillet welds under bending, torsion. Welded joints under eccentric loading **Bolted joints** – Types of Bolts - Design of bolts with pre-stresses – Design of Bolted joints under eccentric loading – bolts of uniform strength		
IV	**Bearings**	9
Sliding contact bearings: Types of Journal bearings – Lubrication –Bearing Characteristic Number and Bearing Modulus –Full and partial bearings – Clearance ratio – Heat Generated and dissipation of bearings, journal bearing design. **Rolling contact bearings:** Types of Rolling Contact bearings, Ball and roller bearings – Static load – dynamic load – equivalent radial load –design and selection of ball & roller bearings.		
V	**Shafts and Shaft Couplings**	10
Shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code. **Shaft Couplings:** Rigid couplings – Muff, Split muff and Flange coupling, Flexible coupling– Bushed-Pin Coupling. **Gears:** Spur gears & Helical gears- Design of gears using AGMA procedure involving Lewis and Buckingham equations. Check for dynamic and wear considerations.		
Textbooks:		
1. Design of Machine Elements, V.B. Bhandari, Mc Graw Hill 2. Machine Design, Jindal, Pearson		
References:		
1. Design of Machine Elements, V. M. Faires, Macmillan 2. Design of Machine Elements-I, Annaiah, M.H, New Age 3. Mechanical Engineering Design, Richard G. Budyanas and J. keith Nisbett, Shygley		

APPLIED THERMODYNAMICS – II

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-ME-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	PO6	PO12	PSO2
CO1	explain Rankine cycle, working of boilers and its accessories	3	3	3	3
CO2	estimate the performance of steam nozzles	3	3	3	3
CO3	evaluate the performance of steam turbines and reaction turbines	3	3	3	3
CO4	outline working principles of steam condensers	3	3	3	3
CO5	illustrate working principles of gas turbines	3	3	2	3

Syllabus

Unit	Title/Topics	Hours
I		10
Basic Concepts: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating. **Boilers:** Classification – Working principles – with sketches including H.P. Boilers – Mountings and Accessories – Working principles.		
II		9
Steam Nozzles: Function of nozzle – applications - types, Flow through nozzles, thermodynamic analysis – assumptions -velocity of nozzle at exit-Ideal and actual expansion in nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape: Super saturated flow, its effects, degree of super saturation and degree of under cooling - Wilson line.		
III		5+5=10
Part-A: Steam Turbines: Classification – Impulse turbine; Mechanical details – Velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-Laval Turbine - its features. Methods to reduce rotor speed-Velocity compounding and pressure compounding, Velocity and Pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine.		
Part-B: Reaction Turbine: Mechanical details – principle of operation, thermodynamic analysis of a stage, degree of reaction –velocity diagram – Parson's reaction turbine – condition for maximum efficiency.		
IV		10
Steam Condensers : Requirements of steam condensing plant – Classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its affects, air pump- cooling water requirement.		
V		9
Gas Turbines : Simple gas turbine plant – Ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating –Closed and Semi-closed cycles – merits and demerits, Brief concepts about compressors, combustion chambers and turbines of Gas Turbine Plant.		
Textbooks:		
1. Thermal Engineering, R.K. Rajput, Lakshmi Publications. 2. Gas turbines – V Ganesan – TMH.		
References:		
1. Gas turbines and propulsive system – P khajuria& S.P. Dubey Dhanpatrai. 2. Thermal Engineering –P.L.Bellaney, Khanna Publishers. 3. Thermal Engineering –R.S.Khurmi, JS Gupta, S.Chand.		

AUTOMOBILE ENGINEERING
(Professional Elective – I)

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-ME-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	PO6	PO7	PO12	PSO2
CO1	explain various components of the automobile and its functions	3	3	3	3
CO2	outline the cooling and electrical systems in automobile	3	3	3	3
CO3	illustrate the transmission system and function of its elements	3	3	3	3
CO4	demonstrate the elements of braking and steering systems	3	3	3	3
CO5	summarize the emission control methods used in automobiles	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction**	9
Layout of automobile - introduction chassis and body components. Types of Automobile engines - Power unit - Introduction to engine lubrication - engine servicing Fuel System: S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pump - filters - carburetor - types - air filters - petrol injection. Introduction to MPFI and GDI Systems. C.I. Engines: Requirements of diesel injection systems, types of injection systems, DI Systems IDI systems. Fuel pump, nozzle, spray formation, injection timing. Introduction to CRDI and TDI Systems.		
II	**Cooling System and Electrical System**	10
Cooling System: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System - Radiators - Types - Cooling Fan - water pump, thermostat, evaporative cooling - pressure sealed cooling - antifreeze solutions. Ignition System: Function of an ignition system, battery ignition system, constructional features and its components, Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers - spark advance and retard mechanism. **Electrical System:** Charging circuit, generator, current - voltage regulator - starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge - oil pressure gauge, engine temperature indicator etc.		
III	**Transmission System**	5+5=10
Part-A: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel - gear boxes, types, sliding mesh, constant mesh, synchro mesh gear boxes, epicyclic gear box, over drive torque converter.		
Part-B: Propeller shaft - Hotch-Kiss drive, Torque tube drive, universal joint, differential rear axles - types - wheels and tyres. Suspension System: Objects of suspension systems - rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.		
IV	**Braking System and Steering System**	10
Braking System: Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes. **Steering System:** Steering geometry – camber, castor, king pin rake, combined angle toein, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.		
V		9
Emissions from Automobiles - Pollution standards National and international - Pollution Control - Techniques - Multipoint fuel injection for SI Engines. Common rail diesel injection Energy alternatives - Solar, Photo-voltaic, hydrogen, Biomass, alcohols, LPG, CNG, liquid Fuels and gaseous fuels, Hydrogen as a fuel for IC Engines. - Their merits and demerits. Standard Vehicle maintenance practice.		
Textbooks:		
1. Automobile Engineering, Dr. Kirpal Singh, Vol I & II, Standard Publishers. 2. A Text Book Automobile Engineering–Manzoor Hussain, Nawazish Mehdi & Yosuf Ali, Frontline Publications.		

INDUSTRIAL ENGINEERING
(Professional Elective – I)

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-ME-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	PO1	PO2	PO8	PO11	PO12
CO1	explain principles of industrial engineering and management	3	3	3	3	3
CO2	design various organizational structures	3	3	2	3	3
CO3	illustrate principles of operations management and line balancing	3	3	3	3	3
CO4	analyze the work study and establish limits using SQC	3	3	3	3	3
CO5	assess the methods of job evaluation and project management	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
Industrial Engineering: Introduction, Industrial Management, Entrepreneurship, organization – Importance of Management, Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Social responsibilities of Management.		
II		9
Designing Organizational Structures: Departmentization and Decentralization, Types of Organization structures – Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organization, Cellular Organization, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure and their merits, demerits and suitability.		
III		5+5=10
Part-A: Operations Management: Objectives- product design process- Process selection-Types of production system(Job, batch and Mass Production), Plant location-factors- Urban-Rural sites comparison- Types of Plant Layouts- Design of product layout.		
Part-B: Line balancing (RPW method) Value analysis-Definition-types of values- Objectives-Phases of value analysis- Fast diagram.		
IV		9
Work Study: Introduction - definition - objectives - steps followed in work study - Method study - definition - objectives - steps of method study. Work Measurement - purpose - types of study - stop watch methods - steps - key rating - allowances - standard time calculations - work sampling. **Statistical Quality Control:** variables-attributes, Shewart control charts for variables- chart, R chart, - Attributes-Defective-Defect- Charts for attributes-p-chart -c chart (simple Problems). Acceptance Sampling- Single sampling- Double sampling plans-OC curves.		
V		10
Job Evaluation: Methods of job evaluation - simple routing objective systems - classification method - factor comparison method - point method - benefits of job evaluation and limitations. **Project Management:** Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (Simple problems)		
Textbooks:		
1. Industrial Engineering and Management, O.P. Khanna, Khanna Publishers. 2. Industrial Engineering and Management Science, T.R. Banga and S.C.Sarma, Khanna Publishers.		
References:		
1. Production & Operation Management, Paneer Selvam, PHI. 2. Industrial Engineering Management, NVS Raju, Cengage Learning.		

ELECTRIC & HYBRID VEHICLES
(Professional Elective – I)

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-ME-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	PO7	PO12	PSO2
CO1	describe about working principle of electric vehicles	3	3	2	2	3
CO2	explain working principles of motors used in electric vehicles	3	3	2	2	3
CO3	illustrate electronic devices & sensorless control in electric vehicles	3	3	2	2	3
CO4	outline the functioning of various hybrid vehicles	3	3	2	2	3
CO5	demonstrate the design concepts of fuel cells	3	3	2	2	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction to Electric Vehicles**	10
Electric Vehicle – Need - Types – Cost and Emissions – End of life. Electric Vehicle Technology – layouts, cables, components, Controls. Batteries – overview and its types. Battery plug-in and life. Ultra-capacitor, Charging – Methods and Standards. Alternate charging sources –Wireless & Solar.		
II	**Electric Vehicle Motors**	9
Motors (DC, Induction, BLDC) – Types, Principle, Construction, Control. Electric Drive Trains (EDT) – Series HEDT (Electrical Coupling) – Power Rating Design, Peak Power Source (PPS);Parallel HEDT (Mechanical Coupling) – Torque Coupling and Speed Coupling. Switched Reluctance Motors (SRM) Drives – Basic structure, Drive Convertor, Design.		
III	**Electronics and Sensor-less control in EV**	5+5=10
Part-A: Basic Electronics Devices – Diodes, Thyristors, BJTs, MOSFETs, IGBTs, Convertors, Inverters. Safety – Risks and Guidance, Precautions, High Voltage safety, Hazard management. Sensors - Autonomous EV cars.		
Part-B: Self Drive Cars, Hacking; Sensor less – Control methods- Phase Flux Linkage-Based Method, Phase Inductance- Based, Modulated Signal Injection, Mutually Induced Voltage-Based, Observer-Based.		
IV	**Hybrid Vehicles**	10
Hybrid Electric vehicles – Classification – Micro, Mild, Full, Plug-in, EV. Layout and Architecture – Series, Parallel and Series-Parallel Hybrid, Propulsion systems and components. Regenerative Braking, Economy, Vibration and Noise reduction. Hybrid Electric Vehicles System – Analysis and its Types, Controls.		
V	**Fuel Cells for Electric vehicles**	9
Fuel cell – Introduction, Technologies & Types, Obstacles. Operation principles, Potential and I-V curve, Fuel and Oxidation Consumption, Fuel cell Characteristics – Efficiency, Durability, Specific power, Factors affecting, Power design of fuel Cell Vehicle and freeze capacity. Lifetime cost of Fuel cell Vehicle – System, Components, maintenance.		
Textbooks:		
1. Hybrid, Electric & Fuel-Cell Vehicles Jack Erjavec, Delmar, Cengage Learning. 2. Hybrid Electric Vehicles – Teresa Donateo, Published by ExLi4EvA, 2017		
References:		
1. Hybrid Electric Vehicle System Modeling and Control - Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017. 2. Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2017. 3. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, MehrdadEhsaniYiminGao Stefano Longo Kambiz M. Ebrahimi, Taylor & Francis Group, LLC, 2018. 4. Electric and Hybrid Vehicles, Tom Denton, Taylor & Francis, 2018.		

INSTRUMENTATION AND CONTROL SYSTEMS LAB

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-ME-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	PO3	PO4	PO5
CO1	calibrate the measuring devices	3	3	3
CO2	demonstrate pressure, displacement and vibration measuring devices	3	3	3
CO3	analyze the temperature measuring devices	3	3	3
CO4	determine the speed using photo and magnetic speed pickups	3	3	3
CO5	perform and calibrate rotameter for flow measurement	3	3	3

List of Experiments

Week	Title/Experiment
1	Calibration of Pressure Gauges
2	Calibration of thermistor and RTD for temperature measurement.
3	Study and calibration of LVDT transducer for displacement measurement.
4	Calibration of strain gauge for deflection measurement.
5	Calibration of thermocouple for temperature measurement.
6	Calibration of capacitive transducer for angular displacement.
7	Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8	Calibration of resistance temperature detector for temperature measurement.
9	Study and calibration of a rotameter for flow measurement.
10	Study and use of a seismic pickup for the measurement of vibration modes of an engine bed at various loads.
11	Study and calibration of Mcleod gauge for low pressure.

References

1. Instrumentation and Control Systems Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd.

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

1. Measurement and control pressure of a process using SCADA system
2. Measurement and control of temperature of a process using RTD with SCADA
3. Measurement and control of flow of a process using SCADA systems
4. Measurement and control of level in a tank using capacitive transducer with SCADA
5. Drawing hysteresis curve and error correction curve for LVDT transducer
6. Measurement of induced vibrations in a system using available instruments
7. Speed measurement and calibration of an automotive
8. Flow measurement and level control using automated system
9. Calibration of pressure measuring device
10. Calibration of angular measurement device

MECHANICAL DRAWING LAB USING CAD

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-ME-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	PO6	PO10	PSO1	PSO2
CO1	apply conventional representation on machine elements	3	3	3	3	3	3
CO2	draw the given machine elements using CAD	3	3	3	3	3	3
CO3	draw the assembly of machine elements using CAD	3	3	3	3	3	3
CO4	read and interpret given drawing using CAD	3	3	3	3	3	3
CO5	draw detailed drawings of machine elements using CAD	3	3	3	3	3	3

List of Experiments

Week	Title/Experiment
Note: First angle projection to be adopted.	
PART A: MACHINE DRAWING	
1	**Conventional Representation & Sectional Views:** Conventional representation of materials, common machine elements and parts. Types of sections, selection of section planes and drawing of sections and auxiliary sectional views, parts not usually sectioned.
2	**Dimensioning & Machine Elements:** Methods of dimensioning, general rules for sizes, and placement of dimensions for holes, centers, and curved and tapered features.
3	**Machine Elements:** Drawing of machine elements and simple parts; Selection of orthogonal views and additional views of screw threads, bolts, nuts, stud bolts.
4	Keys and Cotter Joints, Riveted Joints, Couplings. Journal, pivot, and collar bearing.
5	**Engine Parts:** Assembly drawings of Engine parts, stuffing box. Connecting Rod.
6	**Screw Jack:** Assembly drawing of Screw jack.
7	**Safety Valves:** Tail Stock , Rams-bottom Safety Valve.
PART B : PRODUCTION DRAWING	
8	**Conventional Representation of Materials:** conventional representation of parts – screw joints, welded joints, springs, and gears, Limits, Fits and Tolerances: Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables.
9	Form and position tolerances on drawings, types of run-out and their indication
10	Surface Roughness types and indication - surface roughness obtainable from various manufacturing processes, recommended surface roughness on mechanical components.
11	Detailed and part Drawings of Connecting Rod
12	Detailed and part Drawings of Stuffing Box
13	Detailed and part Drawings of Tail Stock
14	Detailed and part Drawings of Screw Jack

References

1. Mechanical Drawing Lab Using CAD Manual, Department of Mechanical Engineering, CMRIT, Hyd.

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

1. Assembly of eccentric using AutoCAD.
2. Assembly of milling machine tail – stock.
3. Assembly of machine vice using AutoCAD software.
4. Assembly of drill jig using AutoCAD software.
5. Assembly of lathe tail – stock.
6. Part drawing of single tool post using AutoCAD software.
7. Part Drawing of clapper block.
8. Part Drawing of milling fixture.
9. Part Drawing of welded shaft supports.
10. Part Drawing of square tool post.

APPLIED THERMODYNAMICS LAB

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-ME-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	PO3	PO4	PO7	PSO2
CO1	construct valve timing diagram and test the performance of IC engines	3	3	3	3
CO2	find engine frictional power by motoring, retardation and Morse tests	3	3	3	3
CO3	determine volumetric efficiency of IC engines	3	3	3	3
CO4	estimate the efficiency of reciprocating air compressor	3	3	3	3
CO5	study on boilers and identify the parts of the engine by disassembly	3	3	3	3

List of Experiments

(Minimum 10 Experiments to be conducted)

Week	Title/Experiment
1	I.C. Engines Valve / Port Timing Diagrams
2	I.C. Engines Performance Test for 4 Stroke SI engines
3	I.C. Engines Performance Test for 2 Stroke SI engines
4	I.C. Engines Morse, Retardation, Motoring Tests
5	I.C. EnginesHeat Balance – CI/SI Engines
6	I.C. Engines Economical speed Test on a SI engine
7	I.C. Engines effect of A/F Ratio in a SI engine
8	Performance Test on Variable Compression Ratio Engine
9	IC engine Performance Test on a 4S CI Engine at constant speed
10	Performance Test on Reciprocating Air – Compressor Unit
11	Dis-assembly / Assembly of Engines
12	Study of Boilers

References

1. Applied Thermodynamics Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd.

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

1. Fabrication of a cut section model of fuel injector
2. Fabrication of battery ignition system
3. Experimental investigations on stirring time on the properties of bio diesel blends
4. Construction of Portable wind mill for cell phone charging
5. Fabrication of vacuum pump from cycle pump
6. A poster presentation on the automobile chassis with all mountings
7. An assembled model of hermetically sealed compressor used in vapor compression system
8. A comparative experimental study on the fire and flash points of two different biodiesel.
9. An experimental study on the yielding of two different bio diesel
10. A comparative experimental study on the viscosity of two different biodiesel at different temperatures

MACHINE TOOLS AND METROLOGY LAB

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-ME-PC-318	-	-	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	PO3	PO4	PO6	PSO2
CO1	perform various operations on lathe and drilling machines	3	3	3	3
CO2	develop simple features by using shaper, planer and milling machines	3	3	3	3
CO3	measure the bores by internal micrometers and dial bore indicators	3	3	3	3
CO4	determine the angle and taper using Bevel protractor and Sine bar	3	3	3	3
CO5	evaluate screw thread parameters	3	3	3	3

List of Experiments

Week	Title/Experiment
	SECTION - A
1	Introduction on Lathe, Drilling machine, Milling machine, Shaper.
2	Planer, slotter, Cylindrical Grinder, surface grinder and tool and cutter grinder.
3	Step turning and taper turning on lathe machine.
4	Thread cutting and knurling on -lathe machine.
5	Drilling and Taping.
6	Shaping and Planning
7	Slotting.
8	Milling.
9	Cylindrical Surface Grinding.
10	Grinding of Tool angles.
	SECTION - B
1	Check chordal addendum & height of the spur gear by using gear teeth Vernier calipers.
2	Machine tool alignment of test on the lathe.
3	Tool maker's microscope and its application
4	Angle and taper measurements by bevel protractor and sine bars.
5	Use of spirit level and optical flats in finding the flatness of surface plate.
6	Thread measurement by 2-wire and 3-wire methods.

References

1. Machine Tools and Metrology Lab Manual, Department of ME, CMRIT, Hyd.

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

1. Study of cutting tool geometry.
2. Preparation of single point cutting tool according to ASA systems.
3. Preparation of tensile test specimen according to ASTM standards using conventional lathe machine.
4. Preparation of tensile test specimen according to ASTM standards using CNC lathe machine.
5. Multiple turning operations on CNC machine.
6. Preparation of Helical Gear.
7. Comparative study between conventional machining and CNC Machining.
8. To study the characteristic features of lathe machine by comparing the observations recorded at low, medium and high speeds.
9. To study the characteristic features of Milling machine by comparing the observations recorded at low, medium and high speeds.
10. To study the characteristic features of Shaper by comparing the observations recorded at low, medium and high speeds.

SUMMER INTERNSHIP

Course	B.Tech.-V-Sem.	L	T	P	C
Subject Code	20-ME-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

HEAT TRANSFER

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-ME-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	PO1	PO2	PO3	PO12	PSO2
CO1	compute one dimensional steady state conduction heat transfer	3	3	3	3	3
CO2	solve transient heat conduction problems for simple geometries	3	3	3	3	3
CO3	analyze forced and natural convective heat transfer	3	3	3	3	3
CO4	design heat exchangers using LMTD and NTU methods	3	3	3	3	3
CO5	explain the principles of radiation	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
Introduction: Modes and mechanisms of heat transfer: Basic laws of heat transfer – simple general discussion about applications of heat transfer. **Conduction Heat transfer:** Fourier rate equation - General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates.Simplification and forms of the field equation-steady, unsteady and periodic heat transfer-initial and boundary conditions. **One dimensional Steady state conduction Heat transfer:** Homogeneous slabs, hollow cylinders and sphere - composite systems - overall heat transfer coefficient - Electrical analogy - Critical radius of insulation.		
II		9
One Dimensional Transient Conduction Heat Transfer: Variable Thermal conductivity-systems with heat sources or Heat generation-extended surfaces (fins) heat transfer – long fin, fin with insulated tip and short fin, application to error measurement of temperature. **One dimensional transient conduction heat transfer:** Systems with negligible internal resistance-significance of Biot and Fourier numbers-infinite bodies-chart solutions of transient conduction systems.		
III		5+5=10
Part-A: Convective Heat Transfer: Classification of system based on causation of flow, condition of flow, configuration of flow and medium of flow – dimensional analysis as a tool for experimental investigation- Buckingham Pi Theorem and method, application for developing semi – empirical non – dimensional correlation for convection heat transfer.		
Part-B: Forced convection: External flows - concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer – Flat plates and cylinders.		
IV		10
Internal Flows: Concepts about hydrodynamic and thermal entry lengths – Division of internal flow - use of empirical relations for horizontal pipe flow and annulus flow. **Free convection:** Development of Hydrodynamic and thermal boundary layer along a vertical plate use of empirical relations for vertical plates and pipes. **Heat Exchangers:** Classification of heat exchanger – overall heat transfer coefficient and fouling factor – concepts of LMTD and NTU methods –problems using LMTD and NTU methods.		
V		9
Radiation heat transfer: Emission characteristics and laws of black-body radiation-irradiation total and monochromatic quantities- laws of Planck, Wien, Kirchhoff, Lambert, Stefan and Boltzmann -heat exchange between two black bodies- concepts of shape factor- emissivity- heat exchange between grey bodies- radiation shields- electrical analogy for radiation networks.		
Textbooks:		
1. Fundamentals of Engineering Heat and MassTransfer, R.C.Sachdeva, NAI Publisher. 2. Heat Transfer, P. K. Nag, TMH.		
References:		
1. Fundamentals of Heat and Mass Transfer – Cengel and Ghajar - TMH. 2. Heat and mass transfer – D S Kumar- S K Kataria& Sons.		

CAD/CAM

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-ME-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	PO12	PSO1	PSO2
CO1	outline hardware & software requirements for CAD/CAM systems	3	3	3	3	3
CO2	develop surface & solid models using mathematical representations	3	3	3	3	3
CO3	write programs for CNC to manufacture industrial components	3	3	3	3	3
CO4	design GT layouts and process planning using CAD/CAM systems	3	3	3	3	3
CO5	implement FMS and CAQC concepts in CIM environment	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
Fundamentals of CAD/CAM: Automation, CAD & CAM Process, Computer configurations, Design workstation, Graphic terminal, CAD software- definition of system software and application software, CAD database structure. **Geometric Modeling:** 3-D wireframe modeling, wire frame entities and their definitions, parametric and non-parametric representation of curves, cubic spline, Bezier, and B-splines.		
II		9
Surface modeling: Algebraic and geometric form, Parametric space of surface, Blending functions, parameterization of surface patch, Cylindrical surface, Ruled surface, Surface of revolution, Spherical surface, Composite surface, Bezier surface. B-spline surface. **Solid Modeling**: cell composition, spatial occupancy enumeration, Sweep representation, Constructive solid geometry, Boundary representations.		
III		5+5=10
Part A: NC Control Production Systems: Numerical control, Elements of NC system, NC part programming: Methods, manual part programming.		
Part B: Computer assisted part programming, Post Processor, Computerized part program, CNC, DNC and Adaptive Control Systems.		
IV		10
Group Technology: Part families, Parts classification and coding, PFA, Machine cell design. **Computer Aided process planning**: retrieval type and generative type. **Computer aided manufacturing resource planning:** Material resource planning, inputs to MRP, MRP output records, Benefits, Enterprise resource planning, Capacity requirements planning.		
V		9
Flexible manufacturing system: F.M.S equipment, FMS layouts, Analysis methods for FMS. Computer aided quality control: Automated inspection- Off-line, On-line, contact, Noncontact; Coordinate measuring machines, Machine vision. Computer Integrated Manufacturing: CIM system, Benefits of CIM.		
Textbooks:		
1. CAD/CAM, Groover M.P, Pearson education. 2. CAD/CAM Concepts and Applications, Alavala, PHI.		
References:		
1. CAD/CAM Principles and Applications, P.N.Rao, TMH. 2. CAD/CAM Theory and Practice, Ibrahim Zeid and R.Sivasubramanian,TMH.		

OPERATIONS RESEARCH

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-ME-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	PO12	PSO2
CO1	formulate and solve LPP using various methods	3	3	3	3	3
CO2	solve transportation and assignment problems	3	3	3	3	3
CO3	compute sequencing and inventory model problems	3	3	3	3	3
CO4	analyze waiting lines and replacement problems	3	3	3	3	3
CO5	evaluate game theory and dynamic programming problems	3	3	3	2	3

Syllabus

Unit	Title/Topics	Hours
I		10
Introduction to OR: Development – Definition- Characteristics and Phases - Types of models - Operations Research models - applications. Linear Programming Problem Formulation - Graphical solution - Simplex method - Artificial variables techniques: Two-phase method, Big M method.		
II		9
Transportation & Assignment Problem: Formulation - Optimal solution, unbalanced transportation problem - Degeneracy. Assignment problem - Formulation - Optimal solution - Variants of Assignment Problem- Traveling Salesman problem.		
III		5+5=10
Part-A: Sequencing: Introduction - Flow -Shop sequencing - n jobs through two machines - n jobs through three machines - Job shop sequencing - two jobs through m machines.		
Part-B: Inventory: Introduction - Single item, Deterministic models - Purchase inventory models with one price break and multiple price breaks - Stochastic models - demand may be discrete variable or continuous variable - Single Period model and no setup cost.		
IV		10
Waiting Lines: Introduction -Terminology-Single Channel - Poisson arrivals and Exponential Service times - with infinite population and finite population models- Multichannel - Poisson arrivals and exponential service times with infinite population. **Replacement**: Introduction - Replacement of items that deteriorate with time - when money value is not counted and counted - Replacement of items that fail completely- Group Replacement.		
V		9
Theory of Games: Introduction –Terminology- Solution of games with saddle points and without saddle points - 2 x 2 games - dominance principle - m x 2 & 2 x n games - graphical method. **Dynamic Programming**: Introduction - Terminology - Bellman's Principle of Optimality - Applications of dynamic programming - shortest path problem - linear programming problem.		
Textbooks:		
1. Operations Research, J.K.Sharma 4th Edition, MacMilan. 2. Introduction to Operations Research, HilIier & Libermann, TMH.		
References:		
1. Introduction to Operations Research, Taha, PHl. 2. Operations Research, NVS Raju, SMS Education, 3rd Revised Edition. 3. Operations Research, A.M.Natarajan, P, Balasubramaniam, A Tamilarasi, Pearson.		

REFRIGERATION & AIR CONDITIONING
(Professional Elective – II)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-ME-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	PO7	PO12	PSO2
CO1	apply the concepts of refrigeration to various systems	3	3	2	3	3
CO2	analyze the performance of vapor compression systems	3	3	2	3	3
CO3	illustrate the components of refrigeration system	3	3	2	3	3
CO4	outline vapor absorption, steam jet refrigeration systems	3	3	2	3	3
CO5	determine cooling and heating loads in air conditioning systems	3	3	2	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
Introduction to Refrigeration: - Necessity and applications – Unit of refrigeration and C.O.P. – Mechanical Refrigeration – Types of Ideal cycle of refrigeration. Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems – Actual air refrigeration system – Refrigeration needs of Air crafts- Air systems – Actual Air refrigeration system – Refrigeration needs of Air crafts – Application of Air Refrigeration, Justification – Types of systems – Problems.		
II		9
Vapour compression refrigeration: working principle and essential components of the plant – Simple Vapour compression refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – Actual cycle Influence of various parameters on system performance – Use of p-h charts – Problems.		
III		5+5=10
Part-A: System Components: Compressors – General classification – comparison – Advantages and Disadvantages.		
Part-B: Condensers – classification – Working Principles of evaporators – classification – Working Principles of expansion devices – types.		
IV		9
Vapor Absorption System – Calculation of max COP – description and working of NH_3 – water system – Li – Br system. Principle and operation of three fluid absorption system, salient features. Steam Jet Refrigeration System.		
V		10
Introduction to Air Conditioning: Psychometric Properties & Processes – Sensible and latent heat loads – Characterization – Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, ASHF, ESHF and ADP. Concept of human comfort and effective temperature –Comfort Air conditioning –Air conditioning Load Calculations. **Air Conditioning systems:** Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers deodorants, fans and blowers. Heat Pump - Heat sources - different heat pump circuits - Applications.		
Textbooks:		
1. A Course in Refrigeration and Air conditioning, SC Arora &Domkundwar, Dhanpatrai 2. Refrigeration and Air Conditioning, Manohar Prasad, New Age		
References:		
1. Refrigeration and Air Conditioning, CP Arora, TMH. 2. Principles of Refrigeration – Dossat, Pearson Education		

UNCONVENTIONAL MACHINING PROCESSES
(Professional Elective – II)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-ME-PE-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	PO12	PSO2
CO1	explain modern machining processes and principles of USM	3	3	3	3	3
CO2	outline working principles of AJM, WJM and AWJM techniques	3	3	3	3	3
CO3	demonstrate working principles of EDM, EDG and EDW	3	3	3	3	3
CO4	illustrate working principles of EBM, LBM and PAM processes	3	3	3	3	3
CO5	adapt working principles of CM and ECM processes	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
Introduction: Need for non-traditional machining methods-Classification of modern machining processes –considerations in process selection, Materials, Applications. **Ultrasonic machining:** Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development.		
II		9
Abrasive jet machining, Water jet machining and abrasive water jet machine: Basic principles, equipments, process variables, mechanics of metal removal, MRR, application and limitations. Magnetic abrasive finishing, Abrasive flow finishing.		
III		5+5=10
Part-A: General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes –Power circuits for EDM, Mechanics of metal removal in EDM.		
Part-B: Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.		
IV		9
Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes –General Principle and application of laser beam machining –thermal features, cutting speed and accuracy of cut. Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.		
V		10
Fundamentals of electrochemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy economic aspects of ECM –Simple problems for estimation of metal removal rate. Fundamentals of chemical machining, Chemical machining principle, maskants, etchants, advantages and applications of chemical machining. Metal removal rate, Electro stream drilling, Shaped tube electrolytic machining.		
Textbooks:		
1. Advanced machining processes by VK Jain, Allied publishers.		
References:		
1. Modern Machining Process, Pandey P.C. and Shah H.S., TMH. 2. New Technology, Bhattacharya A, The Institution of Engineers, India 1984.		

FINITE ELEMENT ANALYSIS
(Professional Elective – II)

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-ME-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	PO4	PO12	PSO1
CO1	explain the fundamentals of FEM	3	2	2	3	3
CO2	solve the linear equations of truss & beam elements using FEM	3	3	3	3	3
CO3	evaluate the load and displacements for 2-D problems	3	3	3	3	3
CO4	apply the FE method for heat transfer problems	3	3	3	3	3
CO5	demonstrate the dynamic analysis for various objects using FEM	3	3	2	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
Introduction: Historical Background - Mathematical modeling of field problems in Engineering - Governing Equations - Weighted Residual Methods - Variational Formulation of Boundary Value Problems - Ritz Technique - Basic concepts of the Finite Element Method - Stress and Equilibrium. Boundary conditions. Strain - Displacement relations. Stress - strain relations for 2-D and 3-D Elastic problems. **One Dimensional Problems:** Finite element modeling coordinates and shape functions. Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions. Temperature effects.		
II		9
Analysis of Trusses: Stiffness Matrix for Plane Truss Elements, Stress Calculations and problems. **Analysis of Beams:** Element stiffness matrix for two noded, two degrees of freedom per node beam element and simple problems.		
III		5+5=10
Part-A: Finite element modeling of two-dimensional stress analysis with constant strain triangles and treatment of boundary conditions, Estimation of Load Vector, Stresses.		
Part-B: Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements. Two dimensional four noded Iso-parametric elements and problems.		
IV		6
Steady State Heat Transfer Analysis: One dimensional analysis of slab, fin and two-dimensional analysis of thin plate. Analysis of a uniform shaft subjected to torsion.		
V		10
Dynamic Analysis: Formulation of finite element model, element - Mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar, truss. Finite element - formulation to 3 D problems in stress analysis, convergence requirements, Mesh generation, techniques such as semi-automatic and fully Automatic use of softwares such as ANSYS, NISA, NASTRAN, etc.		
Textbooks:		
1. Introduction to Finite element analysis, S.Md.Jalaludeen, Anuradha Publications, Print-2012 2. Finite Element Methods: Basic Concepts and applications, Alavala, PHI.		
References:		
1. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu, PHI. 2. Finite Element Method, Zincowitz, TMH. 3. A First Course in the Finite Element Method, Daryl Logan, Cengage Learning, 5th Edition.		

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.		

HEAT TRANSFER LAB

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-ME-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	PO6	PO7	PSO2
CO1	find thermal conductivity of common metallic materials	3	3	3	3
CO2	calculate heat transfer rate between fluid and solid boundaries	3	3	3	3
CO3	evaluate the performance of heat exchangers	3	3	3	3
CO4	determine the emissivity and Stefan Boltzmann constant for radiation	3	3	3	3
CO5	estimate heat transfer coefficient in natural,forced convection	3	3	3	3

List of Experiments

(Minimum **12** experiments to be conducted**)**

Week	Title/Experiment
1	Composite Slab Apparatus – overall heat transfer coefficient
2	Heat transfer through Lagged pipe
3	Heat transfer through a Concentric Sphere
4	Thermal conductivity of given metal rod
5	Heat transfer in pin fin
6	Experiment on Transient Heat Conduction
7	Heat transfer in forced convection apparatus
8	Heat transfer in natural convection
9	Parallel and counter flow Heat Exchanger
10	Emissivity apparatus
11	Stefan Boltzmann apparatus
12	Critical heat flux apparatus
13	Study of heat pipe and its demonstration
14	Film and Drop wise condensation apparatus

References

1. Heat Transfer Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd.

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

1. Thermal Conductivity of liquids.
2. Demonstration model for Conduction.
3. Demonstration model for Convection.
4. Demonstration model for Radiation.
5. Natural Convection in Rectangular fin.
6. Forced Convection in Rectangular fin.
7. Applications of Heat exchanger in real life-Poster Presentation.
8. Analysis of temperature distribution in an insulated wall.
9. Forced convection using liquids.
10. Natural convection using liquids.

COMPUTER AIDED ENGINEERING LAB

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-ME-PC-325	-	-	2	1

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

COs	Upon completion of course the students will be able to	PO4	PO5	PO10	PSO2
CO1	visualize and prepare detailed 3D drawing of a given object	3	3	3	3
CO2	develop the 3D objects by using CAD software	3	3	3	3
CO3	analyze 2D and 3D trusses and Beams with boundary conditions	3	3	3	3
CO4	analyze plane stress & strain components with boundary conditions	3	3	3	3
CO5	perform thermal and dynamic analysis of structures	3	3	3	3

List of Experiments

(Minimum 10 Experiments to be conducted)

Week	Title/Experiment
1	3D Modelling of Sleeve and Cotter Joint
2	3D Modelling of Socket and Spigot Joint
3	3D Modelling of Gib & Cotter Joint
4	3D Modelling of Knuckle Joint
5	3D Modelling Assembly of Screw Jack
6	3D Modelling of Simple Eccentric
7	Determination of deflection and stresses in 2D and 3D trusses and beams.
8	Determination of deflections, principal and Von-mises stresses in plane stress, plane strain and Axi-symmetric components.
9	Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
10	Study state heat transfer analysis of plane and axi-symmetric components.
11	Buckling analysis of plates and beams to estimate BF and modes
12	Harmonic analysis of a Shaft subjected to periodic force and transient analysis of plates subjected to stepped and ramped loading with varying time.
13	Non linear analysis of cantilever beam with non linear materials at tip moment and post buckling analysis of shells for critical loads

References

1. CAD / CAE Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd.

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

1. 3D modeling of circular fillet welds in machine structures.
2. 3D modeling of eccentrically loaded joints.
3. 3D modeling of plumber block.
4. 3D Modelling of Machine vice.
5. 3D Modelling of Flange coupling.
6. Static analysis of plate with a hole to determine the deformations, the Stresses to study the failure behavior and SCF.
7. Static analysis of connecting rod with tetrahedron and brick elements.
8. Steady state heat transfer Analysis Cross section of chimney and transient heat transfer analysis of solidification of castings. 3D modeling of belt pulley.
9. Determination of the Frequency response of cantilever Beam.
10. Determination of deflections, thermal stresses in a plane slab.

COMPUTER AIDED MANUFACTURING LAB

Course	B.Tech.-VI-Sem.	L	T	P	C
Subject Code	20-ME-PC-326	-	-	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	PO10	PSO1	PSO2
CO1	develop NC programming for lathe and milling operations	3	3	3	3	3
CO2	develop components on CNC lathe	3	3	3	3	3
CO3	create manufactured-components on CNC milling machine	3	3	3	3	3
CO4	generate .stl files from the models	3	3	3	3	3
CO5	create components on 3D Printer	3	3	3	3	3

List of Experiments

Week	Title/Experiment
1	Study of various Post Processor used in NC machines
2	Development of NC codes for lathe operations using CAM software
3	Development of NC codes for milling operations using CAM software
4	Machining of simple components on NC lathe by transferring NC Code/from CAM software
5	Machining of simple components on NC Mill by transferring NC Code/from CAM software
6	Study on 3D printer
7	Create the design files for Rapid Prototyping
8	Create a simple solid cube using 3D Printer
9	Create a Hexagonal Nut using 3D Printer
10	Create a U Bracket Sheet Metal using 3D Printer

References

1. Cpmputer Aided Manufacturing Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd.

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

1. 3D Modelling of a single component.
2. Assembly of CAD modelled Components.
3. Exercise on CAD Data Exchange.
4. Generation of .stl files.
5. Identification of a product for Additive Manufacturing and its AM process plan.
6. Printing of identified product on an available AM machine.
7. Post processing of additively manufactured product.
8. Inspection and defect analysis of the additively manufactured product.
9. Comparison of Additively manufactured product with conventional manufactured counterpart.
10. 3D component production using G codes as inputs to 3D printer.

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.		

ARTIFICIAL INTELLIGENCE AND ROBOTICS

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-ME-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	PO1	PO2	PO12	PSO1
CO1	explain the concepts of artificial intelligence	3	3	3	3
CO2	illustrate various heuristic search techniques	3	3	3	3
CO3	relate AI techniques in industrial robotics	3	3	3	3
CO4	analyze the robot motion through direct kinematics	3	3	3	3
CO5	develop program to control industrial robots	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
AI Introduction: Artificial Intelligence, AI problems, AI techniques, the level of the model, criteria for success. Defining the problem as a state space search, problem characteristics, production systems, search: issues in the design of search programs, un-informed search, BFS, DFS.		
II		9
Heuristic Search Techniques: What is heuristic?, heuristic function, introduction to search techniques: generate – and – test, hill climbing, best-first search, problem reduction, constraint – satisfaction, means- ends analysis.		
III		5+5=10
Part-A: Knowledge Representation: Procedural vs declarative knowledge, representations & approaches to knowledge representation, forward vs backward reasoning, matching techniques, expert systems.		
Part-B: Introduction to Industrial Robots: History, types of robots, robot subsystems, resolution, repeatability and accuracy, degrees of freedom, robot configurations and concept of workspace, mechanisms and transmission, end effectors and different types of grippers, actuators, applications of robots.		
IV		10
Robot Kinematics: transformation matrices and their arithmetic, link and joint description, denavit-hartenberg parameters, frame assignment to links, direct kinematics.		
V		9
Robotic Programming: Lead through programming, robot programming as a path in space, motion interpolation, WAIT, SIGNAL AND DELAY commands, branching capabilities and limitations, robot languages: textual robot languages, generation, robot language structures, elements in function.		
Textbooks:		
1. Elaine Rich & Kevin Knight, 'Artificial Intelligence', 3rd Edition, TMH, 2008. 2. Industrial Robotics, Groover M P, TMH. 3. Robotics, Fu K S, TMH.		
References:		
1. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010. 2. Robot Dynamics and Controls, Spony and Vidyasagar, John Wiley. 3. Robotics and Control, Mittal R K &Nagrath, TMH.		

ADVANCED IC ENGINES
(Professional Elective – III)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-ME-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	PO6	PO7	PO12	PSO2
CO1	outline about various SI Engines	3	3	2	3	3
CO2	demonstrate various issues related to the CI Engines	3	3	2	3	3
CO3	Illustrate Pollutant formation and control in IC Engines	3	3	2	3	3
CO4	make use of Alternate Fuels	3	3	2	3	3
CO5	apply latest trends in IC Engines	3	3	2	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Spark Ignition Engines**	10
Mixture requirements – Fuel injection systems – Monopoint, Multipoint & Direct injection – Stages of combustion – Normal and Abnormal combustion – Knock – Factors affecting knock – Combustion chambers.		
II	**Compression Ignition Engines**	9
Diesel Fuel Injection Systems – Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers – Fuel Spray behaviour – Spray structure and spray penetration – Air motion – Introduction to Turbocharging.		
III	**Pollutant Formation And Control**	5+5=10
Pollutant – Sources – Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter		
Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps – Methods of measurement – Emission norms and Driving cycles.		
IV	**Alternative Fuels**	10
Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel – Properties, Suitability, Merits and Demerits – Engine Modifications.		
V	**Recent Trends**	9
Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems – Hybrid Electric Vehicles – NOx Adsorbers – Onboard Diagnostics.		
Textbooks:		
1. I.C. Engines, V. Ganesan, TMH. 2. Thermal Engineering, Rajput, Lakshmi Publications. 3. Thermal Engineering, P.K.Nag.		
References:		
1. IC Engines – Mathur & Sharma – Dhanpath Rai & Sons. 2. Engineering fundamentals of IC Engines – Pulkrabek, Pearson /PHI 3. Thermal Engineering, Rudramoorthy - TMH 4. Thermal Engineering – R.S. Khurmi & J.K.Gupta – S.Chand		

FLEXIBLE MANUFACTURING SYSTEMS
(Professional Elective – III)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-ME-PE-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	PO12	PSO2
CO1	explain the concepts of FMS	3	3	3	3
CO2	make use of automated material handling systems	3	3	3	3
CO3	perform engineering analysis of ASRS	3	3	3	3
CO4	identify bottlenecks in FMS operational issues	3	3	3	3
CO5	summarize the concepts of JIT and lean manufacturing	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
Introduction: Flexibility – Types of FMS – FMS components: Workstations, Material Handling and Storage Systems – Computer Control Systems – Human Resources – FMS Applications and Benefits.		
II		9
Automated Material Handling Systems: Design Considerations in Material handling – Material Handling Equipment – Industrial Trucks, Automated Guided Vehicles, Monorails and Other Rail-Guided Vehicles –Analysis of Material Transport System.		
III		5+5=10
Part A: Storage Systems in FMS: Storage Systems Performance and Location Strategies – Automated Storage/Retrieval Systems – Carousel Storage Systems.		
Part B: Engineering Analysis of Automated Storage/Retrieval Systems – Carousel Storage Systems.		
IV		9
FMS Planning and Implementation: FMS Planning and Implementation issues- Quantitative Analysis of FMS – Bottleneck Model –FMS Operational Parameters – Simple Problem – Extended Bottleneck Model – Sizing of FMS		
V		10
Just-In-Time and Lean Production: Lean Production and Waste in Manufacturing - Just-In-Time Production Systems – Pull System of Production Control – Setup Time Reduction – Stable and Reliable Operations – Autonomation – Worker Involvement – Visual Management and 5S.		
Textbooks:		
1. Automation, Production Systems, and Computer Integrated Manufacturing, Mikell P.Groover, PHI. 2. Hand Book of Flexible Manufacturing Systems, Jha N K, Academic Press.		
References:		
1. Flexible Manufacturing Systems, H K Shivanand, New Age International, 2006. 2. Flexible Manufacturing Cells & Systems - William W. Luggen –Prentice hall, NJ.		

PRODUCTION PLANNING & CONTROL
(Professional Elective – II)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-ME-PE-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	PO11	PO12	PSO2
CO1	illustrate the functions of PPC	3	3	2	3	3
CO2	outline the principles and types of forecasting	3	3	2	3	3
CO3	differentiate various inventory control techniques	3	3	3	3	3
CO4	solve routing and scheduling problems	3	3	3	3	3
CO5	summarize dispatching process	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
Introduction: Definitions: PPC - Objectives and applications of production planning and control, Functions of production planning and control, elements of production planning and control- Types of productions: job, batch and mass production- Organizations of production planning and control — internal organizations and departments- Marketing aspect.		
II		9
Forecasting: Introduction, Importance and General Principles of forecasting -Types of forecasting techniques: Qualitative methods, quantitative methods, Long term and Short term sales forecasting methods Applications of forecasting.		
III		5+5=10
Part-A: Inventory management: Introduction- Functions of inventory control-ABC analysis-VED Analysis- EOQ technique.		
Part-B: Models of Inventory control systems: P-Systems and Q-Systems -Introduction to MRP And ERP, LOB(Line of balance), JIT inventory, Japanese concepts.		
IV		10
Routing: Definition - routing procedure- Route sheets - Bill of material- factors affecting routing procedure. Schedule - definition - difference with loading -Scheduling policies - techniques, standard scheduling methods- job shop, flow shop- Line balancing, aggregate planning- methods for aggregate planning- Purchase planning, expediting, control aspects.		
V		9
Dispatching: Dispatching procedure, follow up - definition - functions - types of follow up and their functions, applications of computer in production planning and control.		
Textbooks:		
1. Production Planning and Control! M.Mahajan, Dhanpatirai & Co. 2. Production Planning and Control, Jam & Jam, Khanna publications.		
References:		
1. Production Planning and Control, Text & cases, SK Mukhopadhyaya, PHI. 2. Production and operations Management U R.Panneer Selvam, PHI. 3. Production and Operations Management (Theory and Practice), Dipak.		

RENEWABLE ENERGY SOURCES
(Professional Elective – IV)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-ME-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	PO6	PO7	PO12	PSO2
CO1	illustrate the principles of solar radiation	3	3	2	3	3
CO2	utilize the applications of solar energy system	3	3	2	3	3
CO3	make use of wind energy and bio mass for power production	3	3	2	3	3
CO4	extract power from geothermal and tidal energy sources	3	3	2	3	3
CO5	explain the various energy conversion systems	3	3	2	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
Principles of solar radiation: Role and potential of new and renewable source, the solar energy option, environmental impact of solar power-physics of sun, the solar constant, extra-terrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation and sun shine, solar radiation data.		
II		9
Solar energy collection: flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors Solar energy storage and applications: different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications – solar heating / cooling techniques, solar distillation and drying, photovoltaic energy conversion.		
III		5+5=10
Part-A: Wind energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics.		
Part-B: Bio-mass: principles of bio-conversion, anaerobic / aerobic digestion, types of bio-gas digesters, gas yield, combustible characteristics of bio-gas, utilization for cooking.		
IV		10
Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India OTEC: principles, utilization, setting of OTEC plants, thermodynamic cycles. **Tidal energy:** potential and conversion techniques, mini hydel power plants.		
V		9
Direct energy conversion: Need for DEC, Carnot cycle, limitations, principles of DEC, thermo-electric generators, seebeck, Peltier and joule Thompson effects, figure of merit, materials, applications, MHD generators.		
Textbooks:		
1. Renewable energy sources,Twi dell and weir,Taylor and Francis, 2nd special Indian edition. 2. Non-Conventional energy sources, G D Rai, Dhanpat Rai and Sons.		
References:		
1. Energy Resources Utilization and Technologies, Anjaneyulu and Francis, BS publications, 2012. 2. Principles of solar energy, Frank Krieth& John F Kredier, Hemisphere publications.		

PLANT LAYOUT & MATERIAL HANDLING
(Professional Elective – IV)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-ME-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	PO6	PO7	PO12	PSO2
CO1	explain the concepts of various plant layouts	3	3	2	3	3
CO2	make use of heuristics in design of plant layout	3	3	2	3	3
CO3	illustrate various types of material handling systems	3	3	2	3	3
CO4	select appropriate material handling systems	3	3	2	3	3
CO5	apply ergonomics and minimize the material handling costs	3	3	2	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
Introduction: Classification of Layout, Advantages and Limitations of different layouts, Layout design procedures, Overview of the plant layout. Process layout & Product layout: Selection, specification, Implementation and follow up, comparison of product and process layout.		
II		9
Heuristics for Plant layout: ALDEP, CORELAP, CRAFT, Group Layout, Fixed position layout-Quadratic assignment model. Branch and bound method.		
III		5+5=10
Part-A: Material handling systems: Introduction, Material Handling principles, Classification of Material Handling Equipment.		
Part-B: Relationship of material handling to plant layout.		
IV		9
Selection of Material handling systems: Selection, Material Handling method- path, Equipment, function oriented systems.		
V		10
Methods to minimize cost of material handling- Maintenance of Material Handling Equipment, Safety in handling Ergonomics of Material Handling equipment. Design of Miscellaneous equipment.		
Textbooks:		
1. Operations Management/ PB Mahapatra/PHI. 2. Aspects of Material handling! Dr. KC Arora & Shinde/ Lakshmi Publications.		
References:		
1. Facility Layout & Location an analytical approach! RL Francis/ LF Mc Linnis Jr, White/ PHI. 2. Production and Operations Management, R Panneerselvam,PHI. 3. Plant Maintenance and Reliability Engineering/NVS Raju/Cengage Learning.		

DESIGN OF TRANSMISSION SYSTEMS
(Professional Elective – IV)

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-ME-PE-416	3	-	-	3

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO4	PO12	PSO2
CO1	design belts, pulleys and chain drives	3	3	2	3	3
CO2	design spur gears, parallel axis helical gears	3	3	2	3	3
CO3	design bevel, worm and cross helical gears	3	3	2	3	3
CO4	construct the gear box according to the speed variation	3	3	2	3	3
CO5	illustrate design concepts of cams,brakes and clutches	3	3	2	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Design of Flexible Elements**	9
Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.		
II	**Spur Gears and Parallel Axis Helical Gears**	10
Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects – Fatigue strength- Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane- Equivalent number ofteeth-forces for helical gears.		
III	**Bevel, Worm and Cross Helical Gears**	5+5=10
Part-A: Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears.		
Part-B: Worm Gear: Merits and demerits- terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.		
IV	**Gear Boxes**	9
Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Design of multi speed gear box for machine tool applications - Constant mesh gear box - Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.		
V	**Cams, Clutches and Brakes**	10
Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches-Electromagnetic clutches. Band and Block brakes - external shoe brakes – Internal expanding shoe brake.		
Textbooks:		
1. Bhandari V, "Design of Machine Elements", 3rd Edition, TMH, 2010. 2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008.		
References:		
1. Sundararajamoorthy T.V, Shanmugam. N, "Machine Design", Anuradha Publications, Chennai. 2. Gitin Maitra, L. Prasad "Hand book of Mechanical Design", 2nd Edition, TMH, 2001.		

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.		

ARTIFICIAL INTELLIGENCE AND ROBOTICS LAB

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-ME-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	illustrate various search techniques	3	3	3
CO2	solve real-time problems using graph theory	3	3	3
CO3	estimate the accuracy and repeatability of the robot arm	3	3	3
CO4	develop programming for robot trajectory motion	3	3	3
CO5	experiment with robot arm for palletizing, pick and place	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	Estimation of accuracy, repeatability and resolution.
7	Robot arm pick and place experiment.
8	Robot arm palletizing experiment.
9	Robot programming exercises.
10	Machine loading and unloading

References

1. Artifical Intelligence and Robotics Lab Manual, Dept. of Mechanical Engineering, CMRIT, Hyd.

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

2. Intelligent vehicles using Artificial Intelligence.
3. Smart ICU Predictive detection of deterioration of seriously ill patients using Artificial Intelligence.
4. Artificial Intelligence Innovation.
5. Prevention against Cyber security Threats using Artificial Intelligence.
6. Efficient, Scalable Processing of Patient Data using Artificial Intelligence.
7. Building a mobility device using ultrasonic sensor.
8. Building a mobility device using line follower method.
9. Program the robot manipulator for pick and place of selected objects.
10. Program the robot manipulator for stop and proceed in trajectory path.
11. Program for identification of object colour and shape.

INDUSTRY ORIENTED MINI-PROJECT

Course	B.Tech.-VII-Sem.	L	T	P	C
Subject Code	20-ME-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

POWER PLANT ENGINEERING
(Professional Elective – V)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-ME-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	PO2	PO3	PO6	PO12	PSO2
CO1	illustrate energy sources, steam power plants and combustion process	3	2	2	3	3
CO2	explain the working principles of diesel and gas-turbine power plants	3	2	2	3	3
CO3	demonstrate hydro electric power plant with various layouts	3	3	2	3	3
CO4	outline the concepts of nuclear power plants	3	3	2	3	3
CO5	determine optimum parameters for power plants	3	3	2	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
Introduction to the Sources of Energy: Resources and Development of Power in India. **Steam Power Plant:** Plant Layout, Working of different Circuits, Fuel and handling equipment, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems. **Combustion Process:** Properties of coal - overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and drought system, Fluidized Bed Combustion, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection.		
II		9
Diesel Power Plant: Introduction - IC Engines, types, construction - Plant layout with auxiliaries - fuel supply system, engine starting equipment, lubrication and cooling system - super charging, Turbocharging. **Gas Turbine Plant:** Introduction - classification - construction - Layout with auxiliaries - Principles of working of closed and open cycle gas turbines. Combined cycle power plants and comparison.		
III		5+5=10
Part-A: Hydro Electric Power Plant: Water power-Hydro logical cycle / flow measurement, Hydro graphs, storage and Poundage, classification of dams and spill ways.		
Part-B: Hydro Projects and Plant: Classification-Typical layouts, plant auxiliaries-plant operation pumped storage plants.		
IV		9
Nuclear Power Station: Nuclear fuel-breeding and fertile materials -Nuclear reactor - reactor operation. Types of Reactors: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding radioactive waste disposal.		
V		10
Power Plant Economics and Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor -related exercises.		
Textbooks:		
1. A Text Book of Power Plant Engineering / Rajput / Laxmi Publications. 2. Power Plant Engineering! P.C.Sharma / S.K.Kataria Pub. 3. A Course in Power Plant Engineering: Arora and S. Domkundwar.		
References:		
1. Power Plant Engineering: P.K.Nag, 2nd Edition, TMH. 2. Power plant Engg, Elanchezhian, I.K. International Pub.		

PRODUCT LIFE CYCLE MANAGEMENT
(Professional Elective – V)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-ME-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	PO6	PO12	PSO1	PSO2
CO1	outline the product life cycle management	3	3	2	3	3	3
CO2	explain CPLM and DEPLM	3	3	2	3	3	3
CO3	illustrate the digital life cycle	3	3	2	3	3	3
CO4	make use of the PLM Environment	3	3	2	3	3	3
CO5	apply the components of PLM	3	3	2	3	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Introduction To Product Life Cycle Management**	10
Product life cycle – Introduction, growth, maturity & decline, Product Lifecycle Management- Definition & Overview, Background for PLM-corporate challenges, Need of PLM, Components/Elements of PLM, Emergence of PLM, Significance of PLM - life cycle problems to be resolved, product development problems to be resolved, Customer Involvement.		
II	**Constructing & Driving Environment Product Life Cycle Management**	9
Life cycle model- plan, design, build, support & dispose. Threads of PLM, CAD, EDM, PDM, CIM. Weaving the threads into PLM, comparison of PLM to ERP. PLM characteristics - singularity, cohesion, traceability, reflectiveness, Information Mirroring Model. External drivers- scale, complexity, cycle times, globalization & regulation. Internal drivers - productivity, innovation, collaboration & quality. Board room drivers – income, revenues & costs.		
III	**Digital Life Cycle & Product Life Cycle Management System**	5+5=10
Digital Life Cycle: Collaborative Product Development, Mapping Requirements to specifications. Part Numbering, Engineering Vaulting, Product reuse, Engineering Change Management, Bill of Material and Process Consistency. Digital Mock up and Prototype development. Virtual testing and collateral. Introduction to Digital Manufacturing.		
Product Life Cycle Management System: Product life cycle management system- system architecture, Information models and product structure, the product information data model, the product model, functioning of the system. Reasons for the deployment of PLM systems		
IV	**Product Life Cycle Environment**	10
Product Data issues – Access, applications, Archiving, Availability, Change, Confidentiality. Product Workflow, The Link between Product Data and Product Workflow, Key Management Issues around Product Data and Product Workflow, Company's PLM vision, The PLM Strategy, Principles for PLM strategy, Preparing for the PLM strategy, Developing a PLM strategy, Strategy identification and selection, Change Management for PLM.		
V	**Components Of Product Life Cycle Management**	9
Different phases of product lifecycle and corresponding technologies, Foundation technologies and standards e.g. visualization, collaboration and enterprise application integration, Core functions e.g., data vaults, document and content management, workflow and program management, Functional applications e.g., configuration management. Human resources in product lifecycle. PLM Case Study.		
Textbooks:		
1. Grieves Michael, Product Lifecycle Management- Driving the Next Generation of Lean Thinking, McGraw-Hill.		
References:		
1. Antti Saaksvuori, Anselmi Immonen, Product Life Cycle Management - Springer, 1st Edn. 2. Stark, John. Product Lifecycle Management: 21st Century Paradigm for Product Realization, Springer-Verlag.		

TRIBOLOGY
(Professional Elective – V)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-ME-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	PO6	PO12	PSO1
CO1	outline the various parameters related to tribology	3	3	2	3	3
CO2	demonstrate the hydrostatic lubrication	3	3	2	3	3
CO3	illustrate the various theories of lubrication	3	3	2	3	3
CO4	make use of the power losses in bearings	3	3	2	3	3
CO5	apply the concepts of lubrication of bearings	3	3	2	3	3

Syllabus

Unit	Title/Topics	Hours
I	**Study of various parameters**	10
Viscosity, flow of fluids, viscosity and its variation -absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers used.		
II	**Hydrostatic lubrication**	9
Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing.		
III	**Hydrodynamic theory of lubrication**	5+5=10
Various theories of lubrication, petroffs equation, Reynold's equation in two dimensions -Effects of side leakage – Reynolds equation in three dimensions,		
Friction in sliding bearing, hydro dynamic theory applied to journal bearing, minimum oil film thickness, oil whip and whirl anti -friction bearing.		
IV	**Friction and Power Losses in Journal Bearings and its Applications**	9
Calibration of friction loss friction in concentric bearings, bearing moduIus, Sommerfield number, heat balance, practical consideration of journal bearing considerations. Study of current concepts of boundary friction and dry friction.		
V	**Air lubricated bearing**	10
Advantages and disadvantages application to Hydrodynamic journal bearings, hydrodynamic thrust bearings. Hydrostatic thrust bearings. Hydrostatic bearing Analysis including compressibility effect.Types of bearing materials and bearing oil pads: Hydrostatic bearing wick oiled bearings, oil rings, pressure feed bearing, partial bearings -externally pressurized bearings. General requirements of bearing materials, types of bearing materials.		
Textbooks:		
1. Fundamentals of Tribology, Basu, SenGupta and Ahuja/PHI 2. Tribology in Industry: Sushil Kumar Srivatsava, S. Chand &Co.		
References:		
1. Tribology – B.C. Majumdar		

COMPUTATIONAL FLUID DYNAMICS
(Professional Elective – VI)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-ME-PE-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	PO12	PSO2
CO1	distinguish various numerical methods used in CFD	3	3	3	3
CO2	explain the basic rules of FVM	3	3	3	3
CO3	apply FVM to solve convection and diffusion problems	3	3	3	3
CO4	solve flow field problems using CFD	3	3	3	3
CO5	analyze turbulent flows by applying CFD concepts	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
Introduction to Numerical Methods: Finite Difference, Finite element and finite volume methods - classification of partial differential equations – solution of linear algebraic equations – direct and iterative approaches. **Finite difference methods:** Taylor's series – FDE formulation for 1D and 2D steady state heat transfer problems – Cartesian, cylindrical and spherical co-ordinate systems – boundary conditions – Un-steady state heat conduction – Errors associated with FDE – Explicit Method – Stability criteria – Implicit Method – Crank Nickolson method – 2-D FDE formulation – ADI – ADE.		
II		9
Finite Volume Method: Formation of Basic rules for control volume approach using 1D steady heat conduction equation – Interface Thermal Conductivity – Extension of General Nodal Equation to 2D and 3D Steady heat conduction and unsteady heat conduction.		
III		5+5=10
Part-A: FVM to Convection and Diffusion: Concept of Elliptic, Parabolic and Hyperbolic Equations applied to fluid flow – Governing Equations of Flow and Heat transfer.		
Part-B: Steady 1D Convection Diffusion – Discretization Schemes and their assessment – Treatment of Boundary Conditions.		
IV		10
Calculation of Flow Field: Vorticity & Stream Function Method – Staggered Grid as Remedy for representation of Flow Field – Pressure and Velocity Corrections – Pressure Velocity Coupling – SIMPLE & SIMPLER (revised algorithm) Algorithm.		
V		9
Turbulent Flows: Direct Numerical Simulation, Large Eddy Simulation and RANS Models Compressible Flows: Introduction – Pressure, Velocity and Density Coupling.		
Textbooks:		
1. Numerical heat transfer and fluid flow – S.V. Patankar (Hemisphere Pub. House) 2. An Introduction to Computational Fluid Dynamics – FVM Method – H.K. Versteeg, & Co., PHI.		
References:		
1. Computational Fluid Dynamics – Hoffman and Chiang, Engg Education System. 2. Computational Fluid Dynamics – Anderson (TMH).		

OPTIMIZATION TECHNIQUES
(Professional Elective – VI)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-ME-PC-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	PO12	PSO2
CO1	explain the classical optimization techniques	3	3	3	3
CO2	determine solution for linear problems using optimization techniques	3	3	3	3
CO3	solve unconstrained non linear problems using various methods	3	3	3	3
CO4	provide solution for constrained non linear problems using various methods	3	3	3	3
CO5	find solution for multivariable problems using dynamic programming	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I		10
Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems. Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum / maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.		
II		9
Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm. Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems.		
III		5+5=10
Part-A: Unconstrained Nonlinear Programming: One dimensional minimization method, Classification, Fibonacci method and Quadratic interpolation method.		
Part-B: Unconstrained Optimization Techniques: Univariant, Powell's, steepest descent methods.		
IV		10
Constrained Nonlinear Programming: Characteristics of a constrained problem – classification – Basic approach of Penalty Function method – Basic approach of Penalty Function method – Basic approaches of Interior and Exterior penalty function methods – Introduction to convex programming problem.		
V		9
Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution – examples illustrating the tabular method of solution.		
Textbooks:		
1. Singiresu S. Rao, Engineering Optimization: Theory and Practice by John Wiley and Sons, 4/e. 2. H. S. Kasene& K. D. Kumar, Introductory Operations Research, Springer (India), Pvt. Ltd., 2004		
References:		
1. H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007.		

ADDITIVE MANUFACTURING
(Professional Elective – VI)

Course	B.Tech.-VIII-Sem.	L	T	P	C
Subject Code	20-ME-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	PO12	PSO1	PSO2
CO1	explain the concepts of additive manufacturing	3	3	3	3	3
CO2	differentiate liquid and solid based rapid prototyping systems	3	3	3	3	3
CO3	illustrate powder based rapid prototyping and tooling systems	3	3	3	3	3
CO4	apply various data file formats in 3D printing	3	3	3	3	3
CO5	summarize various rapid prototyping applications	3	3	3	3	3

Syllabus

Unit	Title/Topics	Hours
I		9
Introduction: Prototyping fundamentals, Historical development, Fundamentals of Rapid Prototyping, Advantages, and Limitations of Rapid Prototyping, commonly used Terms, Classification of RP process, Rapid Prototyping Process Chain: Fundamental Automated Processes, Process Chain.		
II		10
Liquid-based Rapid Prototyping Systems: Stereo lithography Apparatus (SLA), Models and specifications, Process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, Applications, Case studies. Solid-based Rapid Prototyping Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Case studies.Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Case studies.		
III		5+5=10
Part-A: Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Case studies.		
Part-B: Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, need for RT. Rapid Tooling Classification; Indirect Rapid Tooling Methods: Spray Metal Deposition, Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.		
IV		9
Rapid Prototyping Data Formats: STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats, Features of various RP software's like Magics, Mimics, Solid View, View Expert, 3D View, Velocity 2, Rhino, STL View 3 Data Expert and 3D doctor.		
V		10
RP Applications: Application - Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Biomolecules.		
Textbooks:		
1. Rapid prototyping; Principles and Applications, Chua C.K., Leong K.F. and LIM C.S, WSP. 2. Rapid Manufacturing, D.T. Pham and S.S. Dimov/Springer.		
References:		
1. Terry Wohlers, Wholers Report 2000, Wohlers Associates. 2. Rapid Prototyping and Manufacturing, PaulF.Jacobs, ASME.		

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-ME-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.