ACADEMIC REGULATIONS (R18)

COURSE STRUCTURE AND DETAILED SYLLABUS

(CHOICE BASED CREDIT SYSTEM (CBCS))

MECHANICAL ENGINEERING

For

B. Tech. - Regular Four Year Degree Course

(Applicable for the batches admitted from 2018 - 2019)

&

B. Tech. - Lateral Entry Scheme

(Applicable for the batches admitted from 2019 - 2020)

CMR INSTITUTE OF TECHNOLOGY

(UGC - Autonomous)

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

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FOREWORD

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

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

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

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

CMR INSTITUTE OF TECHNOLOGY

Vision: To create world class technocrats for societal needs.

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

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

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

PREAMBLE

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

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

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

All the rules and regulations specified shall hereafter be read as a whole for the purpose of interpretation, as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, CMRIT (Autonomous) shall be The Chairman, Academic Council.

1. UNDER GRADUATE PROGRAMS OFFERED (E&T)

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

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

2. ADMISSION CRITERIA AND MEDIUM OF INSTRUCTION

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

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

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

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

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

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

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

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

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

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

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

3. B.Tech. PROGRAMME STRUCTURE

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

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

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

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

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

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

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

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

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

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

3.3.2 Credit Courses:

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

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

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

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

3.3.3 Subject / Course Classification and Nomenclature:

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

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

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

4. COURSE REGISTRATION

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

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

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

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

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

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

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

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

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

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

5. SUBJECTS / COURSES TO BE OFFERED

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

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

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

6. ATTENDANCE REQUIREMENTS

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

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

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

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

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

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

7. ACADEMIC REQUIREMENTS

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

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

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

7.3 Promotion Rules

7.3.1 Four year B.Tech. (Regular):

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

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

7.3.2 Four year B.Tech. (LES):

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

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

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

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

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

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

8. EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS

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

8.2 Evaluation of Theory Subjects / Courses

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

9. GRADING PROCEDURE

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

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

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

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

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

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

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

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

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

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

places. SGPA is thus computed as

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

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

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

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

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

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

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

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

10 PASSING STANDARDS

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

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

10 DECLARATION OF RESULTS

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

11.2 The conversion formula from CGPA to percentage of Marks:

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

12 AWARD OF DEGREE

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

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

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

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

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

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

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

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

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

13 WITH HOLDING OF RESULTS

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

14 SUPPLEMENTARY EXAMINATIONS

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

15. TRANSITORY REGULATIONS

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

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

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

c) The maximum credits that a student acquires for the award of degree, shall be the sum of the total number of credits secured in all the regulations of his/her study including R18 Regulations. The performance evaluation of the student will be done as per the rules and regulations applicable at the time of admission(s) regarding award of grade and/or class as the case may be.

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

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

16 STUDENT TRANSFERS

There shall be no transfers from other colleges / streams.

17 RULES OF DISCIPLINE

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

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

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

18. MALPRACTICE

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

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

18.2 Malpractice Rules: Disciplinary Action for Improper Conduct in Examinations

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

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

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

19. SCOPE

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

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

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

20. REVISION AND AMENDMENTS TO REGULATIONS

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

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COURSE STRUCTURE

B.Tech. – R-18 COURSE STRUCTURE

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

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

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

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

III – Semester (II – B.Tech. – I - Semester)							
S. No.	Subject Code	Subject	POs	Hours Per Week			Credits
				L	T	P	
1	BSC-201	Numerical and Statistical Methods	1,2,12	3	1	-	4
2	ESC-204	Thermodynamics	1,2,12,14	3	-	-	3
3	ESC-205	Materials Engineering	1,2,12	3	-	-	3
4	ME-PCC-211	Solid Mechanics	1,2,3,12,13	3	-	-	3
5	ME-PCC-212	Instrumentation & Control systems	1,2,12	3	-	-	3
6	ESC-206	Materials Engineering Lab	3,4,5	-	-	3	1.5
7	ME-PCC-213	Solid Mechanics Lab	3,4,13	-	-	3	1.5
8	ME-PCC-214	Instrumentation & Control systems Lab	3,4,5	-	-	2	1
9	BSC-203	Computational Mathematics Lab using Sci Lab	3,4,5,14	-	-	2	1
TOTAL				**15**	**01**	**10**	**21**
Mandatory Course (Non-Credit)							
10	MC-201	Gender Sensitization Lab	9,12	-	-	2	-

IV – Semester (II – B.Tech. – II - Semester)							
S. No.	Subject Code	Subject	POs	Hours Per Week			Credits
				L	T	P	
1	ME-PCC-221	Design of Machine Elements - I	2,3,8,12,13	3	1	-	4
2	ME-PCC-222	Applied Thermodynamics – I	2,6,12,14	3	-	-	3
3	ME-PCC-223	Fluid Mechanics & Hydraulic Machinery	1,2,3,12	3	-	-	3
4	ME-PCC-224	Kinematics of Machinery	1,2,3,12	3	-	-	3
5	ME-PCC-225	Manufacturing Processes	1,2,12,14	3	-	-	3
6	ME-PCC-226	Applied Thermodynamics Lab	3,4,7,14	-	-	3	1.5
7	ME-PCC-227	Fluid Mechanics & Hydraulic Machinery Lab	3,4,14	-	-	2	1
8	ME-PCC-228	Manufacturing Processes Lab	3,4,14	-	-	3	1.5
9	ME-PCC-229	Machine Drawing using AutoCAD	4,5,6,10,13,14	-	-	2	1
TOTAL				**15**	**01**	**10**	**21**
Mandatory Course (Non-Credit)							
10	MC-202	Environmental Sciences	1,6,7,12	2	-	-	-

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

V – Semester (III – B.Tech. – I - Semester)							
S. No.	Subject Code	Subject	POs	Hours Per Week			Credits
				L	T	P	
1	ME-PCC-311	Dynamics of Machinery	1,2,3,12	3		-	3
2	ME-PCC-312	Machine Tools & Metrology	1,2,3,12,14	3	-	-	3
3	ME-PCC-313	Heat Transfer	1,2,3,12,14	3	-	-	3
4	ME-PCC-314	Design of Machine Elements - II	2,3,8,12,13	3	-	-	3
5	ME-PCC-315	Applied Thermodynamics – II	2,6,12,14	3	-	-	3
6	ME-PCC-316	Kinematics & Dynamics Lab	3,4,13	-	-	2	1
7	ME-PCC-317	Heat Transfer Lab	4,6,7,14	-	-	3	1.5
8	ME-PCC-318	Machine Tools & Metrology Lab	3,4,6,14	-	-	3	1.5
9	ME-PCC-319	Design of Machine Elements Lab using CAD	4,5,6,10,13,14	-	-	2	1
TOTAL				**15**	**-**	**10**	**20**
Mandatory Course (Non-Credit)							
10	MC-311	Employability Skills - I	9,10	3	-	-	-
11	MC-312	Summer Internship - I	1 to 14	-	-	-	-

VI – Semester (III – B.Tech. – II - Semester)							
S. No.	Subject Code	Subject	POs	Hours Per Week			Credits
				L	T	P	
1	ME-PCC-321	Operations Research	1,2,3,12,14	3	-	-	3
2	ME-PCC-322	Computer Aided Design	2,3,12,13	3	-	-	3
3	ME-PCC-323	Automation in Manufacturing	2,3,5,12,13	3	-	-	3
4	**Professional Elective – I**			3	-	-	3
	ME-PEC-301	T: Renewable Energy Sources	2,6,7,12,14				
	ME-PEC-302	I: Industrial Engineering	1,2,8,11,12				
	ME-PEC-303	P: Unconventional machining processes	2,3,5,12,14				
	ME-PEC-304	D: Finite Element Analysis	2,3,4,12,13				
5	**Open Elective – I**			3	-	-	3
	OEC-301	CE: Disaster Management	2,7,8,12				
	OEC-302	ME: Fundamentals of Operations Research	1,2,12				
	OEC-303	ECE: Electronic Measurements and Instrumentation	1,2,12				
	OEC-304	CSE: Java Programming	1,2,3,5,12				
	OEC-305	HSMC: Indian Culture and Constitution	8,12				
6	ME-PCC-324	Automation in Manufacturing Lab	4,5,10,13,14	-	-	2	1
7	ME-PCC-325	Production Drawing Practice using CAD	4,5,6,10,13,14	-	-	2	1
8	ME-PCC-326	Computer Aided Analysis Lab	4,5,10,14	-	-	2	1
9	HSMC-301	Advanced English Communication Skills Lab	5,10	1	-	2	2
TOTAL				**16**	**-**	**08**	**20**
Mandatory Course (Non-Credit)							
10	MC-321	Employability Skills - II	9,10	3	-	-	-

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

VII – Semester (IV – B.Tech. – I - Semester)							
S. No.	Subject Code	Subject	POs	Hours Per Week			Credits
				L	T	P	
1	HSMC-401	Management, Economics and Accountancy	11,12	3	-	-	3
2	ME-PCC-411	Artificial Intelligence and Robotics	1,2,12,13	3	-	-	3
3	**Professional Elective – II**			3	-	-	3
	ME-PEC-401	T: Automobile engineering	6,7,12,14				
	ME-PEC-405	I: Total Quality Management	2,3,5,6,7,8,12,13				
	ME-PEC-409	P: Flexible manufacturing systems	2,3,12,14				
	ME-PEC-413	D: Design of Experiments	2,3,4,11,12,13				
4	**Professional Elective – III**			3	-	-	3
	ME-PEC-402	T: Refrigeration and air conditioning	2,3,7,12,14				
	ME-PEC-406	I: Maintenance and Safety Engineering	2,3,6,7,8,12,13				
	ME-PEC-410	P: Plant Layout & Material Handling	2,6,7,12,14				
	ME-PEC-414	D: Design of Transmission Systems	2,3,4,12,14				
5	**Open Elective – II**			3	-	-	3
	OEC-401	CE: Environmental Impact Assessment	6,7,12				
	OEC-403	ME: Non-Conventional Energy Sources	6,7,12				
	OEC-405	ECE: Principles of Communication Systems	1,2,3,12				
	OEC-407	CSE: Database Management Systems	1,2,3,5,12				
	OEC-409	HSMC: Intellectual Property Rights	1,6,8,12				
6	HSMC-402	Technical Writing Skills Lab	5,10	-	-	2	1
7	ME-PCC-412	Artificial Intelligence and Robotics Lab	4,5,14	-	-	2	1
8	ME-PRJ-413	Project – I	1 to 14	-	-	6	3
TOTAL				**15**	**-**	**10**	**20**
Mandatory Course (Non-Credit)							
9	MC-411	Summer Internship - II	1 to 12	-	-	-	-

VIII – Semester (IV – B.Tech. – II - Semester)							
S. No.	Subject Code	Subject	POs	Hours Per Week			Credits
				L	T	P	
1	**Professional Elective – IV**			3	-	-	3
	ME-PEC-403	T: Power Plant Engineering	2,3,6,12,14				
	ME-PEC-407	I: Production Planning & Control	2,3,11,12,14				
	ME-PEC-411	P: Theory of Metal Cutting	2,3,4,5,12,13				
	ME-PEC-415	D: Mechanics of Composite Materials	2,3,4,12,13				
2	**Professional Elective – V**			3	-	-	3
	ME-PEC-404	T: Computational Fluid Dynamics	2,3,5,12,13				
	ME-PEC-408	I: Optimization Techniques	2,3,12,14				
	ME-PEC-412	P: Additive Manufacturing	2,3,12,13,14				
	ME-PEC-416	D: Design of Press Tools, Jigs and Fixtures	2,3,5,12,13,14				
3	**Open Elective – III**			3	-	-	3
	OEC-402	CE: Green Building Technologies	1,2,7,12				
	OEC-404	ME: Fundamentals of Robotics	1,2,5,12				
	OEC-406	ECE: Fundamentals of Embedded Systems	1,2,3,12				
	OEC-408	CSE: Web Technologies	2,3,5,6,12				
	OEC-410	HSMC: Principles of Entrepreneurship	7,8,9,11,12				
4	ME-PRJ-421	Project-II	1 to 14	-	-	22	11
TOTAL				**9**	**-**	**22**	**20**

I-B.TECH.-I-SEMESTER SYLLABUS

ENGINEERING MATHEMATICS – I
(Linear Algebra and Calculus)

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

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

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

Unit-I: Matrices **9 hours**

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

Unit-II: Eigen values and Eigen vectors **11 hours**

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

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

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

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

Unit-IV: Calculus **9 hours**

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

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

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

Textbooks:

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

References:

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

ENGINEERING PHYSICS

I-B.Tech.-I-Sem. **L T P C**
Subject Code: 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	compare simple and damped harmonic oscillations	3	2	1
CO2	illustrate the interference and diffraction phenomena of light	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

Unit - I: Simple & Damped harmonic motion **10 hours**

Introduction, Simple Harmonic Oscillator, Characteristics of Simple Harmonic oscillator, Energy of Simple Harmonic Oscillator, Frequency of Vibration of a String, Principle of Superposition of Waves: Linear Superposition of Two Waves of Same Frequency.
Damped harmonic motion – over, critical and under – damped oscillators; Energy decay in damped harmonic oscillator, Resonance and Quality factor.

Unit - II: Wave Optics **10 hours**

Interference: Huygen's principle, Superposition of waves, interference of light by Division of wavefront and amplitude, Young's double slit experiment, Newton's rings.
Diffraction: Differences between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction from a single slit, double slit; Diffraction grating: Grating spectrum and resolving power.

Unit-III: Lasers **(4 + 4) 8 hours**

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.
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Unit - IV: Fiber Optics **10 hours**

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.

Unit - V: Nano Science & Technology **10 hours**

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.

Text Books:

1. A Textbook of Engineering Physics, Dr. M.N. Avadhanulu, Dr. P.G Kshirsagar – S.Chand.
2. Haliday and Resnick, Physics – wiley.

References:

1. Classical Mechanics by J.C. Upadyaya, Himalaya Publishing House, 2005.
2. Introduction to Solid State Physics by Charles kittel, wiley student edition.

ENGLISH

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

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	compare simple and damped harmonic oscillations	3	2	1
CO2	illustrate the interference and diffraction phenomena of light	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

Reading Skills:

Objectives:

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

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

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

Writing Skills:

Objectives:

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

Unit –I **7 hours**

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

Vocabulary Building: The Concept of Word Formation --The Use of Prefixes and Suffixes.
Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions.
Reading: Reading and Its Importance- Techniques for Effective Reading.
Basic Writing Skills: Sentence Structures - Use of Phrases and Clauses in Sentences-Importance of Proper Punctuation- Techniques for writing precisely – **Paragraph writing** – Types, Structures and Features of a Paragraph - Creating Coherence-Organizing Principles of Paragraphs in Documents.

Unit –II **6 hours**

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

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

Unit –III **(3 + 3) 6 hours**

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

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

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

Unit-IV **7 hours**

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

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

Unit-V **6 hours**

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

Vocabulary: Technical Vocabulary and their usage
Grammar : Common Errors in English
Reading : Reading Comprehension-Exercises for Practice
Writing : Technical Reports- Introduction – Characteristics of a Report – Categories of Reports; **Formats**- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

Textbook:

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

References:

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

PROGRAMMING FOR PROBLEM SOLVING

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Textbooks:

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

References:

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

ENGINEERING GRAPHICS

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

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

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

List of Experiments:

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

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

Week 3: Construction of Hyperbola, Epicycloid.

Week 4: Construction of hypocycloid, involutes.

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

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

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

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

Week 9: Projections of Solids simple position.

Week 10: Projections of Solids inclined to one plane.

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

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

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

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

Textbooks:

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

References:

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

ENGINEERING PHYSICS LAB

	L	T	P	C
I-B.Tech.-I-Sem.				
Subject Code: 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	evaluate the physical constants and frequency by using simple harmonic vibrations	3
CO2	compare practical results with theoretical calculations in electromagnetic theory and 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	demonstrate the interference and dispersion phenomena of light	3

List of Experiments: (Any 08 experiments compulsory)

1. Torsional pendulum - Calculate the rigidity modulus of a given wire.
2. Melde's Exp - Determination of frequency of an Electronic Vibrator.
3. Coupled Oscillator - Determination frequency of a material.
4. Time constant of an R-C Circuit.
5. Bending Losses of Fibers & Evaluation of numerical aperture of given fiber.
6. Diffraction Grating - Determination of wavelengths of a LASER source.
7. Energy gap of material of a semiconductor.
8. Stewart and Gee's method - Magnetic field along the axis of current carrying coil.
9. Newton's Rings-Radius of curvature of Plano convex lens.
10. Identifying the Dispersive power a material.

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

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

Reference:

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

ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB

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

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

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

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

COMPUTER ASSISTED LANGUAGE LEARNING (CALL) LAB

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

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

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

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

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

INTERACTIVE COMMUNICATION SKILLS (ICS) LAB

Exercise – I (Week 3 & 4): JAMs

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

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

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

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

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

Reference:

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

PROGRAMMING FOR PROBLEM SOLVING LAB

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

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

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

LIST OF EXPERIMENTS

Week 1: Familiarization with programming environment

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

Week 2: Operators

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

Week 3: Simple C programs

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

Week 4: Decision Statements

1. Write program that declares Class awarded for a given percentage of marks, where mark <40%= Failed, 40% to <60% = Second class, 60% to <70%=First class, >= 70% = distinction. Read percentage from standard input.
2. Write a Program to calculate roots of quadratic equation (using if-else).
3. Write a Program to perform arithmetic operations using switch case.
4. Write a Program to display colors using switch case (VIBGYOR).

Week 5: Loops

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

.

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

Week 6: 1-D arrays

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

Week 7: 2-D arrays

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

Week 8: Functions

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

Week 9: Functions and Recursion

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

Week 10: Strings

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

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Week 11: Structures

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

Week 12: File operations

1. Write a C program to display the contents of a file to standard output device.
2. Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.
3. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file).
4. Write a C program to count the number of times a character occurs in a text file.

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

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

Reference:

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

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

I-B.Tech.-I-Sem. **L T P C**
Subject Code: 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	PO1 to PO14
CO1	identify the problems	3
CO2	illustrate social innovation	3
CO3	choose suitable processes	3
CO4	design suitable prototype	3
CO5	develop feasibility report	3

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

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

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

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

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

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

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

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

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

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

Reference:

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

I-B.TECH.-II-SEMESTER SYLLABUS

ENGINEERING MATHEMATICS – II
(Advanced Calculus)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Textbooks:

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

References:

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

ENGINEERING CHEMISTRY

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

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

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

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

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

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

Electrochemistry: Introduction, conductance - specific, equivalent and molar conductance, Electrode-Types of electrodes – Construction and functioning of Standard hydrogen electrode, calomel electrode, Determination of p^H of a solution by using glass electrode. Nernst equation – electrochemical series and its applications. Electrochemical cells: Daniel cell – cell notation, cell reaction and cell EMF – Numerical problems Batteries: Primary (Lithium cell) and secondary batteries (Lead – acid storage battery and Lithium ion battery).
Corrosion: Causes and effects of corrosion – theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion, Types of corrosion: Galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current cathodic methods-protective coatings-metallic coatings-hot dipping and cementation.

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

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

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

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

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

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

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

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

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

Textbooks:

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

References:

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

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Textbooks:

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

References:

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

ENGINEERING MECHANICS

I- B.Tech.- II-Sem. **L T P C**
Course Code: ESC-107 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	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

Unit-I **10 hours**

Introduction to Engineering Mechanics: 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.

Unit-II **09 hours**

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.

Unit-III **(5 + 4) 09 hours**

Part A: Simple Lifting Machines: Basic definitions: effort, Load, mechanical advantage, velocity ratio, efficiency. Simple screw jack, Differential Screw jack.
Centroid: Centroid of simple figures from first principles – Centroid of Composite Figures- Centroid of L, T, I, Z and channel Sections.

Part B: Center of Gravity: Centre of gravity of simple solids (from basic principles), centre of gravity of composite solids.

Unit-IV **10 hours**

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.

Unit-V **10 hours**

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

Reference:

1. A Text of Engineering Mechanics, YVD Rao, K. Govinda Rajulu, M. Manzoor Hussain, Academic Publishing Company.

ENGINEERING CHEMISTRY LAB

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

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

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

LIST OF EXPERIMENTS: (PERFORM ANY 10 EXPERIMENTS)

Volumetric Analysis:

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

Instrumentation:

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

Preparations:

8. Synthesis of Aspirin and paracetamol.

Physical properties:

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

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

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

References:

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

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB

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

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

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

LIST OF EXPERIMENTS

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

Part-A: Electrical lab

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

Part-B: Electronics Lab

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

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

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

Reference:

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

ENGINEERING MECHANICS LAB

I-B.Tech.-II-Sem. **L T P C**
Subject Code: 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	PO3
CO1	determine the resultant of a given system of forces	3
CO2	determine the moment of inertia of a body and support reactions of a given beam	3
CO3	apply the principle of moments to calculate unknown forces	3
CO4	compare frictional forces between two surfaces	3
CO5	estimate the mechanical advantage and velocity ratio for simple machines	3

List of Experiments (Perform any 10 Experiments)

1. Verify the polygon law of forces using universal force table
2. Verify the principle of moments using bell crank lever
3. Verify the force in the members of a jib crane
4. Verify the law of moments by rotating disc apparatus
5. Determine the moment of inertia of a fly wheel
6. Determine the mechanical advantage, velocity ratio and efficiency of square threads screw jack
7. Determination of coefficient of friction by the inclined plane apparatus
8. Verify the polygon law of forces using gravesand apparatus
9. Verify the principle of forces in beam of parallel forces apparatus
10. Determine the mechanical advantage, velocity ratio and efficiency of worm and worm wheel
11. Determine the performance of differential axle and wheel and find its velocity ratio and law of machine
12. Determine the radius of gyration and mass moment of inertia of the given specimen using compound pendulum

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

1. Design and Fabrication of Pneumatic Vice.
2. Fabrication of Reduction Gears.
3. Fabrication of Intelligent Reverse Braking System.
4. Fabrication of Pneumatic Jack for Car.
5. Fabrication of Simple 4-Bar Mechanism.
6. Fabrication of Simple Pendulum for Different Oscillating Positions.
7. Fabrication of Mechanism of a Flywheel for Automobile Vehicles.
8. Fabrication of Parallelogram Law of Force Set Up for Different Loads.
9. Fabrication of Mini Crank to Lever Mechanism.
10. Fabrication of Motorized Screw Jack.

Reference:

1. Engineering Mechanics Lab manual, FED, CMRIT, Hyd.

IT & ENGINEERING WORKSHOP

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

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

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

LIST OF EXPERIMENTS

PART-A: IT Workshop

Week-1: WINDOWS OPERATING SYSTEM & DRIVERS INSTALLATION

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

Week-2: NETWORK CONNECTIONS & TROUBLESHOOTING

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

Week-3: Cyber Hygiene

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

Week-4: MS Word

Prepare the project document and resume.

Week-5: MS Excel

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

Week-6: MS Power Point

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

PART-B: Engineering Workshop

Week-7: House Wiring

Power point, light fitting and switches.

Week-8 & 9: Carpentry

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

Week-10 &11: Fitting

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

Week-12 & 13: Tin Smithy & Black Smithy

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

Week 14: Demonstration of Power Tools

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

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

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

Reference:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Reference:

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

II-B.TECH.-I-SEMESTER SYLLABUS

NUMERICAL AND STATISTICAL METHODS

II-B.Tech.-I-Sem. **L T P C**
Subject Code: BSC-201 **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 using numerical methods	3	2	1
CO2	find the numerical solutions for first order initial value problems and integrals	3	2	1
CO3	differentiate among random variables involved in the probability model	3	2	1
CO4	test hypothesis for small and large samples	3	2	1
CO5	identify the correlation coefficients, strength, direction and significance level	3	2	1

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

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

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

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

Unit- III: Probability, Random variables and Distributions **(6 + 4) 10 hours**

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.

Unit – IV: Sampling Theory and Test of Hypothesis for Large Samples **12 hours**

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.

Unit – V: Test of Hypothesis for Small Samples **8 hours**

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.

Text Books:

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.

THERMODYNAMICS

II-B.Tech.-I-Sem. **L T P C**
Subject Code: 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	PO14
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

Tables/Codes: Steam Tables and Mollier Chart

Unit – I **10hours**

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.

Unit – II **9hours**

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 - Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations - Elementary Treatment of the Third Law of Thermodynamics

Unit – III **(5 + 5) 10 hours**

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 - Various Thermodynamic processes and energy Transfer - Steam Calorimetry.

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

Unit – IV **10 hours**

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 – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier's Equation – Psychrometric chart.

Unit - V **9 hours**

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.

Text Books:

1. Engineering Thermodynamics, P.K. Nag, TMH, 3rd Edition.
2. Thermodynamics, C.P.Arora.

References:

1. Thermodynamics, An Engineering Approach – YunusCengel& Boles, TMH
2. Thermodynamics, J.P.Holman, TMH.
3. Engineering Thermodynamics – Jones & Dugan.
4. An introduction to Thermodynamics, YVC Rao, New Age.

MATERIALS ENGINEERING

II-B.Tech-I-Sem **L T P C**
Subject Code: ESC -205 **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

Unit – I **9 hours**

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.

Unit –II **10 hours**

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.

Unit–III **(5 + 4) 9 hours**

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.

Unit – IV **10 hours**

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.

Unit – V **10 hours**

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.

SOLID MECHANICS

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

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12	PO13
CO1	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

Unit-I **10 hours**

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.

Unit-II **9 hours**

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.

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

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.

Unit – IV **10 hours**

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).

Unit – V **9 hours**

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations: $T/J = q/r = N\theta/L$ – 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.

Text Books:

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

INSTRUMENTATION & CONTROL SYSTEMS

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

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
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

Unit- I **10 hours**

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.

Unit- II **9 hours**

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.

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

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.

Unit-IV **9 hours**

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.

Unit-V **9 hours**

Elements of Control systems: Introduction, Importance-Classification- Open and closed systems servomechanisms- Examples With Block Diagrams- Temperature, Speed and Position Control systems.

Text books:

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.

MATERIALS ENGINEERING LAB

II-B.Tech.-I-Sem. **L T P C**
Subject code: ESC-206 **- - 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:

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.

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

Reference:

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

SOLID MECHANICS LAB

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

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

COs	Upon completion of course the students will be able to	PO3	PO4	PO13
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: (Any 10 Experiments to be performed)

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

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.

Reference:

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

INSTRUMENTATION AND CONTROL SYSTEMS LAB

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

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

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

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.

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

Reference:

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

COMPUTATIONAL MATHEMATICS LAB USING Sci LAB

II-B.Tech.-I-Sem. **L T P C**
Subject Code: BSC-203 **- - 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	PO14
CO1	solve problems on Linear Algebra and plotting of Graphs	3	3	3	3
CO2	find roots of an equation using various Methods	3	3	3	3
CO3	fit a curve for straight line, parabola, exponential and power curves	3	3	3	3
CO4	solve ordinary differential equations using Numerical techniques	3	3	3	3
CO5	solve ordinary integral equations using Numerical techniques	3	3	3	3

LIST OF EXPERIMENTS

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

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

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

Reference:

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

GENDER SENSITIZATION LAB
(MANDATORY COURSE- NON- CREDIT)

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

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

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

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

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

Unit-II: GENDER ROLES AND RELATIONS **6 hours**

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

Unit-III: GENDER AND LABOUR **(4 + 4) 8 hours**

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

Unit-IV: GENDER - BASED VIOLENCE **6 hours**

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

Unit-V: GENDER AND CULTURE **6 hours**

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

Text Book:

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

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

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

II-B.TECH.-II-SEMESTER SYLLABUS

DESIGN OF MACHINE ELEMENTS – I

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

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO8	PO12	PO13
CO1	explain the design procedure and select materials for specific application	3	3	2	3	3
CO2	evaluate the strength, stiffness and fatigue of machine elements	3	3	2	3	3
CO3	design riveted, welded and bolted joints	3	3	3	3	3
CO4	design keys, cotters, knuckle joints	3	3	3	3	3
CO5	design shafts and couplings	3	3	3	3	3

Unit- I: Design for Static Strength **10 hours**

Introduction: General considerations in the design - 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.

Unit- II: Design for Fatigue Strength **9 hours**

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.

Unit- III: Riveted, Welded and Bolted Joints **(5 + 5) 10 hours**

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

Unit- IV: Keys, Cotters and Knuckle Joints **9 hours**

Types of keys - Design of keys - stresses in keys-cottered joints - spigot and socket, sleeve and cotter, jib and cotter joints, Knuckle joints.

Unit- V: Shafts and Shaft Couplings **10 hours**

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.

Textbooks:

1. Design of Machine Elements, V.B. Bhandari, TMH.
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-I

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

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

COs	Upon completion of course the students will be able to	PO2	PO6	PO12	PO14
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

Unit-I **9 hours**

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.

Unit-II **10 hours**

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.

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

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

Unit-IV **10 hours**

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.

Unit- V **9 hours**

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.

Text Books:

1. I.C. Engines, V. Ganesan, TMH.
2. Thermal Engineering, Rajput, Lakshmi Publications.
3. Thermal Engineering, P.K.Nag.

Reference Books:

1. IC Engines – Mathur & Sharma – Dhanpath Rai & Sons.
2. Engineering fundamentals of IC Engines – Pulkrabek, Pearson, PHI.

FLUID MECHANICS & HYDRAULIC MACHINERY

II-B.Tech.-II-Sem. **L T P C**
Subject Code: ME-PCC-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 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

Unit-I **9 hours**

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.

Unit- II **10 hours**

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.

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

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.

Unit-IV **10 hours**

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.

Unit-V **9 hours**

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.

Text Books:

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.

KINEMATICS OF MACHINERY

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

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

COs	Upon completion of course the students will be able to	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

Unit-I **10 hours**

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.

Unit-II **9 hours**

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.

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

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.

Unit-IV **9 hours**

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.

Unit-V **10 hours**

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.

MANUFACTURING PROCESSES

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

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO12	PO14
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

Unit – I **10 hours**

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.

Unit – II **9 hours**

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.

Unit – III **(5 + 5) 10 hours**

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.

Unit – IV **9 hours**

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.

Unit – V **10 hours**

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.

Text Books:

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.

APPLIED THERMODYNAMICS LAB

II-B.Tech.-II-Sem. **L T P C**
Subject Code: ME-PCC-226 **- - 3 1.5**

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

COs	Upon completion of course the students will be able to	PO3	PO4	PO7	PO14
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: (A Minimum of 10 experiments is to be conducted)

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

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

Reference:

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

FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

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

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

COs	Upon completion of course the students will be able to	PO3	PO4	PO14
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:

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.

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

Reference:

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

MANUFACTURING PROCESSES LAB

II-B.Tech.-II-Sem. **L T P C**
Subject Code: ME-PCC-228 **- - 3 1.5**

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

COs	Upon completion of course the students will be able to	PO3	PO4	PO14
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 need to be performed)

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.

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.

Reference:

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

MACHINE DRAWING USING AutoCAD

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

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

COs	Upon completion of course the students will be able to	PO4	PO5	PO6	PO10	PO13	PO14
CO1	apply the principles of engineering drawing in machine drawing	3	3	3	3	3	3
CO2	make use of conventional representation of materials and machine components	3	3	3	3	3	3
CO3	illustrate various permanent and temporary Fasteners, Joints and Couplings	3	3	3	3	3	3
CO4	develop assembly drawings from the given part drawing and vice versa	3	3	3	3	3	3
CO5	construct computer aided drawings using CAD software package	3	3	3	3	3	3

LIST OF EXERCISES

Week-1: Conventional Representation: Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs and ribs; Introduction to AutoCAD.

Week-2: Sectional Views: Types of sections, selection of section planes and drawing of sections and auxiliary sectional views, parts not usually sectioned.

Week-3: Dimensioning: Methods of dimensioning, general rules for sizes, and placement of dimensions for holes, centers, and curved and tapered features.

Week-4: Working Drawings: Types of drawings–working drawings for machine parts.

Week-5: Machine Elements: Drawing of machine elements and simple parts; Selection of orthogonal views and additional views for the following machine elements and parts with every drawing proportion, popular forms of screw threads, bolts, nuts, stud bolts.

Week-6: Keys and Cotter Joints: Keys, cotter joints, and knuckle joint.

Week-7: Riveted Joints: Riveted joints for plates.

Week-8: Couplings: Shaft coupling and spigot joint.

Week-9: Bearings: Journal, pivot, and collar bearing.

Week-10: Assembly Drawings-Engine Parts: Assembly drawings for the following, using conventions and parametric drawing practice: Engine parts, stuffing box.

Week-11: Connecting Rod and Eccentric: Eccentrics, I.C. engine connecting rod.

WeeK-12: Screw Jack: Assembly drawing of Screw jack.

Week-13: Tail Stock and Machine Vice: Machine vice and tailstock.

Week-14: Safety Valves: Rams-bottom Safety Valve, feed check valve.

Note: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

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 single tool post using AutoCAD software.
6. Assembly of clapper block.
7. Assembly of milling fixture.
8. Assembly of welded shaft supports.
9. Assembly of square tool post.
10. Assembly of lathe tail – stock.

Reference:

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

ENVIRONMENTAL SCIENCES
MANDATORY COURSE (NON-CREDIT)

II-B.Tech.-II-Sem. **L T P C**

Subject Code: MC-202 **2 - - -**

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

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

Unit I: Ecosystem **6 hours**

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

Unit II: Natural Resources **7 hours**

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

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

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

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

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

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

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

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

Textbooks:

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

References:

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

III-B.TECH.-I-SEMESTER SYLLABUS

DYNAMICS OF MACHINERY

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

Unit-I **10 hours**

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.

Unit-II **9 hours**

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.

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

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.

Unit-IV **10 hours**

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.

Unit-V **9 hours**

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.

MACHINE TOOLS AND METROLOGY

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

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12	PO14
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

Unit-I **10 hours**

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.

Unit-II **9 hours**

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.

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

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

Unit-IV **10 hours**

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.

Unit-V **9 hours**

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.

HEAT TRANSFER

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

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12	PO14
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

Unit-I **10 hours**

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.

Unit-II **9 hours**

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.

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

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 – significance of non-dimensional numbers – concepts of continuity, Momentum and energy equations-Integral method as approximate method.

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.

Unit-IV **10 hours**

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.

Unit-V **9 hours**

Heat Transfer with phase change: Boiling: - Pool boiling – Regimes - calculations on nucleate boiling, critical heat flux and film boiling.
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, New Age International 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 –Heat and mass transfer – R K Rajput- S. Chand & Company.
3. Heat and mass transfer – D S Kumar- S K Kataria& Sons.

DESIGN OF MACHINE ELEMENTS – II

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

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO8	PO12	PO13
CO1	analyse the importance of sliding contact bearings	3	3	2	3	3
CO2	design the different types of rolling contact bearings	3	3	2	3	3
CO3	explain the concepts of springs and power transmission systems	3	3	3	3	3
CO4	design different categories of engine parts	3	3	3	3	3
CO5	evaluate the design procedure for gears and power screws	3	3	3	3	3

Unit-I **10 hours**

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, Properties of Sliding Contact Bearing, Bearing materials.

Unit-II **9 hours**

Rolling contact bearings: Types of Rolling Contact bearings, Ball and roller bearings – Static load – dynamic load – equivalent radial load – Reliability of a Bearing - design and selection of ball & roller bearings.

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

Part-A: Mechanical Springs: Stresses and deflections of helical springs – Extension and compression springs – Design of springs for fatigue loading – Energy storage capacity.

Part-B: Belts & Pulleys: Transmission of power by Belt and Rope ways, Transmission efficiencies, Belts – Flat and V types, Ropes Drive.

Unit-IV **9 hours**

IC Engine Parts: Piston- Forces acting on piston – Construction, Design and proportions of piston. Connecting Rod: Thrust in connecting rod – stresses due to whipping action on connecting rod ends.

Unit-V **10 hours**

Gears: Spur gears & Helical gears- Brief introduction involving important concepts – Design of gears using AGMA procedure involving Lewis and Buckingham equations. Check for dynamic and wear considerations.
Design of Power Screws: Design of screw. Square, ACME, Buttress screws, Stresses in Power Screws. Compound screw, Differential screw, possible failures.

Textbooks:

1. Machine tool design, V.B. Bhandari, TMH.
2. Design of Machine Elements, Spotts, Pearson.

References:

1. Design of Machine Elements-II, Annaiah, New Age.
2. Design of Machine Elements, Sharma and Purohit, PHI.
3. Mechanical Engineering Design, Richard G. Budyanas and J. Keith Nisbett, Shygley.

Data Books:

1. Design Data Book - P.S.G. College of Technology.
2. Design Data Book – P.V Ramana Murti, M. Vidhyasagar, BS Publications.

APPLIED THERMODYNAMICS – II

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

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

COs	Upon completion of course the students will be able to	PO2	PO6	PO12	PO14
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	3	3	3	3
CO4	outline the working of steam condensers, gas turbines and their performance parameters	3	3	3	3
CO5	assess the performance of turbo jet engines	3	3	2	3

Unit -I **10 hours**

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.

Unit-II **9 hours**

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.

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

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.

Unit-IV **10 hours**

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.
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.

Unit-V **9 hours**

Jet Propulsion: Principle of Operation –Classification of jet propulsive engines – Working Principles with schematic diagrams and representation on T-S diagram - Thrust, Thrust Power and Propulsion Efficiency– Turbo jet engines – Needs and Demands met by Turbo jet – Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation – Methods.

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.

KINEMATICS AND DYNAMICS LAB

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

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

COs	Upon completion of course the students will be able to	PO3	PO4	PO13
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)

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

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

Reference:

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

HEAT TRANSFER LAB

III-B.Tech.-I-Sem. **L T P C**
Subject code: ME-PCC-317 **- - 3 1.5**

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

COs	Upon completion of course the students will be able to	PO4	PO6	PO7	PO14
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 (perform any 12 experiments):

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

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.

Reference:

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

MACHINE TOOLS AND METROLOGY LAB

III-B.Tech.-I-Sem. **L T P C**
Subject Code: ME-PCC-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	PO14
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

Section -A:

1. Introduction of general purpose machine -Lathe, Drilling machine, Milling machine, Shaper.
2. Planing machine, slotting machine, 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. Shapping and Planning
7. Slotting
8. Milling
9. Cylindrical Surface Grinding
10. Grinding of Tool angles

Section -B:

1. Use of gear teeth Vernier calipers for checking the chordal addendum and chordal height of the spur gear.
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.

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.

Reference:

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

DESIGN OF MACHINE ELEMENTS USING CAD LAB

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

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

COs	Upon completion of course the students will be able to	PO4	PO5	PO6	PO10	PO13	PO14
CO1	identify the different types of keys, fasteners and machine element parts	3	3	3	3	3	3
CO2	visualize and prepare detailed drawing of a given object	3	3	3	3	3	3
CO3	draw details and assembly of mechanical systems	3	3	3	3	3	3
CO4	interpret a given machine component drawing	3	3	3	3	3	3
CO5	create 2-D and 3-D models using CATIA with manufacturing considerations	3	3	3	3	3	3

LIST OF EXPERIMENTS (Minimum 10 Experiments to be conducted):

1. Introduction to CATIA Software drawing of isometric view of machine element parts.
2. Assembly of Sleeve and Cotter Joint
3. Assembly of Socket and Spigot Joint
4. Assembly of Shaft Coupling
5. Assembly of Gib& Cotter Joint
6. Assembly of Knuckle Joint
7. Assembly of Universal Joint
8. Assembly of Screw Jack
9. Assembly of Plummer Block
10. Assembly of Simple Eccentric
11. Assembly of Machine Vice
12. Assembly of Flanged Coupling
13. Assembly of Bushed Bearing

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 shaft for complex loading
4. 3D modeling of flexible coupling
5. 3D modeling of rigid coupling
6. 3D modeling of helical spring
7. 3D modeling of splined shaft
8. 3D modeling of belt pulley
9. 3D modeling of protected flange
10. 3D modeling of fork lever

Reference:

1. Design of Machine Elements Using Catia Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd.

EMPLOYABILITY SKILLS – I
MANDATORY COURSE (NON-CREDIT)

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

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

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

Unit–I **10 Hours**

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

Unit–II **10 Hours**

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

Unit–III **(4 + 4) 8 Hours**

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

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

Unit–IV **10 Hours**

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

Unit–V **10 Hours**

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

Activities List:

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

Reference:

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

SUMMER INTERNSHIP - I
MANDATORY COURSE (NON-CREDIT)

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

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

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

Guidelines:

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

III-B.TECH.-II-SEMESTER SYLLABUS

OPERATIONS RESEARCH

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

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12	PO14
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

Unit-I **10 hours**

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.

Unit-II **9 hours**

Transportation Problem: Formulation - Optimal solution, unbalanced transportation problem - Degeneracy. Assignment problem - Formulation - Optimal solution - Variants of Assignment Problem- Traveling Salesman problem.

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

Part-A: Sequencing: Introduction - Flow -Shop sequencing - n jobs through two machines - n jobs through three machines - Job shop sequencing - two jobs through m machines.

Part-B: Inventory: Introduction - Single item, Deterministic models - Purchase inventory models with one price break and multiple price breaks - Stochastic models - demand may be discrete variable or continuous variable - Single Period model and no setup cost.

Unit-IV **10 hours**

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.

Unit-V **9 hours**

Theory of Games: Introduction –Terminology- Solution of games with saddle points and without saddle points - 2 x 2 games - dominance principle - m x 2 & 2 x n games - graphical method.
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.

COMPUTER AIDED DESIGN

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

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO12	PO13
CO1	describe various CAD devices, software and coordinate systems	3	3	3	3
CO2	apply homogeneous transformations on various geometric models	3	3	3	3
CO3	construct both analytical and synthetic entities using parametric representations	3	3	3	3
CO4	build surface models using different representation schemes	3	3	3	3
CO5	create solid primitives using the different representation schemes	3	3	3	3

Unit-I **10 hours**

Introduction: Typical Product Cycle, CAD Tools, CAD Workstation, The Design Process – Applications of CAD – Computer Configurations for CAD Applications – Computer Hardware in CADD – CAD Software – operating software – Graphics Software – Application Software – Programming support software. Concept of Coordinate Systems: Working Coordinate System, Model Coordinate System, Screen Coordinate System.

Unit-II **9 hours**

Computer Graphics & Drafting: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry 2D and 3D transformations, Geometric commands, layers, display control commands, editing, dimensioning.

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

Part-A: **Geometric Modeling:** 3D modelling techniques: Wireframe modelling, Surface Modelling, Solid Modelling. Mathematical Representation of Analytic Curves with parametric Representation: Lines, Circle, Conics.

Part-B: Mathematical Representation of Synthetic Curves: Hermite Cubic Spline,–Bezier Curves – B-Spline Curves – NURBS.

Unit-IV **9 hours**

Mathematical Representation of Surfaces: Surface Entities: Analytical Surfaces- Plane Surface, Tabulated Surface, Ruled Surface, Surface of Revolution, Sweep Surface.
Synthetic Surfaces: Hermite Bi-Cubic Surface, Bezier Surface, Coons Surface, Bilinear Surface, B-Spline Surface. Blending Surface, Offset Surface, Surface Manipulations.

Unit-V **10 hours**

Solids Representation: Geometry and Topology, Solid Entities, Half-Spaces,Boundary Representation (B-rep), Constructive Solid Geometry (CSG), Solid Manipulations.
Product Data Exchange: Translators – IGES, STEP, ACIS and DXF files – Processors- Design and Implementation.

Textbooks:

1. CAD/CAM, A Zimmers&P.Groover, PE, PHI
2. CAD/CAM - Principles and applications, P.N. Rao, TMH

Reference:

1. Mastering CAD/CAM, Ibrahim Zeid, TMH.
2. CAD/CAM Theory and Practice, Ibrahim Zeid& R. Sivasubramanian, TMH.

AUTOMATION IN MANUFACTURING

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

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO12	PO13
CO1	illustrate the fundamentals of CNC part programming	3	3	3	3	3
CO2	explain CNC machine elements and system devices	3	3	3	3	3
CO3	make use of tooling, cooling and fixturing systems for CNC machines	3	3	3	3	3
CO4	create various Rapid Prototyping data files	3	3	3	3	3
CO5	outline the various applications of Rapid Prototyping	3	3	3	3	3

Unit-I **10 hours**

Numerical Control (NC): Basic components of NC System, NC procedure, NC machine tools, NC Machining centres-types, CNC Part Programming-fundamentals, Manual part-programming - Computer Aided Part Programming (APT).

Unit-II **9 hours**

CNC Machine Elements: Machine structure, Guideways, feed drives, spincles, spindle bearings.
System Devices: Drives, feed devices, counting devices. Interpolators for manufacturing systems: DDA integrator, DDA hardware interpolators, CNC software interpolators.

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

Part-A: Tooling for CNC Machines: Interchangeable tooling system, preset and qualified tools, coolant fed tooling system.
Part-B: Modular fixturing, quick change cooling system, automatic head changers.

Unit–IV **10 hours**

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. Rapid Prototyping Software's: Features of various RP softwares like Magic's, Mimics, Solid View, View Expert, 3-D View, Velocity 2 , Rhino, STL View 3 Data Expert and 3-D doctor.

Unit–V **9 hours**

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.

Textbooks:

1. Computer control of manufacturing systems- Yoram Koren, TMH, 2009
2. Rapid prototyping: Principles and Applications -Chua C.K., Leong K.F. and LIM C.S, World Scientific publications , Third Edition, 2010

References:

1. Computer Numerical Control- Operations and Programming- Jon Stenerson and Kelly Curron Pul, 3rd Edition.
2. Mechatronics-HMT, TMH.
3. Rapid Manufacturing –D.T. Pham and S.S. Dimov, Springer , 2001

RENEWABLE ENERGY SOURCES
(Professional Elective – I)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: ME-PEC-301 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO6	PO7	PO12	PO14
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

Unit-I **10 hours**

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.

Unit-II **9 hours**

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.

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

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.

Unit-IV **10 hours**

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.

Unit-V **9 hours**

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.

Text books:

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.

INDUSTRIAL ENGINEERING
(Professional Elective – I)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: ME-PEC-302 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO1	PO2	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

Unit-I **10 hours**

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.

Unit-II **9 hours**

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.

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

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.

Unit-IV **9 hours**

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.

Unit-V **10 hours**

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.

UNCONVENTIONAL MACHINING PROCESSES
(Professional Elective – I)

III-B.Tech.-II-Sem **L T P C**
Course Code: ME-PEC-303 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO12	PO14
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

Unit-I **10 hours**

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.

Unit-II **9 hours**

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

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

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.

Unit-IV **9 hours**

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.

Unit-V **10 hours**

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 – I)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: ME-PEC-304 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO4	PO12	PO13
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

Unit- I **10 hours**

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.

Unit- II **9 hours**

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.

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

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.

Unit-IV **9 hours**

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.

Unit-V **10 hours**

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)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-301 **3 - - 3**

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

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

Unit-I **10 hours**

Understanding Disaster: Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional)
Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards

Unit–II **9 hours**

Disaster Management Mechanism: Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

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

Capacity Building: Capacity Building: Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

Unit- IV **9 hours**

Coping with Disaster: Coping Strategies; alternative adjustment processes – Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management.

Unit-V **10 hours**

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India Organizational structure for disaster management in India - Preparation of state and district, Disaster management plans.

Textbooks:

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.
3. Disaster Science and Management by T. Bhattacharya, TMH, 2015

References:

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BSP 2009.
2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

FUNDAMENTALS OF OPERATIONS RESEARCH
(Open Elective-I)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-302 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO12
CO1	formulate and solve linear programming problem using various methods	3	2	3
CO2	solve transportation and assignment problems	3	3	3
CO3	compute sequencing and inventory model problems	2	2	3
CO4	analyze waiting lines and game theory problems	3	3	3
CO5	evaluate replacement and dynamic programming problems	2	3	3

Unit-I **10 hours**

Introduction to Operations Research: Basics definition, scope, objectives, phases, models, applications and limitations of Operations Research.
Linear Programming Problem Formulation, Graphical solution, Simplex method, Artificial variables techniques: Two-phase method, Big M method.

Unit-II **9 hours**

Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: MODI method.
Assignment model: Formulation. Hungarian method for optimal solution. Solving unbalanced problem. Traveling salesman problem and assignment problem.

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

Part-A: Sequencing: Introduction, Flow-Shop sequencing, n jobs through two machines, n jobs through three machines, Job shop sequencing, two jobs through m machines.

Part-B: Inventory: Introduction, Single item, Deterministic models - Purchase inventory models with one price break and multiple price breaks -Stochastic models - demand may be discrete variable or continuous variable - Single Period model and no setup cost.

Unit-IV **10 hours**

Theory of Games: Introduction, Terminology- Solution of games with saddle points and without saddle points- 2 x 2 games, dominance principle, m x 2 & 2 x n games -graphical method.
Waiting Lines: Introduction, Terminology-Single Channel-Poisson arrivals and Exponential Service times-with infinite population and finite population models-Multichannel-Poisson arrivals and exponential service times with infinite population.

Unit-V **9 hours**

Dynamic Programming: Introduction, Terminology - Bellman's Principle of Optimality - Applications of dynamic programming- Project network - CPM and PERT networks - Critical path scheduling.

Text Books:

1. Operations Research, J.K.Sharma 4th Edition, Mac Milan.
2. Introduction to O. RIHilIier & Libermannf, TMH.

References:

1. Introduction to O.R, Hamdy A. Taha, PHl.
2. Operations Research, A.M.Natarajan, P. Balasubramaniam, A.Tamilarasi, Pearson Education.
3. Operations Research I Wagner, PHI Publications.

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION
(Open Elective-I)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-303 **3 - - 3**

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

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

Unit-I **10 hours**

Block Schematics of Measurement: Performance characteristics-static characteristics, dynamic characteristics; measuring instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC voltmeters and Current Meters, Ohmmeters, Multi-meters; meter protection; Extension of Range; True RMS Responding voltmeters; specifications of instruments.

Unit-II **9 hours**

Signal Analyzers: AF, HF Wave Analyzers, Heterodyne wave Analyzers, Power Analyzers; capacitance-voltage Meters; oscillators; signal generators-sweep frequency generators: AF, RF, pulse and square wave, arbitrary waveform & function generators and Specifications.

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

Part-A: Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, CRO Probes. Applications-measurement of Time period and frequency specifications.

Part-B: Special Purpose Oscilloscopes: introduction to dual trace, dual beam CROs, sampling oscilloscopes, storage oscilloscopes, digital storage CROs.

Unit-IV **10 hours**

Transducers: Classification of transducers; force and displacement transducers; resistance thermometers; hotwire anemometers; LVDT; thermocouples, Synchros, special resistance thermometers; digital temperature sensing system; Piezoelectric; variable capacitance transducers; magneto strictive transducers.

Unit-V **9 hours**

Bridges: Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge; measurement of physical parameters-flow, displacement, level, humidity, moisture, force, pressure, vacuum level, temperature measurements; data acquisition systems.

Textbooks:

1. Electronic Instrumentation: H.S.Kalsi-TMH 2nd Edition 2004.
2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D.Cooper: PHI 5th Edition, 2003.

References:

1. Electronic Instrumentation and Measurements- David A. Bell, Oxford Univ. Press, 1997.
2. Electronic Measurements and Instrumentation K. Lal Kishore, Pearson Education 2010.

JAVA PROGRAMMING
(Open Elective-I)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-304 **3 - - 3**

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

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

Unit-I **10 hours**

Java Basics: History of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, OOP concepts, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, parameter passing, recursion, exploring String class.

Unit-II **9 hours**

Inheritance and Polymorphism: Types of inheritance, member access rules, super uses, using final with inheritance, the object class and its methods, method overloading and overriding, dynamic binding, abstract classes and methods.

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

Part-A: Packages and Inner classes: Defining, creating and accessing a package, CLASSPATH, importing packages, inner classes – local, anonymous and static.

Part-B: Interfaces: Defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces, differences between classes and interfaces.

Unit-IV **9 hours**

Exception handling: Concepts of exception handling, benefits of exception handling, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes.
Multithreading: Differences between multi-threading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication.

Unit-V **10 hours**

Applets: Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets.

Textbooks:

1. Java the complete reference, 8th Edition, Herbert Schildt, TMH.

References:

1. Java How to Program, H. M. Dietel and P. J. Dietel, Sixth Edition, Pearson Education, PHI.
2. Introduction to Java programming, Y. Daniel Liang, Pearson Education.

INDIAN CULTURE AND CONSTITUTION
(Open Elective-I)

III-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-305 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO8	PO12
CO1	identify paradigm shift in indian culture	3	1
CO2	explain features of languages, religions and holy books	3	2
CO3	illustrate provisions of Indian constitution	3	3
CO4	appreciate the structure of Indian administration system	3	3
CO5	appraise the role of Election Commission of India	3	2

Unit –I **10 hours**

Indian Culture: Characteristics of Indian culture, significance of geography on Indian culture, society in India through ages, religions in ancient period, caste system, communalism and modes of cultural exchange.

Unit-II **9 hours**

Indian Languages, Religions and Literature: Evolution of script and languages in India, the Vedas and holy books of various religions. religion and philosophy in India; ancient period – Prevedic, Vedic religion, Buddhism and Jainism.

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

Part A: Indian Constitution: Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Fundamental Rights and Duties.

Part B: Union Administration: Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.

Unit-IV **10 hours**

State Administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Structure and functions Election Commission: Role and Functioning.
District's Administration: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Unit-V **9 hours**

Local Administration: Introduction to local self government, Organizational Hierarchy (Different departments), ZP administration, Mandal level and Village level administration.
Election Commission: Role, structure and Functions of Election Commission of India. Introduction to different welfare boards.

Reference:

1. A Hand Book on Indian Culture and Constitution, FED, CMRIT, Hyderabad.

AUTOMATION IN MANUFACTURING LAB

III-B.Tech.-II-Sem. **L T P C**
Subject Code: ME-PCC-324 **- - 2 1**

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

COs	Upon completion of course the students will be able to	PO4	PO5	PO10	PO14
CO1	develop part programming for lathe and mill operations using CAM software	3	3	3	3
CO2	produce components on CNC lathe	3	3	3	3
CO3	manufacture components on CNC Milling machine	3	3	3	3
CO4	generate .stl files from the models	3	3	3	3
CO5	create components on 3D Printer	3	3	3	3

LIST OF EXPERIMENTS

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

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.

Reference:

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

PRODUCTION DRAWING PRACTICE USING CAD

III-B.Tech.-II-Sem. **L T P C**
Subject Code: ME-PCC-325 **- - 2 1**

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

COs	Upon completion of course the students will be able to	PO4	PO5	PO6	PO10	PO13	PO14
CO1	explain the concepts of conventional representation of machine components	3	3	3	3	3	3
CO2	apply limits, fits and tolerances for a given part drawing	3	3	3	3	3	3
CO3	represent the types of surface roughness and various treatment indications	3	3	3	3	3	3
CO4	create detailed part drawings including tolerances from assembly using CAD	3	3	3	3	3	3
CO5	create drawing of parts from assembly using CAD software	3	3	3	3	3	3

LIST OF EXPERIMENTS

Week-1: Conventional Representation of Machine Components

Conventional representation of parts – screw joints, welded joints, springs, and gears, electrical, hydraulic and pneumatic circuits – methods of indicating notes on drawings.

Week-2: Limits, Fits and Tolerances

Types of fits, exercises involving selection / interpretation of fits and estimation of limits from tables. Indication of form and position tolerances on drawings, types of run-out, total run-out and their indication.

Week-3: Surface Roughness and its Indications

Definition, types of surface roughness indication – surface roughness obtainable from various manufacturing processes, recommended surface roughness on mechanical components.

Week-4: Surface Roughness and its Indications

Surface roughness obtainable from various manufacturing processes, recommended surface roughness on mechanical components. Heat treatment and surface treatment symbols used on drawings.

Week-5: Detailed and part Drawings

Drawing of parts from assembly drawings with indications of size tolerances, roughness, form tolerances and position errors etc.

Week-6: Part drawing of Petrol engine connecting rod using CAD.

Week-7: Part drawing of Split sheave eccentric using CAD.

Week-8: Part drawing of Foot Step Bearing using CAD.

Week-9: Part drawing of (1) Knuckle Joint using CAD, (2) Lathe Tail Stock using CAD.

Week-10: Part drawing of (1) Non-return valve using CAD, (2) Stuffing box using CAD.

Week-11: Part drawing of Pipe vice using CAD Revolving centre using CAD.

Week-12: Part drawing of Screw jack using CAD.

Week-13: Part drawing of (1) Machine vice using CAD (2) Single tool post using CAD.

Week-14: Part drawing of (1) Stuffing box using CAD (2) Feed check valve using CAD.

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

1. Draw the details of protected flange coupling using AutoCAD software.
2. Draw the details of eccentric and AutoCAD software.
3. Draw the details of steam engine cross head using AutoCAD software.
4. Draw the details of protected flange coupling using AutoCAD software.
5. Draw the details of milling machine tail - stock using AutoCAD software.
6. Draw the details of machine vice using AutoCAD software.
7. Draw the details of drill jig using AutoCAD software.
8. Draw the details of crane hook using AutoCAD software.
9. Draw the details of bush bearing using AutoCAD software.
10. Draw the details of stuffing box using AutoCAD software.

Reference:

1. Production Drawing Practice using CAD Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd.

COMPUTER AIDED ANALYSIS LAB

III-B.Tech.-II-Sem. **L T P C**
Subject Code: ME-PCC-326 **- - 2 1**

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

COs	Upon completion of course the students will be able to	PO4	PO5	PO10	PO14
CO1	determine the deflections and stresses in trusses and beams	3	3	3	3
CO2	find the stresses in 2D structural members	3	3	3	3
CO3	develop harmonic and mode shapes for variety of beams	3	3	3	3
CO4	perform heat transfer analysis involving conduction and convection	3	3	3	3
CO5	conduct thermal stress analysis	3	3	3	3

LIST OF EXPERIMENTS

1. Determine the deflections and stresses in 2D truss for the truss system
2. Determination the deflection and stresses in 2D beams also determine the nodal deflections, reaction forces for the beam
3. Determination of deflections, principal and Von-Mises stresses in plane stress components.
4. Determination of deflections, principal and Von-Mises stresses in plane strain components.
5. Determination of stresses in 3D Shell component
6. Determination of the Frequency response of cantilever Beam
7. Determination of deflections, thermal stresses in a plane slab.
8. Determination of Thermal Stress of a cylinder Using Axisymmetric Elements
9. Analysis of a square plate considering conduction and convection
10. Analysis of a compound bodies considering conduction and convection

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

1. Determination of deflection and stresses in a 3D Truss made of different materials.
2. Stress analysis of a propped cantilever beam.
3. Stress Analysis of a Continuous Beam with Overhanging subjected to Concentrated Load and Uniform Load and Distributed Load.
4. Stress analysis of rectangular L bracket.
5. Determination of stresses in 3D and Shell structures (One example in each case).
6. Modal Analysis of 3D Beams (Cantilever, simply supported, Fixed ends).
7. Impact analysis of a 3D cantilever beam.
8. Coupled field analysis a thermocouple.
9. Heat transfer analysis of a system involving both conduction and convective heat transfer.
10. Heat transfer analysis of a system involving both conduction and radiation heat transfer.

Reference:

1. Computer Aided Analysis Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd.

ADVANCED ENGLISH COMMUNICATION SKILLS LAB

III-B.Tech.-II-Sem. **L T P C**
Subject Code: HSMC-301 **1 - 2 2**

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

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

List of Experiments:

Week 1 & 2: Importance of Non-Verbal Communication – Synonyms and Antonyms, One-word substitutes, Prefixes and Suffixes, Idioms, Phrases and Collocations.

Week 3: Conversations, Self introduction, Role Play.

Week 4: General Vs Local Comprehension, Reading for Facts, Guessing Meaning from context, Skimming, Scanning, Inferring Meaning.

Week 5: Unseen Passages on various topics.

Week 6 & 7: Structure and Presentation of different types of Writing – e-correspondence / Technical Report Writing.

Week 8: Letter Writing, Resume Writing, CV, E-mail Writing, Memo Writing.

Week 9 & 10: Oral Presentations (individual or group) and Written Presentation through Posters/ Projects / Reports / e-mails / Assignments, etc.

Week 11: JAMs, Seminars, PPTs, Debate Sessions

Week 12 & 13: Dynamics of Group Discussion, Organization of Ideas and Rubrics of Evaluation – Concept and Process, Interview Preparation Techniques.

Week 14: Group Discussion and Mock Interviews.

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

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

Reference:

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

EMPLOYABILITY SKILLS – II
MANDATORY COURSE (NON-CREDIT)

III-B.Tech.-II-Sem. **L T P C**

Subject Code: MC-321 **3 - - -**

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

COs	Upon completion of course the students will be able to	PO9	PO10
CO1	make use of soft skills to become a professional team member	3	3
CO2	develop professional correspondence skills	3	3
CO3	apply knowledge of decision making, leadership, motivation	3	3
CO4	adapt principles of quantitative aptitude to achieve qualitative results	3	3
CO5	exhibit confidence in facing the interview process	3	3

Unit–I **10 Hours**

Soft Skills:

Introduction to Soft Skills: Self awareness and Self esteem, Discipline, Integrity, Attitude, Change and Adaptability.

Quantitative Aptitude:

Number Systems: Basic Concepts, Number Systems: Natural numbers, whole numbers, integers, fractions, Rational Numbers, Irrational Numbers, Real Numbers, Divisibility Rules, Logic Equations, Remainder theorem, Unit digit calculation

Progressions & Inequalities: Basic Concepts, Types: arithmetic, geometric, harmonic progression and applications.

Unit-II **9 Hours**

Soft Skills:

People Skills: Relationships - Personal & Professional Relationships – Rapport Building – Personal Space; Definition of Motivation –Motivation – Self-motivation; Time Management – Stephen Covey's time management.

Quantitative Aptitude:

Profit and Loss: Basic Concepts, discounts, marked price and list price, dishonest shopkeeper with manipulated weights, successive discounts etc.

Interest (Simple and Compound): Basic Concepts, Yearly, Half-yearly, and quarterly calculations, multiples, differences between simple and compound interest.

Ratio and Proportion: Basic Concepts of ratio and proportion, continued or equal proportions, mean proportions, invest proportion, alternative proportion, division proportion, compound proportion, duplication of ratio, finding values, coins and currencies, etc.

Unit–III **(5 + 5) 10 Hours**

Part-A:

Soft Skills:

Teamwork: Definition of Team, Team Dynamics – Specialization and Teamwork – Rewards of Teamwork.

Quantitative Aptitude:

Speed, Time and Distance: Basic Concepts, Single train problems, two train problems: some point same side, some point opposite sides, relative speed, different points meeting at common points, different points same side (different timings vs. same timings), ratios, number of stoppages, average speed, etc.

Part-B:

Soft Skills:

Leadership: Definition of Leadership, Leading a Team, Leadership Qualities – Leader vs Manager – Leadership Styles.

Quantitative Aptitude:

Time and Work: Basic Concepts, comparative work, mixed work, alternative work, middle leave and middle join, ratio efficiency.

Unit IV **10 Hours**

Soft Skills:

Problem Solving and Decision Making: Definitions –Problem Solving and Decision Making – Hurdles in Decision Making - Case studies.

Quantitative Aptitude:

Permutations and combinations: Basic Concepts, differences between permutations and combinations, always together-never together, alternative arrangement, fixed positions, double fixations, items drawing from a single group, items drawing from a multiple group, total ways of arrangement with repetitions and without repetitions, dictionary, handshakes or line joining between two points or number of matches , sides and diagonals, etc.
Clocks and Calendars: Basic Concepts, Angle between minute hand and hour hand, reflex angle, hours hand angle, time gap between minute hand and hour hand, relative time: coincide, opposite sides and right angle, mirror images, faulty clock (slow/fast), miscellaneous, calendar.

Unit – V **9 Hours**

Soft Skills:

Preparation for Interviews: Body Language – Posture - Dressing and Grooming – Researching the Industry and the Organization- Types of Interviews – First Impressions – Dos and Don'ts of an Interview.

Quantitative Aptitude:

Geometry and Mensuration: Basic concepts, types of angles.
Plane figures: rectangles, squares, triangles, quadrilateral, areas, perimeters, etc.
Solid figures: cubes, cuboids, cylinders-area (total surface area and lateral surface area), volumes, perimeters.
Others: Parallelogram, Rhombus, Trapezium, Circle, Sector, Segment, Cone, Sphere, Hemisphere, etc.

Activities List:

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

Reference:

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

IV-B.TECH.-I-SEMESTER SYLLABUS

MANAGEMENT, ECONOMICS AND ACCOUNTANCY

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: HSMC-401 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO11	PO12
CO1	apply principles of management in professional career	3	2
CO2	make use of principles of economics for decision making	3	2
CO3	solve problems in the areas of production, cost and price	3	2
CO4	prepare balance sheet and maintain books of accounts	2	3
CO5	analyze financial performance of an enterprise	3	3

Unit-I: Management concepts **10 hours**

Introduction to Management and organization, Scientific management, Modern management – Functions, objectives and scope of functional areas of management, Levels of management.

Unit-II: Introduction to Managerial Economics **10 hours**

Fundamental concepts of Managerial Economics, Concept of Law of Demand, Factors influencing and limitations, Concept of Elasticity of Demand, types and methods, Demand forecasting methods and limitations.

Unit-III: Theory of Production, Cost and Market Structure **(4 + 4) 8 hours**

Part-A: Types of Production function, input output relationship and types of costs, cost output relationship.

Part-B: CVP Analysis-BEP analysis assumptions, limitations and uses. Different market structures-Perfect & Monopoly Competition.

Unit-IV: Introduction to Accounts **14 hours**

Accounting Objectives, Functions, GAAP – Basics of Accounting - Rules for preparation of Journal and Ledger. Process of Journalisation and Subsidiary books. Preparation of Trading, Profit & Loss Accounts and Balance Sheet (Simple Problems).

Unit- V: Financial Statement Analysis **6 hours**

Concept of Financial Statement Analysis uses and limitations – Liquidity, Leverage, Activity, Turnover, Profitability Ratios (Simple problems).

References:

1. L.M. Prasad, Principles and Practices of Management, Revised Edition, S. Chand Publishing.
2. IM Pandey, Financial Management, 12th Edition, Vikas, 2017.
3. Philip Kotler, Kevin Lane Keller, Abraham Koshy and Mithleshwar Jha: Marketing Management, 15/e, Pearson Education, 2012.
4. K. Aswathappa, “Human Resource Management, Text and Cases”, TMH, 2016.
5. Panneerselvam “Production and Operations Management” PHI, 2017.

ARTIFICIAL INTELLIGENCE AND ROBOTICS

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: ME-PCC-411 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO12	PO13
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

Unit-I **10 hours**

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.

Unit-II **9 hours**

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.

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

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.

Unit-IV **10 hours**

Robot Kinematics: transformation matrices and their arithmetic, link and joint description, denavit-hartenberg parameters, frame assignment to links, direct kinematics.

Unit-V **9 hours**

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.

AUTOMOBILE ENGINEERING
(Professional Elective – II)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: ME-PEC-401 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO6	PO7	PO12	PO14
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

Unit-I **9 hours**

Introduction: 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, testing of fuel pumps. Introduction to CRDI and TDI Systems.

Unit-II **10 hours**

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 of storage, battery, auto transformer, contact breaker points, condenser, and spark plug – 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.

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

Part-A: Transmission System: 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.

Unit-IV **10 hours**

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.

Unit-V **9 hours**

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.

References:

1. A Text Book of Automobile Engineering by R K Rajput. Laxmi Publications.
2. Automotive Mechanics, Heitner.
3. Automotive Engines, Srinivasan.

TOTAL QUALITY MANAGEMENT
(Professional Elective – II)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: ME-PEC-405 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO6	PO7	PO8	PO12	PO13
CO1	explain the TQM frame work and various quality control techniques	3	3	3	3	3	3	3	3
CO2	identify customer needs and apply benchmarking techniques	3	3	3	3	3	3	3	3
CO3	build organization for TQM using quality management tools	3	3	3	3	3	3	3	3
CO4	assess costs involvement in TQM process	3	3	3	3	3	3	3	3
CO5	apply ISO standards for design and development of products and services	3	3	3	3	3	3	3	3

Unit-I **10 hours**

Introduction: Concept of TQM, Quality and Business performance, attitude and involvement of top management, communication, culture and management systems.
Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

Unit-II **9 hours**

Process and customer relation: Customer satisfaction, internal customer conflict, quality focus, role of Marketing and Sales, Buyer - Supplier relationships.
Benchmarking: Introduction - Evolution of benchmarking, benefits of benchmarking, benchmarking procedure, pitfalls of benchmarking.

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

Part-A: Organizing TQM: systems approach, Organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circles.

Part-B: Seven Tools of TQM: Stratification, check sheet, Scatter diagram, Ishikawa diagram, Pareto diagram, Kepner & Tregoe Methodology.

Unit-IV **9 hours**

Cost of Quality: Definition, Quality Costs, Measuring Quality Costs, use of Quality Cost information, Accounting Systems and Quality Management.

Unit-V **10 hours**

1S09000: Universal Standards of Quality: ISO around the world, lSO9000 ANSI/ASQC Q- 90. Series Standards, benefits of ISO9000 certification, the third party audit, Documentation 1S09000 and services, the cost of certification implementing the system.

Textbooks:

1. Total Quality Management, I Joel E.Ross, Taylor and Franscis Limited.
2. Total Quality Management, P.N.Mukherjee, PHI.

References:

1. Beyond TQM, Robed LFlood.
2. Statistical Quality Control, El. Grant.
3. Total Quality Management: A Practical Approach, H. Lal.

FLEXIBLE MANUFACTURING SYSTEMS
(Professional Elective – II)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: ME-PEC-409 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO12	PO14
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

Unit-I **10 hours**

Introduction: Flexibility – Types of FMS – FMS components: Workstations, Material Handling and Storage Systems – Computer Control Systems – Human Resources – FMS Applications and Benefits.

Unit-II **9 hours**

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.

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

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.

Unit-IV **9 hours**

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.

Unit-V **10 hours**

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.

DESIGN OF EXPERIMENTS
(Professional Elective – II)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: ME-PEC-413 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO4	PO11	PO13
CO1	illustrate the experimental design strategies	3	3	3	3	3
CO2	acquire the concepts of two level and three level factors in DOE	3	3	3	3	3
CO3	adapt various techniques to improve reliability	3	3	3	3	3
CO4	apply orthogonal arrays for the improvement of linear graphs	3	3	3	3	3
CO5	evaluate signal to noise ratio for dynamic problems	3	3	3	3	3

Unit–I **9 hours**

Introduction: Strategy of Experimental design, Basic Principles, Guidelines for Designing Experiments, Concepts of random variable, distribution functions. Sample and population, Measure of Central tendency, Variability, Concept of confidence level. Statistical Distributions:. Illustration through Numerical examples.

Unit –II **10 hours**

Classical Experiments: Factorial Experiments: Terminology: factors, levels, interactions, treatment combination, randomization, Two-level experimental designs for two factors and three factors. Three-level experimental designs for two factors and three factors, Factor effects, Factor interactions, Fractional factorial design, Saturated Designs, Central composite designs. Illustration through Numerical examples.

Unit –III **(5 + 5) 10 hours**

Part-A: Measures of variability, Ranking method, Column effect method & Plotting method, Analysis of variance (ANOVA) in Factorial Experiments: Regression analysis, Mathematical models from experimental data.

Part-B: Taguchi's quality philosophy, elements of cost, Noise factors causes of variation. Quadratic loss function & variations of quadratic loss function. Robust Design: Steps in Robust Design: Reliability Improvement through experiments, Illustration through Numerical examples.

Unit–IV **9 hours**

Types of Orthogonal Arrays, selection of standard orthogonal arrays, Linear graphs and Interaction assignment, Dummy level Technique, Compound factor method, Modification of linear graphs. Illustration through Numerical examples.

Unit–V **10 hours**

Evaluation of sensitivity to noise. Signal to Noise ratios for static problems: Smaller-the-better type, Nominal-the –better-type, Larger-the-better type. Signal to Noise ratios for Dynamic problems. Illustration through Numerical examples.

Textbooks:

1. Quality Engineering using Robust Design, Madhav S Phadke, Prentice Hall.
2. Design of Experiments for Engineers and Scientists, Jiju Antony, Elsevier S&T Books

References:

1. Design and Analysis of Experiments, Montgomery John Wiley and Sons.

REFRIGERATION & AIR-CONDITIONING
(Professional Elective – III)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: ME-PEC-402 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO7	PO12	PO14
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

Unit-I **10 hours**

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

Unit-II **9 hours**

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.

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

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.

Unit-IV **9 hours**

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.

Unit-V **10 hours**

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

MAINTENANCE AND SAFETY ENGINEERING
(Professional Elective – III)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: ME-PEC-406 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO6	PO7	PO8	PO12	PO13
CO1	explain the concepts of maintenance management and control	3	3	3	3	2	3	3
CO2	differentiate methods of maintenance and inventory control	3	3	3	3	2	3	3
CO3	improve quality and safety in maintenance	3	3	3	3	2	3	3
CO4	estimate the maintenance cost	3	3	3	3	2	3	3
CO5	apply the reliability engineering principles	3	3	3	3	2	3	3

Unit-I **10 hours**

Introduction: Need for Maintenance, Facts and Figures, Modern Maintenance, Problem and Maintenance Strategy for the 21st Century, Engineering Maintenance Objectives and Maintenance in Equipment Life Cycle, Terms and Definitions.

Maintenance Management and Control: Maintenance Manual, Maintenance, Facility Evaluation, Functions of Effective Maintenance Management, Maintenance Project Control Methods, Maintenance Management Control Indices.

Unit-II **9 hours**

Types of Maintenance: Preventive Maintenance, Elements of Preventive, Maintenance Program, Establishing Preventive Maintenance Program PM Program Evaluation and Improvement, PM Measures, PM Models, Corrective Maintenance, Corrective Maintenance Types, Corrective Maintenance Steps and Downtime Components, Corrective Maintenance Measures, Corrective Maintenance Models.

Inventory Control in Maintenance: Inventory Control Objectives and Basic Inventory Decisions, ABC Inventory Control Method, Inventory Control Models Two-Bin Inventory Control and Safety Stock, Spares Determination Factors Spares Calculation Methods

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

Part-A: Quality and Safety in Maintenance: Needs for Quality Maintenance Processes, Maintenance Work Quality, use of Quality Control Charts in Maintenance Work Sampling.

Part-B: Post Maintenance Testing, Reasons for Safety Problems in Maintenance, Guidelines to Improve Safety in Maintenance Work, Safety Officer's Role in Maintenance Work, Protection of Maintenance Workers.

Unit-IV **9 hours**

Maintenance Costing: Reasons for Maintenance Costing, Maintenance Budget Preparation Methods and Steps, Maintenance Labor Cost Estimation, Material Cost Estimation, Equipment Life Cycle Maintenance Cost Estimation, Maintenance Cost Estimation Models.

Unit-V **10 hours**

Reliability, Reliability Centered Maintenance (RCM): Goals and Principles, RCM Process and Associated Questions, RCM Program Components Effectiveness Measurement Indicators, RCM Benefits and Reasons for Its Failures, Reliability Versus Maintenance and Reliability in Support Phase, Bathtub Hazard Rate Concept, Reliability Measures and Formulas, Reliability Networks, Reliability Analysis Techniques.

Textbooks:

1. Reliability, Maintenance and Safety Engineering, Dr.A.K.Guptha, Laxmi Publications.
2. Industrial Safety Management' L.M. Deshmukh, TMH.

References:

1. Maintenance Engineering & Management, R.C.Mishra, PHI.
2. Plant Maintenance and Reliability Engineering, NVS Raju, Cengage Learning.

PLANT LAYOUT AND MATERIAL HANDLING
(Professional Elective – III)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: ME-PEC-410 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO6	PO7	PO12	PO14
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 the safety in ergonomics and minimize the material handling costs	3	3	2	3	3

Unit-I **10 hours**

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.

Unit-II **9 hours**

Heuristics for Plant layout: ALDEP, CORELAP, CRAFT, Group Layout, Fixed position layout-Quadratic assignment model. Branch and bound method.

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

Part-A: Material handling systems: Introduction, Material Handling principles, Classification of Material Handling Equipment.

Part-B: Relationship of material handling to plant layout.

Unit-IV **9 hours**

Selection of Material handling systems: Selection, Material Handling method- path, Equipment, function oriented systems.

Unit-V **10 hours**

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 – III)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: ME-PEC-414 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO4	PO12	PO14
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

Unit-I: Design of Flexible Elements **9 hours**

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.

Unit-II: Spur Gears and Parallel Axis Helical Gears **10 hours**

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.

Unit-III: Bevel, Worm and Cross Helical Gears **(5 + 5) 10 hours**

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.

Unit-IV: Gear Boxes **9 hours**

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.

Unit-V: Cams, Clutches and Brakes **10 hours**

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.

ENVIRONMENTAL IMPACT ASSESSMENT
(Open Elective-II)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: OEC-401 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO6	PO7	PO10	PO12
CO1	identify the attributes to be considered for EIA	3	3	3	3
CO2	assess impact of deforestation	3	3	3	3
CO3	interpret impact prediction, significance of soil quality and mitigation	3	3	2	3
CO4	conduct environmental audit and prepare reports	3	3	2	3
CO5	illustrate environmental policies and provisions	3	3	3	3

Unit-I **10 hours**

Basic concept of EIA: Initial environmental Examination, Elements of EIA, factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters. E I A Methodologies: introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis.

Unit-II **9 hours**

Assessment of impact of development activities on vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation.

Unit-III **(5 + 4) 9 hours**

Part A: Procurement of relevant soil quality, impact prediction, assessment of impact significance.

Part B: Identification and incorporation of mitigation measures for enhancement of soil quality.

Unit-IV **10 hours**

Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report, Post Audit activities.

Unit-V **10 hours**

The Environmental Protection Act, The water Act, The Air (Prevention & Control of pollution Act.), Motor Act, Wild life Act. Case studies and preparation of Environmental Impact assessment statement for various Industries.

Textbooks:

1. Environmental Pollution by R.K. Khitoliya S. Chand.
2. Environmental Impact Assessment, Barthwal, R. R. New Age International Publications.

References:

1. Larry Canter – Environmental Impact Assessment, TMH.
2. Suresh K. Dhaneja - Environmental Science and Engineering, S.K. Kataria & Sons Publication.
3. Bhatia, H. S. - Environmental Pollution and Control, Galgotia Publication, Pvt., Ltd., Delhi.

NON-CONVENTIONAL ENERGY SOURCES
(Open Elective-II)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: OEC-403 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO6	PO7	PO12
CO1	analyze global and national energy scenarios	3	3	3
CO2	illustrate the various solar energy systems	3	3	3
CO3	demonstrate the aspects related to wind energy power plants	3	3	3
CO4	build the power plants using bio gas	3	3	3
CO5	estimate the power generation in hydroelectric plants	3	3	3

Unit-I **10 hours**

Global and National Energy Scenario: Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non-renewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO_2 reduction potential of renewable energy- concept of Hybrid systems.

Unit-II **9 hours**

Solar Energy: Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems.

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

Part-A: Wind Energy: Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy.

Part-B: Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Wind mill component design, economics and demand side management, energy wheeling, and energy banking concepts. Safety and environmental aspects, wind energy potential and installation in India.

Unit-IV **10 hours**

Biogas: Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications.

Unit-V **9 hours**

Hydel Energy: Small hydro Power Plant - Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power.

Textbooks:

1. Non-Conventional Energy Sources by G.D Rai.
2. Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd., 1986.

PRINCIPLES OF COMMUNICATION SYSTEMS
(Open Elective-II)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: OEC-405 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12
CO1	outline the fundamentals of communication systems	3	2	2	2
CO2	analyze various analog modulation and demodulation schemes	3	3	3	2
CO3	explain sampling theorem, pulse modulation and multiplexing techniques	3	3	3	2
CO4	illustrate digital modulation schemes	3	3	2	2
CO5	develop source and channel coding techniques	3	3	3	2

Unit-I **9 hours**

Fundamentals of communication systems: Block diagram of communication system; types of communications-analog and digital; Noise–types of noise, sources of noise, calculation of noise in linear systems, and noise figure.

Unit-II **10 hours**

Methods of Modulation: Need for modulation; Types of modulation, generation and detection of AM, DSB-SC, SSB-SC. Angle modulation: frequency & phase modulations, Narrow band and Wide band FM, comparison of AM, FM & PM.

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

Part-A: Pulse Modulations: Sampling theorem, Nyquist criteria, introduction to PAM, PWM and PPM.

Part-B: Multiplexing techniques: TDM, FDM, asynchronous multiplexing.

Unit-IV **10 hours**

Digital Communication: Advantages; Working principle of PCM; comparison of PCM, DM, ADM, ADPCM; introduction to digital modulation techniques-ASK, FSK, PSK, DPSK, QPSK.

Unit-V **9 hours**

Information Theory: Concept of information; rate of information and entropy; Coding efficiency-Shanon-Fano and Huffman coding; introduction to error detection and correction codes.

Textbooks:

1. Communication Systems Analog and Digital – R.P. Singh & SD Sapre, TMH, 20th reprint, 2004.
2. Principles of Communications – H. Taub and D. Schilling, TMH, 2003.

References:

1. Electronic Communication Systems – Kennedy and Davis, TMH, 4th edition, 2004.
2. Communication Systems Engineering – John. G. Proakis and Masoud Salehi, PHI, 2nd Ed. 2004.

DATABASE MANAGEMENT SYSTEMS

(Open Elective-II)

IV-B.Tech.-I-Sem. **L T P C**

Subject Code: OEC-407 **3 - - 3**

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

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

Unit-I **11 hours**

Introduction to Database Systems: Introduction and applications of DBMS, Purpose of data base, History of database, Database architecture - Abstraction Levels, Data Independence, Database Languages, Database users and DBA.

Introduction to Database Design: Database Design Process, Data Models, ER Diagrams - Entities, Attributes, Relationships, Constraints, keys, Generalization, Specialization, Aggregation, Conceptual design with the E-R model for large Enterprise.

Unit-II **9 hours**

Relational Model: Introduction to the relational model, Integrity constraints over relations, Enforcing integrity constraints, Querying relational data, Logical database design: E-R to relational, Introduction to views, Destroying/altering tables and views.

Unit-III **(5 + 4) 9 hours**

Part-A: SQL Basics: DDL, DML, DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, in operator.

Part-B: Functions: Aggregate functions, Built-in functions - numeric, date, string functions, set operations.

Unit-IV **10 hours**

Sub-queries: Introduction, correlated sub-queries, use of group by, having, order by, join and its types, Exist, Any, All, view and its types.

Transaction control commands: ACID properties, concurrency control, Commit, Rollback, save point, cursors, stored procedures, Triggers.

Unit-V **10 hours**

Normalization: Introduction, Normal forms - 1NF, 2NF, 3NF, BCNF, 4NF and 5NF, concept of De-normalization and practical problems based on these forms.

Textbooks:

1. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, TMH.
2. Abraham Silberschatz, Henry F.Korth, S.Sudarshan, Database System Concepts, 6th Edn, TMH.

INTELLECTUAL PROPERTY RIGHTS

(Open Elective-II)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: OEC-409 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO1	PO6	PO8	PO10	PO12
CO1	outline basics of intellectual property law	3	3	2	3	3
CO2	identify the various trademarks	3	3	2	3	3
CO3	analyze patent and copy rights law	3	3	3	3	3
CO4	differentiate trade secret and unfair practice	3	3	3	3	3
CO5	summarize new developments in Intellectual Property Rights	3	3	3	3	3

Unit-I **10 hours**

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

Unit-II **9 hours**

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

Unit-III **(5 + 4) 9 hours**

Part-A: Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Part-B: Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

Unit-IV **10 hours**

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.
Unfair competition: Misappropriation right of publicity, false advertising.

Unit-V **10 hours**

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.
International overview on intellectual property, international - trade mark law, copy right law, international patent law, international development in trade secrets law.

Textbooks:

1. Intellectual property right, Deborah, E. Bouchoux, cengage learning.
2. Intellectual property right - Unleashing the knowledge economy, prabuddha ganguli, TMH.

TECHNICAL WRITING SKILLS LAB

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: HSMC-402 **- - 2 1**

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

COs	Upon completion of course the students will be able to	PO5	PO10
CO1	make use of language for understanding discourse and make notes	3	3
CO2	demonstrate command over using library resources for academic and other pursuits	3	3
CO3	apply knowledge of English language for creative and academic purposes	3	3
CO4	adapt principles in conveying good professional ethics	3	3
CO5	exhibit thorough awareness on research-oriented activities and career development	3	3

List of Experiments

1. Definition of Writing – difference between General and Academic writing process - gathering ideas for academic writing - organizing ideas into sentences –language of writing - analysis of material.
   Assignment: exercises on creative, academic and other written formats.

2. Note making and Note taking techniques - collecting notes - writing outlines – precis writing - writing rough drafts.
   Assignment: exercises on precise writing and note making & taking techniques.

3. Description of mechanisms and processes – Information transfer process – technical vocabulary.
   Assignment: information transfer exercises such as flow charts, pai charts, and discussion on technical vocabulary.

4. Library and Digital Resources - Internet as a Tool for research - reference and research techniques - Proposal writing.
   Assignment: exercises on information gathering techniques using various online and manual resources on the topic assigned; samples on abstracts and research proposals.

5. Technical writing – types – process of technical writing – style and language – editing strategies to achieve appropriate technical style.
   Assignment: dealing with samples of technical reports and writing reports.

6. Technical communication - audience analysis, and persuasion – understanding graphic aids in technical reports.
   Assignment: showing various graphs of sample reports.

7. Elements of the Formal Research Report – Thesis Writing - Title - Abstract – Synopsis – Conclusions – Suggestions - References.
   Assignment: samples of project reports and written exercises on elements mentioned.

8. Job hunt - Resume - Cover Letter - Networking and Professional Success - Sources of networking - Research about Job Profile, Company, Competitors & Industry - Body Language and Grooming.
   Assignment: exercises on cover letter, job application, emails, resume writing, etc. discussion on personality development techniques.

9. Plagiarism and Professional Ethics - understanding Plagiarism and Tools to check plagiarism - Ethics of Research - Engineering ethics - Awareness of Professional Ethics.
   Assignment: exploration of plagiarism checks mechanisms and discussion on professional ethics.

10. Presentation styles - Inforgraphics - types & tools for presentation - audience-centered presentations - cross-cultural communication.
    Assignment: exercises on Oral Presentation.

Text/Reference Books:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004.
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York,2003.
4. Raman Sharma, Technical Communications, Oxford Publication, London,2004.
5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN:07828357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi2002.
7. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN0402213)

ARTIFICIAL INTELLIGENCE AND ROBOTICS LAB

	L	T	P	C
IV-B.Tech.-I-Sem				
Course Code: ME-PCC-412	-	-	2	1

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

COs	Upon completion of course the students will be able to	PO4	PO5	PO14
CO1	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

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

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

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

Reference:

1. Robotics Lab Manual, Department of Mechanical Engineering, CMRIT, Hyd.

PROJECT - I

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: ME-PRJ-413 **- - 6 3**

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

COs	Upon completion of course the students will be able to	PO1 to PO14
CO1	identify the problem statement, assess the scope and develop a prototype	3
CO2	execute the project using modern tools and prepare the report	3
CO3	demonstrate leadership, management skills for project development with ethics	3
CO4	function effectively as individual / member / leader in project teams	3
CO5	make use of engineering knowledge for societal sustenance	3

Guidelines:

The objective of the project work is to imbibe students with technical, analytical and innovative ideas to facilitate with theoretical and practical learning pertaining to relevant domain of interest. An individual or a peer of 2-5 students work under the guidance / mentorship of a departmental faculty with the aim of addressing solution to real world / societal problems using various R & D techniques. The team work fosters the communication and leadership skills among peers to survive and exercise during their career.

The project work normally includes:

1. Survey and study of published literature on the approved / assigned topic.
2. Conduct preliminary Analysis / Modeling / Simulation / Experiment / Design / Feasibility / ethnographical study.
3. Prepare an abstract/synopsis on the opted topic and present before Departmental Review Committee (DRC).
4. Prepare an Action Plan for conducting the investigation, including team work.
5. Apply suitable methodology for Designing / Modelling / Simulation / Experimentation as needed.
6. Develop an end product or process along with conclusions, recommendations and future scope.
7. Present and execute the project before DRC for CIE.
8. Prepare and publish a paper in Conference / Journal, if possible.
9. Prepare and submit the final dissertation in the prescribed format to the Department.
10. Present and execute the project before External Committee for viva-voce.

SUMMER INTERNSHIP - II
MANDATORY COURSE (NON-CREDIT)

IV-B.Tech.-I-Sem. **L T P C**
Subject Code: MC-411 - - - -

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

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

Guidelines:

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

IV-B.TECH.-II-SEMESTER SYLLABUS

POWER PLANT ENGINEERING
(Professional Elective – IV)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: ME-PEC-403 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO6	PO12	PO14
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

Unit-I **10 hours**

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.

Unit-II **9 hours**

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.

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

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.

Unit-IV **9 hours**

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.

Unit-V **10 hours**

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.

PRODUCTION PLANNING AND CONTROL
(Professional Elective – IV)

IV-B.Tech.-IL-Sem. **L T P C**
Subject Code: ME-PEC-407 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO11	PO12	PO14
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

Unit-I **10 hours**

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.

Unit-II **9 hours**

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.

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

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.

Unit-IV **10 hours**

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.

Unit-V **9 hours**

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.

THEORY OF METAL CUTTING
(Professional Elective – IV)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: ME-PEC-411 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO4	PO5	PO12	PO13
CO1	analyze the mechanism involved in chip formation	3	3	2	3	3	3
CO2	explain single and multipoint cutting tool geometry	3	3	2	3	3	3
CO3	evaluate cutting forces and select appropriate material for different types of cutting tools	3	3	2	3	3	3
CO4	identify the type of tool wear and its effect on tool life	3	3	2	3	3	3
CO5	assess the thermal effects in metal cutting and select appropriate cutting fluid	3	3	2	3	3	3

Unit-I **10 hours**

Mechanics of Metal Cutting: Mechanism of chip formation, Orthogonal & Oblique cutting, Types of chips, Built-up edge, Determination of shear plane angle, Forces on the chips, forces in orthogonal cutting, Merchant circle diagram and analysis, Theory of Lee & Shaffer, Co-efficient of friction, Power & Energy Relationship, Velocity Relationship, Shear-Strain, Factors affecting forces and power, Problems.

Unit-II **9 hours**

Geometry of Cutting Tools: Single point and Multi point cutting tools, Tools nomenclature, Tool point reference systems, Tool angle specifications –ISO and ASA systems, Conversion from one system to another. Recommended tool angles, Effect of cutting parameters on tool geometry.

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

Part-A: Tool Materials and Their Properties: Characteristics of Tool Materials, Types of tool materials – Carbon tool steels, High speed steels, Cast alloys, Cemented carbides, Ceramics, Diamonds, SIALON, CBN, UCON, Recommended Cutting Speeds for the above Tools, Water, Oil hardening of Tools and their applications.

Part-B: Measurement of Cutting Forces: Reasons for Measuring cutting forces, Classification of cutting force dynamometers – Mechanical, Hydraulic, Pneumatic, Optical, Inductance, Piezoelectric, and Strain gage type Dynamometers, Dynamometers for lathe, Drilling, and Milling, Calibration of Dynamometers.

Unit-IV **9 hours**

Tool Wear, Tool Life: Mechanisms of tool wear, Sudden & gradual wear, crater wear, Flank wear, Tool failure criteria, tool life equations, Effect of process parameters on tool life, Tool life tests, conventional & Accelerated tool wear measurement, Machinability index.

Unit-V **10 hours**

Thermal Aspects in Metal Cutting: Heat sources in metal cutting, Temperature in chip formation, Temperature Distribution, Experimental Determination of Tool Temperatures.
Cutting Fluids: Basic actions of cutting fluids, properties of cutting fluids, Selection of cutting fluids, application of cutting fluids, Filtration of fluids, Recommended cutting fluids.

Textbooks:

1. Metal Cutting Principles - M.C. Shaw - Oxford Publication – 1985.
2. Fundamentals of Metal Cutting & Machine Tools – by B.L.Juneja& G.S – Sekhar -Wiley Eastern.

References:

1. Metal Cutting - V.C.Venkatesh&S.Chandrasekhanan – Pantice Hall – 1991.
2. Metal Cutting - Dr.B.J.Ranganath -Vikas Publications

MECHANICS OF COMPOSITE MATERIALS
(Professional Elective – IV)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: ME-PEC-415 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO4	PO12	PO13
CO1	explain the applications of composite materials	3	3	2	3	3
CO2	illustrate the concepts of fiber reinforced plastic processing	3	3	2	3	3
CO3	differentiate micro and macro mechanics of composite lamina	3	3	2	3	3
CO4	apply failure criteria and critically evaluate the results	3	3	2	3	3
CO5	analyze the mechanical behavior of metal matrix composites	3	3	2	3	3

Unit- I **10 hours**

Introduction to Composite Materials Applications: Introduction to Composite Materials: Definition, classification and characteristics of composite Materials – fibrous composites, laminated composites, particulate composites. Applications: Automobile, Aircrafts. Missiles. Space hardware, Electrical and electronics, Marine, recreational and sports equipment, future potential of composites.

Unit-II **9 hours**

Fiber Reinforced Plastic Processing : Lay up and curing, fabricating process, open and closed mould process, hand lay up techniques; structural laminate bag molding, production procedures for bag molding; filament winding, pultrusion, pulforming, thermo-forming, injection molding, blow molding.

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

Part-A: Micro Mechanics of a Lamina: Introduction, Evaluation of the four elastic moduli by Rule of mixture, Numerical problems.
Part-B: Macro Mechanics of a Lamina: Hooke's law for different types of materials, Number of elastic constants, Two - dimensional relationship of compliance and stiffness matrix.

Unit-IV **10 hours**

Biaxial Strength Theories: Maximum stress theory, Maximum strain theory, Tsai-Hill theory, Tsai, Wu tensor theory, Numerical problems.
Macro Mechanical Analysis of Laminate: Introduction, code, Kirchoff hypothesis, CL T, A, B, and D matrices (Detailed derivation), Special cases of laminates, Numerical problems.

Unit-V **9 hours**

Metal Matrix Composites Fabrication Process for MMCs: Metal Matrix Composites: Reinforcement materials, types, characteristics and selection base metals selection. Need for production MMC's and its application. Fabrication Process for MMC's: Powder metallurgy technique, liquid metallurgy technique and secondary processing, special fabrication techniques.

Textbooks:

1. Mechanics of Composite Materials/ R. M. Jones, TMH, New York, 1975.
2. Engineering Mechanics of Composite Materials, Isaac and M Daniel, Oxford University Press.

References:

1. Analysis and performance of fibre Composites, B. D. Agarwal and L. J. Broutman, Wiley- Inter Science, New York, 1980.
2. Mechanics of Composite Materials, 2nd Edition, Autar K. Kaw, Publisher: CRC.

COMPUTATIONAL FLUID DYNAMICS
(Professional Elective – V)

IV-B.Tech.-II-Sem. **L T P C**
Course Code: ME-PEC-404 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO12	PO14
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

Unit-I **10 hours**

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

Unit-II **9 hours**

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.

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

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.

Unit-IV **10 hours**

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.

Unit-V **9 hours**

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 – V)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: ME-PEC-408 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO12	PO14
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

Unit-I **10 hours**

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.

Unit-II **9 hours**

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.

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

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.

Unit-IV **10 hours**

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.

Unit-V **9 hours**

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 – V)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: ME-PEC-412 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO12	PO13	PO14
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

Unit-I **9 hours**

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.

Unit-II **10 hours**

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.

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

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.

Unit-IV **9 hours**

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.

Unit-V **10 hours**

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.

DESIGN OF PRESS TOOLS, JIGS AND FIXTURES
(Professional Elective – V)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: ME-PEC-416 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO2	PO3	PO5	PO12	PO13	PO14
CO1	select locating and clamping points on work-piece	3	3	3	3	3	3
CO2	design various types of jigs and fixtures for mechanical applications	3	3	3	3	3	3
CO3	explain the elements of press and dies	3	3	3	3	3	3
CO4	differentiate the functions of bending and drawing dies	3	3	3	3	3	3
CO5	summarize additional forming techniques	3	3	3	3	3	3

Unit-I **10 hours**

Locating and Clamping Principles: Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

Unit-II **9 hours**

Jigs and Fixtures: Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

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

Part-A: Press Working Terminologies and Elements of Cutting Dies: Press Working Terminologies – operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure.

Part-B: Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

Unit-IV **10 hours**

Bending and Drawing Dies: Difference between bending and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing, reverse redrawing and combination dies – Blank development for axisymmetric, rectangular and elliptic parts – Single and double action dies.

Unit-V **9 hours**

Other Forming Techniques: Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design.

Textbooks:

1. Joshi, P.H. "Jigs and Fixtures", 2nd Edition, TMH, New Delhi, 2004.
2. Joshi P.H "Press tools – Design and Construction", wheels publishing, 1996

References:

1. Venkataraman. K., "Design of Jigs Fixtures & Press Tools", TMH, New Delhi, 2005.
2. Donaldson, Lecain and Goold "Tool Design", 3rd Edition, TMH, 2000.

GREEN BUILDING TECHNOLOGIES
(Open Elective-III)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-402 **3 - - 3**

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

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

Unit-I **10 hours**

Overview of the significance of energy use and energy processes in building: Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

Unit-II **9 hours**

Indoor environmental requirement and management: Thermal comfort - Ventilation and air quality - Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement.

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

Part-A: Climate, solar radiation and their influences: Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation.

Part-B: Temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

Unit-IV **10 hours**

End-use, energy utilization and requirements: Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building - Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer.

Unit-V **9 hours**

Energy management options: Energy audit and energy targeting - Technological options for energy management.

Textbooks:

1. Michael Bauer, Peter Mosle and Michael Schwarz, Green Building, Guidebook for Sustainable Architecture, Springer, Heidelberg, Germany.
2. Norbert Lechner, Heating, Cooling, Lighting - Sustainable Design Methods for Architects‖, Wiley, New York.
3. James Kachadorian, The Passive Solar House: Using Solar Design to Heat and Cool Your Home‖, Chelsea Green Publishing Co., USA.

FUNDAMENTALS OF ROBOTICS
(Open Elective-III)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-404 **3 - - 3**

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

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

Unit-I **10 hours**

Introduction to Robotics: Types and components of a robot, Classification of robots, classification with respect to geometrical configuration (anatomy), closed-loop and open- loop control systems. Social issues and safety.

Unit-II **9 hours**

Robot Kinematics: Kinematics systems, Definition of mechanisms and manipulators, Kinematic Modelling: Translation and Rotation Representation, Coordinate transformation, Homogeneous Coordinate representation, DH parameters.

Unit-III **(5 + 4) 9 hours**

Part-A: Sensors and Vision System: Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc., Introduction to Cameras, Camera calibration, Geometry of Image formation, Euclidean / Similarity / Affine / Projective transformations Vision applications in robotics.

Part-B: Robot Actuation Systems: Actuators: Electric, Hydraulic and Pneumatic; Transmission: Gears, Timing Belts and Bearings, Parameters for selection of actuators.

Unit –IV **10 hours**

Robot Control: Basics of control: Transfer functions, Control laws: P, PD, PID, Non-linear and advanced controls.

Unit-V **9 hours**

Control Hardware and Interfacing: Embedded systems: Architecture and integration with sensors, actuators, components, Programming for Robot Applications.

Textbooks:

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

References:

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

FUNDAMENTALS OF EMBEDDED SYSTEMS
(Open Elective – III)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-406 **3 - - 3**

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

COs	Upon completion of course the students will be able to	PO1	PO2	PO3	PO12
CO1	outline the basic concepts of embedded computing	3	3	2	2
CO2	illustrate the architecture of 8051 microcontroller	3	3	3	2
CO3	develop embedded programs using 8051 microcontroller	3	3	3	2
CO4	demonstrate 8051 microcontroller interface with peripherals	3	3	3	2
CO5	explain real time operating system concepts	3	3	3	3

Unit-I **9 hours**

Embedded computing: Introduction, complex systems and microprocessor, the embedded system design process, formalisms for system design, design examples.

Unit-II **10 hours**

The 8051 architecture: Introduction, 8051 micro controller hardware, input / output ports and circuits, external memory, counter and timers, serial data input / output, interrupts.

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

Part-A: Basic assembly language programming concepts: The assembly language programming process, programming tools and techniques, programming the 8051.

Part-B: Instructions set: Data transfer and logical instructions, arithmetic operations, decimal arithmetic. Jump and call instructions.

Unit – IV **9 hours**

Applications: Interfacing with keyboards, displays, D/A and A/D conversions, multiple interrupts, serial data communication.

Unit – V **10 hours**

Introduction to real - time operating systems: Tasks and task states, tasks and data, semaphores, and shared data; message queues, mailboxes and pipes, timer functions, events, memory management, interrupt routines in an RTOS environment.

Textbooks:

1. Computers as Components - Principles of Embedded Computer System Design, Wayne Wolf, Elseveir.
2. The 8051 Microcontroller, Third Edition, Kenneth J.Ayala, Thomson.

References:

1. Microcontrollers, Raj kamal, Pearson Education.
2. An Embedded Software Primer, David E. Simon, Pearson Education.

WEB TECHNOLOGIES
(Open Elective – III)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-408 **3 - - 3**

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

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

Unit-I **10 Hours**

Web: Introduction, Internet and web, web browsers, web servers, protocols.
HTML: Basics, elements, attributes, tags- list, tables, images, forms, frames, cascading style sheets.
Java Script: Introduction to scripting, control structures, conditional statements, arrays, functions, objects.

Unit-II **10 Hours**

PHP: Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, Reading data from web form controls, handling file uploads, connecting to database, executing simple queries, handling sessions and cookies, file handling.

Unit-III **(4 + 4) 8 Hours**

Part-A: XML: Basics of XML, Elements, Attributes, Name space, **Parsing:** DOM and SAX Parsers.
Part-B: Introduction to DTD: internal and external DTD, Elements of DTD, DTD Limitations, XML Schema, Schema structure, XHTML.

Unit-IV **10 Hours**

Servlets: Introduction, Lifecycle, Generic and HTTP servlet, passing parameters to servlet, HTTP servlet Request & Response interfaces, Deploying web Applications,
Session Tracking: Hidden form fields, cookies, URL- Rewriting, session.

Unit-V **10 Hours**

JSP: Introduction, Difference Between servlets & JSP, Anatomy of JSP page, JSP elements: Directives, comments, Expressions, scriptlets, Declaration, Implicit JSP objects, using Action elements.
JDBC: Introduction, JDBC Drivers, Loading Driver, establishing connection, Executing SQL statement in JSP pages, MVC architecture

Text Books:

1. Web Technologies, Uttam K Roy, Oxford University Press.
2. The Complete Reference PHP- Steven Hozner, TMH.

References:

1. Java Server Pages-Hans Bergsten, SPD O'Reilly.
2. JavaScript, D. Flanagan O'Reilly, SPD.
3. Beginning Web Programming-Jon Dckett WROX.

PRINCIPLES OF ENTREPRENEURSHIP
(Open Elective – III)

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: OEC-410 **3 - - 3**

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

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

Unit-I: Entrepreneurship **10 hours**

The revolution impact of entrepreneurship- The evolution of entrepreneurship - Approaches to entrepreneurship- Process approach- Twenty first centaury trends in entrepreneurship.
Case: From candle seller to CEO (Arya Kumar P.No. 48).

Unit-II: Individual and corporate entrepreneurship **9 hours**

The entrepreneurial journey - Stress and the entrepreneur- the entrepreneurial ego- Entrepreneurial motivations- Corporate Entrepreneurial Mindset the nature of corporate entrepreneur.
Case: Globalizing Local Talent, (B. Janakiram, M. Rizwana, page 228).

Unit-III: Launching Entrepreneurial Ventures **(5 + 5) 10 hours**

Part-A: Opportunities identification - entrepreneurial Imagination and Creativity - the nature of the creativity Process - Innovation and Entrepreneurship - Methods to initiate Ventures.

Part-B: Creating New Ventures - Acquiring an established entrepreneurial venture – Franchising - hybrid disadvantage of Franchising.
Case: creativity in start-ups (Arya Kumar Page 166).

Unit-IV: Legal challenges of Entrepreneurship **9 hours**

Intellectual Property Protection-Patents, Copyrights, Trademarks and Trade Secrets-Avoiding Pitfalls- Formulation of the entrepreneurial Plan- The challenges of new venture start-ups.
Case: Tata Motors – Nano (Arya Kumar P.No. 279).

Unit-V: Strategic perspectives in entrepreneurship **10 hours**

Strategic Planning-Strategic actions-strategic positioning-Business stabilization-Building the adaptive firms-understanding the growth stage-unique managerial concern of growing ventures.
Case: To Lease or Not: A Cash flow Question (David H.Holt, Page 452).

References:

1. Arya Kumar “Entrepreneurship- creating and leading an entrepreneurial org” Pearson 2012.
2. ‘Entrepreneurship: New Venture Creation’ David H Holt PHI, 2013.
3. Entrepreneurship: Text and Cases P. Narayana Reddy, Cengage, 2010.

PROJECT - II

IV-B.Tech.-II-Sem. **L T P C**
Subject Code: ME-PRJ-421 **- - 22 11**

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

COs	Upon completion of course the students will be able to	PO1 to PO14
CO1	identify the problem statement, assess the scope and develop a prototype	3
CO2	execute the project using modern tools and prepare the report	3
CO3	demonstrate leadership, management skills for project development with ethics	3
CO4	function effectively as individual / member / leader in project teams	3
CO5	make use of engineering knowledge for societal sustenance	3

Guidelines:

The objective of the project work is to imbibe students with technical, analytical and innovative ideas to facilitate with theoretical and practical learning pertaining to relevant domain of interest. An individual or a peer of 2-5 students work under the guidance / mentorship of a departmental faculty with the aim of addressing solution to real world / societal problems using various R & D techniques. The team work fosters the communication and leadership skills among peers to survive and exercise during their career.

The project work normally includes:

1. Survey and study of published literature on the approved / assigned topic.
2. Conduct preliminary Analysis / Modeling / Simulation / Experiment / Design / Feasibility / ethnographical study.
3. Prepare an abstract/synopsis on the opted topic and present before Departmental Review Committee (DRC).
4. Prepare an Action Plan for conducting the investigation, including team work.
5. Apply suitable methodology for Designing / Modelling / Simulation / Experimentation as needed.
6. Develop an end product or process along with conclusions, recommendations and future scope.
7. Present and execute the project before DRC for CIE.
8. Prepare and publish a paper in Conference / Journal, if possible.
9. Prepare and submit the final dissertation in the prescribed format to the Department.
10. Present and execute the project before External Committee for viva-voce.