SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES

(AUTONOMOUS)

Dr. Visweswaraiah Road, (Bangalore-Tirupathi Bye-pass Road),
Murukambattu,Chittoor – 517127, Andhra Pradesh, India.

B.Tech
Course Structures and Syllabi
Under R20 Regulations

(Applicable for 2021-2022 Regular Students & 2022-2023 Lateral Students)

Department of Mechanical Engineering

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES, CHITTOOR,

(AUTONOMOUS)

Institute Vision

To emerge as a Centre of Excellence for Learning and Research in the domains of engineering, computing and management.

Institute Mission

IM1: Provide congenial academic ambience with state -of -art of resources for learning and research.

IM2: Ignite the students to acquire self-reliance in the latest technologies.

IM3: Unleash and encourage the innate potential and creativity of students.

IM4: Inculcate confidence to face and experience new challenges.

IM5: Foster enterprising spirit among students.

IM6: Work collaboratively with technical Institutes / Universities / Industries of National and International repute

Department Vision

To become a Centre of excellence in Mechanical Engineering studies and research.

Department Mission

DM1: Provide congenial academic ambience with necessary infrastructure and learning resources

DM2: Inculcate confidence to face and experience new challenges from industry and society.

DM3: Ignite the students to acquire self-reliance in the latest Technologies

DM4: Foster Enterprising spirit among students

Program Educational Objectives (PEOs)

Graduates of Mechanical Engineering shall

PEO1: Have Professional competency through the application of knowledge gained from subjects like Mathematics, Physics, Chemistry, Inter-Disciplinary and core subjects like Manufacturing Engineering, Thermal Sciences, CAD/CAM and Design & Development. **(Professional Competency)**.

PEO2: Excel in one's career by critical thinking towards successful services and growth of the organization or as an entrepreneur or through higher studies. **(Successful Career Goals).**

PEO3: Enhance knowledge by updating advanced technological concepts for facing the rapidly changing world and contribute to society through innovation and creativity. **(Continuing Education and Contribution to Society).**

Program Specific Outcomes (PSO's)

After the completion of the Program, The student shall able to,

PSO1: Apply the knowledge obtained in core areas for the design, analysis and manufacturing of mechanical systems and processes.

PSO2: Exhibit novel concepts on product development with the help of modern CAD/CAM integration, while ensuring best manufacturing practices.

Program Outcomes

Engineering Graduates will be able to:

PO1-Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2-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.

PO3-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.

PO4-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.

PO5-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.

PO6-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.

PO7-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.

PO8-Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9-Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10-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.

PO11-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.

PO12-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.

ACADEMIC REGULATIONS (R-20) FOR B. TECH

(Regular-Full Time)

(Effective for the students admitted into I year from the Academic Year 2021-2022- and II-year lateral entry from the Academic year 2022-2023 onwards)

Curriculum for Regular and Honors/Minors B. Tech Program of all Branches

1. Eligibility for Admission

1.1 Admission of the B. Tech program shall be made subjects to the eligibility qualifications and Specialization prescribed by the University for each Program from time to time and also as per the guidelines of Andhra Pradesh State Council of Higher Education (APSCHE).

1.2 Admission shall be made either on the basis of Merit / Rank Obtained by the Qualifying candidates in EAMCET/ECET or otherwise specified whichever is relevant.

2. Award of the Degree: A student will be declared eligible for the award of B. Tech. degree if he/she fulfills the following:

i. For regular entry students, shall pursues a course of study in not less than four and not more than eight academic years.

ii. For lateral entry students, shall pursue a course of study for not less than three academic years and in not more than six academic years.

iii. For regular entry students, after eight academic years from the year of their admission, he/she shall forfeit their seat in B. Tech course and their admission stands cancelled.

iv. For lateral entry students, after six academic years from the year of their admission, he/she shall forfeit their seat in B. Tech course and their admission stands cancelled.

v. For regular entry students shall register for 163 credits and must secure all the 163 credits. For lateral entry students shall register for 124 credits and secure all 124 credits

vi. A student shall be eligible for the award of B. Tech degree with Honors or Minor if he/she earns 20 credits in addition to the 163 credits for Regular entry students /124 credits for lateral entry students.

vii. A student shall be permitted to register either for Honors or for Minor and not for both simultaneously.

3. Structure of the Undergraduate Engineering program:

All subjects / courses offered for the under graduate program in B.Tech. Degree programs are broadly classified as follows.

S.No	Course Classification	Course Category	Course Code
1	Foundation Courses	Humanities and Social Science including Management Courses	HSM
		Basic Science Courses	BSC
		Engineering Science Courses	ESC
2	Core Courses	Professional Core Courses	PCC
3	Elective Courses	Professional Elective Courses	PEC
		Open Elective Courses	OEC
4	Employability Enhancement Courses	Internship, Seminar and Project Work	PROJ
		Skill Oriented Courses / Skill Advanced Courses	SOC/SAC
5	Audit Courses	Mandatory Audit Courses	MAC
6	Minor / Honor Courses	Minor Courses / Honor Courses	MR/HR

4. Assigning of Credits:

i. 1 Hr. Lecture (L) per week – 1 Credit

ii. 1 Hr. Tutorial (T) per week – 1 Credit

iii. 1 Hr. Practical (P) per week – 0.5 Credits

iv. 2 Hours Practical (Lab) per week – 1 Credit

5. Induction Program for I. B. Tech Program

i. There shall be mandatory student induction program for fresher's, with a three-week duration before the commencement of first semester.

ii. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Department / Branch and Innovations etc., shall be included in the guidelines issued by AICTE.

6. Assessment

i. The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory as well as for practical subject and project work.

ii. The audit courses shall be evaluated for a maximum of 30 internal marks.

iii. For theory and practical subjects, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End Semester Examinations.

iv. A student has to secure not less than 35% of marks in the end semester examination and minimum 40% of marks in the sum total of Internal Examination and End Semester Examinations marks to earn the credits allotted to each course.

6.1 Internal Examination

6.1.1 For theory subjects, during the semester, there shall be two Mid-Term Examinations will be conducted.

6.1.2 Each Mid-Term Examination consists of objective paper for 10 marks and subjective paper for 15 marks with the duration of 1 hour 50 minutes (20 minutes for objective and 90 minutes for subjective paper).

6.1.3 The subjective paper shall contain 3 either-or type questions with equal Weightage of 10 marks and the marks obtained for 3 questions shall be condensed to 15 marks; any fraction shall be rounded off to the next higher mark.

6.1.4 If the student is absent for the any internal examination, no re-exam or make up exam shall be conducted and marks for that examination shall be considered as zero.

6.1.5 First Mid-Term Examination shall be conducted for I & II units of syllabus and second Mid-Term Examinations shall be conducted for III, IV & V units.

6.1.6 However, 5 marks are awarded for 5 Assignments (unit-wise).

6.1.7 Final Internal marks shall be arrived at by considering the marks secured by the student in both the Mid-Term examinations with 80% weightage to the better mid exam and 20% to the other

For Example:

- Marks obtained in First Mid-Term: 25
- Marks obtained in Second Mid-Term: 25
- Internal Marks: (25x0.8) + (25x0.2) = 25
- Final internal marks = Internal Marks + Assignment marks

6.1.8 If the student is absent for any one Mid-Term Examinations, the final internal marks shall be arrived at by considering 80% Weightage to the marks securedby the student in the appeared examination and zero to the other.

For Example:

- Marks obtained in First Mid-Term: Absent
- Marks obtained in Second Mid-Term: 25
- Internal Marks: (25x0.8) + (0x0.2) = 20
- Final internal marks = Internal Marks + Assignment marks

6.1.9 For practical courses there shall be 30 internal marks. 15 marks allotted for Internal Practical Examination to be conducted before the last working day and 15 marks for Day-to-Day work in the laboratory shall be evaluated by the concerned laboratory teacher based on the regularity / record / viva-voce.

6.1.10 In a practical subject consisting of two parts (ex: Engineering Workshop & IT Workshop), Internal examination shall be evaluated as above for 30 marks in each part and final internal marks shall be arrived by considering the average of marks obtained in two parts.

6.1.11 The evaluation of the practical courses is done based on the rubrics designed for that curriculum component.

6.2 Semester End Examination

6.2.1 End examination of theory courses shall have the following pattern:

i. There shall be two parts, Part-A and Part-B.

ii. Part-A shall contain 10 compulsory short answer questions for a total of 20 marks such that each question carries 2 marks. There shall be 2 short answer questions from each unit.

iii. Part-B Shall be either-or type questions of 10 marks each. Student shall answer any one of it.

iv. Each of these questions from Part-B shall cover each unit of the syllabus.

6.2.2 End examination of practical courses shall have the following pattern:

i. End Semester Examination shall be for 70 marks.

ii. The end examination shall be conducted by the concerned laboratory teacher and senior expert in the same subject of the department.

iii. In a practical subject consisting of two parts (ex: Engineering Workshop & IT Workshop), the End Semester Examination shall be conducted for 35 marks in each part.

iv. The evaluation of the practical courses is done based on the rubrics designed for that curriculum component.

6.3 Drawing Courses

6.3.1 For the subject having design and/or drawing, such as Engineering Drawing / Graphics.

6.3.2 The distribution shall be 30 marks for internal evaluation (15 marks for Day- to-Day work (unit wise chart work / Assignment) and for another 15 marks there shall be a two MID Term exams will be conducted) and 70 marks for semester end examinations.

6.3.3 There shall be two Mid-Term examinations in a semester for duration of 2hrs each for 15 marks with weightage of 80% to better mid marks and 20% for the other.

6.3.4 The internal subjective paper shall contain 3 either-or type questions with equal Weightage of 10 marks and the marks obtained for 3 questions shall be condensed to 15 marks; any fraction shall be rounded off to the next higher mark and there shall be no objective paper in internal examination.

6.3.5 The sum of Day-to-Day work evaluation / assignments and the internal MID Term test marks will be the final internal marks for the course.

6.3.6 In the end examination pattern for Engineering Drawing / Graphics there shall be 5 questions, either-or type, of 14 marks each.

6.4 Mandatory Audit Courses

6.4.1 Courses like Environmental Sciences, Constitution of India and Design Thinking for Innovation shall be included in the curriculum as non-credit mandatory audit courses.

6.4.2 However, attendance in the audit courses shall be considered while calculating aggregate attendance. A student has to secure 40% of the marks allotted in the internal evaluation for passing the course.

6.4.3 The Internal Marks will be calculated similar to that of Theory course.

6.4.4 In grade sheet the completion of the course indicated as Pass – "P", and No marks or letter grade shall be allotted, for all non-credit mandatory audit courses.

6.4.5 Re-exam shall be conducted for failed candidates for every semester at a mutual convenient date of institution.

6.5 Professional Elective Courses

6.5.1 Students have to choose Professional Elective Courses PEC-I in V semester, PEC-II in VI semester and PEC-III, PEC-IV, PEC-V in VII semester, from the list of elective courses given.

6.5.2 Registration forms are invited from the students 10 days prior to the last instructional day of the preceding semester for registration process for offering the Professional Elective Courses.

6.5.3 There shall be a limit on the minimum and maximum number of registrations based on class/section strength.

6.5.4 The assessments of Professional Elective Courses are same as regular theory courses.

6.6 Open Elective Courses

6.6.1 A student shall opt for any 4 courses from the list given by the institute from time to time, complying with the requirement of the prerequisite course(s), if any.

6.6.2 Students have to choose Open Elective Courses OEC-I in V semester, OEC-II in VI semester and OEC-III, OEC-IV in VII semester, from the list of elective courses given.

6.6.3 All Open Elective Courses are offered to the students of across all branches in general.

6.6.4 Registration forms are invited from the students 10 days prior to the last instructional day of the preceding semester for registration process for offering the Open Elective Courses.

6.6.5 However, a student shall choose an open Elective from the list in such a manner that he/she has not studied the same course in any form during their Program.

6.6.6 There shall be a limit on the minimum and maximum number of registrations based on class/section strength.

6.7 Massive Online Open Courses

6.7.1 MOOC courses under Professional Elective / Open Elective

6.7.2 A student shall be permitted to pursue up to a maximum of two elective courses (Professional Elective Courses or Open Elective Courses) under MOOCs during the Program. Each of the courses must be of minimum 12 weeks in duration for 3 credits. Attendance will not be monitored for MOOC courses.

6.7.3 Student has to pursue and acquire a certificate for a MOOC course only from the organizations / agencies approved by the BoS in order to earn the 3 credits. The Head of the department shall notify the list of such courses at the beginning of the semester.

6.8 Mandatory Internships

6.8.1 Students shall undergo two mandatory summer internships for a minimum of four weeks duration at the end of second and third year of the Program.

6.8.2 The internship can be done by the students at Local Industries, Government Organizations, Public Sector Companies, Research Laboratories, Construction agencies, Power Plants and also in software MNCs.

6.8.3 A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the Department Evaluation Committee nominated by the principal at the end of the semester for the evaluation of summer internship.

6.8.4 The performance of a student in each mandatory summer internships shall be evaluated with a maximum of 100 marks.

6.8.5 The report and the oral presentation shall carry 40% and 60% weightage respectively.

6.9 Project work and Internships

6.9.1 In the final semester, the student should undergo Internship / Project Work with well-defined objectives.

6.9.2 Students Project Batch will have maximum of four students comprising the fast and slow learners.

6.9.3 Every student shall be required to undertake a Project Work in the Institution / Internship cum Project Work in Local Industries / Government Organizations / Public Sector Companies / Research Laboratories / Construction agencies / Power Plants and also in software MNCs in consultation with Head of the Department and Department Project Evaluation Committee.

6.9.4 The Department project evaluation committee continuously monitors and evaluates the progress of the Project Work / Internship cum Project Work by conducting three reviews including abstract review during the project period.

6.9.5 During the project review meetings, batch presentation and individual contributions are monitored to assess individual student performance and also team performance.

6.9.6 The evaluation of the project is done based on the rubrics designed for that curriculum component.

6.9.7 At the end of the semester the candidate shall submit an Internship cum Project completion certificate along with project report on the work carried out during the project work at the industry.

6.9.8 A student shall be permitted to submit project report on the work carried out during the project work at the institution/department.

6.9.9 The project work submitted to the department shall be evaluated for 100 marks, out of which 30 marks are for internal evaluation and 70 marks for external viva-voce.

6.9.10 The internal evaluation shall be made by the Department Project Evaluation Committee, on the basis of three reviews given by each students / batch on the topic of his/her project.

6.9.11 The final viva-voce shall be conducted by a committee consisting of HOD, Project Supervisor and an External Examiner nominated by the principal at the end of the Semester.

6.9.12 In case a student fails in viva voce he /she shall reappear as and when supplementary examinations are conducted.

6.9.13 The distribution of marks for the Internal assessment and End Semester Examination is given below:

Internal Assessment (30 Marks)			**End Semester Examination (70 Marks)**		
Review - I	Review - II	Review - III	Supervisor	Internal Examiner	External Examiner
10	10	10	20	25	25

6.10 Eligibility to appear for Semester End Examinations

6.10.1 A student shall be eligible to appear for Semester End Examinations if he/she acquires a minimum of 75% of attendance in aggregate of all the courses in a semester.

6.10.2 Condonation for 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. Shortage of Attendance below 65% in aggregate shall in NO case be condoned.

6.10.3 Students whose shortage of attendance is not condoned in any semester are not eligible to take their Semester End Examination of that class and their registration shall stand cancelled.

6.10.4 A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester, as applicable. They may seek readmission for that semester when offered next.

6.10.5 A stipulated fee shall be payable towards condonation of shortage of attendance to the college.

6.11 Issue of Photocopy of Answer Script

6.11.1 A student can request for the photo copy of answer script of any theory examination within one week after the declaring the results by paying fee.

6.11.2 The examination section shall issue a notification inviting applications for the issue of photocopy of answer script after publishing the results.

6.11.3 The application forms can be obtained from the examination section.

6.12 Revaluation

6.12.1 A candidate can apply for revaluation of his / her end examination answer paper in a theory course.

6.12.2 The examination section shall issue a notification inviting applications for the revaluation after publishing the results.

6.12.3 The application forms can be obtained from the examination section.

6.12.4 A candidate can apply for revaluation of answer scripts in not more than 5 courses at a time.

6.12.5 No revaluation for practical courses, comprehensive viva-voce / Examination and project work.

6.13 Challenge Valuation

6.13.1 A student can apply for challenge valuation by prescribed fee.

6.13.2 Challenging valuation shall be carried out by an external subject expert.

6.13.3 The challenging valuation should be done strictly as per the scheme of valuation supplied by the examination section in the presence of Principal.

6.13.4 The examination section shall issue a notification inviting applications for the challenging valuation after publishing the revaluation results.

6.13.5 The application forms can be obtained from the examination section.

7. Promotion Rules

7.1 A student shall be promoted from first year to second year if he fulfills the minimum attendance requirements.

7.2 A student will be promoted from II year to III year if he fulfills the academic requirement of 40% of credits up to II-year IV Semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II-year IV semester.

i. **One** regular and **three** supplementary examinations of I B. Tech I Semester.

ii. **One** regular and **two** supplementary examinations of I B. Tech II Semester.

iii. **One** regular and **one** supplementary examination of II B. Tech III Semester.

iv. **One** regular examination of II B. Tech IV semester.

7.3 A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to III-year 6th semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III-year 6th semester.

i. **One** regular and **five** supplementary examinations of I B. Tech I Semester.

ii. **One** regular and **four** supplementary examinations of I B. Tech II Semester.

iii. **One** regular and **three** supplementary examinations of II B. Tech III Semester.

iv. **One** regular and **two** supplementary examinations of II B. Tech IV Semester.

v. **One** regular and **one** supplementary examination of III B. Tech V Semester.

vi. **One** regular examination of III B. Tech VI Semester.

7.4 For Lateral entry student promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to III-year VI semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III-year VI semester.

i. One regular and three supplementary examinations of II B. Tech III Semester.

ii. One regular and two supplementary examinations of II B. Tech IV Semester.

iii. One regular and one supplementary examination of III B. Tech V Semester.

iv. One regular examination of III B. Tech VI Semester.

8. Extra-Curricular Activities

i. Students shall enroll, on admission, in any one of the personality and character development programs (NSS/YRC etc.,) and undergo training and attend a camp.

ii. The training shall include classes on hygiene and health awareness and also training in first-aid.

iii. National Service Scheme (NSS) and Youth Red Cross (YRC) will have social service activities in and around the Institution.

iv. A student will be required to participate in an activity for an hour in a week during their second and third years.

9. Skill Oriented / Skill Advanced Courses

i. There shall be 05 Mandatory Skill-Oriented Courses offered during III to VII semesters.

ii. The list of such courses shall be included in the curriculum structure of each branch of Engineering.

10. Curricular Framework for Honors Program

i. Under Graduate degree with Honors shall be issued by the Institution to the students who fulfill all the academic eligibility requirements for the B. Tech program and Honors program.

ii. Students of a Department are eligible to opt for Honors Program offered by the same Department / Discipline, subject to a maximum of two additional courses per semester.

iii. A student shall be permitted to register for Honors program at the beginning of IV semester provided that the student must have acquired a minimum average of 8.0 SGPA up to the end of II semester without any backlogs. In case of the declaration of the III semester results after the commencement of the IV semester and if a student fails to score the required minimum of 8.0 SGPA, his/her registration for Honors Program stands cancelled and he/she shall continue with the regular Program.

iv. Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. In addition to fulfilling all the requisites of a Regular B.Tech . Program, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. , 163/124 credits).

v. Of the 20 additional Credits to be acquired, and 16 credits (four courses) shall be earned by undergoing specified courses listed as pools (two courses per pool either theory course or theory with lab component), and each carrying 4 credits. The remaining 4 credits (two courses) must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12weeks as recommended by the Board of studies.

vi. The courses offered in each pool (two courses per pool) shall be domain specific courses and advanced courses.

vii. MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the academic council.

viii. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course.

ix. The concerned BoS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

x. The concerned BoS shall also consider courses listed under professional Elective Courses of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Program.

xi. If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Honors will be shown in the transcript. None of the courses done under the dropped Honors will be shown in the transcript.

xii. In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xiii. Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor's degree.

11. Curricular Framework for Minor Program

i. Under graduate Degree with Minor Program shall be issued by the Institution to the students who fulfill all the academic eligibility requirements for the B. Tech program and Minor Program.

ii. Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Computer Science Engineering under this scheme; he/she will get Major degree of Mechanical Engineering with minor degree of Computer Science Engineering. Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B. Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

iii. The concerned BOS shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE, CE, ME etc or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Virtual Realty, VLSI etc.

iv. The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BoS.

v. The concerned BoS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

vi. A student shall be permitted to register for Minors program at the beginning of IV semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8.0 SGPA (Semester Grade point average) upto the end of II semester without any history of backlogs. It is expected that the III semester results may be announced after the commencement of the IV semester. If a student fails to acquire 8.0 SGPA upto III semesters or failed in any of the courses, his registration for Minors program shall stand cancelled. An SGPA of 8.0 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

vii. A student shall earn additional 20 credits in the specified area to be eligible for to award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e., 163/124 credits).

viii. Of the 20 additional Credits to be acquired and 16 credits shall be earned by undergoing specified courses listed in course structure and each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12weeks as recommended by the Board of studies.

ix. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the BoS.

x. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Program.

xi. If a student drops or terminated from the Minor program, they cannot convert the earned credits into open or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.

xii. In case a student fails to meet the CGPA requirement for B. Tech degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree with Minors and they will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

xiii. Minor must be completed simultaneously with a major degree program. A student cannot earn the Minor after he/she has already earned bachelor's degree.

12. Grading

After each subject is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Marks Range	Level	Letter Grade	Grade Point
≥ 90	Outstanding	S	10
80-89	Excellent	A	9
70-79	Very Good	B	8
60-69	Good	C	7
50-59	Fair	D	6
40-49	Satisfactory	E	5
< 40	Fail	F	0
-	Absent	Ab	0

13. Calculation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

i. The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$SGPA = \frac{\sum(C_i \; X \; G_i)}{\sum C_i}$$

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

ii. The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

$$CGPA = \frac{\sum(C_j \; X \; S_j)}{\sum C_j}$$

where 'S_j' is the SGPA of the j^{th} semester and C_j is the total number of credits in that semester

iii. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts

iv. While computing the SGPA/CGPA, the subjects in which the student is awarded Zero grade points will also be included.

v. *Grade Point:* It is a numerical weight allotted to each letter grade on a 10-pointscale.

vi. *Letter Grade:* It is an index of the performance of students in a said course. Grades are denoted by letters S, A, B, C, D, E and F.

vii. As per AICTE regulations, conversion of CGPA into equivalent percentage as follows:

viii. Equivalent Percentage = (CGPA – 0.50) x 10.

14. Award of Class

After a student has satisfied the requirements prescribed for the completion of the program and are eligible for the award of B.Tech. Degree, he/she shall be placed in one of the following:

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5
First Class	≥ 6.5 < 7.5
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 4.0 < 5.5

15. With-Holding the Result

If the candidate has any dues not paid to the institution or if any case of indiscipline or malpractice is pending against him, the result of the candidate shall be withheld and he will not be allowed / promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

16. Transitory Regulations and Gap – Year

i. Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfillment of academic regulations. Candidates who have been detained for attendance shortage or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered and they will be in the academic regulations into which they get readmitted.

ii. Gap Year – concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I year/ II year/ III year to pursue entrepreneurship full time. This period shall be counted for the maximum time for graduation.

iii. An evaluation committee at university level shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for availing the Gap Year.

iv. Candidates who were permitted with Gap Year shall be eligible for rejoining into the succeeding year of their B. Tech from the date of commencement of class work and they will be in the academic regulations into which the candidate is presently rejoining.

17. Industrial Collaborations

i. Institution-Industry linkages refer to the interaction between firms and universities or public research centers with the goal of solving technical problems, working on R&D, innovation projects and gathering scientific as well as technological knowledge.

ii. The Departments are permitted to design any number of Industry oriented minor tracks as the respective BoS feels necessary. In this process the departments can plan to have industrial collaborations in designing the minor tracks and to developthe content and certificate programs.

18. Community Service Project

i. Community Service Project should be an integral part of the curriculum, as an alternative to the Internships, whenever there is an exigency when students cannot pursue their internships.

ii. Every student should put in a minimum of 144 hours for the Community Service Project during the summer vacation. Each class/section should be assigned with a mentor.

iii. Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc

iv. A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded. The log book has to be countersigned by the concerned mentor/faculty in-charge.

v. Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member. The final evaluation to be reflected in the grade memo of the student. The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc. Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college. Award of marks shall be made as per the guidelines of Internship.

vi. A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.

vii. The Community Service Project is a twofold one – First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers; rather, it could be another primary source of data.

viii. Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like – Agriculture, Health, Marketing and Cooperation Animal Husbandry, Horticulture, Fisheries, Sericulture, Revenue and Survey, Natural Disaster Management, Irrigation, Law & Order, Excise and Prohibition, Mines and Geology, Energy, Internet, Free Electricity, Drinking Water etc.,

19. Transfer Details

i. Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh from time to time.

20. Preservation of Records

i. The laboratory records, internal test papers and end examination answer booklets shall be preserved for minimum of 2 years from the date of completion of their degree in the institution.

21. Amendments to Regulations

The Academic Council of SITAMS (Autonomous) reserves the right to revise, amend or change the Regulations, Scheme of Examinations, and / or Syllabi or any other policy relevant to the needs of the society or industrial requirements etc., with the recommendations of the concerned Board(s) of Studies.

22. General

i. The academic regulations should be read as a whole for purpose of any interpretation. Malpractices rules- nature and punishments are appended.

ii. Where the words "he", "him", "his", occur in the regulations, they also include "she", "her", "hers", respectively.

23. Conduct and Discipline

i. Students shall conduct themselves within and outside the precincts of the Institute in a manner befitting the students of an Institute of National importance.

ii. As per the order of the Hon'ble Supreme Court of India, ragging in any form is banned: acts of ragging will be considered as gross indiscipline and will be severely dealt with.

iii. The following additional acts of omission and /or commission by the students within or outside the precincts of the college shall constitute gross violation of code of conduct and are liable to invoke disciplinary measures

a. Ragging
b. Lack of courtesy and decorum: indecent behavior anywhere within or outside the campus.
c. Willful damages or stealthy removal of any property /belongings of the Institute / Hostel or of fellow students
d. Possession, consumption of distribution of alcoholic drinks or any kind of hallucinogenic drugs
e. Mutilation or unauthorized possession of library books
f. Hacking in computer systems
g. Furnishing false statements to the disciplinary committee, or willfully withholding information relevant to an enquiry
h. Organizing or participation in any activity that has potential for driving fellow students along lines of religion caste batch of admission hostel or any other unhealthy criterion.
i. Resorting to noisy and unseemly behavior, disturbing studies of students.

j. Physical or mental harassment of fresher through physical contact or oral abuse
k. Adoption of unfair means in the examination
l. Organizing or participating in any group activity except purely academic and scientific Programmers in company with others in or outside campus without prior permission of the principal
m. Disturbing in drunken state or otherwise an incident in academic or students function or any other public event.

n. Not obeying traffic rules in campus not following safety practices or causing potential danger to oneself or other persons in any way.
o. Any other act or gross indiscipline

iv. Commensurate with the gravity of the offence the punishment may be reprimand fine and expulsion from the hostel debarment from an examination rustication for a specified period or even outright expulsion from the College.

v. The reprimanding Authority for an offence committed by students in the Hostel and in the Department or the classroom shall be respectively, the managers of the Hostels and the Head of the concerned Department

vi. In all the cases of offence committed by students in jurisdictions outside the purview the principal shall be the Authority to reprimand them.

vii. All Major acts of indiscipline involving punishment other than mere reprimand shall be considered and decided by the Principal Students Disciplinary Committee appointed by the principal.

viii. All other cases of Indiscipline of Students like adoption of unfair means in the examinations shall be reported to the Vice-Principal for taking appropriate action and deciding on the punishment to be levied.

ix. In all the cases of punishment levied on the students for any offence committed the aggrieved party shall have the right to appeal to the principal who shall constitute appropriate Committees to review the case.

NATURE OF MALPRACTICES/ IMPROPER CONDUCT PUNISHMENT	PUNISHMENT
1. (a) possesses or keeps access 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/ practical) in which he/she 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.	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 inside 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/she will be handed over to the police and a case is registered against him/her.	Expulsion from the examinations hall and cancellation of the performance in that subject only of all the candidates involved in case of an outsider He / She will be handed over to the police and a case is registered against him/her.

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 examinations hall and cancellation of the performance in that subject and all other subjects thecandidates has already appeared including practical examinations and projects workand shall not be permitted to appear for the reaming examinations of the subjects of that semester/Year. The Hall Ticket of the candidate will be cancelled and retained by the CE.
3. Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall 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 university examinations. The continuation of the course by the candidates subject to the academic regulations in connection with forfeiture of seat.

4. Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper or answer book or additional sheet, during or after the examination.	If the imposter is an outsider, he/shewill be handed over to the police and a case is registered against him/her. 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 university examinations. The continuation of the course by the candidateis 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 Chief - Superintendent / Assistant- Superintendent / 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 officer-in charge or any person on duty in or outside the examination hall or causes any injury to his person or to any of his relatives whether by offensive words spoken or written or by signs or by visible representation or assaults the officer-in-charge, or any person on duty inside or outside the examination hall or any of his relatives, or indulges in any other act of misconduct or mischief which results in damage to or destruction of property in the examination hall or any part of the college	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 are also 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.

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.	
7. Leaves the exam hall taking away answer script or intentionally tears off 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 shallnot 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 the external examinations. The continuation of thecourse by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8. Possesses 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. Belongs to college, who is not a candidate for the particular examination or any person not connected with the college but indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the college will be expelled 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 state to the examination hall.	Expulsion from the examination hall and cancellation of the performance.
11. Copying is 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.	

Note: Failing to read the regulation is not considered as an excuse

B.Tech R20 - COURSE STRUCTURE AND SYLLABI

Semester I (First Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	20HSM111	Communicative English for Engineers	3	0	0	3	30	70	100
2	20BSC111	Algebra and Calculus	2	1	0	3	30	70	100
3	20ESC111	Engineering Graphics	1	0	4	3	30	70	100
4	20ESC114	Basic Electrical and Electronics Engineering	2	1	0	3	30	70	100
5	20ESC115	Programming with Python	2	1	0	3	30	70	100
6	20HSM112	Communicative English Language Lab	0	0	3	1.5	30	70	100
7	20ESC116	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5	30	70	100
8	20ESC118	Programming with Python Lab	0	0	3	1.5	30	70	100
Contact Hours per week			10	3	13	-	-	-	-
Total Hours per week			26			-	-	-	-
Total credits						19.5	-	-	-
Total Marks							240	560	800

Semester II (First Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	20BSC121	Differential Equations and Transformation Techniques	2	1	0	3	30	70	100
2	20BSC122	Engineering Chemistry	3	0	0	3	30	70	100
3	20BSC123	Engineering Physics	3	0	0	3	30	70	100
4	20MEC121	Engineering Mechanics	2	1	0	3	30	70	100
5	20MEC122	Material Science and Metallurgy	3	0	0	3	30	70	100
6	20BSC114	Engineering Chemistry Lab	0	0	2	1	30	70	100
7	20BSC115	Engineering Physics Lab	0	0	2	1	30	70	100
8	20ESC112	Engineering Workshop & IT Workshop	0	0	2	1	30	70	100
9	20MEC124	Computer Aided Drafting Lab	0	0	3	1.5	30	70	100
Contact Hours per week			13	2	9	-	-	-	-
Total Hours per week			24			-	-	-	-
Total credits						19.5	-	-	-
Total Marks							270	630	900

Semester III (Second Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	20BSC231	Numerical Methods and Probability Theory	3	1	0	4	30	70	100
2	20ESC231	Fluid Mechanics and Machinery	2	1	0	3	30	70	100
3	20MEC231	Engineering Thermodynamics	2	1	0	3	30	70	100
4	20MEC232	Manufacturing Technology	3	0	0	3	30	70	100
5	20MEC233	Mechanics of Solids	2	1	0	3	30	70	100
6	20MEC234	Computer Aided Design (SOC)	2	0	0	2	30	70	100
7	20ESC232	Fluid Mechanics and Machinery Lab	0	0	3	1.5	30	70	100
8	20MEC235	Material Science Lab and Manufacturing Technology Lab	0	0	3	1.5	30	70	100
9	20MEC236	Mechanics of Solids Lab	0	0	3	1.5	30	70	100
Contact Hours per week			14	4	9	-	-	-	-
Total Hours per week			27			-	-	-	-
Total credits						22.5	-	-	-
Total Marks							270	630	900

Semester IV (Second Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	20HSM241	Principles of Management	3	0	0	3	30	70	100
2	20BSC243	Operation Research	2	1	0	3	30	70	100
3	20MEC241	Kinematics of Machinery	2	1	0	3	30	70	100
4	20MEC242	Metal Cutting and Machine Tools	2	1	0	3	30	70	100
5	20MEC243	Thermal Engineering	2	1	0	3	30	70	100
6	20MEC244	Automotive Systems (SOC)	2	0	0	2	30	70	100
7	20MEC245	Computer Aided Machine Drawing Lab	0	0	3	1.5	30	70	100
8	20MEC246	Machine Tools Technology Lab	0	0	3	1.5	30	70	100
9	20MEC247	Thermal Engineering Lab and Automotive Systems Lab	0	0	3	1.5	30	70	100
10	20MAC231	Environmental Sciences	2	0	0	0	P	-	-
11	-	Internship during Summer Vacation	-	-	-	-	-	-	-
Contact Hours per week			15	4	9	-	-	-	-
Total Hours per week			28			-	-	-	-
Total credits						21.5	-	-	-
Total Marks							270	630	900
1		Honors / Minor Courses*	3	1	-	4	30	70	100

Semester V (Third Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	20MEC351	Design of Machine Elements	2	1	0	3	30	70	100
2	20MEC352	Dynamics of Machinery	2	1	0	3	30	70	100
3	20MEC353	Metrology and Measurements	3	0	0	3	30	70	100
4	20MEC354	Professional Elective Course – 1	3	0	0	3	30	70	100
5	OE-I	Open Elective Course – 1	3	0	0	3	30	70	100
6	20MEC355	3D Printing Design and Practices (SAC)	0	1	2	2	30	70	100
7	20MEC356	Kinematics and Dynamics Lab	0	0	3	1.5	30	70	100
8	20MEC357	Metrology and Measurements Lab	0	0	3	1.5	30	70	100
9	20MAC352	Design Thinking for Innovation	2	0	0	0	P	-	-
10	20MEC358	Industry Internship / Community Service Project – Evaluation	0	0	0	1.5	-	-	100
Contact Hours per week			15	3	8	-	-	-	-
Total Hours per week			26			-	-	-	-
Total credits						21.5	-	-	-
Total Marks							240	560	900
1		Honors / Minor Courses*	3	1	-	4	30	70	100

Semester VI (Third Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	20MEC361	Design of Transmission System	2	1	0	3	30	70	100
2	20MEC362	Finite Element Analysis	2	1	0	3	30	70	100
3	20MEC363	Heat and Mass Transfer	2	1	0	3	30	70	100
4	20MEC364	Professional Elective Course – 2	3	0	0	3	30	70	100
5	OE-II	Open Elective Course – 2	3	0	0	3	30	70	100
6	20HSM231	Soft Skills (SOC)	0	1	2	2	30	70	100
7	20MEC365	Computer Aided Analysis and Simulation Lab	0	0	3	1.5	30	70	100
8	20MEC366	Heat Transfer Lab	0	0	3	1.5	30	70	100
9	20MEC367	Project Skills Lab	0	0	3	1.5	30	70	100
10	20MAC351	Constitution of India	2	0	0	-	P	-	-
11	-	Industrial / Research Internship during Summer Vacation	-	-	-	-	-	-	-
Contact Hours per week			14	4	11	-	-	-	-
Total Hours per week			29			-	-	-	-
Total credits						21.5	-	-	-
Total Marks							270	630	900
1		Honors / Minor Courses*	3	1	-	4	30	70	100

Semester VII (Fourth Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	20HSM471	Humanities and Social Science Elective	3	0	0	3	30	70	100
2	20HSM472	Universal Human Values and Ethics	3	0	0	3	30	70	100
3	20MEC471	Professional Elective Course – 3	3	0	0	3	30	70	100
4	20MEC472	Professional Elective Course – 4	3	0	0	3	30	70	100
5	20MEC473	Professional Elective Course – 5	3	0	0	3	30	70	100
6	OE-III	Open Elective Course – 3	3	0	0	3	30	70	100
7	OE-IV	Open Elective Course – 4	3	0	0	3	30	70	100
8	20MEC474	Computer Aided Manufacturing (SAC)	0	1	2	2	30	70	100
9	20MEC475	Industrial / Research Internship Evaluation	0	0	0	2	-	-	100
Contact Hours per week			21	1	2	-	-	-	-
Total Hours per week			24			-	-	-	-
Total credits						25	-	-	-
Total Marks							210	490	800
1		Honors / Minor Courses*	3	1	-	4	30	70	100

Semester VIII (Fourth Year)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	20MEC481	Project Work	0	0	0	12	30	70	100
Contact Hours per week			0	0	0	12	-	-	-
Total Hours per week			-			-	-	-	-
Total credits						12	-	-	-
Total Marks							30	70	100

** Eligible and interested students can register either for Honors or for a Minor in IV Semester onwards, as per the regulation guidelines.*

Professional Elective Course – 1 (Semester V)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	20MEC354A	Refrigeration System and Gas Dynamics	3	-	-	3	30	70	100
2	20MEC354B	Applied Hydraulics and Pneumatics	3	-	-	3	30	70	100
3	20MEC354C	Fuel Cell Technologies	3	-	-	3	30	70	100
4	MOOC	Massive Open Elective Course	-	-	-	3	-	-	-

Professional Elective Course – 2 (Semester VI)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	20MEC364A	Hybrid and Electric Vehicles	3	-	-	3	30	70	100
2	20MEC364B	Computational Fluid Dynamics	3	-	-	3	30	70	100
3	20MEC364C	Turbo Machinery	3	-	-	3	30	70	100
4	MOOC	Massive Open Elective Course	-	-	-	3	-	-	-

Professional Elective Course – 3 (Semester VII)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	20MEC471A	Automation and Robotics	3	-	-	3	30	70	100
2	20MEC471B	Production and Operations Management	3	-	-	3	30	70	100
3	20MEC471C	Industrial Safety Management	3	-	-	3	30	70	100
4	MOOC	Massive Open Elective Course	-	-	-	3	-	-	-

Professional Elective Course – 4 (Semester VII)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	20MEC472A	Product Design and Development	3	-	-	3	30	70	100
2	20MEC472B	Design of Heat Exchangers	3	-	-	3	30	70	100
3	20MEC472C	Industrial Tribology	3	-	-	3	30	70	100
4	MOOC	Massive Open Elective Course	-	-	-	3	-	-	-

Professional Elective Course – 5 (Semester VII)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	20MEC473A	Modern Manufacturing Processes	3	-	-	3	30	70	100
2	20MEC473B	Process Planning and Cost Estimation	3	-	-	3	30	70	100
3	20MEC473C	Sustainable and Green Manufacturing	3	-	-	3	30	70	100
4	MOOC	Massive Open Elective Course	-	-	-	3	-	-	-

Open Elective Course – 1 (Semester V)

S.No	Course Code	Course Title	Offered Department	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P	C	I	E	Total
1	20OHSM351	Graph Theory with Applications	S&H	3	-	-	3	30	70	100
2	20OCIV351	Air Pollution and Control	CIV	3	-	-	3	30	70	100
3	20OEEE351	Renewable Energy Sources	EEE	3	-	-	3	30	70	100
4	20OECE351	Automotive Electronics	ECE	3	-	-	3	30	70	100
5	20OCSE351	Relational Database Management System	CSE/CSM	3	-	-	3	30	70	100

Open Elective Course – 2 (Semester VI)

S.No	Course Code	Course Title	Offered Department	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P	C	I	E	Total
1	20OHSM361	LASER and Fiber Optics	S&H	3	-	-	3	30	70	100
2	20OCIV361	Building Technology	CIV	3	-	-	3	30	70	100
3	20OEEE361	Power Plant Engineering	EEE	3	-	-	3	30	70	100
4	20OECE361	Communication Networks	ECE	3	-	-	3	30	70	100
5	20OCSE361	Data Communication and Networks	CSE/CSM	3	-	-	3	30	70	100

Open Elective Course – 3 (Semester VII)

S.No	Course Code	Course Title	Offered Department	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P	C	I	E	Total
1	20OHSM471	Nano Science and Technology	S&H	3	-	-	3	30	70	100
2	20OCIV471	Disaster Mitigation and Management	CIV	3	-	-	3	30	70	100
3	20OEEE471	PLC and Applications	EEE	3	-	-	3	30	70	100
4	20OECE471	Medical Electronics	ECE	3	-	-	3	30	70	100
5	20OCSM471	Fundamentals of Artificial Intelligence	CSE/CSM	3	-	-	3	30	70	100

Open Elective Course – 4 (Semester VII)

S.No	Course Code	Course Title	Offered Department	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
				L	T	P	C	I	E	Total
1	20OHSM472	Total Quality Management	S&H	3	-	-	3	30	70	100
2	20OCIV472	Industrial Waste Treatment and Disposal	CIV	3	-	-	3	30	70	100
3	20OEEE472	Electric Vehicle Technology	EEE	3	-	-	3	30	70	100
4	20OECE472	Pattern Recognition	ECE	3	-	-	3	30	70	100
5	20OCSM472	Foundations of Machine Learning	CSE/CSM	3	-	-	3	30	70	100

Humanities and Social Science Elective Course (Semester VII)

S.No	Course Code	Course Title	Scheme of Instructions Hours per Week				Scheme of Examination Maximum Marks		
			L	T	P	C	I	E	Total
1	20HSM471A	Industrial Engineering and Psychology	3	-	-	3	30	70	100
2	20HSM471B	Intellectual Property Rights and Patents	3	-	-	3	30	70	100
3	20HSM471C	Managing Innovation and Entrepreneurship	3	-	-	3	30	70	100

SUMMARY OF CREDIT ALLOCATION

S.NO	Subject Area	Credits As Per Semester								Total Credits	Percentage – wise Credit Distribution
		I	II	III	IV	V	VI	VII	VIII		
1.	**HSMC**	4.5	-		3	-	-	6	-	13.5	8.28
2.	**BSC**	3	11	4	3	-	-	-	-	21	12.88
3.	**ESC**	12	1	4.5	-	-	-	-	-	17.5	10.73
4.	**PCC**	-	7.5	12	13.5	12	12	-	-	57	34.96
5.	**SOC/SAC**	-	-	2	2	2	2	2	-	10	6.13
6.	**PEC**	-	-	-	-	3	3	9	-	15	9.20
7.	**OEC**	-	-	-	-	3	3	6	-	12	7.36
8	**PROJ**	-	-	-	-	1.5	1.5	2	12	17	10.42
9	**MAC**	-	0	-	0	0	0	-	-	0	0.0
Total		**19.5**	**19.5**	**22.5**	**21.5**	**21.5**	**21.5**	**25**	**12**	**163**	**100**

Note: ***HSMC - Humanities and Social Science including Management Courses; BSC - Basic Science Courses; ESC - Engineering Science Courses; PCC - Professional Core Courses; PEC - Professional Elective Courses; OEC - Open Elective Courses; SOC/SAC - Skill Oriented Courses / Skill Advanced Courses; PROJ - Internship, Seminar and Project Work; MAC - Mandatory Audit Courses; MNRC/HNRC - Minor Courses / Honor Courses***

I B.Tech. - I Semester

20HSM111	**COMMUNICATIVE ENGLISH FOR ENGINEERS (Common to All Branches)**	**L T P C** **3 - - 3**

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To Provide Knowledge on developing Vocabulary and communicating in a verbal manner.
2. To understand in using of technology for societal aspects.
3. To recognize the importance on constructing Entrepreneurship Skills.
4. To Execute Contextual knowledge to recognize the need of ability to engage in independent and life- long learning in the broadest context of technological change.
5. To support and identify the earlier Medical Life Sciences used in India

UNIT –1: COMMUNICATION SKILLS FOR PROFESSIONALS (9)

Listening: Identifying the topic, specific pieces of information by listening by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions; introducing oneself and others. **Reading:** Skimming to get the main idea of a text, scanning to look for specific information. **Reading for writing:** Beginnings and endings of paragraphs. **Grammar and Vocabulary:** Articles and prepositions and word formation. Content words and function words.

UNIT –2: TECHNOLOGY WITH A HUMAN FACE A LECTURE BY E.F.SCHUMACHER (9)

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts. **Speaking:** Discussion in pairs/small groups on specific topics. **Reading:** Identifying sequence of ideas recognizing verbal techniques. **Writing:** Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writings. **Grammar and Vocabulary:** Word formation (Derivation, Borrowing-coinage-compounding) Tenses.

UNIT –3: AZIM PREMJI-AN ENTREPRENEUR (9)

Listening: Identifying the topic, specific pieces of information by listening by listening to short audio texts. **Speaking:** Discussing daily routine activities. **Reading:** Phrasal verbs often used in daily conversations. **Writing:** Beginnings and endings of paragraphs. **Grammar and Vocabulary:** Letter writing (official) - voice of verbs.

UNIT –4: REFLECTIONS OF FUTURE THE YEAR –BY THEODORE J.GORDON (9)

Listening: Identifying the topic, specific pieces of information by listening by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions; introducing oneself and others. **Reading:** Skimming to get the main idea of a text, scanning to look for specific information. **Reading for writing:** Beginnings and endings of paragraphs. **Grammar and Vocabulary:** Direct and Indirect Speech-Email writing.

UNIT –5: Y.SUBBA ROW (9)

Listening: Identifying the topic, specific pieces of information by listening by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions; introducing oneself and others. **Reading:** Skimming to get the main idea of a text, scanning to look for specific information. **Reading for writing:** Beginnings

and endings of paragraphs introducing the topic summarizing the main idea and providing a transition to the next paragraph. **Grammar and Vocabulary:** Subject verb agreement-Report writing.

Total Hours: 45

On successful completion of the course, students will be able to		**POs**
CO1	Understand the concepts on developing vocabulary and communicating in a verbal manner.	**PO1, PO10, PO12**
CO2	Understand and develop knowledge on the use of Technology for social aspects.	**PO1, PO10, PO12**
CO3	Understand Acquiring skills to become an able Entrepreneur	**PO1, PO10, PO12**
CO4	Understand contextual knowledge to recognize the need of ability to engage in independent and life-long learning in the broadest context of technological change.	**PO1, PO10, PO12**
CO5	Understand the importance of Medical advancement and its uses on Human life in India..	**PO1, PO10, PO12**

TEXT BOOKS:

1. V.N.Sudheer, S.Riyaz Ahammed, N.R Tulasi Prasad, N.Lakshmi Sailaja,"Functinal English 1" The Department of English of SITAMS ,1/e. 2016
2. V.N.Sudheer, S.Riyaz Ahammed, N.R Tulasi Prasad, N.Lakshmi Sailaja,"Functinal English 2" The Department of English of SITAMS ,1/e. 2016

REFERENCE BOOKS:

1. K.Srinivasa Krishna , B.Kuberudu , "Business communication and softskills", Excel Books ,1/e 2008.
2. K.R. Lakshminarayana , "English for Technical communication" ,Scitech Publishers, 2/e, 2009
3. R.K. Bansal ,J.B. Harrison, "Spoken English", Orient Longman, Mumbai, 2/e,2009
4. Raymond Murphy ,Murphys English Grammar, Raymond Murphy Publishers , 2/e, 2006, Cambridge English Dictionary for advanced Learners.
5. Inspiring Lives by Dr. Jandhyala Ravindranath,Dr.M.Sarath Babu

REFERENCE WEBSITE:

1. www.english club.com
2. www.easyworldofenglish.com
3. www.languageguide.org/english/
4. www.bbc.co.uk/learningenglish
5. www.eslpod.com/index.html
6. www.myenglishpages.com

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	1	-	-	-	-	-	-	-	-	1	-	1
CO.2	1	-	-	-	-	-	-	-	-	1	-	1
CO.3	1	-	-	-	-	-	-	-	-	1	-	1
CO.4	1	-	-	-	-	-	-	-	-	1	-	1
CO.5	1	-	-	-	-	-	-	-	-	1	-	1
CO*	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**

I B.Tech. - I Semester

20BSC111	**ALGEBRA AND CALCULUS (Common to All Branches)**	**L T P C**
		2 1 - 3

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To familiarize the students with the theory of matrices.
2. To explain the series expansion using means value theorem and basic concepts of partial derivatives and its applications
3. To learn the methods of evaluation of double and triple integrals
4. To explain the concept of vector differentiation
5. To explain the concept of vector integration

UNIT –1: MATRICES **(9)**

Rank - Echelon form and Normal form – Solution of linear system of homogeneous and non-homogeneous equations - Direct method: Gauss elimination method - Eigen values and Eigen vectors of a matrix and properties (without proofs) - Cayley-Hamilton theorem (without proof): Inverse and powers of a matrix. – Diagonalization of a matrix using similarity transformation only.

UNIT –2: DIFFERENTIAL CALCULUS AND ITS APPLICATIONS **(9)**

Rolle's Theorem, Lagrange's Theorem (without proof) - Taylor's and Maclaurin's series for single variable (simple examples) - Functions of several variables - Jacobian – Taylor's and Maclaurin's series for two variables - Maxima and minima of functions of two variables - Lagrangian method of undetermined multipliers with three variables only.

UNIT –3: MULTIPLE INTEGRALS **(9)**

Double and triple integrals: Evaluation of Double integrals (Cartesian and polar coordinates), Change of order of integration (Cartesian form only), Change of variables: double integration from Cartesian to polar coordinates, Evaluation of Triple integrals (Cartesian coordinates).

UNIT –4: VECTOR DIFFERENTIAL CALCULUS **(9)**

Introduction to Vector Differentiation, Scalar and Vector point functions - Gradient of a Scalar function, directional derivative, Divergence of a Vector function, Solenoidal vector, Curl of a Vector function, Irrotational vector, Laplacian operator.

UNIT –5: VECTOR INTEGRAL CALCULUS **(9)**

Line Integral - Potential function - Surface and volume integrals - Green's, Stoke's and Gauss divergence theorem (without proofs) - Verification of Green's, Stoke's and Gauss divergence theorems.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	To solve system of homogenous and non-homogenous linear equations, find the Eigen values and Eigen vectors of a matrix and identify special properties of a matrix.	**PO1, PO2, PO3**
CO2	Illustrate series expansion of functions using mean value theorems, interpret partial derivatives as a function of several variables, Apply Jacobean concept to deal with the problems in change of variables, Evaluate maxima and minima of functions.	**PO1, PO2, PO3**
CO3	To evaluate double and triple integrals of functions of several variables	**PO1, PO2, PO3**
CO4	To illustrate the physical interpretation of gradient, divergence and curl and apply operator del to scalar and vector point functions.	**PO1, PO2, PO3**
CO5	To find line, surface, volume integrals and the work done in moving a particle along the path over a force field and apply Green's, Gauss divergence and Stokes theorem in evaluation of line, surface and volume integrals.	**PO1, PO2, PO3**

TEXT BOOKS:

1. T.K.V. Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad, "Engineering Mathematics–I", S. Chand and Company Ltd, New Delhi.
2. T.K.V. Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad ."Mathematical Methods", S. Chand and Company Ltd, New Delhi.
3. Dr. B. S. Grewa,"Higher Engineering Mathematics", Khanna Publishers, Delhi, , 44/e, 2017

REFERENCE BOOKS:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publishers, New Delhi.
2. N.P.Bali ,"A Text Book of Engineering Mathematics", Laxmi publications (P)Ltd, Delhi.
3. Dr. M. K. Venkata Ramana," Higher Engineering Mathematics", National Pub, Madras
4. E.Rukmangadachari, E.Keshava Reddy, "Engineering Mathematics-I", Pearson Educations, Chennai.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/110/105/111105111/
2. https://www.youtube.com/watch?v=8D3WViAyJvc
3. https://www.youtube.com/watch?v=fKzDtjq0ks4
4. https://www.youtube.com/watch?v=wMd4YRyBmjA
5. https://www.youtube.com/watch?v=ArkDa6d5h9I
6. https://www.youtube.com/watch?v=KgItZSst2sU
7. https://www.youtube.com/watch?v=-I3HUeHi1Ys
8. https://www.youtube.com/watch?v=SZCsFS9izfQ
9. https://www.youtube.com/watch?v=ma1QmE1SH3I

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	2	-	-	-	-	-	-	-	-	-
CO.2	3	3	2	-	-	-	-	-	-	-	-	-
CO.3	3	3	2	-	-	-	-	-	-	-	-	-
CO.4	3	3	2	-	-	-	-	-	-	-	-	-
CO.5	3	3	2	-	-	-	-	-	-	-	-	-
CO*	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

I B.Tech. - I Semester

20ESC111	**ENGINEERING GRAPHICS (Common to all Branches)**	**L T P C**
		1 - 4 3

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To expose them to existing national standards related to technical drawings and develop knowledge of basic engineering curves.
2. To develop drawing skills for communication of concepts, ideas and design of projections of points, lines and planes.
3. To develop geometrical shapes and multiple views of projections of solids and sections of solids.
4. To develop drawing skills for communication of concepts, ideas and design the development of surfaces of objects and isometric views.
5. To develop geometrical shapes and multiple views of orthographic projections of solids and perspective views.

CONCEPTS AND CONVENTIONS (Not for Examination) (3)

Importance of drawings in engineering applications - Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets - Lettering, numbering and dimensioning – Basic geometrical constructions – Scales.

UNIT –1: ENGINEERING CURVES (9)

Engineering Curves: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method and rectangular hyperbola – Construction of cycloid, epi cycloid and hypo cycloid – Involutes of square, circle, pentagon and hexagon – Drawing of tangents and normal to the above curves.

UNIT –2: PROJECTION OF POINTS, LINES AND PLANE SURFACES (12)

Projection of Points: Principles of orthographic projection – First angle and third angle projections – Projection of points. **Projection of Lines:** Projection of straight lines (only first angle projections) inclined to one and both the principal planes – Determination of true lengths, true inclinations by rotating line and trapezoidal method and traces. **Projection of Planes:** Planes (polygonal and circular surfaces) inclined to both theprincipal planes by change of position method.

UNIT –3: PROJECTION OF SOLIDS AND SECTION OF SOLIDS (12)

Projection of Solids: Projection of simple solids like prisms, pyramids, cylinder and cone, when the axis is inclined to one principal plane. **Section of Solids:** Sectioning of right regular solids like prisms, pyramids, cylinder and cone, solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other plane – Obtaining true shape of section.

UNIT –4: DEVELOPMENT OF SURFACES AND ISOMETRIC PROJECTIONS (12)

Development of Surfaces: Development of lateral surfaces of simple and sectioned solids like prisms, pyramids, cylinder and cone. **Isometric Projection:** Principles of isometric projection – Isometric scale – Isometric views of simple solids and truncated solids like prisms, pyramids, cylinder and cone – Combination of two solid objects in simple vertical positions.

UNIT –5: ORTHOGRAPHIC PROJECTIONS AND PERSPECTIVE PROJECTIONS (12)

Orthographic Projections: Visualization principles – Plane of projections – Representation of three-dimensional objects – Layout of views – Sketching of multiple views from pictorial views of objects. **Perspective Projection:** Perspective projection of simple solids like prisms and pyramids by visual ray method.

Total Hours: 60

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Construct the Engineering curves and generate tangent and normal for those curves.	**PO1, PO2, P03, P10, PO12**
CO2	Draw the projection of points, lines and plane surfaces.	**PO1, PO2, P03, P10, PO12**
CO3	Draw the projection of solids, sections of solids like prisms, pyramids, cylinder and cone.	**PO1, PO2, P03, P10, PO12**
CO4	Draw the isometric projections and views and also develop the development of surfaces.	**PO1, PO2, P03, P10, PO12**
CO5	Draw the orthographic and perspective projections of solids.	**PO1, PO2, P03, P10, PO12**

TEXT BOOKS:

1. N.D. Bhatt and V. M. Panchal, "Engineering Drawing", Charotar Publishing House, 50th edition, 2010.
2. K.V.Natrajan , "A Text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai. 2009.

REFERENCE BOOKS:

1. K.L.Narayana and P.Kannaiah, "Engineering Drawing", 2/e, 2012, Scitech Publishers.
2. Luzzader, Warren.J and Duff,John M, "Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production",Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. K.Venugopal and V.Prabhu Raja ,"Engineering Graphics", New Age International (P) Limited, 2008.
4. M.B.Shah and B.C.Rana , "Engineering Drawing", Pearson Education, 2/e, 2009.
5. Basant Agarwal and C.M.Agarwal ,"Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, , 2008,

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/102/112102304/
2. https://nptel.ac.in/courses/112/105/112105294/
3. https://nptel.ac.in/courses/112/103/112103019/
4. https://nptel.ac.in/courses/112/104/112104172/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	-	-	-	-	-	1	-	1
CO.2	3	2	2	-	-	-	-	-	-	1	-	1
CO.3	3	2	2	-	-	-	-	-	-	1	-	1
CO.4	3	2	2	-	-	-	-	-	-	1	-	1
CO.5	3	2	2	-	-	-	-	-	-	1	-	1
CO*	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**

I B.Tech. - I Semester

		L	T	P	C
20ESC114	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common to Civil and Mechanical Branches)**	**2**	**1**	**-**	**3**

PRE-REQUISITES: NIL

COURSE EDUCATIONAL OBJECTIVES:

1. To introduce electric circuits and its analysis using network theorems.
2. To impart knowledge on construction and operation of D.C. machines.
3. To learn construction and operation of A.C. machines and transformers.
4. To learn basic principles of all measuring instruments.
5. To demonstrate knowledge on overview of the principles, operation and application of basic electronic devices and Logic gates.

UNIT –1: INTRODUCTION TO ELECTRICAL ENGINEERING (9)

Ohm's Law – Basic circuit components–Kirchhoff's laws with simple problems – Types of sources, series, parallel circuits, star-delta Transformation – Network Theorems – Superposition and reciprocity – Thevenin's and Norton's Theorems and Maximum Power Transfer Theorem.

UNIT –2: DC MACHINES (9)

Principle of operation of DC generators – Types of DC generators – EMF equation in DC generator – OCC of a DC shunt generator – Principle of operation of DC motors – Types of DC motors – Torque equation – Losses and efficiency calculation in DC motors – Swinburne's test and brake test – Speed control of DC shunt motor.

UNIT –3: AC MACHINES (9)

Principles of operation of transformer – Constructional details – Losses and efficiency – Regulation of transformer – O.C and S.C tests – Principles of operation of three phase induction motor.

UNIT –4: MEASURING INSTRUMENTS (9)

Introduction – Classification of instruments–Operating principles – Essential features of measuring instruments – Moving coil and moving iron instruments – Dynamometer wattmeter and energy meter.

UNIT –5: ANALOG AND DIGITAL ELECTRONICS (9)

The P-N junction diode – Volt-Ampere characteristics – Applications of diode – Zener diode - Volt-Ampere characteristics – Bipolar Junction Transistor (BJT) – Operation of NPN transistor – Input-Output characteristics of CE configuration – Logic gates and truthtables– NOT, OR, AND, EX-OR, EX-NOR, Universal Gates - NAND, NOR Gates – Boolean algebra and De Morgan's Theorems.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Demonstrate knowledge on basic circuit components and basic concepts of electrical engineering, Analyze Circuits by different network reduction techniques	**PO1, PO2**
CO2	Demonstrate knowledge on Construction and performance of DC Motors and Analyze Losses and Efficiency of motors	**PO1, PO2**
CO3	Demonstrate knowledge on Construction and performance of AC motor and transformer and Analyze Losses and Efficiency of motors and transformer	**PO1, PO2**
CO4	To understand and evaluate the calibration of different electrical measuring instruments	**PO1, PO2, PO3**
CO5	To Acquire sound knowledge on internal structure of PN junction, all the electronic devices. and logic gates	**PO1, PO2**

TEXT BOOKS:

1. M.S Naidu and S Kamakshaiah. "Basic Electrical Engineering",
2. T.K.Nagasarkar and M.S Sukhija "Basic Electrical Engineering"
3. N.Salivahanan, and N.Suresh Kumar "Electronic Devices and Circuits", TMH, 3rd Edition, 2012
4. Morris Mano, "Digital Design", 3/e, 2006, Prentice Hall of India, New Delhi

REFERENCE BOOKS:

1. DP Kothari and IJ Nagrath. "Theory and Problems of BEE".
2. V.K Mehtha "Principle of Electrical Engineering",S Chand Publications.
3. R.L. Boylestad "Introductory Circuit Analysis", Pearson,12th edition, 2013.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/108/105/108105112/
2. https://nptel.ac.in/courses/108/101/108101091/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	-
CO.2	3	2	-	-	-	-	-	-	-	-	-	-
CO.3	3	2	-	-	-	-	-	-	-	-	-	-
CO.4	3	2	2	-	-	-	-	-	-	-	-	-
CO.5	3	2	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**3**	**2**	-	-	-	-	-	-	-	-	-

I B.Tech. - I Semester

		L	T	P	C
20ESC115	**PROGRAMMING WITH PYTHON**				
	(Common to All Branches)	**2**	**1**	**-**	**3**

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To impart the basics of python and its IDEs.
2. To understand the basic data structure in python.
3. To familiarize with python GUI and files.
4. To develop broad understanding of various object-oriented concepts in python.
5. To introduce the python libraries for solving real-time problems.

UNIT –1: BASICS OF PYTHON (9)

Python programming Language: About Python- Introduction to various IDEs- IDLE- PyCharm, Spyder- Sublime text- Jupyter Notebook. **Literals:** Numeric literals - String literals- Variables and Identifiers: Variable assignment and keyboard input – Identifiers - keywords and other predefined identifiers. **Control Structures:** Sequential control- Selection control- Iterative control statements.

UNIT –2: LISTS, DICTIONARIES AND SETS (9)

Lists: List structures - Common list operations - List traversal - Lists in Python - Python list type – Tuples – sequences - Nested lists - Iterating over lists in python. **Dictionaries and Sets:** Dictionary types in Python - Set data type - Strings and its operations.

UNIT –3: FUNCTIONS AND TEXT FILES (9)

Functions: Function declaration - Category of Functions - Parameter Passing - Keyword Arguments in Python - Default Arguments in Python - Variable Scope, Lambda function.

Files: Fundamentals – opening, reading and writing text files, .csv and .xlsx files.

UNIT –4: OBJECT-ORIENTED CONCEPTS USED IN PYTHON (9)

Features of object-oriented programming - Fundamental concepts – Class – Encapsulation – Inheritance - Polymorphism. Object references - Turtle graphics - creating a Turtle Graphics Window - the "Default" Turtle - Fundamental Turtle Attributes and Behavior - Additional Turtle Attributes - Creating Multiple Turtles.

UNIT –5: INTRODUCTION TO PYTHON LIBRARIES (9)

Python Libraries - Introduction to Libraries - Creating and Exploring Packages - Numpy, SciPy, matplotlib, Pandas, Scikit-learn- seaborn.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Identify and apply the appropriate control statements for solving problems.	**PO1, PO2, PO5**
CO2	Demonstrate knowledge of basic data structures and functions.	**PO1, PO3, PO4**
CO3	Analyse and apply the appropriate file handling mechanism.	**PO1, PO2, PO5**
CO4	Identify and implement the suitable object-oriented concepts.	**PO1, PO2, PO5**
CO5	Evaluate the real-world problems using python packages.	**PO1, PO4, PO5**

TEXT BOOKS:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India Edition, 2016.
2. John V. Guttag., "Introduction to computation and programming using python: with applications to understanding data", PHI Publisher, 2016.
3. John Hunt, "A Beginners Guide to Python 3 Programming", Springer Publisheers, 2020.

REFERENCE BOOKS:

1. Donald Hearn and M. Pauline Baker, "Computer Graphics", Prentice Hall, 2/e, 1992.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", SecondEdition,Shroff/O'ReillyPublishers,(http://greenteapress.com/wp/thinkpython/),
3. Charles Severance, "Python for everybody: exploring data in Python 3", Creative Commons Attribution-Non Commercial Share Alike 3.0 Unported License, 2016.

REFERENCE WEBSITE:

1. https://onlinecourses.swayam2.ac.in/aic20_sp33
4. https://onlinecourses.nptel.ac.in/noc22_cs32
5. https://spoken-tutorial.org
6. https://www.w3schools.com/python.
7. https://www.geeksforgeeks.org.

CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO.1	3	2	2	2	3	-	-	-	-	-	-	1
CO.2	3	2	2	2	3	-	-	-	-	-	-	1
CO.3	3	2	2	2	3	-	-	-	-	-	-	1
CO.4	3	2	2	2	3	-	-	-	-	-	-	1
CO.5	3	2	2	2	3	-	-	-	-	-	-	1
CO*	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

I B.Tech. - I Semester

		L	T	P	C
20HSM112	**COMMUNICATIVE ENGLISH LANGUAGE LAB (Common to All Branches)**	**-**	**-**	**3**	**1.5**

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To provide Knowledge on developing Soft Skills and its techniques.
2. To understand Knowledge on the use of technology for giving Presentations.
3. To apply gained information in Preparing Resume.
4. To analyze the use of body language while participating in Group Discussions.
5. To execute the complete knowledge on facing Job Interviews.

LIST OF EXERCISES:

1. Introduction and importance of Soft Skills
2. Attributes of Soft Skills
3. Categories of Soft Skills- (Social, Thinking, Negotiating)
4. Exhibiting, Identifying, and Improving your Soft Skills
5. Acquiring Soft Skills (Train yourself)
6. Soft Skills practicing tips
7. Power Point presentation on Scientific/Technical Topics.
8. Designing a Resume
9. Resume Styles
10. Preparing Model Resumes
11. Group Discussion
12. Group Discussion strategies
13. Mock GDs.
14. Job Interviews
15. Interview Techniques
16. Model Interview questions – Mock Interview

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Remembering the concepts on developing Soft Skills and its techniques. (Topics from 1 to 5)	**PO1**
CO2	Understand and Develop Knowledge on the use of technology in giving presentations. (Topic No:6)	**PO5**
CO3	Apply one's skills in Preparing a Resume before applying for a job. (Topic 7 to 9)	**PO6**
CO4	Analyze and execute body language while participating in Group Discussions. (Topics 10 to 12)	**PO2**
CO5	Evaluate by weighing one's communicative skills in facing Job Interviews through Mock Interviews. (Topics 13 to 15)	**PO10**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-		-	-	-	-	-	-	-	-	-
CO2	-	-		-	3	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	-	-	-	-	-	-
CO4	-	3	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-
CO	**3**	**3**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**-**

I B.Tech. - I Semester

		L	T	P	C
20ESC116	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB (Common to Civil and Mechanical Branches)**	**-**	**-**	**3**	**1.5**

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To gain practical experience on fundamental electric laws.
2. To gain practical experience on verification of theorems.
3. To evaluate the performance characteristics of DC and AC Machines
4. To gain practical experience on basic electronic devices and Circuits
5. To gain practical experience on different logic gates

LIST OF EXPERIMENTS: MATERIAL SCIENCE LAB

1. Verification of KCL and KVL
2. Verification of Superposition Theorem.
3. Verification of Thevinins Theorem.
4. Verification of Maximum Power Transfer Theorm.
5. Magnetization Characteristics of D.C Shunt Generator & determination of Critical Resistance.
6. Load Test on Three Phase Squirrel Cage Induction Motor.
7. Swinburne's Test of DC Shunt Machine.
8. Speed Control of DC Shunt Motor.
9. Brake Test on DC Shunt Motor. Determination of Performance Characteristics.
10. OC & SC Tests on Single- Phase Transformer to Find the Efficiency.
11. Volt-Ampere Characteristics of P-N Junction Diode and Zener Diode
12. Verification of Basic Logic gates- AND, OR, NOT.

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Understand the fundamental electrical laws in engineering applications.	**PO1**
CO2	Verify different network theorems and digital circuits practically.	**PO2**
CO3	Design electrical circuits for measuring complicated electrical parameters.	**PO3**
CO4	Investigate DC and AC Machines like Induction Motor for solving complex problems.	**PO4**
CO5	Follow the ethical principles in implementing the experiments.	**PO8**
CO6	Do experiments effectively as an individual and as a team member in a group.	**PO9**
CO7	Communicate verbally and in written form, the understanding about the experiments.	**PO10**
CO8	Continue updating their skills related to electronic circuits	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-		-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

I B.Tech. - I Semester

		L	T	P	C
20ESC118	**PROGRAMMING WITH PYTHON LAB (Common to All Branches)**	-	-	3	1.5

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the basic IDEs in python.
2. To gain expertise for problem solving using control structures in python
3. To develop the python programs using functions.
4. To solve various engineering problems using different data structures.
5. To gain knowledge on python libraries.

RECOMMENDED SYSTEMS/SOFTWARE REQUIREMENTS:

1. For Windows: IDLE/ Spyder python development environment.
2. For Linux: Default python version installed/ higher version.

LIST OF TASKS:

TASK-1: BASICS

a) Develop a simple python script to illustrate numeric literals and string literals.
b) Write a Python Program to Convert Kilometres to Miles.

TASK-2: LOOPS

a) Write a python Program to Make a Simple Calculator
b) Write a python program that reads a rating from the user and indicates whether the performance was unacceptable, acceptable or meritorious. The amount of the employee's raise should also be reported. Your program should display an appropriate error message if an invalid rating is entered. (The amount of an employee's raise is $2400.00 multiplied by their rating).

Rating	Meaning
0.0	Unacceptable performance
0.4	Acceptable performance
0.6 or more	Meritorious performance

TASK-3: LOOPS

a) Write a program containing a pair of nested while loop that displays the integer values 1–100. Ten numbers per row - with the columns aligned as shown below

```
 1  2  3  4  5  6  7  8  9 10
11 12 13 14 15 16 17 18 19 20
21 22 23 24 25 26 27 28 29 30
                .
                .
91 92 93 94 95 96 97 98 99 100
```

b) Display the integer values 1–100 as given in question 3a) using only one while loop.

TASK-4: DICTIONARIES

a) Write a Python script to generate all the possible spellings of the last four digits of any given phone number – use Dictionaries.

TASK-5: STRINGS

a) Write a program to figure out if the register number format is correct or not using a Python code. (Hint: sample register number format- 20751A0500). Use string methods to solve the above problem.

TASK-6: FUNCTIONS

a) Write a function that generates a random password. The password should havea random length of between 7 and 10 characters. Each character should be randomly selected from positions 33 to 126 in the ASCII table. Your function will not take any parameters. It will return the randomly generated password as its only result. Display the randomly generated password in your file's main program. Your main program should only run when your solution has not been imported into another file.

TASK-7: PATTERN PRINTING

a) Write a python program to print half pyramid pattern with star (asterisk)

```
*
* *
* * *
* * * *
* * * * *
```

b) Write a python program to print the characters/alphabets in right-angled triangle pattern.

```
A
B  C
D E F
G H IJ
K L M N O
P Q RS T U
V W X Y Z
```

TASK-8: TURTLE

a) Write a python program to draw the basic shapes using turtle (Hint: Square, circle, triangle).

TASK-9: FILES

a) Write a python script to create a simple text file. Write the contents into the created file and read the contents from the file and display the same on to the console screen.

b) Write a python script to Create and write on excel file using xlsxwriter module.

c) Write a python script to write the contents into a csv file.

TASK 10: FILE HANDLING

Write a python program to perform the following tasks:

a) Copy the contents of one file into another file.

b) Count number of lines in a file.

c) Count number of characters in a file.

d) Count number of words in a file.

TASK 11: INHERITANCE

a) Write a python program to illustrate the inheritance concept.

TASK-12: MATH LIBRARIES

a) Write a python program to calculate area of a circle. Use the pi constant in the math module in your calculations. (Area of the circle $= \pi r^2$)

b) Write a python program to calculate Volume of a sphere. Use the pi constant in the math module in your calculations. (Volume of a sphere $= \frac{4}{3}\pi r^3$).

TASK-13: PANDAS

a) Write a Pandas program to create a line plot of the historical stock prices of a company between two specific dates.

TASK-14: PANDAS

a) Write a Pandas program to create a bar plot of the trading volume of a company stock between two specific dates.

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Learn various problem-solving approaches and ability to identify an appropriate approach to solve the problem	**PO1**
CO2	Implement conditionals and loops to design the python programming	**PO2**
CO3	Implement lists, set, tuples and dictionaries to develop python program.	**PO3**
CO4	Able to modulate the given problem using structural approach of programming	**PO4**
CO5	Build Python Programs using packages to solve real-time problems.	**PO5**
CO6	Follow the ethical principles in implementing the programs	**PO8**
CO7	Do experiments effectively as an individual and as a team member in a group.	**PO9**
CO8	Communicate verbally and in written form, the understanding about the experiments.	**PO10**
CO9	Continue updating their skill related to lists, tuples and dictionaries implementing programs in future.	**PO12**

REFERENCE BOOKS:

1. John V. Guttag., "Introduction to computation and programming using python: with applications to understanding data", PHI Publisher, 2016.
2. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India Edition, 2016.
3. John Hunt, "A Beginners Guide to Python 3 Programming", Springer Publisheers, 2020.

REFERENCE WEBSITES:

1. https://onlinecourses.swayam2.ac.in/aic20_sp33
2. https://onlinecourses.nptel.ac.in/noc22_cs32
3. https://spoken-tutorial.org
4. https://www.w3schools.com/python.
5. https://www.geeksforgeeks.org.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

I B.Tech. - II Semester

20BSC121	**DIFFERENTIAL EQUATIONS AND TRANSFORMATION TECHNIQUES (Common to All Branches)**	**L**	**T**	**P**	**C**
		2	**1**	**-**	**3**

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To learn the methods of solving the ordinary differential equations of first & higher order and applications of first order ordinary differential equations.
2. To learn partial differential equations and how they can serve as models for physical processes and also master the technique of separation of variables to solve partial differential equation.
3. To learn the concepts of Laplace Transforms and inverse Laplace Transforms and to explore the solving initial value problems by using Laplace transform method.
4. To develop skill to design Sine and Cosine waves with the help of Fourier series
5. To learn the concepts of Fourier transform and inverse Fourier Transform.

UNIT –1: ORDINARY DIFFERENTIAL EQUATIONS (9)

Differential Equations of First Order and First Degree: Formation – Linear and Bernoulli's equations – Applications to L-R and C-R circuit's problems. **Linear Differential Equations of Higher Order:** Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type eax, Sin ax, Cos ax, polynomials in x, e^{ax} v(x) & xm v(x) - Method of variation of parameters.

UNIT –2: PARTIAL DIFFERENTIAL EQUATIONS (9)

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of first order linear (Lagrange's) equation and Non-Linear (standard forms) equations - Solution of PDE by the Method of separation of variables.

UNIT –3: LAPLACE TRANSFORMS (9)

Definition of Laplace transform, Laplace transform of standard functions - Laplace Transform of Unit step function, Dirac's delta function and Periodic function – Properties of Laplace Transforms(without proof): Linear property, First shifting theorem, Change ofScale Property, Second shifting theorem, Multiplication & Division by t, Transform of Derivatives & Integrals - Inverse transform - Convolution theorem(without proof) – Application: Solution of ordinary differential equations of first and second order with constant coefficients.

UNIT –4: FOURIER SERIES (9)

Determination of Fourier coefficients, Euler's formulae, Dirichlet's conditions - Fourier series of periodic functions, even and odd functions - Fourier series in an arbitrary interval - Half-range Fourier sine and cosine expansions.

UNIT –5: FOURIER TRANSFORM (9)

Fourier integral theorem (without proof) - Fourier sine and cosine integrals - Fourier transform – Fourier sine and cosine transforms - Properties - Inverse transforms - Finite Fourier transforms.

Total Hours: 45

On successful completion of the course, students will be able to		POs
CO1	To identify whether the given differential equation of first order is linear or Bernoulli and to solve the higher order linear differential equations with constant coefficients.	**PO1, PO2, PO3**
CO2	Apply a range of techniques to find solutions of standard PDE's and outline the basic properties of standard PDE's	**PO1, PO2, PO3**
CO3	To understand the concepts of Laplace transform and elementary functions, general functions using its properties and special functions.	**PO1, PO2, PO3**
CO4	To understand finding Fourier series expression of the given function.	**PO1, PO2, PO3**
CO5	Understand Fourier transforms and properties of Fourier transforms	**PO1, PO2, PO3**

TEXT BOOKS:

1. K.V. Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad,"Engineering Mathematics–I", T, S. Chand and Company Ltd, New Delhi.
2. T.K.V. Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad,"Mathematical Methods", S. Chand and Company Ltd, New Delhi.
3. Dr. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, Delhi, 44/e, 2017.

REFERENCE BOOKS:

4. Bruce R. Munson, Donald F. Young, Theodore H. Okiishi, "Fundamentals of Fluid Mechanics", McGraw Hill, New York, 5/e, 2008.
5. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publishers, New Delhi.
6. Dr. M. K. Venkata Ramana, "Higher Engineering Mathematics", National Pub & Co, Madras.
7. N.P.Bali , "A Text Book of Engineering Mathematics", Laxmi publications (P)Ltd, New Delhi.
8. E.Rukmangadachari, E.Keshava Reddy, "Engineering Mathematics-II", Pearson Educations, Chennai.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/111/106/111106100/
2. https://www.youtube.com/watch?v=OBhZvyhc8JQ&t=982s
3. https://nptel.ac.in/courses/111/106/111106100/
4. https://www.youtube.com/watch?v=3zCdNO2xp3s
5. https://www.youtube.com/watch?v=XU5hUrh6-18&t=948s
6. https://nptel.ac.in/courses/111/106/111106139/
7. https://www.youtube.com/watch?v=LGxE_yZYigI
8. https://www.youtube.com/watch?v=6spPyJH6dkQ
9. https://www.youtube.com/watch?v=GFKggEkKtLM

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	2	-	-	-	-	-	-	-	-	-
CO.2	3	3	2	-	-	-	-	-	-	-	-	-
CO.3	3	3	2	-	-	-	-	-	-	-	-	-
CO.4	3	3	2	-	-	-	-	-	-	-	-	-
CO.5	3	3	2	-	-	-	-	-	-	-	-	-
CO*	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

I B.Tech. - II Semester

20BSC122	**ENGINEERING CHEMISTRY (Common to Civil and Mechanical Branches)**	**L**	**T**	**P**	**C**
		3	**-**	**-**	**3**

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To learn different purification methods and analyze the impurities present in water.
2. To develop skill to describe the mechanism and control of corrosion.
3. To train the students on the fundamentals and applications of polymers.
4. To understand and apply the concepts of electrochemistry effectively.
5. To introduce basic principles of spectroscopy and chromatography

UNIT –1: WATER AND WATER FOR INDUSTRIAL PURPOSE (9)

Water: Sources of water - Types of Impurities in Water - Hardness of water - Temporary and permanent hardness - Estimation of hardness by EDTA Method and numerical problems - Analysis of water - Dissolved oxygen - Disadvantages of hard water - Methods of treatment of water for domestic purpose - Sterilization - Chlorination, Ozonisation. **Water for Industrial Purpose:** Water for steam making - Boiler troubles - Priming and foaming, Boilercorrosion, Scales and sludge, Caustic embrittlement - Water treatment - Internal treatment - Colloidal, Phosphate, Calgon, Carbonate and Sodium aluminate conditioning of water -External treatment - Ion - exchange process - Demineralization of brackish water – Reverse osmosis.

UNIT –2: SCIENCE OF CORROSION (9)

Definition - Types of corrosion - Dry corrosion (Direct chemical attack) - Wet corrosion - Theories of corrosion and mechanism - Electro chemical theory of corrosion - Galvanic corrosion - Concentration cell corrosion - Oxygen absorption type - Factors influencing the corrosion - Control of corrosion - Cathodic protection - Sacrificial anode and impressedcurrent cathodic protection method.

UNIT –3: POLYMERS (9)

Polymerization reactions - Basic concepts - Types of polymerizations - Addition polymerization with mechanism - condensation polymerization - Plastics - Thermosetting and thermoplastics - Composition, Properties and Engineering applications of teflon, bakelite, nylon and rubber - Processing of natural rubber and compounding. Elastomers: Buna S - Buna N - Polyurethane Rubber and Silicone Rubber.

UNIT – 4: PHASE RULE, STRUCTURAL MATERIALS AND REFRACTORIES (9)

Phase Rule: Definition – Terms involved in phase rule – Phase rule equation – Phase diagrams – One component system (water system) – Two component system (lead- silver system). **Structural Materials:** Cement – Composition of Portland cement – Analysis – Setting and hardening of cement (reactions) and manufacture of Portland cement. **Refractories:** Definition – Classification with examples – Criteria of a good refractorymaterial – Causes for the failure of refractory materials.

UNIT –5: FUELS AND LUBRICANTS (9)

Fuels: Definition and classification of fuels – Liquid fuels – Classification of petroleum, refining of petroleum – Synthetic petrol – Bergius Process - Gaseous fuels-natural gas, produce gas, water gas, coal gas and bio gas. **Lubricants:** Principles and functions of lubricants – Properties of lubricants – Viscosity – Flash and fire points – Cloud and pour points – Aniline point – Neutralization number.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	To understand the fundamentals of water technology and developanalytical skills in determination hardness of water and to acquire awareness to societal issues on quality of water.	**PO1, PO2,PO3, PO6**
CO2	Acquire the knowledge in corrosion phenomenon and develop skills inthe design of methods for control of corrosion	**PO1, PO2, PO3**
CO3	Acquire knowledge on polymeric materials and to prepare polymericmaterial for environmental safety and society need.	**PO1, PO3,PO6, PO7**
CO4	Analyze the effect of cement materials, causes for the failure ofrefractory materials and understanding of phase rule.	**PO1, PO2**
CO5	Apply the basic knowledge of fuel chemistry and lubricants to identifythe quality of fuels and lubricants.	**PO1, PO2**

TEXT BOOKS:

1. Prof. K. N. Jayaveera, Dr. G. V. Subba Reddy and Dr. C. Ramachandraiah, "Chemistry for Engineers", Tata McGraw Hill Publishers, New Delhi, 4/e, 2009.
2. Jain and Jain, "Text book of Engineering Chemistry", Dhanat Rai Publishing Company, New Delhi.15/e, 2008
3. Text book of Engineering Chemistry, 18/e, 2008, S. S. Dara, S. Chand & Co, New Delhi.

REFERENCE BOOKS:

1. Dr. K. B. Chandrasekhar, Dr. U.N. Dash, Dr. Sujatha Mishra, Scitech Publications(India) Pvt. Ltd, Hyderabad,"Engineering Chemistry, 5/e, 2009.
2. B.Viswanath, M. Aulice Scibioh, "Fuel Cells Principles and Applications", Universities press, Hyderabad, 4/e, 2008.
3. Skoog and West, "Principles of Instrumental analysis",6/e Thomson,2007.
4. Glasston & Lewis, Dhanptharai Publishers, Physical Chemistry, New Delhi ,12/e, 2009.
5. JC Kuriacose and J. Rajaram," Engineering Chemistry (Vol.1&2)", Tata McGraw Hill Publishers, New Delhi, 5/e, 2004.

REFERENCE WEBSITE:

1. https://www.youtube.com/watch?v=zVZ9c6EXfTA
2. https://nptel.ac.in/courses/113/104/113104082/
3. https://nptel.ac.in/courses/104/105/104105039/
4. https://nptel.ac.in/courses/104/106/104106132/
5. https://www.digimat.in/nptel/courses/video/103108100/L01.html

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	2	2	-	-	2	-	-	-	-	-	-
CO.2	2	2	2	-	-	-	-	-	-	-	-	-
CO.3	2	-	2	-	-	2	2	-	-	-	-	-
CO.4	2	2	-	-	-	-	-	-	-	-	-	-
CO.5	2	2	-	-	-	-	-	-	-	-	-	-
CO*	**2**	**2**	**2**	**-**	**-**	**2**	**2**	-	-	-	-	-

I B.Tech. - II Semester

20BSC123	**ENGINEERING PHYSICS**	**L T P C**
	(Common to Civil and Mechanical Branches)	**3 0 - 3**

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To enlighten the periodic arrangement of atoms in crystals, Bragg's law and to provide fundamentals related to structural analysis through powder diffraction method.
2. To identify the importance of the optical phenomenon i.e. interference and diffraction related to its Engineering applications.
3. To understand the mechanisms of Lasers and the propagation of light wave through optical fibres along with engineering applications
4. To acquire the knowledge in dielectric, magnetic materials and nano materials and their applications in different fields of Engineering
5. To familiarize the concepts of theoretical acoustics to practical use in engineering field. To explain the significance of ultrasound and its application in NDT for diversified engineering application.

UNIT –1: CRYSTALLOGRAPHY AND X-RAY DIFFRACTION (9)

Crystallography: Space lattice, Basis, unit cell and lattice parameters – Bravais Lattice – Crystal systems – Packing fraction – Coordination number – Packing fraction of SC, BCC & FCC . **X-Ray Diffraction:** Bragg's law – Bragg's X-ray diffractometer – Crystal structure determination by Powder method.

UNIT –2: WAVE OPTICS (9)

Interference: Interference – Principle of superposition – Interference of light – Conditions for sustained interference – Interference in thin films (Reflection Geometry) – Colors in thin films – Newton's Rings – Determination of wavelength and refractive index. **Diffraction:** Diffraction – Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to single slit.

UNIT –3: LASERS AND FIBER OPTICS (9)

Lasers: Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Applications of lasers. **Fiber Optics:** Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers – Propagation Losses (Qualitative) – Applications.

UNIT –4: ENGINEERING MATERIALS (9)

Dielectric Materials: Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarization (Qualitative) – Lorentz internal field – Clausius-Mossotti equation. **Magnetic Materials:** Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro – Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials. **Nanomaterials:** Introduction – Surface

area and quantum confinement – Physical properties: electrical and magnetic properties – Synthesis of nanomaterials – Top-down – Ball Milling – Bottom-up – Chemical Vapour Deposition – Applications of nanomaterials.

UNIT –5: ACOUSTICS AND ULTRASONIC (9)

Acoustics: Introduction – Requirements of acoustically good hall – Reverberation – Reverberation time – Sabine's formula (Derivation using growth and decay method) – Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedies. **Ultrasonics:** Introduction – Properties – Production by piezoelectric methods – Detection – Non-Destructive Testing – Pulse echo system through transmission and reflection modes – Applications.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Enlighten the periodic arrangement of atoms in crystals, Bragg's law and to provide fundamentals related to structural analysis throughpowder diffraction method	**PO1, PO2**
CO2	Identify the importance of the optical phenomenon i.e. interferenceand diffraction related to its Engineering applications.	**PO1, PO2**
CO3	Understand the mechanisms of Lasers and the propagation of lightwave through optical fibres along with engineering applications	**PO1, PO2**
CO4	Acquire the knowledge in dielectric, magnetic materials and nano materials and their applications in different fields of Engineering	**PO1, PO2,PO12**
CO5	Familiarize the concepts of theoretical acoustics to practical use in engineering field. To explain the significance of ultrasound and its application in NDT for diversified engineering application.	**PO1, PO2**

TEXT BOOKS:

1. Palanisamy ,"Engineering Physics", Palanisamy, Scitech Publications
2. K.Thyagarajan ,"Engineering Physics", McGraw Hill Publications
3. Maninaidu,"Engineering Physics", Pearson Publications

REFERENCE BOOKS:

4. Kittel ,"Solid State Physics", Wiley Publications
5. Gaur and Gupta , "Engineering Physics", Dhanpatrai Publications

REFERENCE WEBSITE:

1. https://www.youtube.com/watch?v=PEXSH8dB-Uk
2. https://www.youtube.com/watch?v=YvrwVK9ZqQY
3. https://www.digimat.in/nptel/courses/video/115107095/L01.html
4. https://www.youtube.com/watch?v=6QUFuZpCgGw
5. https://www.youtube.com/watch?v=etjZmdmrjSU
6. https://nptel.ac.in/courses/115/105/115105122/
7. https://nptel.ac.in/courses/108/108/108108122/
8. https://nptel.ac.in/courses/118/104/118104008/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	-
CO.2	3	2	-	-	-	-	-	-	-	-	-	-
CO.3	3	2	-	-	-	-	-	-	-	-	-	-
CO.4	3	2	-	-	-	-	-	-	-	-	-	2
CO.5	3	2	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**-**	**-**	-	**-**	-	**-**	-	**-**	-	**2**

I B.Tech. - II Semester

20MEC121	**ENGINEERING MECHANICS (Common to Civil and Mechanical Branches)**	**L T P C**
		2 1 - 3

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To apply the methods to determine the resultant forces and itsequilibrium.
2. To analyze the bodies subjected to friction, simple frames and apply.
3. To apply the concepts of centroids/center of gravity of various sections
4. To analyze the kinematics of a body undergoing rectilinear, curvilinear motion.
5. To apply the Dynamic equilibrium principles and work energy equations tosolve appropriate problems.

UNIT –1: STATICS OF PARTICLES (9)

Statics of Particles: Laws of mechanics – Parallelogram, triangular and polygon law of forces – Lame's theorem – Force and its characteristics – Resultant of coplanar forces – Equilibrium of a particle (plane) – Equilibrium of a particle in space – Equivalent forces – Principle of transmissibility. **Equilibrium of Rigid Bodies:** Law's of equilibrium – Free body diagram – Action and reaction forces – Moments and couples – Moment of a force about a point and axis – Varignon's theorem (all particles only analytical method).

UNIT –2: ANALYSIS OF FRAMES, VIRTUAL WORK AND FRICTION (9)

Perfect Frames: Simple trusses – Analysis of trusses by method of joints and sections (analytical method only) – Simple frames. **Virtual Work:** Principle of virtual work – Applying the virtual work in mechanical efficiency of real machines. **Friction:** Laws of friction – Co-efficient of friction – Angles of friction – Angle repose – Friction on horizontal and inclined plane – Friction on ladder and wedges.

UNIT –3: DISTRIBUTED FORCES (9)

Centre of Gravity: Centroid and centre of gravity – First moments of areas and lines – Centroids of simple and composite sections by method of moments – Centers of gravity and centroids of volumes – Theorems of Pappus-Guldinus. **Moment of Inertia:** Second moment of inertia of an area – Parallel and perpendicular axis theorem – Radius of gyration – Moments of inertia of simple and composite areas – Polar moment of inertia – Product of inertia – Principal axes and principal moments.

UNIT –4: KINEMATICS (9)

Kinematics of Particles: Equations of motion – Position, velocity and acceleration – Constant and variable acceleration – Rectilinear and curvilinear motion – Motion under gravity – Projectile motion – Rectangular, tangential and normal components of velocity and acceleration – Radius of curvature. **Kinematics of Rigid Bodies:** Translation and rotation about a fixed axis – General plane motion in velocity and acceleration.

UNIT –5: KINETICS (9)

Kinetics of Particles: Newton's laws of motion and gravitation – Dynamic equilibrium (D'alembret's principle). – Motion on rough and inclined surfaces – Motion of two bodies connected by strings – Linear and angular momentum of a particle – Principle of work and energy – Power and efficiency – Principle of conservation of energy – Principle of impulse and momentum – Impacts.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Demonstrated and applied the knowledge of the various methods to determine the resultant forces and its equilibrium acting on a particle in two and three dimensional.	**PO1, PO2, PO3, PO4**
CO2	Analyze the bodies subjected to friction, simple frames andapply principle of virtual work to find reactions.	**PO1, PO2, PO3, PO4**
CO3	Find the location of centroid, center of gravity and moment ofinertia for the given appropriate sections.	**PO1, PO2, PO3, PO4**
CO4	Analyze the kinematics of a body undergoing rectilinear, curvilinear motion.	**PO1, PO2, PO3, PO4**
CO5	Apply the dynamic equilibrium principles and work energy equations to solve appropriate problems.	**PO1, PO2, PO3, PO4**

TEXT BOOKS:

1. Ferdinand P. Beer, E. Russell Johnston, David Mazurek, Phillip J. Cornwell, Brian Self, Sanjeev Sanghi," Vector Mechanics for Engineers", Tata McGraw-Hill Education Pvt., Ltd.,12/e, 2019,
2. J. L. Meriam, L. G. Kraige and J. N. Bolton, Engineering Mechanics: Statics, SI Version, & Engineering Mechanics: Dynamics, SI Version, John Wiley & Sons, Inc.,2017.

REFERENCE BOOKS:

1. S S Bhavikatti, Engineering Mechanics, New Age International Ltd, 2019.
2. R.C Hibbeler, Engineering Mechanics, Pearson Education Ltd, 2017.
3. A K Tayal, "Engineering Mechanics Statics and Dynamics", Umesh publications, New Delhi ,14/e, 2010.
4. N.H.Dubey, "Engineering Mechanics Statics and Dynamics", Tata McGraw-Hill Education Pvt. Ltd, Noida, 1/e, 2012.
5. Andrew Pytel, Jaan Kiusalaas, Ishan Sharma,"Engineering Mechanics – Statics, (SI Edition)", Cengage Learning, 3/e, 2010.
6. Andrew Pytel, Jaan Kiusalaas and Ishan Sharma, "Engineering Mechanics – Dynamics, (SI Edition)", Cengage Learning, 3/e, 2010.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/103/112103109/
2. https://nptel.ac.in/courses/122/104/122104015/
3. https://www.digimat.in/nptel/courses/video/112106180/L01.html 4. https://nptel.ac.in/courses/112/106/112106286/
5. https://nptel.ac.in/courses/112/105/112105164/
6. https://nptel.ac.in/courses/112/103/112103108/
7. https://nptel.ac.in/courses/122/104/122104014/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	2	-	-	-	-	-	-	-	-
CO.2	3	2	2	2	-	-	-	-	-	-	-	-
CO.3	3	2	2	2	-	-	-	-	-	-	-	-
CO.4	3	2	2	2	-	-	-	-	-	-	-	-
CO.5	3	2	2	2	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

I B.Tech. - II Semester

20MEC122	MATERIAL SCIENCE AND METALLURGY	L	T	P	C
		3	-	-	3

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. Constructing the phase diagram and using of iron-iron carbide phase diagram for microstructure formation.
2. Selecting and applying various heat treatment processes and its microstructure formation.
3. Applying the different types of ferrous and non-ferrous alloys and their uses in engineering field.
4. Applying the different polymer, ceramics and composites and their uses in engineering field.
5. Applying the various mechanical testing procedures and failure mechanism in engineering field.

CRYSTALLOGRAPHY (Not for Examination) (2)

Crystal structure – Cubic systems SC, BCC, FCC and HCP structure – Space and Bravais lattices –Unit cell – Miller indices – Packing factor in cubic systems – Co-ordination number.

UNIT –1: CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS (7)

Crystal Defects: Point, line, Surface and volume defects. **Constitution of Alloys:** Solidification – Solid solutions – Hume-Rothery rule – Gibb's phase rule – Cooling curves. **Phase Diagrams:** One component system– Lever rule – Binary phase diagrams of Cu-Ni, Al-Cu, and Fe-Fe3C– Iron-iron carbide equilibrium diagram – Isomorphous, eutectic, eutectoid, peritectic, peritectoid.

UNIT –2: HEAT TREATMENT (9)

Effect of alloying elements on iron – Isothermal transformation diagrams – Cooling curves superimposed on TTT diagrams and CCT diagrams – Critical cooling rate – Annealing and its types – Normalizing – Hardening and its methods – Hardenability and Jominy end quench test – Tempering, martempering, austempering and maraging – Carburizing, nitriding, cyaniding and carbonitriding – Case hardening, flame hardening, induction hardening, vacuum and plasma hardening – Sintering.

UNIT –3: FERROUS AND NON-FERROUS METALS (9)

Ferrous Materials: Effect of alloying elements on steel (Mn, Si, Cr, Mo, V, Ti, W) – Specification, classification, composition, properties and applications of carbon steels, alloy steels, stainless steels, tool steels, maraging steels and HSLA steels – Classification, structure, composition, properties and applications of gray, ductile, white, malleable cast irons and compacted graphite iron. **Non- Ferrous Materials:** Copper and copper alloys – Brass, bronze and cupronickel – Aluminum and its alloys – Gun metal – Bearing materials – Tin and its alloys – Magnesium and nickel alloys – Shape memory alloys – Titanium alloys.

UNIT –4: NON-METALLIC MATERIALS (9)

Polymers: Mechanical behavior of polymers – Commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastics – Strengthening of polymers. **Engineering Ceramics:** Properties and applications of Al2O3, SiC, Si3N4, PSZ and SIALON – Intermetallics. **Composites Materials:** Classification, properties and applications composites – Particle-reinforced, fiber-reinforced and structural composites – Introduction of hybrid composites and nano composites.

UNIT –5: MECHANICAL DEFORMATION AND TESTING (9)

Mechanical Properties: Deformation of metals – Elastic and plastic deformation – Slip and twinning – Fundamentals of fracture mechanics, Griffith's theory, ductile and brittle fracture. **Material Testing:** Testing of materials under tension, compression and shear – Hardness tests (Brinell, Vickers and Rockwell) – Charpy and Izod impact tests – Fracture, fatigue and creep test.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Apply the knowledge of engineering fundamentals of alloys and Phase diagram of various materials and the classification ofmicro structure in steel and cast iron.	**PO1, PO2,PO3, PO4**
CO2	Acquire the knowledge of engineering fundamentals for treatment process and identify appropriate techniques used in all the heat treatment process with an understanding of its limitations.	**PO1, PO2,PO3**
CO3	Understand the engineering knowledge of ferrous and non-ferrous metal and its alloys and identify the engineering applications.	**PO1, PO3**
CO4	Understand the engineering knowledge of polymers, ceramics and composites and identify the engineering application of polymers, ceramics and composites.	**PO1, PO3**
CO5	Understand the engineering knowledge of mechanical properties and its deformation mechanisms.	**PO1, PO3,PO4**

TEXT BOOKS:

1. Materials Science and Engineering: An Introduction, William D. Callister, 9/e, 2014,Wiley India Pvt. Ltd.
2. Introduction to Physical Metallurgy, Sidney H Avner, 2/e, 2013, Tata McGraw-HillEducation Pvt. Ltd., Noida.

REFERENCE BOOKS:

1. Engineering Materials 1, An Introduction to Properties, Applications and Design, David
2. R.H. Jones and Michael Ashby, 5/e, 2018, Butterworth-Heinemann, Elsevier Publishers.
3. The Science and Engineering of Materials, SI Edition, Pradeep Fulay, Wendelin Wright and Donald R. Askeland, 6/e, 2011, Cengage Learning, India.

4. A Text book of Material Science and Metallurgy, O.P.Khanna, 2010, Dhanpat Rai Publications.
5. Materials Science and Engineering: A First Course, V. Raghavan, 6/e, 2015, Prentice- Hall of India, Pvt. Ltd.
6. Elements of Material Science and Engineering, Lawrence H.Vanvlack, 6/e, 2002, Pearson Education, New Delhi.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/113/102/113102080/
2. https://nptel.ac.in/courses/122/102/122102008/
3. https://nptel.ac.in/courses/112/108/112108150/
4. https://nptel.ac.in/courses/113/107/113107078/
5. https://nptel.ac.in/courses/113/105/113105081/
6. https://nptel.ac.in/courses/113/106/113106034/
7. https://nptel.ac.in/courses/113/104/113104004/
8. https://nptel.ac.in/courses/113/104/113104014/
9. https://nptel.ac.in/courses/113/108/113108054/
10. https://nptel.ac.in/courses/113/105/113105028/
11. https://nptel.ac.in/courses/113/106/113106032/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	2	3	-	-	-	-	-	-	1
CO.2	3	2	2	2	3	-	-	-	-	-	-	1
CO.3	3	2	2	2	3	-	-	-	-	-	-	1
CO.4	3	2	2	2	3	-	-	-	-	-	-	1
CO.5	3	2	2	2	3	-	-	-	-	-	-	1
CO*	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

SREENIVASAINSTITUTEOFTECHNOLOGYANDMANAGEMENTSTUDIES
(Autonomous)
DEPARTMENT MECHANICAL ENGINEERING
(Accredited by NBA)

I B.Tech. - II Semester

20BSC114	**ENGINEERING CHEMISTRY LAB (Common to All Branches)**	**L**	**T**	**P**	**C**
		-	**-**	**2**	**1**

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To provide solid foundation in chemistry laboratory to solve engineering problems.
2. To apply the theoretical principles and perform experiments on hardness of water,dissolved oxygen, alkalinity and acidity.
3. To experience the importance of theory by using analytical equipment's like redwood viscometer and conductometry

LIST OF EXPERIMENTS:

1. Preparation of Standard EDTA solution and Estimation of Hardness of Water
2. Preparation of Standard EDTA and Estimation of Copper
3. Estimation of dissolved oxygen in given water sample
4. Estimation of alkalinity of water
5. Estimation of Acidity of water sample.
6. Preparation of Standard Potassium Dichromate and Estimation of Ferrous Iron
7. Preparation of Standard Potassium Dichromate and Estimation of Copper by Iodometry
8. Determination of strength of the given Hydrochloric acid against standard sodiumhydroxide Solution by Conductometric titration
9. Conductometric titration of BaCl2 Vs Na2SO4 (Precipitation Titration).
10. Determination of viscosity of the given oils through Redwood viscometer

COURSE OUTCOMES:

On the successful completion of this course, the student should be able to,		**POs related to COs**
CO1	Prepare standard solutions.	**PO1**
CO2	Acquire knowledge about volumetric analysis of estimation copper byEDTA and by Iodometry	**PO2**
CO3	Acquire analytical skills in estimation of hardness of water, Alkalinity and Acidity of water, dissolved oxygen in water and estimation of ironthrough laboratory methods	**PO3**
CO4	Acquire skills to use instrumental techniques for the determination ofelectrical conductance of electrolytes and viscosity of lubricants	**PO4**
CO5	Provide solutions for environmental issues through determination ofquality of water	**PO6**
CO6	Communicate verbally and in written form pertaining to results of theExperiments	**PO8**
CO7	Learns to perform experiments involving chemistry in future years.	**PO9**
CO8	Communicate verbally and in written form, the understanding aboutthe experiments.	**PO10**
CO9	Continue updating their skill related to chemistry laboratory.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	3	-	-	-	-	-	-
CO6	-	-	-	-	-			3	-	-	-	-
CO7	-	-	-	-	-	-	-		3	-	-	-
CO8	-	-	-	-	-	-	-	-	-	3	-	-
CO9	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	-	**3**	**-**	**3**	**3**	**3**	**-**	**3**

I B.Tech. - II Semester

20BSC115	ENGINEERING PHYSICS LAB (Common to All Branches)	L	T	P	C
		-	-	2	1

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the concepts of interference, diffraction and their applications.
2. To understand the role of optical fiber parameters in communication.
3. Recognize the importance of energy gap in the study of conductivity
4. To Illustrates the properties of Magnetic and their applications
5. To understand and evaluate the properties of materials and sounds

LIST OF EXPERIMENTS:

1. Diffraction grating - Measurement of wavelength of given Laser.
2. To determine the frequency of AC using Sonometer
3. Determination of magnetic field along the axis of a current carrying circular coil -Stewart Gees method
4. Determination of numerical aperture and acceptance angle of an optical fiber
5. Determination of particle size using a laser source
6. Parallel fringes – Determination of thickness of thin object using wedge method
7. Newton's rings – Determination of radius of curvature of given plano convex lens
8. B-H curve – Determination of hysteresis loss for a given magnetic material
9. Determination of Energy band gap of semiconductor
10. To find the rigidity modulus of the material using torsional pendulum

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Demonstrate Knowledge on measurement of various physical quantities using optical methods and fundamentals of magnetic fields	**PO1**
CO2	Identify different physical properties of materials like band gap, magnetic field intensity etc, for engineering and technological applications	**PO2**
CO3	Provide valid conclusions on phenomena Interference and Diffraction	**PO4**
CO4	Follow the ethical principles in implementing the experiments	**PO8**
CO5	Do experiments effectively as an individual and as a team member ina group.	**PO9**
CO6	Communicate verbally and in written form, the understanding aboutthe experiments.	**PO10**
CO7	Continue updating their skill related to physics for engineering applications in future.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

I B.Tech. - II Semester

20ESC112	**ENGINEERING WORKSHOP AND IT WORKSHOP (Common to All Branches)**	**L**	**T**	**P**	**C**
		-	**-**	**2**	**1**

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To provide exposure to the students with hands on experience on various basic engineering practices in civil, mechanical and electrical engineering.
2. To include training on PC Hardware, Internet & World Wide Web and Productivity Tools including Word, Excel and Power Point.

A. ENGINEERING WORKSHOP

Trade for Exercises:

1. **Carpentry:** Two exercises from: Middle T lap joint – Dove tail lap joint – Mortise and tenon joint from out of 300 x 50 x 35 mm soft wood stock.
2. **Sheet Metal:** Two exercise from: square tray – Open scoop – Frustum of pyramid from out of 22- or 20-gauge G.I. sheet.
3. **Fitting:** Two exercises from: square joint – V joint – Dove tail joint from out of 50 x 50 x 5 mm M.S. flat piece.
4. **House Wiring:** Two exercise from: Two lamps controlled by one switch in series and parallel – One lamp controlled by 2 two-way switches (stair case) – Wiring for fluorescent lamp.
5. **Plumbing:** Two exercise from: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
3. **Machining:** Exercise on drilling and tapping.

Trade for Exercises:

1. Lathe machine.
2. Grinding machine.
3. Arc and gas welding.

COURSE OUTCOMES (Engineering Workshop):

On successful completion of the course, students will be able to		**POs**
CO1	Demonstrate the knowledge on different tools used in carpentry, fitting, sheet metal, house wiring and plumbing sections and also basic machining process	**PO1**
CO2	Analyze the basic pipeline connection using different joints	**PO2**
CO3	Design and develop simple components by using different materialsincludes wood, GI sheet and MS plates	**PO3**
CO4	Apply basic electrical engineering tools on the house wiring practice	**PO5**
CO5	Follow the ethical principles in while doing the exercises.	**PO8**
CO6	Do the exercises effectively as an individual and as a team member in a group	**PO9**
CO7	Communicate verbally among team members and in written form, theunderstanding about the trade exercises.	**PO10**
CO8	Continue updating their skill related to trades.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

B. IT WORKSHOP

PC Hardware

1. Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

2. Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video shall be given as part of the course content.

3. Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

4. Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

5. **Hardware Troubleshooting:** Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva

6. **Software Troubleshooting:** Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition. The work done should be verified by the instructor and followed up with a Viva.

LaTeX and Word

7. **Word Orientation:** The mentor needs to give an overview of LaTeX and Microsoft (MS) office 2007/ equivalent (FOSS) tool word: Importance of LaTeX and MS office 2007/ equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.
8. Using LaTeX and Word to create project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

Excel

9. Excel Orientation:The mentor needs to tell the importance of MS office 2007/ equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing,overview of toolbars, saving excel files, Using help and resources.
10. Creating a Scheduler - Features to be covered:- Gridlines, Format Cells, Summation, auto fill, Formatting Text

LaTeX and MS/equivalent (FOSS) tool Power Point

11. Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered during this Exercise includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in both LaTeX and PowerPoint. Students will be given model power point presentation which needs to be replicated (exactly how it's asked).

12. Second Exercise helps students in making their presentations interactive. Topic covered during this Exercise includes: Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts

Internet& World Wide Web

13. **Internet & World Wide Web -Orientation & Connectivity Boot Camp:** Students should get connected to their Local Area Network and access the Internet.In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

    Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers.

14. Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated by the student to the satisfaction of the instructors. Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computersto be safe on the internet. They need to first install an antivirus software, configure their personal firewall and windows update on their computer.

Course Outcomes (IT Workshop):

On the successful completion of this course, the student should be able to,		POs related to COs
CO1	Acquire knowledge on computer system such as system unit, input devices, and output devices connected to the computer.	**PO1**
CO2	Demonstrate the booting process that includes switching on the system, execution of POST routine, then bootstrap loader, and loading of the operating system, and getting it ready for use.	**PO2**
CO3	Demonstrate the working of the internet that include the use of protocols, domains, IP addresses, URLs, web browsers, web servers, mail-servers, etc.	**PO3**
CO4	Familiarize with parts of MS Office, To create and save a document, To set page settings, create headers and footers, To use various formatting features such as bold face, italicize, underline, subscript, superscript, line spacing, etc.	**PO5**
CO5	Follow the ethical principles in implementing the programs	**PO8**
CO6	Do experiments effectively as an individual and as a team member in a group.	**PO9**
CO7	Communicate verbally and in written form, the understanding about the experiments and	**PO10**
CO8	Continue updating their skill related to MS Office, Internet and Computer in future.	**PO12**

Reference books:

1. Comdex Information Technology course tool kit , 2003, Vikas Gupta, WILEY Dream tech, New Delhi
2. The Complete Computer upgrade and repair book, 3/e, 2008, Cheryl A Schmidt, WILEY Dream Tech,New Delhi
3. Introduction to Information Technology, 2008, ITL Education Solutions limited, Pearson Education, New Delhi
4. PC Hardware and A+ Handbook, 2004, Kate J. Chase, Microsoft press
5. LaTeX Companion,2/e, 2002, Leslie Lamport, Addison Wesley, New Delhi
6. IT Essentials PC Hardware and Software Companion Guide, 3/e, 2008, David Anfinson and Ken Quamme, CISCO Press, Pearson Education, New Delhi
7. IT Essentials PC Hardware and Software Labs and Study Guide, 3/e, 2008, Patrick Regan, CISCO Press, Pearson Education, New Delhi
8. Troubleshooting, Maintaining and Repairing PCs, 5/e, 2008, S.J.Bigelow, TMH, New Delhi

I B.Tech. - II Semester

20MEC124	COMPUTER AIDED DRAFTING LAB	L	T	P	C
	(Common to Civil and Mechanical Engineering)	-	-	3	1.5

Course Educational Objectives:

1. To understand the design of the engineering components in a machine
2. To develop a skill on creating the 2D and 3D models of components
3. To understand part drawing and Assembly of components in a machine

List of Exercises:

1. Study of capabilities of software for Drafting and Modeling - Coordinate systems (absolute, relative, polar, etc.) - Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a title block with necessary text and projection symbol.
3. Draw the two dimensional diagram and follow with the principles of dimensioning.
4. Drawing of curves like parabola, spiral, involute using B-spline or cubic spline.
5. Drawing of front view and top view of simple solids like prisms, pyramids, cylinder, cone, etc. with dimensioning.
6. Drawing sectional views of prisms, pyramids, cylinder, cone, etc.
7. Draw the development of surfaces on simple objects like prisms, pyramids, cylinder, cone, etc.
8. Creation of 3D models of simple objects and obtaining 2D multi-view drawings from 3D model.
9. Drawing front view, top view and side view of objects from the given pictorial views. (eg. V-block, base of a mixie, simple stool, objects with hole and curves.)
10. Drawing of simple 3D mechanical components like bolt, nut, screws, shafts, gears and other machine components etc.
11. Drawing of a plan of residential building (two bed rooms, kitchen, hall, etc.)
12. Drawing of a simple steel truss.

Course Outcomes:

On the successful completion of this course, the student should be able to,		POs related to COs
CO1	Create knowledge on technical drawings and presentations of models from mechanical engineering disciplines.	**PO1**
CO2	Analyze the 2D diagrams for developing the models.	**PO2**
CO3	Generate 3D models for various machine components using Autodesk AutoCAD.	**PO3**
CO4	Select appropriate tools to complete the designing process in AUTOCAD	**PO5**
CO5	Follow ethical principles in designing laboratory and procedures used in software tools.	**PO8**
CO6	Develop the design model in AUTOCAD as an individual.	**PO9**
CO7	Communicate verbally and in written form, the understandings about the experiments.	**PO10**
CO8	Continue updating their skill in designing software package and procedure for various innovation components.	**PO12**

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

II B.Tech. - III Semester

		L	T	P	C
20BSC231	**NUMERICAL METHODS AND PROBABILITY THEORY** (Common to CIVIL, MECH, ECE, CSE & AIML)	**3**	**1**	**-**	**4**

PRE-REQUISITES: A Course on Algebra & Calculus, Differential equations & Transform Techniques

COURSE EDUCATIONAL OBJECTIVES:

1. To develop skill to analyze appropriate method to find the root of the Algebraic and Transcendental Equations and to develop skill to apply the concept of interpolation for the Prediction of required values
2. To learn the method of evaluation of numerical integration and to solve ordinary differential equations numerically using numerical methods
3. To develop skill to analyze the discrete and continuous data
4. To develop skill to analyze the discrete and continuous data using appropriate Statistical Distributions like Binomial, Poisson, Normal etc., and To inculcate skill to investigate different applications of statistical distributions and the corresponding conclusions required for the analysis of sample data.
5. To develop skill in testing of hypotheses and Tests of significance for small and large samples

UNIT – 1: SOLUTION OF ALGEBRAIC, TRANSCENDENTAL EQUATIONS & INTERPOLATION (9)

Solution of Algebraic and Transcendental Equations: Introduction - The Bisection method - The method of False position - The Iteration method - Newton-Raphson method (Single Variable).

Interpolation: Introduction - Finite differences - Forward differences, Backward differences - Newton's forward, Newton's backward - Lagrange's method of interpolation.

UNIT – 2: NUMERICALINTEGRATION AND NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS (9)

Numerical integration: Trapezoidal rule - Simpson's 1/3 Rule - Simpson's 3/8 Rule.

Numerical solution of Ordinary Differential equations: Solution by Taylor's series - Picard's method of successive approximations - Euler's method - Runge-Kutta methods.

UNIT - 3: PROBABILITY, RANDOM VARIABLES (9)

Probability: Sample space and events - Probability - The axioms of probability - Some elementary theorems - Conditional probability - Baye's theorem.

Random variables: Discrete and continuous distributions – Statistical Parameters (Mean, Variance and Standard Deviation) of distribution functions.

UNIT -4: PROBABILITY DISTRIBUTIONS & SAMPLING THEORY (9)

Binomial - Poisson and Normal distributions - Related properties.

Sampling distribution: Populations and samples - Sampling distributions of mean (σ: known and unknown) - Proportions - Sums and differences.

UNIT - 5: TEST OF HYPOTHESIS AND TEST OF SIGNIFICANCE (9)

Test of Hypothesis: Means - Hypothesis concerning one and two means - Type I and Type II errors - One tail, two-tail tests.
Test of Significance: Student's t-test - F-test - Chi-square test of goodness of fit.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs related to COs**
CO1	Demonstrate knowledge in solving algebraic and transcendental equations by various mathematicalmethods and Design novel mathematical methods for constructing the interpolating polynomials to the given	**PO1,PO2**
CO2	Demonstrate knowledge infinding the numerical values to integrals through different mathematical methods and solving ordinary differential equations numerically through various methods and Design novel mathematical methods for solving the ordinary differential equations.	**PO1,PO2**
CO3	Demonstrate knowledge on use the probability and Random Variables in the field of engineering	**PO1,PO2,PO3**
CO4	Demonstrate knowledge in probability distributions and develop analytical skills for the problems involving means, probability distributions and standard deviations sampling techniques for decision making in uncertain environments	**PO1,PO2,PO3**
CO5	Demonstrate knowledge in testing of hypotheses and Tests of significance for small and large samples and Develop skills for analyzing the data with suitable tests of significance for practical situations through probability	**PO1,PO2,PO3,PO4**

TEXT BOOKS:

1. S.C. Gupta, V.K. Kapoor, "Fundamentals of Mathematical Statistics", 10/e, 2001, S. Chand and Company Publishers, New Delhi.
2. T.K.V. Iyengar, B. Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad , "Probability and Statistics", 2012, S. Chand and Company Publishers, New Delhi.

REFERENCE BOOKS:

1. V. Ravindranath, T.S.R. Murthy,"Probability and Statistics, 2011, I.K. International Pvt. Ltd, New Delhi.
2. Johnson A. Richard, Miler &Fruends,"Probability and Statistics for Engineers", 6/e, 2006, Pearson Education, New Delhi.
3. Dr. B. S. Grewal, "Higher Engineering Mathematics", 34/e, 1999, Khanna Publishers, Delhi
4. Dr. J. Ravichandran, "Probability and Statistics for Engineers", 2011, Wiley-India Publishers, New Delhi.
5. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, "Probability and Statistics for Engineers and Scientists", 7/e, 2002, Pearson Education Asia, New Delhi.

REFERENCE WEBSITE:

1. https://www.youtube.com/watch?v=hizXlwJO1Ck
2. https://www.youtube.com/watch?v=5817fLmsTGE
3. https://www.youtube.com/watch?v=yv6i9plC9nk
4. https://www.youtube.com/watch?v=r1sLCDA-kNY&list=PL46B9EA2CFEB51241
5. https://www.youtube.com/watch?v=r1sLCDAkNY&list=PL46B9EA2CFEB51241&index=1
6. https://www.youtube.com/watch?v=HnvB8BCDQm0&list=PL46B9EA2CFEB51241&index=2

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	-	-	-	-	-	-	-	-	-	-
CO.2	3	3	-	-	-	-	-	-	-	-	-	-
CO.3	3	3	2	-	-	-	-	-	-	-	-	-
CO.4	3	3	2	-	-	-	-	-	-	-	-	-
CO.5	3	3	2	2	-	-	-	-	-	-	-	-
CO*	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

II B.Tech. - III Semester

20ESC231	**FLUID MECHANICS AND MACHINERY (Common to Mechanical & EEE Branches)**	**L T P C**
		2 1 - 3

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the properties of fluids and concept of kinematic of flow.
2. To study the applications of the conservation laws to flow through pipes.
3. To understand the importance of dimensional analysis and basics of turbomachinery.
4. To understand the importance of various types of flow in turbines.
5. To understand the importance of various types of flow in pumps.

UNIT –1: PROPERTIES OF FLUIDS, BUOYANCY AND KINEMATICS OF FLOW (9)

Properties of Fluids: Fluid properties – Compressibility, surface tension and capillarity. **Pressure Measurements:** Variation of static pressure – Atmospheric, absolute, gauge and vacuum pressure – Pressure measurements – Piezometer, U-tube and differential manometers. **Buoyancy and Floatation:** Concepts of buoyancy, buoyancy force, center of buoyancy, meta center and meta centric height (theoretical concept only). **Kinematics of Flow:** Principles of fluid flow – Types of fluid flow – Rate of flow – Continuity equation.

UNIT –2: DYNAMICS OF FLUID FLOW AND FLOW THROUGH PIPES (9)

Dynamics of Fluid Flow: Equations of motion – Euler's equation – Bernoulli's equation for real fluid – Application of Bernoulli's equation in venturimeter, orifice meter and pitot tube. **Boundary Layer Theory:** Boundary layer characteristics – Boundary layer, displacement, momentum and energy thickness (Basics only). **Forces on Submerged bodies:** Expression for Drag and Lift – Drag on a sphere. **Flow Through Pipes:** Reynold'sexperiment – Loss of energy in pipes – Darcy's Weisbach equation and Chezy's formula – Minor energy losses – Pipes in series and parallel – Equivalent pipe.

UNIT –3: DIMENSION ALANALYSIS AND TURBOMACHINERY (9)

Dimensional Analysis: Dimensions – Dimensional homogeneity – Rayleigh method – Buckingham π-method – Selection of repeating variables – Model analysis – Similitude and similarities – Forces acting in moving fluid – Dimensionless numbers – Similarity laws – Model testing of partially submerged bodies – Distorted and undistorted models. **Basics of Turbo Machinery:** Force exerted by the jet on a stationary and moving of flat, inclined and curved – Jet on a hinged plate – Jet striking centrally and at tip of curved plate.

UNIT –4: HYDRAULIC TURBINES (9)

Hydraulic Turbines: Classification of hydraulic turbines – Heads and efficiencies – Working principles of Pelton wheel, Francis turbine and Kaplan turbine – Velocity triangle diagrams, work done, heads and efficiencies – Draft tube - Unit quantities and specific speed – Characteristics curves –Governing of turbines – Water hammer –Surge tank.

UNIT –5: HYDRAULIC PUMPS (9)

Centrifugal Pumps: Principles of working – Work done – Heads and efficiencies – Minimum starting speed – Multi stage centrifugal pump – Specific speed – Model testing – Priming – Characteristics curves – Cavitations – Suction height – NPSH. **Reciprocating Pumps:** Principles of working – Slip – Work saved by fitting air vessels.

Total Hours: 45

On successful completion of the course, students will be able to		POs
CO1	Apply mathematical knowledge to predict the properties and characteristics of a fluid, analysis.	PO1, PO2, PO12
CO2	Demonstrate knowledge and understanding the basic equations of fluid flows, compute drag and lift coefficients and solve problems in flow of fluids	PO1, PO2, PO3, PO4, PO12
CO3	Analyze the model and the prototype using dimensional analysis and force exerted in turbomachinery.	PO1, PO2, PO3, PO4, PO12
CO4	Design the working proportions of hydraulic turbines and analysis to improve the performances.	PO1, PO2, PO3, PO4, PO12
CO5	Analyze to improve the performance of pumps and ability to engage in independent.	PO1, PO2, PO3, PO4, PO12

TEXT BOOKS:

1. Hydraulics and Fluid Mechanics, "P.N. Modi and S.M. Seth", Standard Book House, Delhi, 18/e, 2011.
2. Fluid Mechanics, "Yunus A. Cengel and John Cimbala", McGraw Hill Education Private Ltd., 2017.

REFERENCE BOOKS:

1. Bruce R. Munson, Donald F. Young, Theodore H. Okiishi, "Fundamentals of Fluid Mechanics", McGraw Hill, New York, 5/e, 2008.
2. S.K. Som and G. Biswas, "Introduction to Fluid Machines", Tata McGraw-Hill Education, Pvt. Ltd., Noida, 2/e, 2010.
3. R.K. Bansal, "Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P) Ltd., 10/e, 2018.
4. A.K. Jain, "Fluid Mechanics", Khanna Publishers, New Delhi, 11/e, 2012.
5. R.K. Rajput, "Fluid Mechanics and Hydraulic Machinery", S. Chand & Company, Pvt. Ltd., New Delhi, 4/e, 2010.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/105/112105171/
2. https://nptel.ac.in/courses/112/105/112105287/
3. https://nptel.ac.in/courses/105/103/105103192/
4. https://nptel.ac.in/courses/112/105/112105183/
5. https://nptel.ac.in/courses/112/104/112104118/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	1
CO.2	3	2	1	1	-	-	-	-	-	-	-	1
CO.3	3	2	1	1	-	-	-	-	-	-	-	1
CO.4	3	2	1	1	-	-	-	-	-	-	-	1
CO.5	3	2	1	1	-	-	-	-	-	-	-	1
CO*	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

II B.Tech. - III Semester

20MEC231	**ENGINEERING THERMODYNAMICS**	**L T P C**
		2 1 - 3

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To introduce the basic principles of thermodynamics and to acquire knowledge on zeroth and first law of thermodynamics.
2. To acquire knowledge on second law of thermodynamics and its application to various systems.
3. To introduce the properties of pure substances and properties of gases and gas mixtures.
4. To understand thermodynamic equations, functions, relations, various specific heats and basics of psychometry.
5. To understand and to analyze air standard cycles applied for engines.

UNIT –1: BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS (9)

Basic Concepts: Concept of continuum - Microscopic and macroscopic approach - Point and path functions - Systems and their types - Property - State, path and process - Quasi static process - Work - Modes of work - Zeroth law of thermodynamics - Measurement of temperature - Thermodynamic temperature scales. **First Law of Thermodynamics:** Internal energy - Specific heat capacities - Enthalpy - Application of steady flow processes.

UNIT –2: SECOND LAW OF THERMODYNAMICS AND ENTROPY (9)

Second Law of Thermodynamics: Kelvin's Plank and Clausius statement and their equivalence - Reversibility and irreversibility - Carnot cycle - Reversed Carnot heat engine - Carnot theorem. **Entropy:** Concept of entropy - Clausius theorem - TS plot - Clausius inequality - Entropy change in irreversible process - Entropy principle and its applications - Entropy generation in a closed and open system.

UNIT –3: PROPERTIES OF PURE SUBSTANCES, GASES AND GAS MIXTURES (9)

Properties of Pure Substances: Formation of steam and its thermodynamic properties - Phase change of a pure substance - pv, pT, TS, hS diagrams for a pure substance - pvT surfaces - Dryness fraction - Steam tables - Measurement of steam quality. **Properties of Gases and Gas Mixtures:** Ideal gas - Avogadro's Law - Equation of state - Van der Waal's equation - Viral expansions - Compressibility chart - Dalton's law of partial pressure.

UNIT –4: THERMODYNAMIC RELATIONS AND PSYCHROMETRY (9)

Thermodynamic Relations: Exact differential - Helmholtz and Gibbs function - Maxwell's relations - Tds equations – Joule Thomson effect - Clausius Claperyon equation - Difference in heat capacities - Change in thermodynamic properties with variable specific heat - Isentropic expansion with variable specific heat. **Psychrometry:** Definition - Psychrometric properties - Psychrometric relations - Psychrometry charts - Psychrometric process.

UNIT –5: AIR STANDARD CYCLES (9)

Air Standard Cycles: Assumptions and working of Carnot cycle - Otto, Diesel and dual combustion cycle analysis – MEP - Comparison of air standard and actual cycles - Problems on thermal efficiency and work output in Otto and Diesel cycles - Stirling, Ericsson, Atkinson, Lenoir, Brayton cycles (basics only).

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Demonstrate knowledge and understanding the concept of conservation of mass, energy, work interaction, heat transfer and law of thermodynamics.	**PO1, PO2, PO4, PO12**
CO2	Identify closed and open systems and/or apply the concept of second law to analyze simple systems	**PO1, PO2, PO4, PO12**
CO3	Evaluate properties of pure substances and gas mixtures and use steam tables and Mollier chart in solving complex problems.	**PO1, PO2, PO4, PO12**
CO4	Understand the various thermodynamic equations, functions and relations and basics of various psychrometric relations and properties.	**PO1, PO2, PO12**
CO5	Understand the various air standard cycles applied in engines and identify methods to improve thermodynamic performance.	**PO1, PO2, PO4, PO12**

TEXT BOOKS:

1. P.K.Nag, "Engineering Thermodynamics", Tata McGraw-Hill Education Pvt. Ltd., 5/e, 2013.
2. Yunus Cengel and Boles, "Thermodynamics-An Engineering Approach", Tata McGraw-Hill Education Pvt. Ltd., 4/e, 2004.

REFERENCE BOOKS:

1. Howard N.Shapiro, Michael J.Moran, "Fundamentals of Engineering Thermodynamics", Wiley India Pvt, Ltd, 6/e, 2010.
2. J.B.Jones and R.E.Dugan, "Engineering Thermodynamics", Prentice-Hall of India Pvt. Ltd., 1/e, 2009.
3. A.Venkatesh, "Basic Engineering Thermodynamics", University Press (India) Private Ltd., 1/e, 2007.
4. Rayner Joel, "Basic Engineering Thermodynamics", Pearson Education, 5/e, 2008.
5. D.S.Kumar, "Engineering Thermodynamics", S.K.Kataria and Sons, 3/e, 2012.

NOTE:

Use of standard thermodynamic tables, Mollier diagram and psychometric charts are permitted.

REFERENCE WEBSITE:

1. https://swayam.gov.in/nd1_noc19_me56/preview
2. https://www.classcentral.com/course/nptel-engineering-thermodynamics-7904
3. https://www.edx.org/course/thermodynamics-2
4. https://www.courses.com/indian-institute-of-technology-kharagpur/basic-thermodynamics

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	1	-	-	-	-	-	-	-	1
CO.2	3	2	-	1	-	-	-	-	-	-	-	1
CO.3	3	2	-	1	-	-	-	-	-	-	-	1
CO.4	3	2	-	-	-	-	-	-	-	-	-	1
CO.5	3	2	-	1	-	-	-	-	-	-	-	1
CO*	**3**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

II B.Tech. - III Semester

20MEC232	MANUFACTURING TECHNOLOGY	L T P C 3 0 - 3

PRE-REQUISITES: Material Science and Metallurgy

COURSE EDUCATIONAL OBJECTIVES:

1. To apply the working principles of various metal casting processes.
2. To apply the working principles of various metal joining processes.
3. To apply the working principles of bulk deformation of metals.
4. To apply the working principles of sheet metal forming process.
5. To apply the working principles of plastics molding.

UNIT –1: METAL CASTING (9)

Fundamentals of Casting: Steps involved in foundry and casting – Types of patterns – Pattern materials – Pattern allowances – Molding sand types, properties and testing – Core molding – Molding machines – Concept of solidification of metals and alloys – Principles of gating – Methods of melting by crucible, blast and cupola furnaces – Defects in casting. **Special Casting:** Pressure die, centrifugal and investment casting – Shell, plaster and ceramic mould – Continuous and vacuum casting – CO2 process and stir casting.

UNIT –2: JOINING PROCESS (9)

Classification of welding –Types of welds, welded joints and electrodes. **Gas welding:** Flame characteristics – Oxy-acetylene, Oxy-hydrogen and air-acetylene welding. **Arc Welding:** Metal arc welding –TIG and MIG welding –Submerged arc welding – Electro slag and gas welding –Plasma arc welding. **Solid State Welding:** Friction and friction stir welding – Explosive welding. **Resistance Welding:** Spot and projection welding. **Modern Welding Process:** Thermit welding – Electron beam welding – Induction welding – Laser welding. **Welding Defects:** Causes and remedies. **Other Process:** Gas cutting –Brazing and soldering – Introduction of Nondestructive testing of welds.

UNIT –3: BULK FORMING (9)

Hot and Cold working: Introduction to the theory of plastic deformation – Strainhardening – Recovery, recrystallization and grain growth – Cold and hot working. **Rolling:** Theory of rolling – Types of rolling mills and products – Forces in rolling and power requirements – Rolling operations – Defects in rolled parts. **Extrusion of Metals:** Extrusion process and its characteristics – Hot and cold extrusion – Forward and backward extrusion – Impact and hydrostatic extrusion. **Drawing:** Types of drawing methods – Wiredrawing and tube drawing – Design for manufacturing and economics of bulk forming.

UNIT –4: FORGING AND SHEET METAL FORMING (9)

Forging: Principles– Forging process – Tools and dies – Types: Smith, drop, roll and rotary forging – Forging hammers – Forging defects. **Sheet Metal Forming:**Characteristics – Formability of sheet metals – Test methods for formability – Shearing, bending and drawing– Stretch and hydro forming – Rubber and explosive forming – Magnetic pulse and peen forming – Super plastic and micro forming – Metal spinning – Design for manufacturing and economics of forging and sheet metal forming.

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UNIT –5: PROCESSING OF PLASTICS AND POWDER METALLURGY (9)

Processing Thermo Plastics: Characteristics – Bonding of thermoplastics – Molding of thermoplastics – Extrusion, injection, blow and rotational molding, calendaring, film and thermoforming, foaming. **Processing of Thermosets:** Compression, transfer, injection, jet, liquid and resin molding – Resin transfer molding, reaction injection molding and rotational molding. **Powder Metallurgy:** Powder production methods – Particle size characterization – Blending – Compacting – Sintering – Secondary and finishing operations – Advantages and applications of powder metallurgy.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Illustrate principles of foundry and recognize the different types of casting processes for manufacturing components and design the gating and riser system.	**PO1, PO2, PO12**
CO2	Demonstrate various types of joining processes and choose the appropriate one according to the application.	**PO1, PO2, PO12**
CO3	Explain the concept of rolling, extrusion and drawing operations.	**PO1, PO2, PO12**
CO4	Illustrate the various sheet metal forming processes for a specific application.	**PO1, PO2, PO12**
CO5	Acquire the knowledge of metal powder production methods and classify different molding process and select suitable manufacturing process for the typical components.	**PO1, PO2, PO12**

TEXT BOOKS:

1. Serope Kalpak Jain and Steven R. Schmid, "Manufacturing Processing for Engineering Materials (SI Edition)", Pearson Education, New Delhi, 6/e, 2018.
2. P.N. Rao, "Manufacturing Technology - Foundry, Farming and Welding, Volume-I", Tata McGraw-Hill Education Pvt. Ltd., Noida, 5/e, 2018.

REFERENCE BOOKS:

1. Hajra Choudhury S.K and Nirjhar Roy, "Elements of Workshop Technology, Volume-I", Media Promoters and Publishers Pvt.Ltd, 15/e, 2010.
2. Roy A Lindberg, "Process and Materials of Manufacturing", Pearson Education, New Delhi, 4/e, 2015.
3. R.K. Jain, "Production Technology", Khanna publishers, New Delhi, 17/e, 2011.
4. R.K. Rajput, "A Textbook of Manufacturing Technology: Manufacturing Processes", Laxmi Publications (P) Ltd., New Delhi, 2/e, 2017.
5. "A Text book of Manufacturing Technology-I", P.C.Sharma, S.Chand& Company Pvt. Ltd., New Delhi, 1/e, 2011.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/104/112104301/
2. https://nptel.ac.in/courses/112/107/112107219/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	1
CO.2	3	2	-	-	-	-	-	-	-	-	-	1
CO.3	3	2	-	-	-	-	-	-	-	-	-	1
CO.4	3	2	-	-	-	-	-	-	-	-	-	1
CO.5	3	2	-	-	-	-	-	-	-	-	-	1
CO*	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

II B.Tech. - III Semester

20MEC233	MECHANICS OF SOLIDS	L	T	P	C
		2	1	-	3

PRE-REQUISITES: Engineering Mechanics

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the concepts of stress, strain, principal stresses and planes.
2. To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
3. To determine various stresses in the beam, and different sections.
4. To compute slopes and deflections in determinate beams by various methods.
5. To study the stresses and deformations induced in thin and thick shells.

UNIT –1: STRESS, STRAIN AND DEFORMATION OF SOLIDS (9)

Rigid bodies and deformable solids – 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 – Elastic constants – Volumetric strains – Thermal stresses – Deformation of simple, compound and composite structure – Extension oftapering rods (rectangular and circular) – Analysis of stress – Strain energy – Resilience – Gradual, sudden, impact and shock loadings – Mohr's circle of stress.

UNIT –2: STRESSES IN BEAMS (9)

Bending Stresses: Theory of simple bending with assumptions – Neutral axis – Moment of resistance – Practical applications of bending equations in circular (solid and hollow), I, T, angle, channel and beam sections. **Shear Stresses:** Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T and angle sections.

UNIT –3: TRANSVERSE LOADING ON BEAMS (9)

Types of beams – Types of loads – Concept of shear force and bending moment – S.F and B.M diagrams for simply supported, cantilever and overhanging beams subjected to point loads, U.D.L, U.V.L 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 –4: DEFLECTION OF BEAMS (9)

Deflection of Beams: Bending into a circular arc – Slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L, U.V.L. – Mohr's theorems – Moment area method – Application to simple cases including overhanging beams.

UNIT –5: TORSION OF SHAFTS, COLUMNS, THIN AND THICK CYLINDERS (9)

Torsion: Theory of pure torsion – Assumptions – Torsional moment of resistance – Polar modulus – Torsion formulation – Deformation in solid and hollow shafts – Strength of a shaft – Composite shafts. **Columns:** Modes of failure – Euler's and Rankine's theory. **Thin Cylinders:** Thin seamless cylindrical shells – Riveted boiler shells – Thin spherical shells. **Thick Cylinders:** Lame's equation – Cylinders subjected to inside and outside pressures.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Apply the knowledge of basic theory of science and principles to attain engineering problems on deformation of materials.	**PO1, PO2, PO3, PO4, PO12**
CO2	Identify, formulate to perform the stress analysis of a beam under axial loading, torsion, transverse loading to provide valid conclusions.	**PO1, PO2, PO3, PO4, PO12**
CO3	Evaluate and interpreted the various stresses and deformation in circular and hollows shafts, sections to analyze complex engineering problems.	**PO1, PO2, PO3, PO4, PO12**
CO4	Analyze and understand the fundamental concepts of deflection of beam by various methods.	**PO1, PO2, PO3, PO4, PO12**
CO5	Apply reasoning in formed by the contextual knowledge to perform stress and strain deformations in thin, thick cylinders, spherical shells.	**PO1, PO2, PO3, PO4, PO12**

TEXT BOOKS:

1. S. Ramamrutham and R.Narayanan, "Strength of Materials", DhanpatRai Publishing Company (P) Ltd., New Delhi, 20/e, 2020.
2. Dr.B.C.Punmia, Dr.Arun Kumar Jain, Er.Ashok Kumar Jain, "Mechanics of Materials", Laxmi Publications (P) Ltd., New Delhi, 12/e, 2017.

REFERENCE BOOKS:

2. R.C.Hibbeler, "Mechanics of Materials", Pearson Education, New Delhi, 9/e, 2018.
3. Ferdinand P. Beer, E. Russell Johnston Jr., John T. DeWolf, David F. Mazurek, SanjeevSanghi, "Mechanics of Materials", McGraw-Hill Education Pvt. Ltd., Noida, 8/e, 2020.
4. Barry J Goodno and James M Gere, "Mechanics of Materials", Cengage Publication, 9/e, 2019.
5. Egor P Popov, "Mechanics of Materials", Pearson Education India, 2/e, 2015.
6. R.K Bansal, "A Textbook of Strength of Materials (Mechanics of Solids) In SI Units", Laxmi Publications (P) Ltd., New Delhi, 7/e, 2018.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/105/106/105106116/
2. https://nptel.ac.in/courses/105/102/105102090/
3. https://nptel.ac.in/courses/112/106/112106141/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	2	-	-	-	-	-	-	-	1
CO.2	3	2	2	2	-	-	-	-	-	-	-	1
CO.3	3	2	2	2	-	-	-	-	-	-	-	1
CO.4	3	2	2	2	-	-	-	-	-	-	-	1
CO.5	3	2	2	2	-	-	-	-	-	-	-	1
CO*	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

II B.Tech. - III Semester

20MEC234	COMPUTER AIDED DESIGN	L	T	P	C
		2	-	-	2

PRE-REQUISITES: Computer Aided Drafting

COURSE EDUCATIONAL OBJECTIVES:

1. Applying the fundamental concepts of computer graphics and its tools in a generic framework.
2. To impart the parametric fundamentals to create and manipulate geometric models using curves, surfaces and solids.
3. To impart the parametric fundamentals to create and manipulate geometric models using NURBS and solids
4. Creating and adding geometric tolerances in assembly modeling.
5. Applying concept of CAD systems and standards for 3D modeling and visual realism.

UNIT –1: FUNDAMENTALS OF COMPUTER GRAPHICS (6)

Fundamentals of Computer Graphics: Product cycle and design process – Concepts of Computer Aided Design – Principles of computer graphics – Co-ordinate systems – 2D and 3D transformations – Homogeneous coordinates – Graphic primitives (point, line, circle drawing algorithms) – Clipping – Viewing transformation.

UNIT –2: CURVES AND SURFACES MODELLING (6)

Curves: Curve entities and representation – Analytic curves – Line, circle, ellipse, parabola, hyperbola and conics – Synthetic and Hermite cubic spline – Bezier and B-spline curve – Curve manipulations. **Surfaces Modeling:** Surface entities and representation – Surface analysis – Analytic surfaces – Plane and ruled surface – Surface revolution – Tabulated cylinder – Synthetic and Hermitebicubic surface – Bezier and B- spline surface –Coons, blending and offset surface – Triangular patches – Surface manipulators.

UNIT –3: NURBS AND SOLID MODELLING (6)

NURBS: Curves – Lines – Arcs – Circles – Bilinear and ruled surface. **Solid Modeling:** Geometry and topology – Solid entities and representation – Fundamentals of solidmodeling – Half spaces – Boundary representations (B-rep) – Constructive Solid Geometry(CSG) – Sweeps – Solid manipulators. **Features:** Feature entities and representation – Three-dimensional sketching – Parametric relations – Constraints – Feature manipulations.

UNIT –4: ASSEMBLY MODELLING AND PRODUCT DATA EXCHANGE (6)

Mass Properties: Geometric and mass properties. **Assembly Modeling:** Assembly tree and planning – Mating conditions – Bottom up and top-down assembly – Testing matting – Assembly load – Managing assemblies and sub-assemblies – Inference of position and orientation. **Engineering Tolerances:** Conventional and geometric tolerances – Fits and limits – Surface quality – Datum's – Tolerance analysis by Monte Carlo simulation.

UNIT –5: VISUAL REALISM AND CAD STANDARDS (6)

Visualization: Model clean-up – Hidden line, surface and solid removal – Shading and colors. **Computer Animation:** Engineering animation – Types – Animation techniques – Key frame technique – Key frame technique – Simulation technique – **Product Data Exchange:** Types of translators – IGES – STEP – ACIS and DXF – Processors.

Total Hours: 30

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Understand fundamental concepts of computer graphics and its tools in a generic framework.	**PO1,PO2,PO3, PO4,PO5,PO12**
CO2	Impart the parametric fundamentals to create and manipulate geometric models using curves, surfaces and solids.	**PO1,PO2,PO3, PO4,PO5**
CO3	Impart the parametric fundamentals to create and manipulate geometric models using NURBS and solids.	**PO1,PO2,PO3, PO4,PO5**
CO4	Provide clear understanding of mass properties, engineering tolerances and assembly modeling.	**PO1,PO2,PO3, PO4,PO5**
CO5	Provide clear understanding of visual realism, computer animation and product data exchange.	**PO1,PO2,PO3, PO4,PO5**

TEXT BOOKS:

1. R Ibrahim Zeid, "Mastering CAD/CAM", McGraw Hill Education, India, 2018.
2. Rajesh K. Maurya, "Computer Graphics with Virtual Reality System", Wiley India Pvt. Ltd., 3/e, 2018.

REFERENCE BOOKS:

1. Donald Hearn and M. Pauline Baker, "Computer Graphics", Prentice Hall, 2/e, 1992.
2. Michael E. Mortenson, "Geometric Modeling", Industrial Press, Inc. 3/e, 2006.
3. P.N.Rao, "CAD/CAM-Principles and Applications", Tata McGraw-Hill Education Pvt. Ltd., Noida, 3/e, 2010.
4. M.Ganesh, "Basics of Computer Aided Geometric Design: An Algorithmic Approach", Dreamtech Press, Wiley India, 3/e.
5. P. Radhakrishnan, S.Subramanyan and V.Raju, "CAD/CAM/CIM", New Age International Publishers, 1/e (Revised), 2018.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/104/112104031/
2. https://nptel.ac.in/courses/112/102/112102101/
3. https://nptel.ac.in/courses/112/102/112102102/
4. https://nptel.ac.in/courses/112/102/112102103/
5. https://nptel.ac.in/courses/112/105/112105211/
6. https://nptel.ac.in/courses/112/104/112104289/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	2	3	-	-	-	-	-	-	1
CO.2	3	2	2	2	3	-	-	-	-	-	-	1
CO.3	3	2	2	2	3	-	-	-	-	-	-	1
CO.4	3	2	2	2	3	-	-	-	-	-	-	1
CO.5	3	2	2	2	3	-	-	-	-	-	-	1
CO*	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

II B.Tech. - III Semester

		L	T	P	C
20ESC232	**FLUID MECHANICS AND MACHINERY LAB (Common to Mechanical & EEE Branches)**	**-**	**-**	**3**	**1.5**

PRE-REQUISITES: A Course on Fluid Mechanics and Machinery

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the properties of fluid, types of fluid and types of flow.
2. To understand about flow measuring devices based on Bernoulli's principle.
3. To help the students acquire knowledge on fluids flow through pipes.
4. To perform characteristic study of turbines and pumps.

LIST OF EXPERIMENTS:

1. Calibration of venturi meter and orifice meter.
2. Determination of coefficient of discharge for small orifice by a constant head method.
3. Determination of coefficient of discharge for an external mouth piece by variable head method.
4. Calibration of contracted rectangular notch and triangular notch.
5. Determination of coefficient of loss of head in a sudden contraction and friction factor.
6. Verification of Bernoulli's theorem.
7. Impact of jet on vanes.
8. Turbine flow meter.
9. Study of hydraulic jump.
10. Performance test on Pelton wheel
11. Performance test on Francis turbine
12. Performance test on Kaplan turbine
13. Performance test on centrifugal pump
14. Performance test on Single stage centrifugal pump.
15. Performance test on Multi stage centrifugal pump.
16. Performance test on reciprocating pump.

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Demonstrate the knowledge on properties of fluids and fluid flow characteristics of various hydraulic machines.	**PO1**
CO2	Measure and analyze the flow parameters using orifice, mouth	**PO2**
CO3	Determine and design the pipe flow by considering various loss of energy	**PO3**
CO4	Understand working, performance of hydraulic turbine by conduct investigation.	**PO4**
CO5	Follow the ethical principles while doing the experiments	**PO8**
CO6	Do the experiments effectively as an individual and as a team member in a group.	**PO9**
CO7	Communicate verbally and in written form pertaining to results of the experiments	**PO10**
CO8	Continue updating their skills related to fluid mechanics and hydraulic machines in future.	**PO12**

CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	-	**-**	**-**	**3**	**3**	**3**	**-**	**3**

II B.Tech. - III Semester

20MEC235	MATERIAL SCIENCE LAB AND MANUFACTURING TECHNOLOGY LAB	L	T	P	C
		-	-	3	1.5

PRE-REQUISITES: A course on Material Science and Manufacturing Technology

COURSE EDUCATIONAL OBJECTIVES:

1. To help students acquire knowledge about the behavior and properties of all engineering materials and basic manufacturing processes.

LIST OF EXPERIMENTS: MATERIAL SCIENCE LAB

1. a) Study of metallurgical microscope. b) Preparation of specimen.
2. a) Study of Fe-Fe_3C diagram. b) Study of the micro structures of cast irons.
3. Study of the microstructure of mild steels, low carbon and high carbon steels.
4. Study of the micro structures of Cu and brass.
5. Study of the micro structures of Al.
6. Hardenability of steels by Jominy end quench test.

LIST OF EXPERIMENTS: MANUFACTURING ENGINEERING LAB

1. Pattern design and molding a) Single pattern b) Split pattern
2. Melting and casting.
3. a) Lap and Butt joint, b) Single 'V' and Double 'V' butt joint c) T-corner joint
4. Spot welding.
5. Gas welding and Gas cutting.
6. Study of simple, compound and progressive press tool a) Blanking b) Piercing
7. Bending operations.
8. Injection molding.

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Gain the knowledge on the microstructure with properties and principles of foundry, metal joining and forming processes.	**PO1**
CO2	Analyze the mechanical properties of materials by suitable testing and choose the appropriate metal joining processes.	**PO2**
CO3	Design and manufacturing components by adopting the concept of casting, forging, rolling and drawing operations.	**PO3**
CO4	Conduct investigation on the hardness of different materials	**PO4**
CO5	Evaluate the structure of the material by using modern microscope.	**PO5**
CO6	Follow the ethical principles while doing the experiments	**PO8**
CO7	Do the experiments effectively as an individual and as a team member in a group.	**PO9**
CO8	Communicate verbally and in written form pertaining to results of the experiments	**PO10**
CO9	Continue updating their skill related to materials and manufacturing in future.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

II B.Tech. - III Semester

20MEC236	**MECHANICS OF SOLIDS LAB**	**L**	**T**	**P**	**C**
		-	**-**	**3**	**1.5**

PRE-REQUISITES: A Course on Engineering Mechanics and Mechanics of Solids

COURSE EDUCATIONAL OBJECTIVES:

1. To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness.

LIST OF EXPERIMENTS:

1. Tension test on a mild steel rod under Universal Testing Machine
2. Compression test on wood / concrete under Universal Testing Machine
3. Shear test on Mild steel under Universal TestingMachine
4. Torsion test on mild steel rod
5. Charpy and Izod impact test on metal specimen
6. Brinnell hardness test on metal specimen
7. Rockwell hardness test on specimen
8. Compression and tension test on helical springs
9. Bending test on cantilever beam.
10. Bending test on simply supported beam.
11. Tension and compression test on metals / plastics / wood / timber / ceramics / rubber / fabric using Electronic Tensometer
12. Shear and bending test on metals / plastics / wood / timber / ceramics / rubber / fabric using Electronic Tensometer

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Demonstrate the knowledge on the strength of materials	**PO1**
CO2	Analyze the mechanical properties of materials by suitable testing.	**PO2**
CO3	Design the materials strength using various impact and deflection test.	**PO3**
CO4	Conduct investigation on the hardness of different materials	**PO4**
CO5	Evaluate the material properties by computerized machine.	**PO5**
CO6	Follow the ethical principles while doing the experiments	**PO8**
CO7	Do the experiments effectively as an individual and as a team member in a group.	**PO9**
CO8	Communicate verbally and in written form pertaining to results of the experiments	**PO10**
CO9	Continue updating their skill related to material science in future.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

II B.Tech. - IV Semester

20HSM241	**PRINCIPLES OF MANAGEMENT**	**L T P C**
		3 - - 3

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the concepts of total quality management, and Contributions of TQM
2. To learn TQM principles and impact of 5s, Kaizen, PDSA cycles in continuous process improvement.
3. To study the basic need of quality control and process control in an organization
4. To learn the traditional and modern TQM tools and techniques
5. To study the quality standard, requirements and elements in Quality management system

UNIT –1: INTRODUCTION TO MANAGEMENT (9)

Definition of management – Science or Art – Manager Vs Entrepreneur – Types of managers – Managerial roles and skills – Levels of management – Functions of management –Principles of management and Scientific Management and its approaches – Corporate Social Responsibilities – Organization culture and Environment.

UNIT –2: PLANNING AND DECISION MAKING (9)

Planning: Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques **Decision Making**: Importance of decision making – – Decision making steps and process.

UNIT –3: ORGANIZING AND DIRECTING (9)

Organizing: Nature and purpose – Formal and informal organization – Organization chart and structure – Line and staff authority – Departmentalization – Delegation of authority – Centralization and decentralization – Job Design – HR planning, recruitment, selection, training and development, performance management, career planning and management. **Directing:** Principles of directing – Process of communication – Barrier in communication – Effective communication.

UNIT –4: CONTROLLING AND CO-ORDINATING (9)

System and process of controlling – Budgetary and non-budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

UNIT –5: MODERN CONCEPTS OF MANAGEMENT (9)

Concept, features, merits and demerits of SWOT Analysis, Business Process Re-engineering, Supply Chain Management – Concepts, functions importance of marketing – Competitive analysis and advantages of E-marketing.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Understand the concepts of management, roles to be adopted by manager, functions of manager and inculcating the social responsibility towards different stake holders.	**PO1, PO11**
CO2	Demonstrate knowledge with regard to planning, planning process and the process of making effective decisions.	**PO1, PO11**
CO3	Demonstrate knowledge about organizational environment, the process of staffing and the application of directive principles.	**PO1, PO11**
CO4	Demonstrate knowledge about controlling and Co-ordinating	**PO1, PO11**
CO5	Demonstrate knowledge about modern concepts in management.	**PO1, PO11**

TEXT BOOKS:

1. Total Quality Management, Besterfield Dale H, Besterfield Carol, Besterfield Glen H, Besterfield Mary, Urdhwareshe Hemant and Urdhwareshe Rashmi, 5/e, 2018, Pearson Education, New Delhi.
2. Principles of Management, "M. Govindarajan and S. Natarajan", Prentice Hall of India Pvt. Ltd.

REFERENCE BOOKS:

1. Management, "Stephen P. Robbins and Mary Coulter", Prentice Hall of India, 8/e,
2. Principles of Management, "Charles W.L Hill, Steven L McShane", 2007, McGraw Hill
3. Education, Special Indian Edition.
4. Management-A Competency Based Approach, "Hellriegel, Slocum and Jackson", Thomson South Western, 10/e, 2007.
5. Management - A global and Entrepreneurial Perspective, "Harold Koontz, Heinz Weihrich and Mark V Cannice", Tata McGraw Hill, 12/e, 2007.
6. Essentials of Management, "Andrew J. Dubrin", Thomson South western. 7/e, 2007.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/110/105/110105146/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	2	-
CO.2	3	-	-	-	-	-	-	-	-	-	2	-
CO.3	3	-	-	-	-	-	-	-	-	-	2	-
CO.4	3	-	-	-	-	-	-	-	-	-	2	-
CO.5	3	-	-	-	-	-	-	-	-	-	2	-
CO*	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**

II B.Tech. - IV Semester

20BSC243	OPERATIONS RESEARCH	L	T	P	C
		2	1	-	3

PRE-REQUISITES: A Course on Probability Theory.

COURSE EDUCATIONAL OBJECTIVES:

1. To select the constraints on the availability of resources and developing a model for rendering an optimal solution.
2. To evaluate the challenges in the transportation and assignment problems and furnishing a rational solution to maximize the benefits.
3. To investigate the nature of the project/ failure and offering methodical assistance towards sequencing
4. To analyze the decision criteria and strategies in game theory.
5. To expand the basic knowledge on queuing theory.

UNIT –1: LINEAR PROGRAMMING MODELS (9)

Characteristics, phases and scope of operations research – Linear programming formulation – Graphical method of solution – Simplex method – Artificial variables – Big-M method – Two-phase method – Dual simplex method – Duality theorem – Principle of duality – Economic interpretation of the duality – Complementary slackness theorem – Revised simplex method.

UNIT –2: TRANSPORTATION AND ASSIGNMENT PROBLEMS (9)

Transportation Problem: Formulation – Feasible solutions – North west corner rule, least cost method and Vogel`s approximation method – Optimal solution by MODI method – Unbalanced transportation problem – Degeneracy – Maximization type. **Assignment Problem:** Formulation – Minimization and maximization problems – Unbalanced assignment problem – Traveling salesman problem.

UNIT –3: NETWORK AND SEQUENCING MODELS (9)

Network models – Minimal spanning tree algorithm – Shortest route problem – Maximal flow models – Minimum cost flow problem – Network simplex method – Project network – CPM and PERT – Critical path and float calculations – Determining minimum time required to complete the project. Sequencing: 'n' jobs through two machines – 'n' jobs through three machines – 'n' jobs through 'm' machines.

UNIT –4: DECISION THEORY AND GAME THEORY (9)

Decision Theory: Decision criteria and trees – Maximin and maximax – Hurwicz, laplace, savage and EOL criterion – Decision making under risk. **Game Theory:** Zero sum games – Games with and without saddle points – 2×2 games – Games with mixed strategies – Dominance principle and property – Graphical method.

UNIT –5: QUEUING THEORY (9)

Queuing Theory: Queuing models and networks – Pure birth and death models Poisson queuing model – Poisson queuing model – Balking, Reneging, Jockeying – Kendall notation – Single, multi and machine server model – Exponential distribution – Constant rate service – Infinite and finite population – Exponential service –Monte Carlo simulation technique.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Select the constraints on the availability of resources, develop a model and render an optimal solution during the given circumstances.	**PO1, PO2, PO4, PO12**
CO2	Appraise the challenges in the transportation and assignment problems and furnish a rational solution to maximize the benefits.	**PO1, PO2, PO4, PO12**
CO3	Construct the network diagram and estimate the time required to complete the project and determine optimum processing job order and investigate the nature of the project/ failure and offering methodical assistance towards sequencing.	**PO1, PO2, PO4, PO12**
CO4	Analyze the decision criteria's and strategies in game theory.	**PO1, PO2, PO4, PO12**
CO5	Expand the basic knowledge on queuing theory.	**PO1, PO2, PO4, PO12**

TEXT BOOKS:

1. P. Sankara Iyer, "Operations Research", McGraw Hill Education (India) Private Ltd. 1/e.
2. Hamdy A. Taha, "Operations Research an Introduction", Pearson Education Limited. 10/e, 2017.

REFERENCE BOOKS:

1. Frederick S. Hillier, Gerald J. Lieberman, Bodhibrata Nag and Preetam Basu, "Introduction to Operations Research", Tata McGraw Hill Education Pvt. Ltd. 10/e, 2017.
2. Wayne L Winston, "Operations Research: Applications and Algorithms", Cengage Learning, India. 4/e, 2020.
3. R. Panneerselvam, "Operations Research", PHI, Learning (P) Ltd. 2/e.
4. M. Sreenivasa Reddy, "Operations Research", Cengage Learning, India, 4/e, 2019.
5. N D Vohra, "Quantitative Techniques in Management", McGraw Hill Education(India) Private Ltd, 5/e, 2017.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/106/112106134/
2. https://nptel.ac.in/courses/112/106/112106131/
3. https://nptel.ac.in/courses/110/106/110106059/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	1	-	-	-	-	-	-	-	1
CO.2	3	2	-	1	-	-	-	-	-	-	-	1
CO.3	3	2	-	1	-	-	-	-	-	-	-	1
CO.4	3	2	-	1	-	-	-	-	-	-	-	1
CO.5	3	2	-	1	-	-	-	-	-	-	-	1
CO*	**3**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

II B.Tech. - IV Semester

20MEC241	KINEMATICS OF MACHINERY	L	T	P	C
		2	1	-	3

PRE-REQUISITES: A Course on Engineering Mechanics.

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the basic components and layout of linkages in the assembly of a system machine. To study the applications of the conservation laws to flow through pipes.
2. To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
3. To understand the motion resulting from a specified set of linkages, design few linkage mechanisms.
4. To understand the basic concepts cam mechanisms for specified output motions.
5. To understand the basic concepts of toothed gearing and kinematics of gear trains.

UNIT –1: BASICS OF MECHANISMS (9)

Basics of kinematics – Types of motions – Kinematic links – Kinematic pairs – Kinematic chain – Types of joints in chains – Degree's of freedom – Application of plane mechanism – Inversion of mechanism – Inversions of quadric, single and double slider. **Straight Line Motion Mechanisms:** Exact and approximate copiers and generated types – Peaucellier, Hart's and Scott-Russell's mechanism – Grasshopper mechanism – Watt's-modified Scott-Russell mechanism – T.Chebicheff's and Robert mechanism – Pantograph.

UNIT –2: KINEMATICS OF LINKAGE MECHANISMS (9)

Instantaneous Centre Method: Instantaneous center of rotation, centroids and axodes – Relative motion between two bodies – Three centers in-line theorem – Locating instantaneous centers for simple mechanisms and determination of angular velocity. **Relative Velocity Method:** Velocity and acceleration – Motion of link in machine – Determination of velocity and acceleration diagrams – Graphical method - Application of relative velocity method – Slider crank mechanism – Four bar mechanism. **Acceleration Method:** Acceleration diagrams for simple mechanisms, Coriolis acceleration and determination of Coriolis component of acceleration – Kleins construction – Analysis of slider crank mechanism for displacement, velocity and acceleration.

UNIT –3: STEERING MECHANISMS AND DRIVE SYSTEM (9)

Steering Mechanisms: Conditions for correct steering – Davis steering gear – Ackerman's steering gear – Velocity ratio – Hooke's joint – Single and double Hooke's joint. **Drive Systems:** Belt, Rope and chain drives – Selection of belt drive – Types of belt drives – Materials used for belts and ropes – Velocity ratio of belt drives, slip of belt, creepof belt, tension for flat belt drive, angle of contact, centrifugal tension, maximum tensionof belt. **Chains**: Length, angular speed ratio – Classification of chains (theory only).

UNIT –4: KINEMATICS OF CAM (9)

Classification of cams and followers – Displacement diagrams – Uniform velocity, parabolic, simple harmonic and cycloidal motions – Derivatives of follower motions –Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.

UNIT –5: GEARS AND GEAR TRAINS **(9)**

Gearing: Law of toothed gearing – Involutes and cycloidal tooth profiles – Spur gear terminology – Gear tooth action – Contact ratio – Interference and undercutting – Helical, bevel, worm, rack and pinion gears. **Gear trains:** Gear trains – Speed ratio – Train value – Simple gear train – Compound and reverted gear train – Epicyclic gear trains.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Define link, pairs, mechanisms, inversion, structure and machines. Explain various terminologies associated with theory of machine. Draw inversions of different mechanisms.	**PO1, PO2, PO3, PO4, PO12**
CO2	Draw velocity and acceleration diagram for a given mechanism. Calculate velocity and acceleration from a given mechanism.	**PO1, PO2, PO3, PO4, PO12**
CO3	Explain steering geometry. Describe various steering mechanisms with its need and importance. Identify various linkages of steering mechanisms, steering gears.	**PO1, PO2, PO3, PO4, PO12**
CO4	Explain different types of cams and cam followers and its motions. Construct different types of CAM profile for a given data.	**PO1, PO2, PO3, PO4, PO12**
CO5	Develop a practical approach to optimizing gear trains with spur gears based on a selection matrix of optimal materials, gear ratios and shaft axes positions.	**PO1, PO2, PO3, PO4, PO12**

TEXT BOOKS:

1. S.S.Rattan, "Theory of Machines and Mechanisms", Tata McGraw-Hill Education Pvt.Ltd, Noida, 5/e, 2019.
2. Robert L Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill Education Pvt.Ltd, 1/e, 2009.

REFERENCE BOOKS:

1. John J. Uicker Jr, Gordon R. Pennock & Joseph E. Shigley, "Theory of Machines and Mechanisms", SI Edition, Oxford University Press, 3/e, 2009.
2. Thomas Bevan, "Theory of Machines", Pearson Education, New Delhi, 3/e, 2009.
3. Sadhu Singh, "Theory of Machines", Pearson Education, New Delhi, 3/e, 2011.
4. R.S Khurmi and J.K Gupta, "Theory of Machines", S.Chand & Company Pvt. Ltd. New Delhi, 14/e, 2013.
5. Amitabha Ghosh and Asok Kumar Mallik, "Theory of Mechanisms and Machines", East-West Press Pvt Ltd., 3/e, 2008.

REFERENCE WEBSITE:

1. http://nptel.ac.in/courses/112/104/112104121/
2. https://nptel.ac.in/courses/112/105/112105268/
3. https://nptel.ac.in/courses/112/106/112106270/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	1	-	-	-	-	-	-	-	1
CO.2	3	2	1	1	-	-	-	-	-	-	-	1
CO.3	3	2	1	1	-	-	-	-	-	-	-	1
CO.4	3	2	1	1	-	-	-	-	-	-	-	1
CO.5	3	2	1	1	-	-	-	-	-	-	-	1
CO*	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

II B.Tech. - IV Semester

20MEC242	**METAL CUTTING AND MACHINE TOOLS**	**L T P C**
		2 1 - 3

PRE-REQUISITES: Manufacturing Engineering

COURSE EDUCATIONAL OBJECTIVES:

1. To apply the fundamental knowledge, and principles of metal cutting.
2. To apply the fundamental knowledge on lathe and automatic machine tools.
3. To apply the principles of shaper, slotter, planer and milling machines.
4. To understand the working principles of drilling, boring, jigs and fixtures.
5. To apply the principles of abrasive process and finishing process.

UNIT –1: THEORY OF METAL CUTTING (9)

Theory of Metal Cutting: Elements of cutting process – Geometry of single point tool and its angles – Mechanics of chip formation – Types of chips – Chip breakers –Orthogonal and oblique cutting – Cutting forces – Merchant's force diagram – Thermal aspects – Cutting speeds feed, depth of cut and surface finish – Tool life, tool wear and tool materials – Cutting fluids – Machinability – Economics of machining.

UNIT –2: LATHE (9)

Engine Lathe: Constructional features – Specification – Principle of working – Operations – Taper turning and thread cutting methods – Work holders and tool holders – Special attachments – Machining time and power estimation. **Capstan and Turret Lathes:** Constructional features – Collet chucks – Work and tool holding devices – Tool layout. **Automatic Lathes:** Principal features of semi-automatic and automatic lathes – Single spindle and multi-spindle automatic lathes – Swiss type and automatic screw type lathe.

UNIT –3: MILLING, SHAPER, SLOTTER, PLANNER AND BROACHING (9)

Milling Machine: Principles of working – Specifications – Classifications – Principal features of horizontal, vertical and universal milling machines – Milling operations –Geometry of milling cutters – Methods of indexing – Accessories to milling machines – Machining time calculations. **Shaping, Slotting, Planning and Broaching Machines:** Principles of working – Principal parts – Specification, classification, operations performed – Kinematic scheme of the shaping slotting and planning machines – Machining time calculations – Broach construction push, pull and continuous broaching machines.

UNIT –4: DRILLING, BORING, JIGS AND FIXTURES (9)

Drilling and Boring Machines: Principles of working, specifications, types, operations performed – Tool holding devices – Twist drill – Boring machines – Fine boring and jig boring machine – Deep hole drilling – Kinematics scheme of the drilling and boring machines. **Jigs and Fixtures:** Principles of design – Principles of location and clamping – Types of clamping and work holding devices – Typical examples of jigs and fixtures.

UNIT –5: ABRASIVE PROCESSES (9)

Grinding Machine: Theory of grinding – Classification – Cylindrical and surface grinding – Tool and cutter grinding – Special types of grinding. **Grinding wheel:** Types of abrasives, bonds, specification and selection of a grinding wheel. **Super Finishing:** Lapping – Honing – Gear and thread finishing – Comparison of grinding, lapping and honing.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Understand the theory of metal cutting, tool life and geometry of single point cutting tool.	**PO1, PO2, PO12**
CO2	Understand the basic principle of lathe and identify various cutting tools used for different operations.	**PO1, PO2, PO12**
CO3	Select suitable reciprocating machines for typical component.	**PO1, PO2, PO12**
CO4	Design jigs for drilling and fixtures for turning, milling.	**PO1, PO2, PO12**
CO5	Identify various grinding machines used for different operations.	**PO1, PO2, PO12**

TEXT BOOKS:

1. Rao. P.N, "Manufacturing Technology - Metal Cutting and Machine Tools, Volume – II", Tata McGraw Hill, New Delhi, 4/e, 2018.
2. Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology (SI Edition)", Pearson Education, New Delhi, 7/e, 2018.

REFERENCE BOOKS:

2. Amitabha Ghosh and Ashok Kumar Mallik, "Manufacturing Science", East-West Press Pvt Ltd, 2/e, 2010.
3. R.K. Jain, "Production Technology - Machining Techniques and Automated Machine Tool Systems, Volume – II", Khanna Publishers, New Delhi, 19/e, 2018.
4. Geoffrey Boothroyd and Winston A. Knight, "Fundamentals of Metal Machining and Machine Tools", Routledge, CRC Press, Taylor and Francis Group, 3/e, 2005.
5. "Production Technology", Hindustan Machine Tools, Bangalore, India.
6. Hajra Choudhury S.K and Nirjhar Roy, "Elements of Workshop Technology- Machine Tools, Volume – II", Media Promoters and Publishers Pvt.Ltd. 15/e, 2010.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/105/112105306/
2. https://nptel.ac.in/courses/112/105/112105233/
3. https://nptel.ac.in/courses/112/105/112105211/
4. https://nptel.ac.in/courses/112/104/112104189/
5. https://nptel.ac.in/courses/112/104/112104204/
6. https://nptel.ac.in/courses/112/105/112105126/
7. https://nptel.ac.in/courses/112/105/112105127/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	1
CO.2	3	2	-	-	-	-	-	-	-	-	-	1
CO.3	3	2	-	-	-	-	-	-	-	-	-	1
CO.4	3	2	-	-	-	-	-	-	-	-	-	1
CO.5	3	2	-	-	-	-	-	-	-	-	-	1
CO*	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

II B.Tech. - IV Semester

20MEC243	THERMAL ENGINEERING	L	T	P	C
		2	1	-	3

PRE-REQUISITES: A Course on Engineering Thermodynamics.

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the principal, construction, working in IC engines.
2. To analyze the stages of combustion and performance of IC engines.
3. To analyze the steam power cycles and study the boilers and draught.
4. To realize the concepts of steam flow through nozzle, understand the thermodynamic concepts for steam turbines and the condenser.
5. To gain basic knowledge about air compressor.

UNIT – 1: INTERNAL COMBUSTION ENGINES (9)

Introduction of IC Engines: Classification of IC engines - Components and their function - Valve timing diagram and port timing diagram - Comparison of two stroke and four stroke engines, S.I and C.I engines. **Fuel Systems:** S.I. Engine: Carburetor -Mechanical and electrical fuel pump - C.I. Engine: Fuel injection pump - Fuel injector - Types of fuel injector nozzles. **Cooling Systems:** Cooling requirements - Air cooling and water cooling (thermosyphon and forced circulation system). **Lubrication Systems:** Petroil, splash, pressurized and mist lubrication. **Ignition Systems:** Function of anignition system - Battery coil, magneto coil and electronic coil ignition system.

UNIT – 2: COMBUSTIONS AND PERFORMANCE OF IC ENGINES (9)

Combustion S.I. Engine: Normal and abnormal combustion - Importance of flame speed and effect of engine variables - Stages of combustions - Knocking - Fuel rating - Antiknock additives - Combustion chambers. **Combustion C.I. Engine:** Stages of combustion - Effect of engine variables - Diesel knock - Combustion chambers – Fuel rating. **Performance of IC Engines:** Performance parameters - Indicated power - Brake power - Morse test - Efficiencies of an I.C. engines - Air consumption - Heat balance sheet.

UNIT – 3: STEAM POWER CYCLE, BOILERS AND DRAUGHT (9)

Steam Power Cycle: Rankine cycle – Schematic layout - Thermodynamic analysis - Concept of mean temperature of heat addition - Methods to improve cycle performance: Reheat cycle - Regenerative cycle - Binary vapour cycle. **Boilers:** Classification of steam boilers - Boiler mountings and accessories - Equivalent evaporation - Boiler efficiency - Heat balance sheet. **Draught:** Classification – Natural draught: Chimney height anddiameter - Condition for maximum discharge through a chimney - Artificial draught: Forced draught, induced draught and balanced draught (basics only).

UNIT – 4: STEAM NOZZLES, TURBINES AND CONDENSERS (9)

Steam Nozzles: Introduction - Steam flow through nozzles – Nozzle efficiency - Supersaturated flow in a nozzle – Problems in steam nozzles. **Steam Turbines:** Classifications – Compounding – Problems on velocity diagrams for impulse and reaction turbines - Governing and control. **Steam Condensers:** Requirements of steam condensing plant – Classification of condensers – Sources of air in condensers – Effects of air leakage in a condenser.

UNIT – 5: AIR COMPRESSOR (9)

Classification of air compressors – Reciprocating compressor – Workdone by single stage reciprocating air compressor with and without clearance volume – Efficiencies of reciprocating compressors - Multistage air compressor and inter cooling – Rotary air compressors (basics only).

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Understand the basic knowledge on IC engines and its various systems.	**PO1, PO2, PO12**
CO2	Analyze the stages of combustion and performance of IC engines.	**PO1, PO2, PO12**
CO3	Analyze the steam power cycles and knowledge based on different types of boilers and draughts.	**PO1, PO2, PO12**
CO4	Analyze the performance of steam nozzle, steam turbines through velocity triangles and steam condenser.	**PO1, PO2, PO4, PO12**
CO5	Understand the various types of compressors and its performance.	**PO1, PO2, PO12**

TEXT BOOKS:

1. P.K. Nag, "Basic and Applied Thermodynamics", Tata McGraw-Hill Education Pvt. Ltd., 2/e, 2009.
2. R.K Rajput, "Thermal Engineering", Laxmi Publications (P) Ltd, New Delhi, 8/e, 2010.

REFERENCE BOOKS:

1. V. Ganesan, "Internal Combustion Engines", Tata McGraw-Hill Education Pvt. Ltd., 4/e, 2012.
2. Mathur and Sharma, "IC Engines", Dhanpat Rai Publishing Company (P) Ltd., 1/e, 2010.
3. Ballaney. P.L., "Thermal Engineering", Khanna publishers, 25/e, 2017.
4. Heywood, "I .C. Engines", Tata McGraw-Hill Education Pvt.Ltd., Noida, 1/e, 1998.
5. Kothandaraman, C.P., Domkundwar .S and Domkundwar A.V., "A Course in Thermal Engineering", Dhanpat Rai & Sons, 6/e, 2011.

NOTE: Use of standard thermodynamic tables and Mollier diagram are permitted.

REFERENCE WEBSITE:

2. https://nptel.ac.in/courses/112106133/2
3. http://en.wikipedia.org/wiki/Applied_Thermal_Engineering
3. https://nptel.ac.in/courses/112/103/112103307/
4. https://nptel.ac.in/courses/112/103/112103275/
5. https://nptel.ac.in/courses/112/105/112105266/
6. https://nptel.ac.in/courses/112/106/112106133/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	1
CO.2	3	2	-	-	-	-	-	-	-	-	-	1
CO.3	3	2	-	-	-	-	-	-	-	-	-	1
CO.4	3	2	1	-	-	-	-	-	-	-	-	1
CO.5	3	2	-	-	-	-	-	-	-	-	-	1
CO*	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

II B.Tech. - IV Semester

20MEC244	AUTOMOTIVE SYSTEMS	L	T	P	C
		2	-	-	2

PRE-REQUISITES: A Course on Thermal engineering.

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the construction and working principle of vehicle structure.
2. To acquire knowledge on power transmission systems in automobiles.
3. To understand the construction and working principle of steering system and functioning of suspension and braking system.
4. To understand the principle detecting the emission from automobile, standards and electrical systems
5. To understand the basic principle of hybrid and electrical vehicle systems.

UNIT –1: VEHICLE STRUCTURE AND ENGINES (6)

Vehicle Structure: Basic structure of an automobile – Power unit – Chassis, frames and body – Resistance to vehicle motion – Power transmission – Rear wheel drive, Front wheel drive and four-wheel drive. **Automobile Engines:** Types - Construction – Components – Functions and materials – Turbo charging and super charging – Oil filters air filters – Fuel filters. **Wheels and Tyers:** Types of wheels and tyer with properties.

UNIT –2: TRANSMISSION SYSTEM (6)

Clutches: Types – Friction clutches – Dry friction and wet clutches – Clutch operations – Principles of fluid fly wheel – Trouble shooting. **Gear Box:** Function of transmission – Principles of sliding mesh, constant mesh, synchromesh, epi-cyclic gear box and torque converter – Over drive – Automated manual transmissions – Trouble shooting. **Drive Line:** Propeller shaft, universal joint, final drive, rear axles and rear axle drives.

UNIT –3: STEERING, SUSPENSION AND BRAKING SYSTEM (6)

Steering: Front axle – Wheel alignment and its factors – Factors pertaining to wheels – Steering geometry – Center point steering – Steering mechanisms – Vehicle handling – Steering linkages – Steering gears – Power steering – Four-wheel steering – Trouble shooting. **Suspension:** Rigid axle suspension system – Torsion bar – Shock absorber – Independent suspension system – Air suspension system. **Braking System:** Drum and disc brake system, mechanical, hydraulic, pneumatic and vacuum brake systems – Antilock braking system, electronic brake force distribution and traction control.

UNIT –4: EMISSION AND ELECTRICAL SYSTEM (6)

Emission: Emission from automobiles – Pollution standards – Pollution control and techniques – Multipoint fuel injection for SI engines – Common rail diesel injection, emissions from alternative energies – Hydrogen, biomass, alcohols, LPG, CNG. **Electrical System:** Charging circuit, generator, current-voltage regulator – Starting system, Bendix drive – Mechanism of solenoid, lighting, horn, wiper, fuel gauge, oil pressure and engine temperature indicator – Engine management system – Intelligent lighting system.

UNIT –5: INTRODUCTION OF HYBRID AND ELECTRICAL VEHICLE SYSTEMS (6)

Environmental Impact: Air pollution, global warming, petroleum resources and different transportation development strategies – History of EVs, HEVs and Fuel Cell Vehicles. **Energy Sources:** Battery basics, parameters, power and characteristics – Electro chemical batteries Ultracapacitors – Ultra-high-speed flywheels – Hybridization of energy storages. **Electric Vehicles:** Configurations and performance of EVs – Tractive effort – Energy consumption. **Hybrid Electric Vehicles:** Concept and architectures of hybrid electric drivetrains.

Total Hours: 30

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Acquired knowledge on vehicle components and basic construction.	**PO1, PO2, PO12**
CO2	Understand the principles of power transmission system in automobiles.	**PO1, PO2, PO12**
CO3	Understand the working principle of steering system and steering geometry.	**PO1, PO2, PO12**
CO4	Understand the functioning of suspension and braking system.	**PO1, PO2, PO12**
CO5	Understand the emissions from automobile and engine electrical systems.	**PO1, PO2, PO12**

TEXT BOOKS:

1. Kirpal Singh, "Automobile Engineering-Vol.I and II", Standard Book House, New Delhi, 12/e, 2011.
2. William Crouse, "Automotive Mechanics", Tata McGraw-Hill Education Pvt. Ltd., Noida, 10/e, 2006.

REFERENCE BOOKS:

1. V.Ganesan, "Internal Combustion Engines", Tata McGraw-Hill Education Pvt. Ltd., Noida, 4/e, 2012.
2. R.K.Rajput, "Automobile Engineering", Laxmi Publications (P) Ltd., New Delhi, 1/e, 2007.
3. P.S.Gill, "Automobile Engineering: Vol-I", S.K.Kataria and Sons Publications, New Delhi, 2011.
4. Mehrdad Ehsani, Yimin Gao, Stefano Longo, and Kambiz M. Ebrahimi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: 3/e, 2018, CRC Press, Taylor & Francis Group, LLC.
5. Husain Iqbal "Electric and Hybrid Vehicles: Design Fundamentals", , 2/e, 2016, CRC Press, Taylor & Francis Group, LLC.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/107/106/107106088/
2. https://nptel.ac.in/courses/108/106/108106182/
3. https://nptel.ac.in/courses/108/106/108106170/
4. https://nptel.ac.in/courses/108/102/108102121/
5. https://nptel.ac.in/courses/108/103/108103009/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	1	-	-	-	-	-	-	-	-	-	1
CO.2	3	1	-	-	-	-	-	-	-	-	-	1
CO.3	3	1	-	-	-	-	-	-	-	-	-	1
CO.4	3	1	-	-	-	-	-	-	-	-	-	1
CO.5	3	1	-	-	-	-	-	-	-	-	-	1
CO*	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

II B.Tech. – IV Semester

20MEC245	COMPUTER AIDED MACHINE DRAWING LAB	L	T	P	C
		-	-	3	1.5

PRE-REQUISITES: A Course on Computer Aided Drafting Lab and Computer Aided Design.

COURSE EDUCATIONAL OBJECTIVES:

1. To make the students understand and interpret drawings of machine components.
2. To prepare assembly drawings using standard CAD packages.
3. To familiarize the students with Indian Standards on drawing practices and standard components.
4. To gain practical experience in handling 2D drafting and 3D modeling software systems.

LIST OF EXERCISES:

The following exercises are to be done by 2D software package

1. **Detachable Joints:** Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint and foundation bolts.
2. **Riveted Joints:** Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.
3. **Welded Joints:** Lap joint and T joint with fillet, butt joint with conventions (Any Two).
4. **Keys:** Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.
5. **Couplings:** Rigid – Muff, flange; flexible – bushed pin-type flange coupling, universal coupling, Oldhams' coupling.

The following exercises are to be done by 3D software package (Any Six)

1. Assembly drawing of (a) sleeve and cotter joint (b) socket and spigot joint.
2. Assembly drawing of knuckle joint
3. Assembly drawing of universal joint.
4. Assembly drawing of screw jack.
5. Assembly drawing of plummer block.
6. Assembly drawing of stuffing box.
7. Assembly drawing of piston and connecting rod.
8. Assembly drawing of tailstock.
9. Assembly drawing of eccentrics.
10. Assembly drawing of pipe vice.

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Develop knowledge on design procedure for specific machine components.	**PO1**
CO2	Analysis of various types of force and its influences on machine components.	**PO2**
CO3	Design the assembly models.	**PO3**
CO4	Investigate the results of analyzing tool with theoretical calculation.	**PO4**
CO5	Create models and analyze using CATIA V6 and solid works.	**PO5**
CO6	Follow ethical principle in conduction of exercise.	**PO8**
CO7	Perform individually and also in a team to complete the process	**PO9**
CO8	Communicate in verbally or in written form, their understanding about the exercise.	**PO10**
CO9	Continue updating their knowledge on various analysing tools for model designs and drawing.	**PO12**

CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

II B.Tech. - IV Semester

20MEC246 **MACHINE TOOLS TECHNOLOGY LAB** **L T P C**
- - 3 1.5

PRE-REQUISITES: A course of Metal Cutting and Machine Tools

COURSE EDUCATIONAL OBJECTIVES:

1. To study and acquire knowledge on various basic machining operations and special purpose machines and their applications.

LIST OF EXPERIMENTS:

1. Demonstration of construction and operations of general-purpose machines: Lathe, drilling machine, milling machine, shaper, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.
2. Step turning and taper turning on given work piece using lathe machine.
3. Thread cutting and knurling on given work piece using lathe machine.
4. Eccentric turning on lathe machine on given work piece using.
5. External and internal thread cutting on given work piece using lathe machine.
6. Drilling and reaming operation on given work piece.
7. Contour milling on given work piece using milling machine.
8. Gear cutting on given work piece using milling machine.
9. Shaping operation on given work piece using shaping machine.
10. Slotting operation on given work piece using slotting machine.
11. Grinding operation on surface grinding machine.
12. Grinding operation on cylindrical grinding machine.
13. Grinding operation on tool cutter grinding machine.
14. Study on abrasive jet machining (AJM).

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Knowledge in general purpose machines: Lathe, drilling machine, milling machine, shaper, planning machine, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.	**PO1**
CO2	Analyze problems and offer a qualitative assessment on problem.	**PO2**
CO3	Design the model and develop the parts.	**PO3**
CO4	Identify different manufacturing techniques to produce complex shapes.	**PO4**
CO5	Manufacture simple parts using lathe/milling drilling/shaper and alignment are verified by standard metrology instruments	**PO5**
CO6	Follow the ethical principles in conducting the experiments	**PO8**
CO7	Perform experiments individually and also a team to complete the work	**PO9**
CO8	Communicate in verbally or in written form their understanding about the experiments.	**PO10**
CO9	Continue updating their skill related to machine tools for various applications during their life time.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

II B.Tech. - IV Semester

20MEC247	THERMAL ENGINEERING LAB AND AUTOMOTIVE SYSTEMS LAB	L	T	P	C
		-	-	3	1.5

PRE-REQUISITES: A course on Thermal Engineering

COURSE EDUCATIONAL OBJECTIVES:

1. To develop the basic knowledge of timing diagram and to analyze the performance of IC engines.
2. To introduce the methods to study the heat distribution and improve the performance of IC engines.
3. To analyze the performance of air compressor and refrigeration system.

LIST OF EXPERIMENTS (THERMAL ENGINEERING LAB):

1. Valve timing diagram and port timing diagram of an IC engine.
2. Performance test on four stroke single cylinder diesel engine.
3. Retardation test on four stroke single cylinder diesel engine.
4. Performance test on four stroke single multi cylinder petrol engine.
5. Evaluation of engine friction by conducting Morse test on four stroke multi cylinder petrol engine.
6. Heat balance sheet of an IC engine.
7. Performance test on two stroke single cylinder petrol engine.
8. Performance test on two stage reciprocating air compressor.
9. Determination of flash and fire points of various fuels / lubricants.
10. Determination of COP of a vapour compression refrigeration system.
11. Study of variable compression ratio four stroke petrol engines.
12. Study on steam boilers, steam turbines and steam condensers.

LIST OF EXPERIMENTS (AUTOMOTIVE SYSTEMS LAB):

1. Study, dismantling and assembling of four stroke engines.
2. Study, dismantling and assembling of two stroke engines.
3. (a) Study of petrol engine fuel system (b) Study of diesel engine fuel system
4. (a) Study, dismantling and assembling of multi cylinder petrol/diesel engine.
   (b) Study, dismantling and assembling of front and rear axles.
5. (a) Study, dismantling and assembling of clutch
   (b) Study, dismantling and assembling of gear box.
   (c) Study, dismantling and assembling of differential.
6. (a) Study, dismantling and assembling of differential.
   (b) Study of braking system.
7. (a) Study of emission characteristics in diesel engine using isobutanol–diesel fuel blends.
   (b) Study of gasoline – ethanol blends in spark-ignition engines.
8. Study the design concepts of hybrid and electric vehicles.

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Demonstrate the knowledge on automobile system, engines, air compressor, refrigeration systems and boilers.	**PO1**
CO2	Identify and analyze various performance parameters of engines and compressors.	**PO2**
CO3	Develop systems to identify the performance parameters of engines and compressors and dismantle and assemble the various parts of transmission systems in automobiles.	**PO3**
CO4	Conduct investigation on performance of various engines, air compressors and provide valid conclusion about its efficiency, heat balance, engine friction, speed and retardations.	**PO4**
CO5	Follow ethical principle in conduction of experiments.	**PO8**
CO6	Perform individually and also in a team to complete the process.	**PO9**
CO7	Communicate in verbally or in written form, their understanding about the experiments.	**PO10**
CO8	Continue updating their knowledge on various testing methods evolve in future for the identification of performance of engines and compressors.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

20MAC231	ENVIRONMENTAL SCIENCE (Common To All Branches)	L	T	P	C
		2	-	-	-

PRE-REQUISITES: NIL

COURSE EDUCATIONAL OBJECTIVES:

1. To recognize nature of environmental studies and various renewable and nonrenewable resources.
2. To understand flow and bio-geo- chemical cycles and ecological pyramids.
3. To identify various causes of pollution and solid waste management and related preventive measures.
4. To evaluate and interpret the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
5. To understand the causes of population explosion, value education and welfare programmes.

UNIT - I: INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES (6)

Multidisciplinary nature of environmental studies: Definition, scope and importance. Need for public awareness.

Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and nonrenewable energy resources.

UNIT – II: CONCEPT OF ECOSYSTEM AND BIODIVERSITY (6)

Structure and function of an ecosystem: Producers, consumers and decomposers- Energy flow in the ecosystem- Ecological succession- Food chains, food webs and ecological pyramids- Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation: Introduction – Definition: genetic, species and ecosystem diversity-Biogeographical classification of India-Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels- India as a mega-diversity nation-Hot-sports of biodiversity-Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
-Endangered and endemic species of India -Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
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UNIT – III: ENVIRONMENTAL POLLUTION AND WASTE MANAGEMENT (6)

Environmental Pollution: Definition - Cause, effects and control measures of: - a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes-Role of an individual in prevention of pollution. Pollution case studies-Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV: SOCIAL ISSUES AND THE ENVIRONMENT (6)

From Unsustainable to Sustainable development: Urban problems related to energy Water conservation, rain water harvesting, watershed management-Resettlement and rehabilitation of people; its problems and concerns. -Environment Protection Act-Air (Prevention and Control of Pollution) Act-Water (Prevention and control of Pollution) Act-Wildlife Protection Act- Forest Conservation Act -Issues involved in enforcement of environmental legislation- Public awareness**.**

UNIT – V: HUMAN POPULATION AND THE ENVIRONMENT (6)

Population growth: variation among nations-Population explosion – Family Welfare Programme-Environment and human health-Human Rights-Value Education-HIV/AIDS. Women and Child Welfare-Role of Information Technology in Environment and human Case Studies.

Total hours: 30

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs mapped with COs**
CO1	Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.	**PO1, PO2, PO3 PO4, PO5, PO6,PO7**
CO2	Understand flow and bio-geo- chemical cycles and ecological pyramids.	**PO1, PO2, PO3 PO4, PO5, PO6,PO7**
CO3	Understand various causes of pollution and solid waste management and related preventive measures.	**PO1, PO2, PO3 PO4, PO5, PO6,PO7**
CO4	Understand concept of rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.	**PO1, PO2, PO3 PO4, PO5, PO6,PO7**
CO5	Causes of population explosion, value education and welfare programmes.	**PO1, PO2, PO3 PO4, PO5, PO6,PO7**

TEXT BOOKS:

1. R. Rajagopalan," Environmental Studies", Oxford University Press.
2. Gilbert M. Masters and Wendell P. Ela.,"Environmental Engineering and science" PHI Learning Pvt. Ltd, 2008

REFERENCE BOOKS:

1. ErachBharucha "Textbook of Environmental Studies for Undergraduate Courses", University grants commission, 2/e,2013.
2. C.P.Kaushik and Anubhakaushik "Text book of environmental studies", New age International publishers, 4/e,2006.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/127/105/127105018/
2. https://nptel.ac.in/courses/113/104/113104061/
3. https://nptel.ac.in/courses/120/108/120108005/
4. https://nptel.ac.in/courses/120/108/120108002/

CO\PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO.1	3	2	1	2	2	2	3	-	-	-	-	-
CO.2	3	2	1	2	2	2	3	-	-	-	-	-
CO.3	3	2	1	2	2	2	3	-	-	-	-	-
CO.4	3	2	1	2	2	2	3	-	-	-	-	-
CO.5	3	2	1	2	2	2	3	-	-	-	-	-
CO*	**3**	**2**	**1**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**

III B.Tech. - V Semester

20MEC351	DESIGN OF MACHINE ELEMENTS	L	T	P	C
		2	1	-	3

PRE-REQUISITES: Engineering Mechanics and Kinematics of Machinery

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the design concepts and stress developed in machine members.
2. To design the machine elements subjected to static and variable loads.
3. To analyze the bolted and welded joints for various kinds of loads.
4. To design and analyze the temporary joints like cotter, knuckle and screwed joints.
5. To design the shafts and couplings for various applications.

UNIT –1: DESIGN CONCEPTS AND STRESSES IN MACHINE ELEMENTS (9)

Design Concepts: Traditional design methods – Design synthesis and standards – Classifications, general considerations, and basic requirements of machine design – Safety, ecological, societal, aesthetic and ergonomic considerations in design – Selection of engineering materials – Manufacturing considerations in the design. **Stresses in Machine Elements:** Applications of fracture mechanics – Simple stresses – Direct, bending and torsional stress equations – Impact, shock eccentric loading – Calculation of principle stresses for various load combinations – Curved beams – Crane hook and 'C' frame – Factor of safety – Theories of failure – Design for stiffness, strength and rigidity.

UNIT –2: DESIGN FOR VARIABLE LOADS (9)

Cyclic stresses – Fatigue and endurance limit – Effect of loading, surface finish and size on endurance limit – Fatigue loading – Stress concentration factor – Stress concentration due to holes and notches – Fatigue failure – Fatigue stress concentration factor – Notch sensitivity – Gerber method, Goodman method and Soderberg method – Combinedvariable normal stress and variable shear stress.

UNIT –3: DESIGN OF PERMANENT JOINTS (9)

Riveted Joints: Types, Methods and material of riveting – Caulking and fullering – Failures – Strength and efficiency – Design of boiler through riveted joints – Design of boiler joints and pressure vessels – Uniform strength and eccentric loading. **Welded Joints:** Types – Weld symbols – Strength of transverse and parallel fillet welded joints – Special cases of fillet joint – Strength of butt joints – Stresses and stress concentration factor – Axially loaded unsymmetrical welded sections – Eccentrically load.

UNIT –4: DESIGN OF TEMPORARY JOINTS (9)

Screwed Joints: Types – Designation of screw threads – Stresses in screwed fastening – Design of cylinder covers – Bolts of uniform strength – Design of a nut – Bolted joints under eccentric loading. **Cotter and Knuckle Joints:** Design of socket and spigot cotter joint, and sleeve and cotter, – Gib and cotter joint for Square rod, connecting rod, piston and crosshead – Cotter foundation bolt – Design of knuckle joint – Methods of failure of knuckle joint – Design of turnbuckle.

UNIT –5: DESIGN OF SHAFTS, KEYS AND COUPLING (9)

Design of Shafts: Types and standard sizes of the shafts – Stresses in shafts – Design of shafts subjected to twisting, bending and combined moment – Shafts subjected to fluctuating, axial and combination loads – Design of shafts on the basis of rigidity. **Design of Keys and Coupling:** Types of keys – Forces and strength of sunk key – Effect of keyways – Types of shaft couplings – Design of rigid and flexible couplings.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Understand the design concepts and analyze the stress development in machine elements.	**PO1,PO2, PO3**
CO2	Design the machine members subjected to static and variable loads.	**PO1,PO2,PO3**
CO3	Analyze the bolted and welded joints for various kinds of loads.	**PO1,PO2, PO3, PO4**
CO4	Design and analyze the temporary joints like cotter, knuckle and screwed joints.	**PO1,PO2, PO3, PO4**
CO5	Design and analyze the shafts and couplings for various applications.	**PO1,PO2, PO3, PO4**

TEXT BOOKS:

1. V.B. Bhandari, "Design of Machine Elements", Tata McGraw-Hill Education Pvt. Ltd., Noida, 4/e, 2016.
2. Richard G. Budynas and Keith J. Nisbett, "Shigley's Mechanical Engineering Design", Tata McGraw-Hill Education Pvt. Ltd., Noida, 10/e, 2015.

REFERENCE BOOKS:

1. Robert L. Norton, "Machine Design", Pearson Education Ltd., India, 5/e, 2018.
2. R S Khurmi and J. K. Gupta, "A Text Book of Machine Design", S.Chand & Company Pvt. Ltd., New Delhi, 34/e, 2018.
3. N. C. Pandya and C. S. Shah, "Machine Design", Charotar Publishing House Pvt. Ltd, 20/e, 2015.
4. Robert L Mott, "Machine Elements in Mechanical Design", Pearson Education Ltd., India, 4/e, 2020.
5. Ansel C. Ugural, "Mechanical Design of Machine Components", Taylor & Francis Group, LLC, 2/e, 2015.
6. Robert C. Juvinall and Kurt M. Marshek, "Machine Component Design", Wiley India Edition, 1/e, 2016.

DATA BOOK: Design data book is permitted in the examinations.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/105/112105124/
2. https://nptel.ac.in/courses/112/105/112105125/
3. https://nptel.ac.in/courses/112/106/112106137/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	-	-	-	-	-	-	-	-	-
CO.2	3	2	1	-	-	-	-	-	-	-	-	-
CO.3	3	2	1	1	-	-	-	-	-	-	-	-
CO.4	3	2	1	1	-	-	-	-	-	-	-	-
CO.5	3	2	1	1	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

III B.Tech. - V Semester

20MEC352	DYNAMICS OF MACHINERY	L	T	P	C
		2	1	-	3

PRE-REQUISITES: Engineering Mechanics and Kinematics of Machinery

COURSE EDUCATIONAL OBJECTIVES:

1. To study of friction in various machine elements and examine the dynamic concepts of the clutches, Brakes and dynamometer
2. To understand the concepts of inertia forces and turning moment diagrams of IC engines.
3. To understand the force analysis and effects of balancing in rotors and engines.
4. To understand the effect of dynamics of undesirable vibrations.
5. To gain the basic knowledge on gyroscopic effect on vehicles and the mechanisms of various governors.

UNIT –1: FRICTION, CLUTCHES, BRAKES AND DYNAMOMETER (9)

Friction: Laws of friction – Friction of screw, nuts, screw jack – Friction of journal bearing – Friction of journal pivot and collar bearing – Film friction. **Clutches:** Friction clutches – Single disc or plate clutch, multiple disc clutch, cone clutch and centrifugal clutch. **Brakes:** Materials for brake lining – Single, double and pivoted block – Simple and differential band brake – Internal expanding brake – Braking of a vehicle. **Dynamometers:** Prony brake and rope brake absorption dynamometers.

UNIT –2: INERTIA FORCES AND TURNING MOMENT DIAGRAMS (9)

Inertia Forces: D-Alembert's principle – Velocity, acceleration and forces of the reciprocating parts in engines – Velocity and acceleration of the piston and connecting rod – Equivalent dynamical system. **Turning Moment Diagrams:** Turning moment diagrams for steam engine, I.C. Engine and multi cylinder engine – Fluctuation of Energy – Crank effort – Coefficient of fluctuation of energy – Fly wheels – Coefficient of fluctuation of speed – Energy stored in fly wheel – Fly wheel design – Flywheel in punching press.

UNIT –3: BALANCING OF ROTATING AND RECIPROCATING MASSES (9)

Rotating Masses: Balancing of single and two masses in same and different planes – Balancing of different masses in same and different planes. **Reciprocating Masses:** Primary, secondary and higher balancing of reciprocating masses – Unbalanced forces and couples – Balancing of coupled locomotives – Variation of tractive force, hammer blow and swaying couple – Analytical and graphical methods.

UNIT –4: MECHANICAL VIBRATIONS (9)

Free Vibration: Vibratory systems – Degrees of freedom – Single degree of freedom – Free vibration – Equations of motion – Natural frequency – Types of damping – Damped vibration– Torsional vibration of shaft – Critical speeds of shafts – Torsional vibration – Two and three rotor torsional systems. **Forced Vibration:** Response of one degreefreedom systems to periodic forcing – Harmonic disturbances – Disturbance caused by unbalance – Support motion –transmissibility – Vibration isolation vibration measurement.

UNIT –5: GYROSCOPIC EFFECTS AND GOVERNORS (9)

Gyroscopes: Angular motion – Gyroscopic couple – Effect of gyroscopic couple an aero planes – Effect of gyroscopic couple on a naval ship – Stability of moving four wheel and two wheel drive. **Governors:** Types - Watt, Porter and Proell governors – Hartnell, Hartung, Wilson-Hartnell and Pickering governors with auxiliary springs – Sensitiveness, stability, isochronous and hunting of governors – Effort and power of governor – Controlling force – Coefficient of insensitiveness.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Analyse the effects of friction in various mechanical elements and also analyse the effects of friction in clutches, brakes and dynamometers.	**PO1, PO2**
CO2	Analyze the force-motion relationship in components subjected to external forces and analyze of standard mechanisms.	**PO1, PO2**
CO3	Analyze the undesirable effects of unbalances resulting from prescribed motions in mechanism.	**PO1, PO2, PO4**
CO4	Compute the frequency of free and forced vibration and damping coefficient.	**PO1, PO2, PO4**
CO5	Understand the gyroscopic effects on various moving elements and also analyze the different types of governors.	**PO1, PO2, PO4**

TEXT BOOKS:

1. S.S.Rattan, "Theory of Machines and Mechanisms', Tata McGraw-Hill Education Pvt.Ltd, Noida, 5/e, 2019.
2. Robert L Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill Education Pvt.Ltd, 1/e, 2009.

REFERENCE BOOKS:

2. John J. Uicker Jr, Gordon R. Pennock & Joseph E. Shigley, "Theory of Machines and Mechanisms", SI Edition, Oxford University Press, 3/e, 2009.
3. Thomas Bevan, "Theory of Machines", Pearson Education, New Delhi, 3/e, 2009.
4. Sadhu Singh, "Theory of Machines", Pearson Education, New Delhi, 3/e, 2011.
5. R.S Khurmi and J.K Gupta, "Theory of Machines", S.Chand & Company Pvt. Ltd, New Delhi, 14/e, 2013.
6. Amitabha Ghosh and Asok Kumar Mallik, "Theory of Mechanisms and Machines", East-West Press Pvt Ltd, 3/e, 2008.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/101/112101096/
2. https://nptel.ac.in/courses/112/104/112104114/
3. https://nptel.ac.in/courses/112/105/112105304/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	1	-	-	-	-	-	-	-	-
CO.2	3	2	-	1	-	-	-	-	-	-	-	-
CO.3	3	2	-	1	-	-	-	-	-	-	-	-
CO.4	3	2	-	1	-	-	-	-	-	-	-	-
CO.5	3	2	-	1	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

III B.Tech. - V Semester

20MEC353	METROLOGY AND MEASUREMENTS	L	T	P	C
		3	-	-	3

PRE-REQUISITES: Machine Tools Technology

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the basic need for metrology and standards of measurements
2. To study the principle and applications of various linear, angular and measuring instruments.
3. To apply the principles and methods of form measurements and surface metrology.
4. To discuss various measuring techniques of mechanical properties in industrial applications.
5. To develop the advanced measurements for quality control in manufacturing industries.

UNIT –1: NEED FOR METROLOGY AND STANDARDS OF MEASUREMENTS (9)

Introduction: Need for inspection and quality control – Factors affecting themeasurements – Methods of measurements – Characteristics of measuring instruments – Errors in measurements – Precision, accuracy, calibration and uncertainty. **Standards:** Line, end and wave length standards – BIS codes – Preferred numbers – Limits, fits and tolerances – Unilateral and bilateral system – Hole and shaft basis systems – Interchangeability and selective assembly – Fundamentals of GD & T – Indian Standard Institution (ISI) system – International Standard (IS) system. **Gauges:** Plug, ring, snap, taper and position gauges – Taylors's principle – Design of Go and No Go gauges.

UNIT –2: LINEAR, ANGULAR MEASUREMENTS AND COMPARATORS (9)

Linear Measuring Instruments: Graduated scales – Scaled instruments – Verniercaliper – Vernier height gauge – Micrometer – Types of micrometers – Slip gauges – Dial indicators. **Angular measurements:** Bevel protector, sine bar, sine centre, angle dekkor, clinometer, angle gauges, autocollimator and alignment telescope. **Comparator:** Mechanical, pneumatic, optical and electrical comparators and applications.

UNIT –3: FORM MEASUREMENTS AND SURFACE FINISH MEASUREMENT (9)

Form Measurements: Principles and methods of straightness – Flatness measurements – Measurements of roundness – Measurement of screw thread elements – Measurement of gear elements. **Surface Finish Measurement:** Surface texture – Surface roughness – Codes – Analysis of surface traces – Methods for measuring surface roughness – Introduction to 3D surface metrology.

UNIT –4: MEASUREMENT OF DISPLACEMENT, FORCE, TORQUE & TEMPERATURE (9)

Displacement, Speed, Force, Torque, and Strain: LVDT – Piezo electric, inductive, capacitance, resistance, ionization and photo electric transducers – Tachometers – Stroboscope – Measurement of force by direct methods, load cells and proving rings – Measurement of torque by torsion-bar, servo-controlled and absorption dynamometer – Measurement of strain by mechanical and electrical strain gauges. **Temperature and Pressure:** Measurement of temperature by bimetallic strip, thermocouples, pyrometry, thermistors and electrical resistance thermometer – Measurement of pressure by dead weight gauges and manometers, elastic and resonant transducers, vibrating cylinder, high and low pressure measurement – Measurement of vacuum by McLeod and Pirani gauge.

UNIT –5: ADVANCES IN METROLOGY (9)

Laser in Metrology: Michelson, single frequency, NPL and DC interferometer – Laser interferometer – Optical flats – Toolmaker's microscope – Profile projector – Ball bar tests. CMM: Constructional features, types, probes, accessories, software and applications. **Machine Vision:** Basic concepts – Elements – Applications – On-line and in-process monitoring – Computed tomography – White light Scanners.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Understand the importance of measurements in engineering and the factors affecting measurements and to estimate measurement uncertainty and its knowledge using lifelong.	**PO1, PO2, PO5, PO12**
CO2	Apply the working principle and applications of various linear and angular measuring instruments and basic concepts of comparators uncertainty and its knowledge using lifelong.	**PO1, PO2, PO5**
CO3	Apply the principles and methods of form measurements and surface metrology	**PO1, PO2, PO5**
CO4	Understand various measuring techniques of mechanical parameters in industrial applications.	**PO1, PO2, PO5**
CO5	Apply the advances in measurements for quality control in manufacturing industries.	**PO1, PO2, PO5**

TEXT BOOKS:

1. R.K. Jain, "Engineering Metrology", Khanna Publishers, New Delhi, 21/e, 2020.
2. N.V. Raghavendra and L.Krishnamurthy, "Engineering Metrology and Measurements", Oxford University Press, 1/e, 2013.

REFERENCE BOOKS:

1. Connie L. Dotson, "Fundamentals of Dimensional Metrology", Cengage Learning, India, 6/e, 2016.
2. Anand K Bewoor and Vinay A. Kulkarni, "Metrology & Measurement", Tata McGraw-Hill Education Pvt. Ltd., Noida, 1/e, 2009.
3. Mark Curtis and Francis T. Farago, "Handbook of Dimensional Measurement", Industrial Press, 5/e, 2013.
4. S. P. Venkateshan, "Mechanical Measurements", John Wiley&Sons, 2/e, 2015.
5. Thomas G. Beckwith, Roy D. Marangoni and John H. Lienhard V, "Mechanical Measurements", Pearson Educations, New Delhi, 6/e, 2009.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/106/112106139/
2. https://nptel.ac.in/courses/112/104/112104250/
3. https://nptel.ac.in/courses/112/106/112106179/
4. https://nptel.ac.in/courses/112/106/112106138/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	1	-	-	-	-	-	-	2
CO.2	3	2	-	-	1	-	-	-	-	-	-	-
CO.3	3	2	-	-	1	-	-	-	-	-	-	-
CO.4	3	2	-	-	1	-	-	-	-	-	-	-
CO.5	3	2	-	-	1	-	-	-	-	-	-	-
CO*	**3**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

III B.Tech. - V Semester

20MEC355	**3D PRINTING DESIGN AND PRACTICES**	**L**	**T**	**P**	**C**
		-	**1**	**2**	**2**

PRE-REQUISITES: Material Science, Manufacturing Engineering, Computer Aided Design

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the need for additive manufacturing technology.
2. To learn the additive manufacturing, CAD modeling and printingprocess.
3. To study the liquid and solid based additivemanufacturing processes
4. To explain the powder based additive manufacturing process
5. To demonstrate the post processing techniques and applications of AM process

UNIT –1: OVERVIEW OF ADDITIVE MANUFACTURING (AM) (6)

Additive V/s Conventional Manufacturing / CNC – Rapid prototyping – Rapid Tooling – Rapid manufacturing – Generic AM process – Development of AM technology – Use of layers – Classification of AM process – Basic steps for AM process – Differentiation between photopolymer, powder based, molten material, solid sheets and metal system.

UNIT –2: CAD MODELING AND DESIGN FOR ADDITIVE MANUFACTURING (6)

CAD Modeling: Preparation of CAD models – Data processing – STL format. **DFAM:** Part orientation and structure generation – Removal supports – Hollowing out parts – Undercuts – Inter locking features – Reduction of part and identification – Model slicing – Tool path generation. **Printing Processes:** Droplet formation technologies – Continuous mode – Drop on demand mode – Bio-plotter.

UNIT –3: LIQUID AND SOLID BASED ADDITIVE MANUFACTURING PROCESS (6)

Principle, materials, properties, process and applications of Stereo lithography (SLA), Poly Jet, Fused Deposition Modeling (FDM), Laminated Object Manufacturing (LOM) and Ultrasonic Consolidation.

UNIT –4: POWDER BASED ADDITIVE MANUFACTURING PROCESS (6)

Principle, materials, properties, process and applications of Selective Laser Sintering (SLS), Selective Laser Melting (SLM), Electron Beam Melting (EBM), Laser Engineered Net Shaping (LENS) and Binder Jetting.

UNIT –5: POST PROCESSING TECHNIQUES AND APPLICATIONS (6)

Product Quality: Support material removal – Surface texture improvements – Accuracy improvements – Aesthetic improvements – Preparation for use of pattern – Property enhancement using thermal and non-thermal techniques – Inspection and testing –Defects and their causes. **Applications:** Additive Manufacturing application of aerospace, electronics, healthcare, defense, automotive, construction, food processing, machine tool Business opportunities and future directions of AM.

Total Hours: 30

List of Experiments

1. Study on 3D printing system:
    - List the differences between RP, 3DP and conventional machining.
    - List the main components of 3DP and how the components are selected.
    - Describe the 3D printing process.
2. Study file format used for 3D printing:
    - SLA & SLS process.
    - Shortcomings of the STL file format
    - How more than one STL file merge together?
    - Exercise on any component for STL files preparation, slicing, support structure generation & build setup preparation.
3. Study on Mechanical behavior of 3D printed metals:
    - Characterization of 3D printed materials.
    - List of parameters consider for material selection of 3DP.
    - List five types of material that can be directly printed.
4. Design and prototype a product:
    - Use a standard CAD system to design any mechanical component (single component)
    - Convert the drawing file into an STL file using conversion rules.
    - Use an available 3D printing system to prototype the part.
    - Use post processing techniques to complete the prototyping cycle.
5. Design and fabrication of a component using extrusion based additive manufacturing.
    - Design any mechanical component (two/three component)
    - Convert the drawing file into an STL file using conversion rules.
    - Use an available 3D printing system to prototype the part.
    - Use post processing techniques to complete the prototyping cycle.
    - Assemble the parts based on the applications required.
6. Design and prototype a product under freeform modeling:
    - Differentiate curves based modeling and polygon-based modeling.
    - Design any medical component (single component)
    - Convert the drawing file into an STL file using conversion rules.
    - Use an available 3D printing system to prototype the part.
    - Use post processing techniques to complete the prototyping cycle.

7. Design and prototype a medical product:
    - Design any mechanical component
    - Convert the drawing file into an STL file using conversion rules.
    - Use an available 3D printing system to prototype the part.
    - Use post processing techniques to complete the prototyping cycle.
    - Assemble the parts based on the applications required.
8. Role of 3DP in biomedical applications:
    - How does Computerized Tomography actually generate 3D images?
    - What are the benefits of using color in production of medical models?
    - Give several examples where color can be beneficial?
    - Why might extrusion-based technology be particularly useful for bone tissue engineering?
    - What AM materials are already approved for medical applications and for what types of application are they suitable?
9. Role of 3DP in automobile applications:
    - How can the use of AM assist in the development of a new, mass-produced automobile?
    - Why would AM be particularly useful for military applications?
10. Study on various defects in 3D printing materials.

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**Pos**
CO1	Understand the need and development of additive manufacturing technology	**PO1, PO2**
CO2	Explain the design for additive manufacturing, CAD modeling, printing process	**PO1, PO2, PO3**
CO3	Illustrate the process of liquid and solid based additive manufacturing processes	**PO1, PO2, PO3**
CO4	Explain the powder based additive manufacturing process and material jetting	**PO1, PO2, PO3**
CO5	Summarize the post processing techniques and applications of AM process	**PO1, PO2, PO3**

TEXT BOOKS:

1. Ian Gibson, David W.Rosen and Brent Stucker, "Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping and Direct Digital Manufacturing", Springer, 2/e, 2015.
2. Chee Kai Chua, Kah Fai Leong and Chu Sing Lim, "Rapid Prototyping: Principles and Applications", World Scientific Publishers, 3/e, 2010.

REFERENCE BOOKS:

1. T.S. Srivatsan and T.S. Sudarshan, "Additive manufacturing: Innovations, Advances and Applications", Taylor & Francis Group, LLC.
2. Bandar AlMangour, "Additive Manufacturing of Emerging Materials", Springer, 2018.
3. L. Jyothish Kumar, Pulak M. Pandey and David Ian Wimpenny, "3D Printing and Additive Manufacturing Technologies", Springer Nature Singapore Pvt Ltd, 2019.
4. Rafiq Noorani, "3D Printing: Technology, Applications and Selection", CRC Press, Taylor & Francis Group, 2018.
5. Adedeji B. Badiru, Vhance V. Valencia, and David Liu, "Additive Manufacturing Handbook: Product Development for the Defense Industry", CRC Press, Taylor & Francis Group, 2017.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/103/112103306/
2. https://nptel.ac.in/courses/112/104/112104162/
3. https://nptel.ac.in/courses/112/107/112107078/
4. https://nptel.ac.in/courses/112/107/112107077/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	-
CO.2	3	2	1	-	-	-	-	-	-	-	-	-
CO.3	3	2	1	-	-	-	-	-	-	-	-	-
CO.4	3	2	1	-	-	-	-	-	-	-	-	-
CO.5	3	2	1	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

III B.Tech. - V Semester

20MEC356	KINEMATICS AND DYNAMICS LABORATORY	L	T	P	C
		-	-	3	1.5

PRE-REQUISITES: A Course on Kinematics of Machinery and Dynamics of Machinery.

COURSE EDUCATIONAL OBJECTIVES:

1. To impart practical knowledge about the elements and techniques involved in mechatronics systems
2. To understand the concept of automation by hydraulic and pneumatic actuators.
3. To study the parameter of gears, Mechanism, Joints and gear trains
4. To study of gyroscopic effect and determination of range sensitivity, effort of Governors
5. To determination of natural frequency of single degree and two degree of freedom.

LIST OF EXPERIMENTS:

1. Study of gear parameters.
2. Experimental study of velocity ratios of simple, compound, epicyclic and differential gear trains
3. Experimental study of kinematics of four bar, slider crank, crank rocker, double crank, double rocker, oscillating cylinder mechanisms.
4. Experimental study kinematics of single and double universal joints.
5. Determination of mass moment of inertia of axisymmetric bodies using turn table apparatus.
6. Motorized gyroscope – Study of gyroscopic effect and couple.
7. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
8. Cams – Cam profile drawing, motion curves and study of jump phenomenon.
9. Single degree of freedom spring mass system – determination of natural frequency and verification of laws of springs – damping coefficient determination.
10. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
11. a) Transverse vibration of Free-Free beam – with and without concentrated masses. b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies. c) Determination of transmissibility ratio using vibrating table.
12. Study of Balancing of rotating masses. (b) Balancing of reciprocating masses.

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Understand the principles of kinematics and dynamics involved in various mechanisms.	**PO1**
CO2	Apply the measurement of various kinematic parameters.	**PO2**
CO3	Describe the parameter of gears, Mechanism, Joints and gear trains.	**PO3**
CO4	Determine the range sensitivity, effort of Governors and gyroscopic effect.	**PO4**
CO5	Determine natural frequency of single degree and two degree of freedom.	**PO5**
CO6	Follow the ethical principles while doing the experiments.	**PO8**
CO7	Do the experiments effectively as an individual and as a team member in a group.	**PO9**
CO8	Communicate verbally and in written form pertaining to results of the experiments.	**PO10**
CO9	Continue updating their skill related to theory of machines in future.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

III B.Tech. - V Semester

20MEC357	METROLOGY AND MEASUREMENTS LABORATORY	L	T	P	C
		-	-	3	1.5

PRE-REQUISITES: Machine Tools Technology and Metrology and Measurements

COURSE EDUCATIONAL OBJECTIVES:

1. To demonstrate the theoretical concepts taught in mechanical measurements and metrology.
2. To understand and use various measuring instruments.

LIST OF EXPERIMENTS:

1. Calibration of following measuring instruments using slip gauges a) Vernier caliper b) Micrometer.
2. Comparison and measurements of linear dimensions using following measuring instruments a) Digital vernier caliper b) Micrometer.
3. Measurements of thread diameters using screw thread micrometer.
4. Measurements of inside diameter using inside micrometer.
5. Comparison and measurements of height and depth by using following measuring instruments a) Vernier height gauge b) Vernier depth gauge.
6. Measurement of gear parameters using gear tooth vernier.
7. Taper angle measurement using sine bar and slip gauge.
8. Measurement of angle using vernier bevel protractor.
9. Measurement of dimension of given specimen using tool maker's microscope.
10. Measurement of thread parameter using profile projector.
11. Quality checking & comparison of the dimensions of standard component using comparator.
12. Measurement of alignment using autocollimator.
13. Checking the flatness of surface plate using sprit level.
14. Measurement of bore diameter using dial bore gauge.
15. Calibration of following measuring instruments a) Temperature measurement b) Pressure measurement

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Develop the knowledge on measuring instruments such as vernier caliper, micrometer, sine bar, bevel protractor, autocollimator, etc.,	**PO1**
CO2	Analyze the instrumental error and calibration of the instruments.	**PO2**
CO3	Calibrate simple linear measuring instruments like Vernier caliper, micrometer, Vernier height gauge, etc. using gauge blocks.	**PO3**
CO4	Create complex analysis knowledge on measurements and alignment test on machines such as lathe, drilling, milling machines.	**PO4**
CO5	Use of Modern tools to measure the complex shape of the specimen such as gear tooth.	**PO5**
CO6	Follow ethical principle during usage of instruments.	**PO8**
CO7	Evaluate the value of measurements and compare with group members.	**PO9**
CO8	Communicate verbally and in written form of the understanding about the experiments.	**PO10**
CO9	Continue updating their measurement knowledge for various components and continue learning of new technology in metrology.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

III B.Tech. - V Semester

		L	T	P	C
20MEC358	**INDUSTRY INTERNSHIP / COMMUNITY SERVICE PROJECT EVALUATION**	**-**	**-**	**-**	**1.5**

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To give an opportunity to the student to get hands on training industry.
2. The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

SCHEME OF INDUSTRY INTERNSHIP:

1. At the end of the Industrial Internship / Community service project, the candidate shall submit a certificate from the organization where he/she has undergone training and also a brief report.
2. An Industrial Internship / Community service project report to be submitted by the individual and along with the certificate provided by the organization, which will be reviewed and evaluated by a committee constituted by the Head of the Department.
3. The evaluation for 100 marks will be carried out internally based on this internship / Community service project report and a Viva-Voce Examination will be conducted by a Departmental Committee constituted by the Head of the Department/Institution.

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Demonstrate in-depth knowledge on the industry environment	**PO1**
CO2	Identify, analyze and formulate complex problem chosen for internship study to attain substantiated conclusions.	**PO2**
CO3	Design solutions to the chosen internship domain.	**PO3**
CO4	Undertake investigation of internship study problem to provide valid conclusions	**PO4**
CO5	Use the appropriate techniques, resources and modern engineering tools necessary for internship work.	**PO5**
CO6	Apply internship study results for sustainable development of the society.	**PO6**
CO7	Understand the impact of internship study in the context of environmental sustainability.	**PO7**
CO8	Understand professional and ethical responsibilities while executing the internship study.	**PO8**
CO9	Function effectively as individual and a member in the internship.	**PO9**
CO10	Develop communication skills, both oral and written for preparing and presenting during internship.	**PO10**
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the internship.	**PO11**
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the internship study.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	3	-	-	-	-	-	-
CO7	-	-	-	-	-	-	3	-	-	-	-	-
CO8	-	-	-	-	-	-	-	3	-	-	-	-
CO9	-	-	-	-	-	-	-	-	3	-	-	-
CO10	-	-	-	-	-	-	-	-	-	3	-	-
CO11	-	-	-	-	-	-	-	-	-	-	3	-
CO12	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

III B.Tech. - V Semester

20MEC354A	REFRIGERATION SYSTEM AND GAS DYNAMICS	L	T	P	C
		3	-	-	3

PRE-REQUISITES: Engineering Thermodynamics and Thermal Engineering

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the Basic concepts of compressible flows and Isentropic flows
2. To know the variation of flow properties in constant area ducts - Rayleigh flow and Fanno flow
3. To derive the conditions for change in pressure, density and temperature for flows through normal and oblique shock waves
4. To understand the Basic concepts of compressible flows and Isentropic flows
5. To study the characteristics of rocket propulsion systems and space flights

UNIT –1: AIR AND VAPOUR REFRIGERATION SYSTEMS (9)

Unit of refrigeration and C.O.P – Refrigeration methods. **Air Refrigeration:** Open and dense air systems – Reversed Carnot and Bell-Coleman cycle – Refrigeration needs of air craft's and its types (basics only). **Vapour Compression Refrigeration:** Working principle and essential components of the plant – COP – Representation of cycle on T-Sand P-h charts – Effect of sub cooling and super heating – **Vapour Absorption Refrigeration:** Working of aqua-ammonia (NH3) – LiBr2-water (two shells and four shells) systems – Principle and operation of electrolux refrigerator (three fluid systems).

UNIT –2: REFRIGERANTS, SYSTEM COMPONENTS AND SPECIAL REFRIGERATION SYSTEMS (9)

Refrigerants: Desirable properties, classification, nomenclature and secondary refrigerants – Ozone depletion – Global warming. **System Components:** Classificationand working of compressors, condensers, evaporators and expansion valves. **Special Refrigeration Systems:** Working principle and basic components of steam jet refrigeration system and vortex tube (Hilsch tube).

UNIT –3: AIR CONDITIONING SYSTEMS (9)

Psychrometric properties and processes – Psychrometric chart – Problems on psychrometry – By-pass factor (BPF), efficiency of heating and cooling coils (contact factor-CF), sensible heat factor (SHF), RSHF, GSHF and ERSHF. Air Conditioning Equipment's (basics only): Humidifiers, dehumidifiers, air filters, ducts, fans and blowers. Requirements of human comfort and concept of effective temperature – Comfort chart – Comfort air conditioning – Working principle of centralized air conditioning systems,Summer-Winter-Year-round air-conditioning systems. **Cooling Load Calculations:** Types of loads and heat load concepts (basics only).

UNIT –4: COMPRESSIBLE FLUID FLOW (9)

Basic equations – Propagation of disturbances in fluid and velocity of sound – Mach number – Propagation of disturbance in compressible fluid – Stagnation properties – Area- velocity relationship and effect – Flow of compressible fluid through a convergent nozzle – Variables of flow in terms of Mach number – Flow through Laval nozzle – Shock waves.

UNIT –5: JET AND ROCKET PROPULSION (9)

Jet Propulsion: Theory of jet propulsion – Thrust equation – Performance parameters – Operation, cycle analysis and performance of ram jet, turbojet, turbofan, turbo prop and pulse jet engines. **Rocket Propulsion:** Types of rocket engines and propellants – Characteristic velocity – Thrust equation – Ignition and combustion – Theory of rocket propulsion – Staging – Terminal and characteristic velocity – Liquid fuel feeding systems – Solid propellant geometries – Orbital and escape velocity – Applications – Space flights.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Acquire knowledge to understand the principles and applications of refrigeration systems.	**PO1, PO2, PO4**
CO2	Know the working of vapour compression and vapour absorption refrigeration system and identify methods for performance improvement	**PO1, PO2, PO4**
CO3	Understand the air conditioning systems and cooling load estimation and also to engage in independent and life-long Learning	**PO1,PO2, PO4**
CO4	Understand the basic concepts of compressible flows and Isentropic flows	**PO1, PO2, PO4**
CO5	Understand the types, functions of jet propulsion also study the characteristics of rocket propulsion systems and space Flights	**PO1, PO2, PO4**

TEXT BOOKS:

1. C P Arora, "Refrigeration and Air Conditioning", Tata McGraw-Hill Education Pvt. Ltd., Noida, 3/e, 2008.
2. Yahya, S.M., "Fundamentals of Compressible Flow with Aircraft and Rocket propulsion", New Age International (P) Ltd, 4/e, 2012.

REFERENCE BOOKS:

1. Anderson, J.D., "Modern Compressible Flow", McGraw Hill, 3/e, 2012.
2. Roy J Dossat, "Principles of Refrigeration", Pearson Education, New Delhi, 4/e, 2007.
3. Ananthanarayanan, "Basic Refrigeration and Air-Conditioning", Tata McGraw-Hill Education Pvt. Ltd., Noida, 4/e, 2013.
4. Jack Mattingly, "Elements of Gas Turbine Propulsion", McGraw Hill, 2017.
5. Irwin E. Treager, "Aircraft Gas Turbine Engine Technology", McGraw Hill, 3/e, 2013.
6. Zucker, R.D and Biblarz, O, "Fundamentals of Gas Dynamics", John Wiley & Sons, Inc, 2/e, 2011.

CODES/TABLES: Steam table, Psychrometric chart and Gas table is permitted in the examinations.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/106/112106166/
2. https://nptel.ac.in/courses/112/103/112103021/
3. https://nptel.ac.in/courses/112/106/112106196/
4. https://nptel.ac.in/courses/112/106/112106056/
5. https://nptel.ac.in/courses/112/107/112107208/
6. https://nptel.ac.in/courses/112/105/112105128/
7. https://nptel.ac.in/courses/112/105/112105129/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	1	-	-	-	-	-	-	-	-
CO.2	3	2	-	1	-	-	-	-	-	-	-	-
CO.3	3	2	-	1	-	-	-	-	-	-	-	-
CO.4	3	2	-	1	-	-	-	-	-	-	-	-
CO.5	3	2	-	1	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

III B.Tech. - V Semester

20MEC354B	APPLIED HYDRAULICS AND PNEUMATICS	L	T	P	C
		3	-	-	3

PRE-REQUISITES: Fluid Mechanics and Machinery

COURSE EDUCATIONAL OBJECTIVES:

1. To study the basic principles of fluid power system and hydraulic pumps
2. To know the hydraulic actuators and control components of a fluid power system
3. To understand the hydraulic circuits and systems for industrial purposes
4. To study the fluidics and pneumatic logic circuits of pneumatic and electro pneumatic systems.
5. To learn the trouble shooting and application of fluid power system

UNIT –1: FLUID POWER PRINICIPLES AND HYDRAULIC PUMPS (9)

Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids – Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow - Friction loss – Work, Power and Torque Problems. Sources of Hydraulic power: Pumping Theory – Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of Linear and Rotary – Fixed and Variable displacement pumps – Problems.

UNIT –2: HYDRAULIC ACTUATORS AND CONTROL COMPONENTS (9)

Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning – Hydraulic motors - Control Components: Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Servo and Proportional valves – Applications – Accessories: Reservoirs, Pressure Switches – Applications – Fluid Power ANSI Symbols – Problems.

UNIT –3: HYDRAULIC CIRCUITS AND SYSTEMS (9)

Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative – Pump unloading – Double- Pump – Pressure Intensifier – Air-over oil – Sequence – Reciprocation – Synchronization – Fail-Safe – Speed Control – Hydrostatic transmission – Electro hydraulic circuits – Mechanical hydraulic servo systems.

UNIT –4: PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS (9)

Properties of air – Perfect Gas Laws – Compressor – Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit – Cascade method – Electro Pneumatic System – Elements – Ladder diagram – Problems – Introduction to fluidics and pneumatic logic circuits.

UNIT –5: TROUBLE SHOOTING AND APPLICATIONS (9)

Installation – Selection – Maintenance – Trouble Shooting and Remedies in Hydraulic and Pneumatic systems – Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications – Design of pneumatic circuits for pick and place applications – Tool handling in CNC Machine tools – Low cost Automation – Hydraulic and Pneumatic power packs.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Explain the basic principles of fluid power system and hydraulic pumps	**PO1, PO2, PO3**
CO2	Summarize the hydraulic actuators and control components of a fluid power system	**PO1, PO2, PO3**
CO3	Explain the hydraulic actuators and control components of a fluid power system	**PO1, PO2, PO3, PO4**
CO4	Explain the hydraulic circuits and systems for industrial purposes	**PO1, PO2, PO3, PO4**
CO5	Summarize the various trouble shooting methods and applications of hydraulic and pneumatic systems.	**PO1, PO2, PO3**

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education, India, 7/e, 2013.
2. Jagadeesha T and Thammaiah Gowda, "Fluid Power: Generation, Transmission and Control", Wiley India, 2019.

REFERENCE BOOKS:

1. Andrea Vacca and Germano Franzoni, "Hydraulic Fluid Power: Fundamentals, Applications, and Circuit Design", Wiley, 2020.
2. M. Galal Rabie, "Fluid Power Engineering", McGraw-Hill Companies, Inc, 2009.
3. Shanmugasundaram.K, "Hydraulic and Pneumatic Controls", S.Chand & Co, 2006.
4. Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw-Hill, 1/e, 2001.
5. William S. Janna, "Design of Fluid Thermal Systems", Cengage Learning, 4/e, 2015.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/106/112106175/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	-	-	-	-	-	-	-	-	-
CO.2	3	2	1	-	-	-	-	-	-	-	-	-
CO.3	3	2	1	1	-	-	-	-	-	-	-	-
CO.4	3	2	1	1	-	-	-	-	-	-	-	-
CO.5	3	2	1	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**1**	1	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

III B.Tech. - V Semester

20MEC354C	FUEL CELL TECHNOLOGIES	L	T	P	C
		3	-	-	3

PRE-REQUISITES: Engineering Thermodynamics and Thermal Engineering

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the basics of electro chemicals and characteristics of fuel cell
2. To know the working of Alkaline Fuel Cells and Phosphoric Acid Fuel Cells
3. To understand the principles of solid oxide and molten carbonate fuel cells
4. To demonstrate the working of direct methanol & proton membrane fuel cells
5. To understand the fuel processing and hydrogen storage

UNIT –1: INTRODUCTION AND BASIS OF ELECTRO CHEMISTRY (9)

Fuel Cells: Relevance and importance – Historical highlights – Definition – Differentiation from other batteries – Fuel choice – Classification of fuel cells. **Electrochemistry Basis:** Thermodynamic aspects of electrochemical energy conversion – Theoretical efficiency for conversion of liberated heat in a chemical reaction into mechanical energy – Efficiency of electrochemical energy conversion – Factors affecting the efficiency of electrochemical energy conversion – Electrode kinetics of electrochemical energy conversion.

UNIT –2: ALKALINE AND PHOSPHORIC ACID FUEL CELLS (9)

Alkaline Fuel Cells: Description of the alkaline fuel cell – Working principle – Components of an alkaline fuel cell – Modules – Fuel cell stacks – General performance characteristics – attempts towards advancements – System issues – Ammonia as AFC fuel. **Phosphoric Acid Fuel Cells:** Science underlying the technology – Electrodes: Materials and manufacturing - stacks and systems.

UNIT –3: SOLID OXIDE AND MOLTEN CARBONATE FUEL CELLS (9)

Solid Oxide Fuel Cells: History of solid oxide fuel cells - Benefits and limitations – Cell components – Cathode materials – Anode materials – Interconnects – Fuel – Configurations and performance – Environmental impact of solid oxide fuel cells – Applications and future of SOFCs. **Molten Carbonate Fuel Cells:** General principle – Cell components – Mechanisms of electrode reactions – Status of MCFCs.

UNIT –4: DIRECT METHANOL & PROTON EXCHANGE MEMBRANE FUEL CELLS (9)

Direct Methanol Fuel Cells: Direct methanol fuel cell technology – The noble metal issue – The catalysis aspect – Electro-oxidation of methanol – Electrolyte – Non-catalytic aspects – State-of-the-art of methanol crossover in DMFC – Catalyst optimization and scale-up. **Proton Exchange Membrane Fuel Cells:** Fundamental scientific aspects and challenges – Technology development – Fuel processing – Modeling studies of PEMFC.

UNIT –5: FUEL PROCESSING AND HYDROGEN STORAGE (9)

Fuel Processing: Processing hydrogen from alcohols – Producing hydrogen from hydrocarbons – Hydrogen from other sources – Gas clean-up – Hydrogen storage – Challenges and opportunities. Hydrogen Storage: Hydrogen production – Relevant properties – Hydrogen as an Engine fuel – Methods of hydrogen storage – Reduction of hydrogen uptake in carbon materials – Critical analysis.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Illustrate the basics of electro chemicals and performance characteristics of fuel cell.	**PO1, PO2**
CO2	Understand the working of alkaline fuel cells and phosphoric acid fuel cells.	**PO1, PO2, PO3**
CO3	Demonstrate the working principles of solid oxide and molten carbonate fuel cells.	**PO1, PO2, PO3**
CO4	Summarize the working of direct methanol and proton exchange membrane fuel cells.	**PO1, PO2, PO3**
CO5	Recognize the fuel processing and hydrogen storage in fuel cells.	**PO1, PO2, PO3**

TEXT BOOKS:

1. James Larminie and Andrew Dicks, "Fuel Cell Systems Explained", John Wiley & Sons Ltd, 2/e, 2003.
2. B.Viswanathan and Aulice Scibioh, "Fuel Cells Principles and Applications", Universities Press, Hyderabad, 2006.

REFERENCE BOOKS:

1. Matthew M. Mench, "Fuel Cell Engines", John Wiley & Sons, Inc, 2003.
2. Gregor Hoogers, "Fuel Cell Technology Handbook (FCTH)", CRC Press LLC, 2003.
3. Dushyant Shekhawat, James J. Spivey and David A. Berry, "Fuel Cells: Technologies for Fuel Processing", Elsevier B.V., 2013.
4. Supramaniam Srinivasan, "Fuel Cells: From Fundamentals and Applications", Springer, 2006.
5. Noriko Hikosaka Behling, "Fuel Cells: Current Technology Challenges and Future Research Needs", Elsevier B.V., 2013.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/103/102/103102015/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	-
CO.2	3	2	1	-	-	-	-	-	-	-	-	-
CO.3	3	2	1	-	-	-	-	-	-	-	-	-
CO.4	3	2	1	-	-	-	-	-	-	-	-	-
CO.5	3	2	1	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

20OCIV351	AIR POLLUTION AND CONTROL (OPEN ELECTIVE – 1)	L T P C 3 - - 3

PRE-REQUISITES: A Course on Environmental Studies and Engineering

COURSE OUTCOMES:

4. To provide knowledge about the various sources of Air pollution and its effects on human beings , Vegetation and Materials.
5. To Analyse The various air pollutant dispersion models
6. To provide knowledge about control methods and details of control equipments
7. To demonstrate Various sources of Noise pollution and control measures
8. To Identify the major sources of noise pollution, effects and control measures

UNIT I: SOURCES AND EFFECTS OF AIR POLLUTANTS (9)

Air Pollution – Definitions, Scope- Significance and Episodes- Air Pollutants – Classifications – Natural and Artificial – Primary and Secondary- point and Nonpoint- Lineand Areal Sources of air pollution- stationary and mobile sources. Effects of Air pollutantson man-material and vegetation- Global effects of air pollution – GreenHouse effect- Heat Islands- Acid Rains- Ozone Holes etc. Lapse Rates- Pressure Systems- Winds and moisture plume behaviour and plume Rise Models- Gaussian Model for Plume Dispersion

UNIT II: DISPERSION OF POLLUTANTS (9)

Thermodynamics and Kinetics of Air-pollution – Applications in the removal of gases like SOx; NOx; CO; HC etc., air-fuel ratio- Computation and Control of products of combustion- Meteorology and plume Dispersion- properties of atmosphere- Heat- Pressure- Wind forces- Moisture and relative Humidity- Influence of Meteorological phenomena on Air Quality wind rose diagrams.

UNIT III: AIR POLLUTION CONTROL (9)

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment – gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries.

UNIT IV : AIR QUALITY MANAGEMENT (9)

Air quality standards – Air quality monitoring – Preventive measures – Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement

UNIT V: NOISE POLLUTION (9)

Introduction -Sources of noise pollution – Effects – Assessment – Standards – Control methods – Prevention- Environmental Impact Assessment and Air quality.

TOTAL HOURS: 45

COURSE OUTCOMES:

On successful completion of the course the student will be able to,		POs related to COs
CO 1	Identify the major sources of air pollution and understand their effects on health and environment.	**PO1, PO7**
CO 2	Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models	**PO2, PO3**
CO 3	Design the control techniques for particulate and gaseous emissions	**PO3, PO1**
CO 4	Understand the standards of air quality and legal framework	**PO1, PO6**
CO 5	Identify the major sources of noise pollution, effects and control measures	**PO1, PO7**

TEXTBOOKS:

1. M. N. Rao and H. V. N. Rao," Air pollution",– Tata McGraw Hill Company.
2. K.V.S.G. Murali Krishna ,"Air pollution and control", Kaushal Publishers.

REFERENCE BOOKS:

1. S.Padmanabha Murthy," Environmental meteorology" , I.K.International Pvt Ltd,New Delhi.
2. BSN.Raju, Fundamentals of air pollution, Oxford and IBH Publishers, India.

REFERENCE WEBSITES:

https://nptel.ac.in/courses/105/102/105102089/https://nptel.ac.in/courses/105/104/105104099/

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2			-	-	-	2	-	-	-	-	-
CO.2	-	2	2	-	-	-	-	-	-	-	-	-
CO.3	2		2	-	-	-	-	-	-	-	-	-
CO.4	1			-	-	3	-	-	-	-	-	-
CO.5	2			-	-	-	2	-	-	-	-	-
CO*	**1.75**	**2**	**2**	-	-	3	2	-	-	-	-	-

SREENIVASAINSTITUTEOFTECHNOLOGYANDMANAGEMENTSTUDIES
(Autonomous)

III B.Tech. - V Semester

20OEEE351	**RENEWABLE ENERGY SOURCES**	**L T P C**
		3 - - 3

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. Describing the current energy scenario in terms of renewable energy plan.
2. To describe the solar energy sources for electricity generation.
3. To understand the functions of wind turbine and ocean thermal energy conversion process.
4. To describe the types bio-energy for electricity generation and geothermal energy.
5. To educate the various new and alternative sources such as MHD power and fuel cells.

UNIT –1: ENERGY SCENARIO (9)

Indian energy scenario in various sectors of domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status – Potential of various renewable energy sources – Global energy status – Per capita energy consumption in various countries – Future energy plans.

UNIT –2: SOLAR ENERGY (9)

Solar radiation – Measurements of solar radiation and sunshine – Solar thermal collectors – Flat plate and concentrating collectors – Solar thermal applications – Solar thermal energy storage – Fundamentals of solar photo voltaic conversion – Solar cells – Solar PV Systems – Solar PV applications.

UNIT –3: WIND ENERGY AND OCEAN THERMAL ENERGY (9)

Wind Energy: Wind data and energy estimation – Betz limit – Site selection for wind farms – Characteristics – Horizontal and vertical axis wind turbine – Wind turbine generators and its performance – Hybrid systems – Environmental issues – Applications. **Ocean Thermal Energy:** Tidal energy – Wave energy – Open and closed OTEC cycles.

UNIT –4: BIOMASS ENERGY AND GEOTHERMAL ENERGY (9)

Biomass Energy: Bio resources – Biomass direct combustion – Thermochemical conversion – Biochemical conversion – Mechanical conversion – Biomass gasifier – Types of biomass gasifiers – Cogeneration – Carbonisation – Pyrolysis – Biogas plants –Digesters – Biodiesel production – Ethanol production – Applications. **Geothermal Energy:** Geothermal energy sources – Types of geothermal power plants – Applications – Environmental impact – Small hydro.

UNIT –5: NEW AND ALTERNATIVE ENERGY SOURCES (9)

Fuel Cell: Principle – Types of fuel cells – Hydrogen energy – Properties – Hydrogen production – Storage – Transport and utilization – Safety issues. **Magneto Hydro Dynamic Power:** Principles of magneto hydro dynamic (MHD) power generation – MHD systems – MHD accelerator – MHD engine, power generation systems – Electron gas dynamic conversion.

Total Hours: 45

On successful completion of the course, students will be able to		POs
CO1	Explain the current energy scenario in terms of conventional renewable energy and future plan	**PO1, PO2, PO7, PO12**
CO2	Describe the types solar thermal collectors and solar energy sources for electricity generation	**PO1, PO2, PO7, PO12**
CO3	Understand the functions of wind turbine and Ocean Thermal Energy conversion process	**PO1, PO2, PO7, PO12**
CO4	Illustrate the bio-energy for electricity generation and advancement in geothermal Energy	**PO1, PO2, PO7, PO12**
CO5	Demonstrate the various new and alternative sources such as MHD Power and fuel cells	**PO1, PO2, PO7, PO12**

TEXT BOOKS:

1. G.D. Rai, "Non-Conventional Energy Sources", Khanna Publishers, Delhi, 6/e, 2017.
2. Khan.B.H, "Non-Conventional Sources", McGraw-Hill Education Pvt. Ltd, 3/e, 2017.

REFERENCE BOOKS:

1. G. S. Sawhney, "Non-Conventional Energy Resources", PHI Learning, 2012.
2. R.K.Rajput, "Non-Conventional Energy Sources and Utilisation (Energy Engineering)", S. Chand Publishing, 2012.
3. Aldo Vieira da Rosa, "Fundamentals of Renewable Energy Processes", Elsevier Academic Press, 2005.
4. S. P. Sukhatme and J K. Nayak, "Solar Energy", McGraw-Hill Education, 4/e, 2017.
5. Efstathios E. (Stathis) Michaelides, "Alternative Energy Sources", Springer-Verlag Berlin Heidelberg, 2012.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/121/106/121106014/
2. https://nptel.ac.in/courses/112/105/112105221/
3. https://nptel.ac.in/courses/108/108/108108078/
4. https://nptel.ac.in/courses/103/103/103103206/
5. https://nptel.ac.in/courses/103/107/103107157/
6. https://nptel.ac.in/courses/109/101/109101171/
7. https://nptel.ac.in/courses/115/103/115103123/
8. https://nptel.ac.in/courses/108/105/108105058/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	1	-	-	-	-	1	-	-	-	-	2
CO.2	3	1	-	-	-	-	1	-	-	-	-	2
CO.3	3	1	-	-	-	-	1	-	-	-	-	2
CO.4	3	1	-	-	-	-	1	-	-	-	-	2
CO.5	3	1	-	-	-	-	1	-	-	-	-	2
CO*	**3**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**2**

III B.Tech. – V Semester

20OECE351	**AUTOMOTIVE ELECTRONICS** (Open Elective – 1)	**L T P C** **3 - - 3**

PRE-REQUISITES: NIL

COURSE EDUCATIONAL OBJECTIVES:

1. To provide knowledge on basics of automotive electronics in vehicle system
2. To comprehend the working principles of sensors and actuators in automobiles
3. To develop skills on engine control and management systems
4. To study various automotive vehicle management systems in automobiles.
5. To gain knowledge on various communication protocols in vehicles.

UNIT –1: INTRODUCTION TO VEHICLE SYSTEM & AUTOMOTIVE ELECTRONICS (9)

Evolution and Need of Automotive electronics, Need of electronics in engine and chassis systems, Fuel Injection system engine, braking and steering systems, Need of Electronic Control Unit (ECU) in vehicle system, Components of ECU, Inputs and Outputs of ECU, Control of Vehicle systems using ECU.

UNIT –2: AUTOMOTIVE SENSORS AND ACTUATORS (9)

Speed sensors, Pressure sensors: Manifold Absolute Pressure sensor, Temperature sensors: Coolant and Exhaust gas temperature, Position sensors: Throttle position sensor, accelerator pedal position sensor and crankshaft position sensor, Air mass flow sensor. Solenoids, stepper motors and relays

UNIT –3: ELECTRONIC ENGINE MANAGEMENT SYSTEM (9)

Electronic engine control: Input, output and control strategies, electronic fuel control system, fuel control modes: open loop and closed loop control at various modes, EGR control, Electronic ignition systems. Starting and charging system.

UNIT –4: ELECTRONIC VEHICLE MANAGEMENT SYSTEM (9)

Antilock braking system, electronic suspension system, electronic steering control, traction, Transmission control, Safety: Airbags, collision avoiding system, low tire pressurewarning system

UNIT –5:EMBEDDED SYSTEM COMMUNICATION PROTOCOLS (9)

Introduction to control networking – Communication protocols in embedded systems – SPI, I2C, USB – Vehicle communication protocols – Introduction to CAN, LIN, FLEXRAY, MOST, KWP2000.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Describe various vehicle systems in an automobiles and electronic control unit.	PO1
CO2	Illustrate different types of sensors and actuators in an Automobiles	PO1
CO3	Provide knowledge about engine management system.	PO1,PO2
CO4	Comprehend the various control systems used in automotive Applications	PO1,PO2
CO5	Describe various vehicle communication protocols used in automobiles.	PO1,PO2

TEXT BOOKS:

1. Joerg Schaeuffele, Thomas Zurawka, "Automotive Software Engineering Principles, Processes, Methods and Tools", SAE International, 2005.
2. Ronald K. Jurgen, "Automotive Electronics Handbook", McGraw Hill Publications,1999.
3. BOSCH "Automotive Handbook", SAE International, 10th Edition, 2018.

REFERENCE BOOKS:

1. Denton. T, "Automobile Electrical and Electronic Systems", 4th edition, 2012.
2. Nicholas Navit, "Automotive Embedded System Handbook", CRC Press, Taylorand Francis Group, 2009.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/107/106/107106088/
2. https://onlinecourses.nptel.ac.in/noc21_ee32/preview
3. https://ncert.nic.in/vocational/pdf/ivas103.pdf

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	-	-
CO.2	3	-	-	-	-	-	-	-	-	-	-	-
CO.3	3	2	-	-	-	-	-	-	-	-	-	-
CO.4	3	2	-	-	-	-	-	-	-	-	-	-
CO.5	3	2	-	-	-	-	-	-	-	-	-	-
CO*	3	2	-	-	-	-	-	-	-	-	-	-

III B.TECH-V SEMESTER

20OCSE351	**RELATIONAL DATA BASAE MANAGEMENT SYSTEMS**	**L**	**T**	**P**	**C**
	(OPEN ELECTIVE - 1)	**3**	**0**	**0**	**3**

PRE-REQUISITES: NIL

COURS EEDUCATIONAL OBJECTIVES:

1. Discuss the basic data base concepts, applications, data models, schemes and instances and design Entity Relationship (E-R) model for a data base.
2. Demonstrate the use of integrity constraints and relational algebra operations
3. Describe the basics of SQL; construct queries using SQL, SQL functions, triggers andPL/SQL.
4. Understand reasoning about functional dependency and to make the students to identify the role of normalization in data base management systems.
5. To present the students with the knowledge of Transaction, concurrency control strategies of DBMS

UNIT1: DATA BASE SYSTEMS AND ENTITY RELATIONSHIP MODELING (9)

Database System Applications - Purpose of Database Systems - View of Data – Database Languages Database Users and Administrators – Various Components of over all Database System Structure- Data Models-The Entity-Relationship Model - Attributes and Entity Sets- Relationship Sets -Entity- Relationship Diagrams.

UNIT2: RELATIONALDATAMODEL (9)

Introduction to the Relational Model - Integrity Constraints - Relational algebra, selection and projection, set operations, renaming, joins, division, examples of algebra queries.

UNIT3: INTRODUCTIONS TO SQL (9)

Structured Query Language (SQL): Introduction to SQL, Data types, Data Definition language commands, Data Manipulation language Commands and Data control Language Commands, Candidate Key, Primary key, foreign key, Select Clause, Where Clause, Logical Connectivity's – AND, OR, Range Search, Pattern Matching, Order By, Group By,Set Operations – Union, Intersect and Minus, Join Operations, SQL Functions. PL/SQL: Control Structures and looping statements.

UNIT4: NORMALIZATION (9)

Introduction to Schema Refinement – Properties of Decompositions– Functional Dependencies – Attribute closure - Normal Forms - First - Second - Third – BCNF – Basic definitions of MVDs and Fourth normal forms.

UNIT5: TRANSACTION PROCESSING CONCEPTS AND CONCURRENCY CONTROL TECHNIQUES (9)

Transaction Concept - Transaction States - Implementation of Atomicity and Durability – Serializability – Recoverability – Concurrent Executions–Lock Based Protocols for Concurrency Control

Total Hours: 45

COURSE OUTCOME:

On successful completion of the course, students will be able to		POs
CO1	Demonstrate knowledge on Data models and Data base Languages and Design Entity Relationship model for a Database	PO1,PO3
CO2	Analyze the relational database theory, and be able to write relational algebra and relational calculus expressions for queries.	PO1,PO2
CO3	Analyze and evaluate the databases using SQL DML/DDL Commands	PO1, PO2, PO3, PO5
CO4	Analyze databases using normal forms to provide solutions for real time applications.	PO1,PO2
CO5	Understand the properties of transactions in a database system, Analyze concurrency control techniques for handling concurrent transactions and understand recovery of data from failures	PO1,PO3,PO4

TEXTBOOKS:

1. Henry F.Korth, Silberchatz, Sudarshan, Tata McGraw-Hill, "Database System Concepts", 5/e, NewYork, 2006.
2. Raghu Rama Krishnan, " Database Management System", Tata McGraw Hill, 2/e, NewYork, 2000.

REFERENCEBOOKS:

1. Fundamentals of Database Systems, Elmasri, Navathe, Pearson Education, USA, 5/e, 2008.
2. Database Management Systems, Peter Rob, A.Ananda Rao and Carlos Coronel, Cengage Learning, USA, 5/e,2003.
3. SQL, PL/SQL Programming, Ivan Bayross, BPB Publications, New Delhi, India, 2/e,2011.
4. Introduction to Database Systems, C.J.Date, Pearson Education, USA, 8/e, 2004.
5. Fundamentals of Database Management Systems, M.L.Gillenson, Wiley, New Delhi, India, 1/e,2006.

CO-POMAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	-
CO.2	2	-	3	3	-	-	-	-	-	-	-	-
CO.3	2	2	3	-	-	-	-	-	-	-	-	-
CO.4	2	2	-	3	-	-	-	-	-	-	-	-
CO.5	3	-	-	2	-	-	-	-	-	-	-	-
CO*	**2.4**	**2**	**3**	**2.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

III B.Tech-V Semester

20OHSM351	**GRAPH THEORY WITH APPLICATIONS (OPEN ELECTIVE - 1)**	**L T P C** **3 - - 3**

PRE-REQUIEST: NIL

COURSE EDUCATIONAL OBJECTIVES:

1. To learn the representation of graphs and understanding the Graph Isomorphism, Sub graph-Vertex degrees, Walk, Paths, Cycles-graph connection, Bipartite graphs.
2. To understand the Trees concepts, digraphs, binary relations, Shortest path algorithms and to familiarize the knowledge of graph theory
3. To understand the matrix representation of graphs, designing incidence matrix, Adjacency matrix and circuit matrix
4. To explore the use of graphs in various applications in Switching and Coding Theory
5. To identify the important graph based real time applications of electrical networks such as RLC Networks with Independent sources, LOOP circuits

UNIT – 1: GRAPH THEORY INTRODUCTION (9)

Graph and simple graphs (Complete graphs, Complement of graph)- Graph isomorphism–Sub graph- Vertex degrees, walk, paths, cycles-graph connection and components-Bipartite graphs.

UNIT – 2: DIRECTED GRAPHS AND SHORTEST PATH ALGORITHMS (9)

Trees – Cut edges- Cut vertices-Blocks , Directed graphs types of directed graphs - digraphs and binary relations – directed paths and connectedness - Dijkstra's shortest path algorithm, Floyd-Warshall shortest path algorithm

UNIT – 3: MATRIX REPRESENTATION OF GRAPHS (9)

Introduction - Adjacency matrix -Applications of Adjacency matrix-sufficient condition for isomorphism of graphs-power of an adjacency matrix-Adjacency matrix of a digraph-incidence matrix-circuit matrix-cut set matrix.

UNIT - 4: GRAPHS IN SWITCHING AND CODING THEORY (9)

Contact Networks – Analysis of Contact Networks – Synthesis of Contact Networks – Sequential Switching Networks – Unit Cube and its Graph – Graphs in Coding Theory.

UNIT – 5: ELECTRICAL NETWORK ANALYSIS BY GRAPH THEORY (9)

Introduction - Kirchhoff's current and Voltage laws-Loop currents and Node Voltages- RLC Networks with Independent sources: Nodal analysis, Loop analysis.

TOTAL HOURS: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs related to Cos
CO1	Demonstrate knowledge in reading and writing rigorous mathematical proofs involving introductory aspects of graphs and develop analytical skills in solving graph theoretic problems	**PO1,PO2,PO3 PO4**
CO2	Demonstrate knowledge in Trees concepts, digraphs, binary relations, and Develop analytical skills in solving problems involving directed graphs and shortest path algorithm	**PO1,PO2,PO3 PO4**
CO3	Demonstrate knowledge in matrix representation of graphs, designing incidence matrix, Adjacency matrix and circuit matrix and explore analytical skills in solving problems involving adjacency matrix and incidence matrix	**PO1,PO2,PO3 PO4**
C04	Demonstrate knowledge in significant practical applications of graphs in Switching and Coding Theory; explore analytical skills in solving practical problems using graph theory concepts and Develop skills in designing Mathematical models for real time applications in coding theory.	**PO1,PO2,PO3 PO4**
CO5	Demonstrate knowledge in significant real time applications of electrical networks such as RLC Networks Independent sources; explore analytical skills in solving practical problems involving using graph theory concepts and Develop skills in designing Mathematical models for real time electrical networks.	**PO1,PO2,PO3 PO4**

TEXT BOOKS:

1. J.P.Trimblay and R.Manohar ,"Discrete mathematical structures with pplications to computer science", 27/e, Tata Mc Graw Hill Publications , 2006, New Delhi.
2. NarasinghDeo,"Graph Theory with applications to engineering and computer Science", 25/e, Printice – Hall of India Private Limited, 2003, New Delhi

REFERENCES:

1. Clark J. And Holton D.A., " A first look at Graph theory", Allied Publishers, 199
2. R.B.Bapat , Graphs and Matrices, Springer, London Dordrecht Heidelberg, New York, 2010 .
3. Gary Haggard John Schlipf, Sue Whitesides, "Discrete Mathematics for Computer Science", 4/e, 2007, Thomson Publication, 2008, New Delhi.
4. S.D Sharma , "Operation Research", KedarNath Ram Nath & Co, Meerut . 2007.
5. J.A.Bonday and U.S.R. Murthy, "Graph Theory with application" , North Holland, 1976 .

REFERENCE WEBSITE:

1. https://onlinecourses.nptel.ac.in/noc21_cs48/preview

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	3	2	-	-	-	-	-	-	-	-
CO.2	3	3	3	2	-	-	-	-	-	-	-	-
CO.3	3	3	3	2	-	-	-	-	-	-	-	-
CO.4	3	3	3	2	-	-	-	-	-	-	-	-
CO.5	3	3	3	2	-	-	-	-	-	-	-	-
CO*	**3**	**3**	**3**	2	-	-	-	-	-	-	-	-

III B.Tech.-V Semester

20MAC352	DESIGN THINKING FOR INNOVATION	L	T	P	C
		2	-	-	-

PRE-REQUISITES: NIL.

COURSEEDUCATIONALOBJECTIVES:

1. To Study the concepts of design thinking and innovations.
1. To know the basic research concepts in design thinking.
2. To learn the basic concepts of start-ups in design process.
3. To understand the business model design concepts.
4. To study the principles of innovations in design thinking.

UNIT–1: INTRODUCTION TO DESIGN THINKING (6)

Concept, frame work and principles of design thinking – Criteria of an inspirational design – Writing the inspirational design – Research findings about inspirational design – Pitfalls toavoid – Defining personas – Creating Personas – Importance and application of Personas –Customer experience mapping.

UNIT–2: DESIGN THINKING TO BRIDGE RESEARCH AND CONCEPT (6)

Challenges in idea generation – Need for a systematic method – Visualizing and empathizing – Applying the method – New design ideas – Design heuristics – Value of the design heuristics. **Prototypes in Design:** Product development framework – Prototypes in process – Integrating design into the front end of the innovation process and challenges – Design practice and tools – Integrate design professionals in front end innovation process.

UNIT–3: START-UPS UNDERSTAND AND APPLY DESIGN PROCESSES (6)

Emerging start-up culture – IPR to protect innovation – Path from idea to product – Impact of corporate culture and forces – Pillars of innovation– Knowledge management as intelligence and task – Designing amidst uncertainty– Selected tools for breakthrough innovation – Organizational implications – Design thinking within the firm – Role of key personnel – Organizational practices and culture – Value of design thinking.

UNIT–4: BUSINESS MODEL DESIGN AND PRINCIPLES OF INNOVATION (6)

Business model – Business model design and method – Process of designing a business model – Implementation of business model. **Principles of Innovations:** Most powerful competitors – Type of products will buy the – Best customers for products – Scope of the business right – Avoid commoditization – Disruptive growth – Strategy development process – Good money and bad money – Role of senior executives.

UNIT–5: INNOVATION MANAGEMENT (6)

Importance and overview of innovation process – Innovation in an organizational context – Development activities and design environment – Innovation and invention – Successful and unsuccessful innovation – Different types of innovation – Models of innovation – Disruptive innovations – Cyclic model of innovation with interconnected cycles.

Total Hours: 30

COURSEOUTCOMES:

On successful Completion of the course, students will be able to		Pos
CO1	Understand the concepts of design thinking and innovations.	**PO1,PO2,PO3**
CO2	Explain the basic research concepts in design thinking.	**PO1,PO2,PO3**
CO3	Describe the basic concepts of start-ups in design process.	**PO1,PO2,PO3**
CO4	Explain the business model design concepts.	**PO1,PO2,PO3**
CO5	Demonstrate the principles of innovations in design thinking.	**PO1,PO2,PO3**

TEXTBOOKS:

1. Michael G. Luchs, K. Scott Swan and Abbie Griffin., "Design Thinking - New Product Development Essentials from the PDMA", John Wiley & Sons, Inc., 2016.
2. Clayton M. Christensen and Clayton M. Christensen "The Innovator's Solution - Creating and Sustaining Successful Growth", Harvard Business School Press.

REFERENCEBOOKS:

1. Paul Trott, "Innovation Management and New Product Development" 6/e, Pearson Education Ltd.,
2. Creativity in Product Innovation, Jacob Goldenberg and David Mazursky, 2002, Cambridge University Press.
3. The Design of Everyday Things - Revised Edition, Don Norman, 2013, Perseus Books Group.
4. From Imagination to Innovation - New Product Development for Quality of Life, A. Coskun Samli, 2011, Springer New York Dordrecht Heidelberg London
5. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons.

REFERENCEWEBSITE:

1. https://nptel.ac.in/courses/110106124
2. https://nptel.ac.in/courses/109104109
3. https://nptel.ac.in/courses/107101086
4. https://nptel.ac.in/courses/107104076

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	3	-	-	-	-	-	-	-	-	-
CO.2	3	2	3	-	-	-	-	-	-	-	-	-
CO.3	3	2	3	-	-	-	-	-	-	-	-	-
CO.4	3	2	3	-	-	-	-	-	-	-	-	-
CO.5	3	2	3	-	-	-	-	-	-	-	-	-
CO*	3	2	3	-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

III B.Tech. - VI Semester

20MEC361	DESIGN OF TRANSMISSION SYSTEM	L	T	P	C
		2	1	-	3

PRE-REQUISITES: A Course on Engineering mechanics and Design of Machine Elements

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the design the parts in the internal combustion engines.
2. To demonstrate the design of components such as power screws and drives.
3. To design the energy storing elements of springs and flywheel.
4. To know the procedure of designing the sliding contact and rolling bearings.
5. To gain the knowledge in the design of gears.

UNIT –1: DESIGN OF INTERNAL COMBUSTION ENGINE PARTS (9)

Principal parts of an I.C. engine – Design of a cylinder and cylinder liner – Design of piston, piston head, piston rings, piston skirt and piston pin – Forces acting on the connecting rod – Design of connecting rod – Bearing pressure and stresses in crankshafts – Design of crankshaft – Design of valves and rocker arm.

UNIT –2: DESIGN OF POWER SCREWS AND TRANSMISSION SYSTEM (9)

Power Screws: Types of screw threads – Torque required rising and lowering load – Efficiency – Overhauling and self-locking – Coefficient of friction – ACME – Stresses in power screws – Design of screw jack. **Belt and Chain Drives:** Types of belt and rope drives – Materials used for belt and rope drives – Design of flat belt, V-belt and rope drives – Classification of chains – Design of chain drives.

UNIT –3: DESIGN OF ENERGY STORING ELEMENTS (9)

Springs: Types – Design of helical springs – Energy stored in helical springs – Design of composite springs – Design of helical torsion springs – Design of flat spiral springs – Design of leaf springs. **Flywheel:** Coefficient of fluctuation of speed – Fluctuation of energy – Maximum fluctuation of energy – Coefficient of fluctuation of energy – Energy stored in a flywheel – Stresses in a flywheel rim – Stresses in flywheel arms – Design of flywheel arms – Design of shaft, hub and key – Construction of flywheels.

UNIT –4: DESIGN OF BEARINGS (9)

Sliding Contact Bearings: Properties and materials – Lubricants – Critical pressure – Sommerfeld number – Heat generation – Design procedure for journal bearing – Design of bearing caps and bolts – Solid journal bearing – Bushed bearing – Plummer block – Oil grooves – Design of thrust bearing. **Rolling Contact Bearings:** Static dynamic and equivalent loading – Life of a bearing – Lubrication – Reliability and Selection.

UNIT –5: DESIGN OF SPUR, HELICAL, BEVEL AND WORM GEARS (9)

Spur Gears: Types – Gear materials – Load concentration factor – Design spur gear – Design of shaft and arm for spur gear. **Helical Gears:** Proportions – Strength – Design of helical gear. **Bevel Gear:** Types – Pitch angle – Formative number – Strength and forces – Design procedure for bevel gear. **Worm Gears:** Types – Proportions – Efficiency and strength of worm gear teeth – Wear tooth load – Thermal rating – Forces acting on worm gears – Design of worm gearing.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Design and analyze the parts in the internal combustion engines	**PO1, PO2, PO3, PO4**
CO2	Design of mechanical components such as power screws and drives	**PO1, PO2, PO3, PO4**
CO3	Design and analyze the energy storing elements of springs and Flywheel	**PO1, PO2, PO3, PO4**
CO4	Know the procedure of designing the sliding contact bearings and rolling contact bearings	**PO1, PO2, PO3, PO4**
CO5	Know the procedure of designing various.	**PO1, PO2, PO3, PO4**

TEXT BOOKS:

1. V.B. Bhandari, "Design of Machine Elements", Tata McGraw-Hill Education Pvt. Ltd., Noida, 4/e, 2016.
2. Richard G. Budynas and Keith J. Nisbett, "Shigley's Mechanical Engineering Design", Tata McGraw-Hill Education Pvt. Ltd., Noida, 10/e, 2015.

REFERENCE BOOKS:

1. Robert L. Norton, "Machine Design", Pearson Education Ltd., India, 5/e, 2018.
2. R S Khurmi and J. K. Gupta, "A Text Book of Machine Design", S.Chand & Company Pvt. Ltd., New Delhi, 34/e, 2018.
3. N. C. Pandya and C. S. Shah, "Machine Design", Charotar Publishing House Pvt. Ltd, 20/e, 2015.
4. Robert L Mott, "Machine Elements in Mechanical Design", Pearson Education Ltd., India, 4/e, 2020.
5. Ansel C. Ugural, "Mechanical Design of Machine Components", Taylor & Francis Group, LLC, 2/e, 2015.

DATA BOOK/TABLES: Design data book is permitted in the examinations.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/105/112105124/
2. https://nptel.ac.in/courses/112/105/112105125/
3. https://nptel.ac.in/courses/112/106/112106137/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	1	-	-	-	-	-	-	-	-
CO.2	3	2	1	1	-	-	-	-	-	-	-	-
CO.3	3	2	1	1	-	-	-	-	-	-	-	-
CO.4	3	2	1	1	-	-	-	-	-	-	-	-
CO.5	3	2	1	1	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

III B.Tech. - VI Semester

20MEC362	FINITE ELEMENT ANALYSIS	L	T	P	C
		2	1	-	3

PRE-REQUISITES: A Course on Mechanics of Solids

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the fundamental concepts of finite element analysis.
2. To analyze one dimensional element and truss element problems.
3. To evaluate the constant strain triangle element in two dimensional scalar problems.
4. To formulate the modern of two dimensional vector variable problems.
5. To demonstrate the isoparametric formulations and applications in heat transfer.

UNIT –1: FUNDAMENTAL CONCEPT (9)

Historical background – Methods of engineering analysis – General steps of finite element analysis – Mathematical modeling of field problems in engineering – Weighted residual methods – Ritz technique – Boundary, initial and eigen value problems – Application of FEA.

UNIT –2: ONE-DIMENSIONAL PROBLEMS (9)

One Dimensional Elements: Modeling – Shape function – Stiffness matrix – Analysis of element stiffness equation, displacements, load vector, treatment of boundary condition, Element stress calculation and support reactions for one dimensional bar, spring and tapered elements – Analysis of temperature effects with one dimensional bar element. **Truss Element:** Analysis of length, stiffness matrix, and assembly of element equation, load vector, boundary condition and element stresses in one dimensional truss element.

UNIT –3: TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS (9)

Constant Strain Triangle Element (CST): Plane stress and plane strain – Finite element modeling – Shape function – Analysis of strain displacement matrix, stress-strain relationship, stiffness matrix, element stresses, element strains for CST element –Analysis of temperature effects with CST element.

UNIT –4: TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS (9)

Axisymmetric Element: Finite element modeling – Shape function – Analysis of strain displacement matrix, stress-strain relationship, stiffness matrix, element stresses, element strains for CST element – Analysis of temperature effects with axisymmetric element.

UNIT –5: ISOPARAMETRIC ELEMENT AND APPLICATIONS IN HEAT TRANSFER (9)

Isoparametric Element: Co-ordinates – Shape function for four noded rectangular elements and isoparametric quadrilateral element – Evaluation of Jacobian matrix, Strain-displacement matrix and element stresses – Numerical Integration. **Heat Transfer Applications:** Gaussian quadrature – Temperature and shape function for one dimensional heat conduction element – Stiffness matrix – Finite element 00000equations for one dimensional heat conduction – Heat conduction in fin element.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Understand the fundamental concepts behind variation methods	**PO1, PO2, PO3, PO4**
CO2	Analyze in one dimensional elements and trusses	**PO1, PO2, PO3, PO4**
CO3	Implement the formulation techniques to solve the Constant Strain Triangle element in two dimensional scalar problems	**PO1, PO2, PO3, PO4**
CO4	Formulate FE characteristic equations for two dimensional vector variable problems	**PO1, PO2, PO3, PO4**
CO5	Able to identify the isoparametric formulations and how the finite element method expands beyond the structural domain	**PO1, PO2, PO3, PO4**

TEXT BOOKS:

1. Tirupathi R. Chandrupatla and Ashok D.Belegundu, "Introduction to Finite Elements in Engineering", Pearson Education, India, 4/e, 2015.
2. Singiresu S Rao, Butterworth-Heinemann, "Finite Element Method in Engineering", Elsevier India Pvt.Ltd Publishers. New Delhi, 6/e, 2017.

REFERENCE BOOKS:

2. Daryl L Logan, "A First Course in the Finite Element Method", Cengage Learning, India, 5/e, 2012.
3. JN Reddy, "An Introduction to Finite Element Method", Tata McGraw-Hill Education Pvt. Ltd., Noida, 3/e, 2013.
4. David V Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw-Hill Education Pvt. Ltd., Noida, 1/e, 2012.
5. Seshu,P, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.
6. Saeed Moaveni, "Finite Element Analysis Theory and Application with ANSYS", Pearson India Education Services Pvt. Ltd, 3/e, 2011.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/104/112104115/
2. https://nptel.ac.in/courses/112/104/112104193/
3. https://nptel.ac.in/courses/112/104/112104205/
4. https://nptel.ac.in/courses/112/106/112106135/
5. https://nptel.ac.in/courses/112/104/112104116/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	1	-	-	-	-	-	-	-	-
CO.2	3	2	1	1	-	-	-	-	-	-	-	-
CO.3	3	2	1	1	-	-	-	-	-	-	-	-
CO.4	3	2	1	1	-	-	-	-	-	-	-	-
CO.5	3	2	1	1	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

III B.Tech. - VI Semester

20MEC363	HEAT AND MASS TRANSFER	L	T	P	C
		2	1	-	3

PRE-REQUISITES: A Course on Engineering Thermodynamics and Thermal Engineering

COURSE EDUCATIONAL OBJECTIVES:

1. To understand and analyze the basics of heat transfer and steady state and unsteady state conduction
2. To understand the convective heat transfer systems with types
3. To illustrate the basic knowledge on phase change heat transfer and heat exchangers
4. To demonstrate the transfer of heat on radiation
5. To expand the basic knowledge of mass transfer in a system

UNIT –1: CONDUCTION (9)

Mechanism of heat transfer – General differential equation – Cartesian, cylindrical and spherical coordinates – One dimensional steady state heat conduction – Heat generation – Thermal conductivity – Composite system – Critical radius of insulation – System with heat resources – Extended surfaces – Unsteady heat conduction – Lumped heat analysis – Surface resistance – Semi-infinite and infinite solids – Heislers chart for transient conduction.

UNIT –2: CONVECTION (9)

Convective Heat Transfer: Heat transfer coefficient – Boundary layer concepts and equations – Turbulence and time averaging equations – Flow through pipes – Dimensional analysis. **Forced Convection:** Flow over a flat plate, cylinders and spheres – Flow through tubes – Flow of liquid metals. **Natural Convection:** Free convection on vertical flat plate – Transition and turbulence in free convection – Free Convection in vertical plates, horizontal plates, inclined surfaces, blocks, cylinders and spheres.

UNIT –3: PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS (9)

Boiling and Condensation: Nusselt's theory of condensation – Regimes of Pool boiling and flow boiling – Condensation heat transfer – Film and dropwise condensation. **Heat Exchangers:** Types – Overall heat transfer coefficient – Fouling factors – LMTD and NTU methods – Introduction to TEMA Standards.

UNIT –4: RADIATION (9)

Radiation: Nature of radiation – Emissive power – Absorption, reflection, transmission – Black body and gray body Radiation – Laws of radiation – Radiation from real surfaces – Shape factor – Electrical network analogy – Radiation shields.

UNIT –5: MASS TRANSFER (9)

Diffusion Mass Transfer: Concepts – Fick's Law – Diffusion coefficient – Steady state molecular diffusion. Convective **Mass Transfer:** Mass transfer coefficient – Governing equations – Momentum, heat and mass transfer analogy – Convective mass transfer correlations.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Understand and analyze the basics of heat transfer and steady state and unsteady state conduction.	**PO1, PO2, PO3, PO4**
CO2	Understand the convective heat transfer systems with types.	**PO1, PO2, PO3, PO4**
CO3	Illustrate the basic knowledge on phase change heat transfer and heat exchangers.	**PO1, PO2, PO3, PO4**
CO4	Demonstrate the transfer of heat on radiation.	**PO1, PO2, PO3, PO4**
CO5	Know and expand the basic knowledge of mass transfer in a system.	**PO1, PO2, PO3, PO4**

TEXT BOOKS:

1. Sachdeva, R.C., "Fundamentals of Engineering Heat and Mass Transfer (SI Units)", New Age International (P) Ltd, Publishers, New Delhi, 5/e, 2018.
2. J.P. Holman and Souvik Bhattacharyya, "Heat Transfer", Tata McGraw-Hill Education Pvt.Ltd, Noida, 10/e, 2017.

REFERENCE BOOKS:

2. Yunus A. Cengel and Afshin J. Ghajar, "Heat and Mass Transfer: Fundamentals and Applications (SI Units)", Tata McGraw-Hill Education Pvt.Ltd, Noida, 2015.
3. C.P.Kothandaraman, "Fundamentals of Heat and Mass Transfer", New Age International (P) Ltd, Publishers, New Delhi, 4/e, 2012.
4. P.K.Nag, "Heat and Mass Transfer", Tata McGraw-Hill Education Pvt.Ltd., Noida, 3/e, 2011.
5. Frank P. Incropera, David P. Dewitt, Theodore L. Bergman, Adrienne S. Lavine, "Principles of Heat and Mass Transfer", Wiley India Edition, 2018.
6. Frank Kreith, Raj M. Manglik and Mark S. Bohn, "Principles of Heat Transfer", Cengage Learning, India, 7/e, 2011.

CODES/TABLES: Heat and mass transfer data book is permitted in the examinations.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/101/112101097/
2. https://nptel.ac.in/courses/112/108/112108149/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	1	-	-	-	-	-	-	-	-
CO.2	3	2	1	1	-	-	-	-	-	-	-	-
CO.3	3	2	1	1	-	-	-	-	-	-	-	-
CO.4	3	2	1	1	-	-	-	-	-	-	-	-
CO.5	3	2	1	1	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

III B.Tech. - VI Semester

20HSM231	SOFT SKILLS	L	T	P	C
		-	1	2	2

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To encourage all round development of the students by focusing on soft skills
2. To make the students aware of critical thinking
3. To develop problem-solving skills and decision making
4. To develop Emotional Intelligence and Stress Management
5. To develop leadership skills and to function effectively with heterogeneous teams

UNIT –1: SOFT SKILLS & COMMUNICATION SKILLS (9)

Introduction, meaning, significance of soft skills – definition, significance, types of communication skills - Intrapersonal & Inter-personal skills - Verbal and Non-verbal Communication

Activities:

Intrapersonal Skills: Narration about self- strengths and weaknesses- clarity of thought – self- expression – articulating with felicity

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

Interpersonal Skills: Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication: Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.

Non-Verbal Communication: Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation

UNIT –2: CRITICAL THINKING (9)

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking

Activities:

Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

UNIT –3: PROBLEM SOLVING & DECISION MAKING (9)

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Methods of decision making – Effective decision making in teams – Methods & Styles

Activities:

Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision. Case Study & Group Discussion

UNIT –4: EMOTIONAL INTELLIGENCE & STRESS MANAGEMENT (9)

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self- Regulation – Stress factors – Controlling Stress – Tips.

Activities:

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

UNIT –5: LEADERSHIP SKILLS (9)

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk- Taking - Team Building - Time Management.

Activities:

Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making, Group discussion etc.

NOTE-:

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.

Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear or for good Leadership – Mahendar Singh Dhoni etc.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Demonstrateknowledge effectively on Soft Skill & Communication Skills	**PO1, PO6, PO7, PO8, PO9, PO10,PO12**
CO2	Demonstrate knowledge on Critical Thinking	**PO1, PO6, PO7, PO8, PO9, PO10, PO12**
CO3	Solve problems and take appropriate decisions	**PO1, PO2, PO6, PO7, PO8, PO9, PO10, PO12**
CO4	Effectively manage Emotional Intelligence and Stress Management	**PO1, PO6, PO7, PO8, PO9, PO10,PO12**
CO5	Function effectively as a leader and with heterogeneous team	**PO1, PO6, PO7, PO8, PO9, PO10, PO11, PO12**

TEXT BOOKS:

1. Personality Development and Soft Skills (English, Paperback, Mitra Barun K.) Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha Kapoor, Publisher : I K International Publishing House; (February 28, 2018)

REFERENCE BOOKS:

1. Soft skills: personality development for life success by Prashant Sharma, BPB publications 2018.
2. Soft Skills By Alex K. Published by S.Chand
3. Soft Skills: An Integrated Approach to Maximise Personality Gajendra Singh Chauhan, Sangeetha Sharma Published by Wiley.
4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books
5. SOFT SKILLS for a BIG IMPACT (English, Paperback, RenuShorey) Publisher: Notion Press
6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher: Vayu Education of India

REFERENCE WEBSITE:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	2	2	2	2	3	-	2
CO.2	3	-	-	-	-	2	2	2	2	2	-	2
CO.3	3	2	-	-	-	2	2	2	2	2	-	2
CO.4	3	-	-	-	-	2	2	2	2	2	-	2
CO.5	3	-	-	-	-	2	2	2	2	2	3	2
CO*	**3**	**2**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**2.2**	**3**	**2**

III B.Tech. - VI Semester

20MEC365	COMPUTER AIDED ANALYSIS AND SIMULATION LAB	L	T	P	C
		-	-	3	1.5

PRE-REQUISITES: Finite Element Analysis and Computer Aided Manufacturing

COURSE EDUCATIONAL OBJECTIVES:

1. To gain practical experience in FEA software systems.
2. To use the commercial Finite Element packages to build Finite Element models and solve a selected range of engineering problems.
3. To validate a Finite Element model using a range of techniques.
4. To understand the basics of simulation concepts.

LIST OF EXERCISES:

1. Study the basic steps for finite element analysis and FEA packages.
2. Static Analysis
   - Stress analysis using link elements in Trusses.
   - Stress analysis of a plate with a circular hole and L-Bracket – 2D and 3D
   - Stress analysis of beams (cantilever, simply supported & fixed ends)
   - Stress analysis of an axi-symmetric component
   - Torsion based Problem
3. Thermal Analysis
   - Conductive heat transfer analysis of a 2D and 3D components
   - Conduction and Convective heat transfer analysis of a 2D component
   - Heat transfer rate of a composite wall
   - Coupled field analysis of a component
4. Modal Analysis
   - Mode frequency analysis of a 2D component
   - Mode frequency analysis of beams (cantilever, simply supported)
5. Modeling and analysis of basic hydraulic, pneumatic, electro-pneumatic, electrical and electronic circuits by using simulation software.
6. Robot Programming and Simulation:
   - Robot programming and simulation for pick and place.
   - Robot programming and simulation for color and shape identification.
7. IoT Fundamentals
   - Mathematical Modeling and Simulation of a Physical Systems
8. Modeling and simulation of aerial vehicle / drone.

COURSE OUTCOMES:

On successful completion of the course, students will be able to		Pos
CO1	Explain the practical experience in FEA and Modeling software systems	**PO1**
CO2	Determine the deflection and stresses in 2D and 3D trusses and beams	**PO2**
CO3	Determine the thermo-mechanical stresses of a 3D component	**PO3**
CO4	Estimate the natural frequencies and mode shapes, harmonic response of 2D beam	**PO4**
CO5	Execute the analysis and simulation works in the given task.	**PO5**
CO6	Follow the ethical principles while doing the experiments	**PO8**
CO7	Do the experiments effectively as an individual and as a team member in a group.	**PO9**
CO8	Communicate verbally and in written form pertaining to results of the experiments	**PO10**
CO9	Continue updating their skill related to manufacturing process in future.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

III B.Tech. - VI Semester

20MEC366	HEAT TRANSFER LAB	L	T	P	C
		-	-	3	1.5

PRE-REQUISITES: A course on Heat and Mass Transfer

COURSE EDUCATIONAL OBJECTIVES:

1. To determination of thermal conductivity of materials and overall heat transfer co-efficient
2. To know the heat transfer modes and heat flux.
3. To determination of emissivity, condensation and gain knowledge on heat exchangers

LIST OF EXPERIMENTS:

1. Thermal conductivity of insulating powder material through concentric sphere apparatus.
2. Thermal conductivity of insulating material through lagged pipe apparatus.
3. Overall heat transfer co-efficient through composite slab apparatus.
4. Thermal conductivity of metal (conductor).
5. Heat transfer in pin-fin.
6. Experiment on transient heat conduction.
7. Heat transfer coefficient in forced convection.
8. Heat transfer coefficient in natural convection.
9. Experiment on parallel and counter flow heat exchanger.
10. Emissivity of a gray body through emissivity apparatus.
11. Experiment on Stefan Boltzman apparatus.
12. Heat transfer in drop and film wise condensation.
13. Experiment on critical heat flux apparatus.
14. Study of heat pipe and its demonstration.
15. Study of two-phase flow.
16. Study of Triple-pipe heat exchangers.

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Demonstrate the knowledge on conduction, convection and radiation.	**PO1**
CO2	Identify and analyze various performance parameters of conduction, convection and radiation equipment's.	**PO2**
CO3	Develop systems to identify the performance parameters of various heat transfer mechanisms.	**PO3**
CO4	Conduct investigation on performance of heat conduction, composite walls, transient heat flow, critical heat flux, forced and natural convection, emissivity and radiation.	**PO4**
CO5	Measure the values of conductivity, heat transfer co-efficient, effectiveness, Stephen-Boltzman constant by using modern tools like sensors.	**PO5**
CO6	Follow ethical principle in conduction of experiments.	**PO8**
CO7	Perform individually and also in a team to complete the process	**PO9**
CO8	Communicate in verbally or in written form, their understanding about the experiments.	**PO10**
CO9	Continue updating their knowledge on various testing methods in future, for the identification of performance parameters of heat transfer equipment's.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	3	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	-	-	-
CO7	-	-	-	-	-	-	-	-	-	3	-	-
CO8	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

III B.Tech. - VI Semester

20MEC367	PROJECT SKILLS LAB	L	T	P	C
		-	-	3	1.5

PRE-REQUISITES: A Course on Computer Aided Design and DME&DTS

COURSE EDUCATIONAL OBJECTIVES:

1. To give an opportunity to the student to get hands on training in design and innovation.
2. Comparing and contrast the several existing solutions for the problem identified.
3. Formulating and propose a plan for creating a solution for the research plan identified.
4. Conducting the experiments as a team and interpret the results.
5. Reporting and presenting the findings of the work conducted.

SCHEME OF PROJECT SKILLS LAB:

The aim of the project skill lab is to deepen comprehension of principles by applying them to a new problem which may be the device / system / component / working mode to be created / fabricated may be decided in consultation with the supervisor and if possible, with an industry. A project topic must be selected by the students in consultation with their supervisor. The students may be grouped into 3 to 5 and work under a project supervisor.

A project report to be submitted by the group and along with the model / system, which will be reviewed and evaluated for internal assessment by a committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report along with device / system / component / working model jointly by external and internal examiners constituted by the Head of the Department.

COURSE OUTCOMES:

On successful completion of the course, students will be able to		Pos
CO1	Demonstrate in-depth knowledge on the project topic	**PO1**
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	**PO2**
CO3	Design solutions to the chosen project problem.	**PO3**
CO4	Undertake investigation of project problem to provide valid conclusions	**PO4**
CO5	Use the appropriate techniques, resources and modern engineering tools necessary for project work	**PO5**
CO6	Apply project results for sustainable development of the society.	**PO6**
CO7	Understand the impact of project results in the context of environmental sustainability.	**PO7**
CO8	Understand professional and ethical responsibilities while executing the project work.	**PO8**
CO9	Function effectively as individual and a member in the project team	**PO9**
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	**PO10**
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	**PO11**
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	3	-	-	-	-	-	-
CO7	-	-	-	-	-	-	3	-	-	-	-	-
CO8	-	-	-	-	-	-	-	3	-	-	-	-
C09	-	-	-	-	-	-	-	-	3	-	-	-
C010	-	-	-	-	-	-	-	-	-	3	-	-
C011	-	-	-	-	-	-	-	-	-	-	3	-
C012	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

20MAC351	CONSTITUTION OF INDIA	L	T	P	C
		2	1	-	3

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the design the parts in the internal combustion engines.
2. To demonstrate the design of components such as power screws and drives.
3. To design the energy storing elements of springs and flywheel.
4. To know the procedure of designing the sliding contact and rolling bearings.
5. To gain the knowledge in the design of gears.

UNIT –1: INTRODUCTION (6)

Introduction to Indian Constitution – Constitution -Meaning of the term - Indian Constitution – Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

UNIT –2: UNION GOVERNMENT AND ITS ADMINISTRATION (6)

Union Government and its Administration Structure of the Indian Union - Federalism – Centre – State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions

UNIT –3: STATE GOVERNMENT AND ITS ADMINISTRATION (6)

Governor Role and Position, CM and Council of ministers. State Secretariat: Organization, Structure and Functions

UNIT –4: LOCAL ADMINISTRATION (6)

District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Pachayati Raj - Functions– PRI – Zilla Parishath - Elected officials and their roles – CEO,Zilla Parishath - Block levelOrganizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy.

UNIT –5: ELECTION COMMISSION (6)

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Total Hours: 30

COURSE OUTCOMES:

On successful completion of the course, students will be able to		Pos
CO1	Understand historical background of the constitution making and its importance for building a democratic India.	**PO6, PO8, PO12**
CO2	Understand the functioning of three wings of the government ie., executive, legislative and judiciary.	**PO6, PO8, PO12**
CO3	Understand the value of the fundamental rights and duties for becoming good citizen of India.	**PO6, PO8, PO12**
CO4	Analyze the decentralization of power between central, state and local self-government	**PO6, PO8, PO12**
CO5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.	**PO6, PO8, PO12**

TEXT BOOKS:

1. Durga Das Basu, "Introduction to the Constitution of India", Prentice – Hall of India Pvt. Ltd.. New Delhi
2. Subash Kashyap, "Indian Constitution", National Book Trust

REFERENCE BOOKS:

1. J.A. Siwach, "Dynamics of Indian Government & Politics".
2. H.M.Sreevai, " Constitutional Law of India", 4th edition in 3 volumes (Universal Law Publication)
3. J.C. Johari, " Indian Government and Politics", Hans India
4. M.V. Pylee, "Indian Constitution", Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi

REFERENCE WEBSITE:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	-	-	-	-	-	3	-	3	-	-	-	3
CO.2	-	-	-	-	-	3	-	3	-	-	-	3
CO.3	-	-	-	-	-	3	-	3	-	-	-	3
CO.4	-	-	-	-	-	3	-	3	-	-	-	3
CO.5	-	-	-	-	-	3	-	3	-	-	-	3
CO*	-	-	-	-	**-**	**3**	**-**	**3**	**-**	**-**	**-**	**3**

III B.Tech. – VI Semester

20MEC364A	**HYBRID AND ELECTRIC VEHICLES**	**L T P C**
		3 - - 3

PRE-REQUISITES: Automotive Systems.

COURSE EDUCATIONAL OBJECTIVES:

1. To introduce the fundamental concepts of automotive system components.
2. To understand the fundamental concepts of electric and hybrid vehicles.
3. To provide the knowledge about design of series and parallel HEVs.
4. To provide the knowledge about design of hybrid and electric drive train.
5. To learn the basics of regenerative braking system and fuel cell vehicles.

UNIT –1: BASICS OF TO AUTOMOTIVE SYSTEMS AND ENERGY SOURCES (9)

Environmental Impact: Air pollution, global warming, petroleum resources and different transportation strategies – History of EVs, HEVs and Fuel Cell Vehicles.**IC Engines:** Operation principle with Otto and Atkinson cycle – Techniques for improving engine performance, efficiency, and emissions – SI and CI control system – Alternative fuels and fuel engines. **Energy Sources:** Battery basics, parameters, power and characteristics – Electrochemicalbatteries – High-speed flywheels and capacitors – Hybrid energy storages.

UNIT –2: ENERGY SOURCES, ELECTRIC AND HYBRID ELECTRIC VEHICLES (9)

Electric Vehicles: Configurations and performance of EVs – Tractive effort – Energy consumption. **Hybrid Electric Vehicles:** Concept and architectures of hybrid electric drivetrains. **Electric Propulsion Systems:** DC motor drives – Induction motor drives – Permanent magnetic BLDC motor drives – SRM drives.

UNIT –3: SERIES AND PARALLEL HYBRID ELECTRIC DRIVE TRAIN DESIGN (9)

Electrical Coupling: Operation patterns – Control strategies – Design principles of a series hybrid drivetrain. **Mechanically Coupling:** Drivetrain configuration and design – Control strategies – Parametric design of a drivetrain. **Torque and Speed Coupling:** Drivetrain configuration – Drivetrain control methodology – Drivetrain parameter design.

UNIT –4: HYBRID ELECTRIC DRIVE TRAIN DESIGN (9)

Design and Control Principles: Statistics of driving distance – Energy management and storage design. **Hybrid Electric Drivetrain:** Energy consumed in braking and transmission – Series and parallel hybrid electric drivetrain – Motion resistance – Tracked series architecture – Parametric design of drivetrain – Engine/generator power design – Power and energy design. **Design of Full-Size HEV Engine:** Optimal hybridization ratio – Electrical drive packages – Powertrain Optimization, performance and structure.

UNIT –5: REGENERATIVE BRAKING AND FUEL CELL VEHICLES (9)

Regenerative Braking: Braking energy consumed in urban driving – Braking energy versus vehicle speed, braking power and vehicle deceleration – Braking energy on front and rear axles – Brake system of EV, HEV, and FCV. **Fuel Cells:** Types, operation, electrode potential and current-voltage – Fuel and oxidant consumption – Fuel cell system characteristics, and fuel supply – Non-hydrogen fuel cells. **Fuel Cell Hybrid Electric Drivetrain:** Configuration, control strategy, parametric design and design examples.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Describe the components of automotive systems and working performance.	**PO1,PO2, PO3,PO4**
CO2	Select the proper energy storage systems for vehicle applications.	**PO1,PO2, PO3,PO4**
CO3	Design the series and parallel hybrid electric drive train design.	**PO1,PO2, PO3,PO4**
CO4	Design the hybrid electric drive train design.	**PO1,PO2, PO3,PO4**
CO5	Select the proper regenerative braking systems and design the fuel cell vehicles.	**PO1,PO2, PO3,PO4**

TEXT BOOKS:

1. Mehrdad Ehsani, Yimin Gao, Stefano Longo, and Kambiz M. Ebrahimi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRC Press, LLC, 3/e, 2018.
2. Husain Iqbal, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, Taylor & Francis Group, LLC, 2/e, 2016.

REFERENCE BOOKS:

1. Amir Khajepour, Saber Fallah and Avesta Goodarzi, "Electric and Hybrid Vehicles, Technologies, Modeling and Control: A Mechatronic Approach", John Wiley & Sons Ltd, 2014.
2. Tom Denton, "Electric and Hybrid Vehicles", Routledge and CRC Press, 2/e, 2020.
3. David A. Crolla, Butterworth-Heinemann, "Automotive Engineering: Powertrain, Chassis System and Vehicle Body", Elsevier Inc, 2009.
4. Chris Mi, M. Abul Masrur and David Wenzhong Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, Ltd, 1/e,2011.
5. Yangsheng Xu, Jingyu Yan, Huihuan Qian and Tin Lun Lam, "Hybrid Electric Vehicle Design and Control: Intelligent Omnidirectional Hybrids", Mc-Graw-Hill, 2014.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/108/103/108103009/
2. https://nptel.ac.in/courses/108/106/108106170/
3. https://nptel.ac.in/courses/108/102/108102121/
4. https://nptel.ac.in/courses/108/106/108106182/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	1	-	-	-	-	-	-	-	-
CO.2	3	2	1	1	-	-	-	-	-	-	-	-
CO.3	3	2	1	1	-	-	-	-	-	-	-	-
CO.4	3	2	1	1	-	-	-	-	-	-	-	-
CO.5	3	2	1	1	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

III B.Tech. – VI Semester

		L	T	P	C
20MEC364B	**COMPUTATIONAL FLUID DYNAMICS**	**3**	**-**	**-**	**3**

PRE-REQUISITES: Finite Element Analysis.

COURSE EDUCATIONAL OBJECTIVES:

1. To formulate the Governing equation and boundary conditions of fluid dynamics
2. To derive and solve the finite difference equations of fluid dynamics
3. To formulate the Finite volume formulation for steady state one-, two- and three-dimensional diffusion
4. To study the pressure-velocity corrections and equation of computational fluid dynamics
5. To learn the turbulence models and mesh generation

UNIT –1: GOVERNING EQUATIONS AND BOUNDARY CONDITIONS (9)

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, momentum and energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for turbulent flow – Turbulent-kinetic energy equations – Mathematical behaviour of PDEs on CFD – Elliptic, parabolic and hyperbolic equations.

UNIT –2: FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION (9)

Derivation of finite difference equations– General Methods for first and second order accuracy – Finite volume formulation for steady and transient diffusion problems –Example problems – Use of finite difference and finite volume methods.

UNIT –3: FINITE VOLUME METHOD FOR CONVECTION DIFFUSION (9)

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes, properties of discretization schemes – Conservativeness, boundedness, trasnportiveness, hybrid, power-law, quick schemes.

UNIT –4: FLOW FIELD ANALYSIS (9)

Stream function and vortices – Representation of the pressure gradient term – Staggered grid – Momentum equations – Pressure and velocity corrections – Pressure correction equation – SIMPLE algorithm and its variants – PISO Algorithms.

UNIT –5: TURBULENCE MODELS AND MESH GENERATION (9)

Turbulence models, mixing length model, two equation (k-Є) models – High and low Reynolds number models – Mesh Generation and refinement Techniques – Software tools.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		Pos
CO1	Solve the Governing equation and boundary conditions of fluid dynamics	**PO1,PO2, PO3,PO4**
CO2	Derive and solve the finite difference equations of fluid dynamics	**PO1,PO2, PO3,PO4**
CO3	Formulate the Finite volume formulation for steady state one-, two- and three-dimensional diffusion problems	**PO1,PO2, PO3,PO4**
CO4	Study the pressure-velocity corrections and equation of computational fluid dynamics	**PO1,PO2, PO3,PO4**
CO5	Learn the turbulence models and mesh generation.	**PO1,PO2, PO3,PO4**

TEXT BOOKS:

1. Computational Fluid Dynamics, Basics with Applications, John. D. Anderson, 1/e, 2017, McGraw-Hill Education Pvt. Ltd., Noida.
2. Computational Fluid Dynamics: A Practical Approach, Jiyuan Tu, Guan Heng Yeoh and Chaoqun Liu 3/e, 2018, Butterworth-Heinemann.

REFERENCE BOOKS:

1. An Introduction to Computational Fluid Dynamics: The Finite Volume Method, H. Versteeg and W. Malalasekra, 2/e, 2008, Pearson Education, India.
2. Applied Computational Fluid Dynamics, S C Gupta, 2019, Wiley India.
3. Computational Fluid Dynamics, John F. Wendt, 3/e, 2009, Springer-Verlag Berlin Heidelberg.
4. Introduction to Computational Fluid Dynamics, Anil W. Date 1/e, 2005, Cambridge University Press, UK.
5. Introduction to Computational Fluid Dynamics, Anil W. Date 1/e, 2005, Cambridge University Press, UK.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112107080
2. https://nptel.ac.in/courses/103106073
3. https://nptel.ac.in/courses/103106119
4. https://nptel.ac.in/courses/112105254
5. https://nptel.ac.in/courses/112106294
6. https://nptel.ac.in/courses/112107079

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	1	-	-	-	-	-	-	-	-
CO.2	3	2	1	1	-	-	-	-	-	-	-	-
CO.3	3	2	1	1	-	-	-	-	-	-	-	-
CO.4	3	2	1	1	-	-	-	-	-	-	-	-
CO.5	3	2	1	1	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

III B.Tech. - VI Semester

20MEC364C	TURBO MACHINERY	L	T	P	C
		3	-	-	3

PRE-REQUISITES: A course on Fluid Mechanics and Machinery.

COURSE EDUCATIONAL OBJECTIVES:

1. Explaining the energy transfer in rotor and stator parts of the turbo machines.
2. Explaining the function of various elements of centrifugal fans and blowers.
3. Evaluating the working and performance of centrifugal compressor.
4. Analyzing flow behavior and flow losses in axial flow compressor.
5. Explaining the types and working of axial and radial flow turbines.

UNIT –1: WORKING PRINCIPLES (9)

Classification of Turbomachines – Energy transfer between fluid and rotor – Euler equation and its interpretation – Velocity triangles – Efficiencies in Compressor and Turbine stages – Degree of reaction – Dimensionless parameters for Turbomachines.

UNIT –2: CENTRIFUGAL FANS AND BLOWERS (9)

Types – Components – Working – Flow analysis in impeller blades-volute and diffusers – Velocity triangles – h-s diagram – Stage parameters in fans and blowers – Performance characteristic curves – Various losses – Fan – Bearings, drives and noise.

UNIT –3: CENTRIFUGAL COMPRESSOR (9)

Components – Blade types – Velocity triangles – h-s diagram, stage work – Slip factor and Degree of Reaction – Performance characteristics and various losses – Geometry and performance calculation.

UNIT –4: AXIAL FLOW COMPRESSOR (9)

Construction details – Work done factor – Velocity triangles – h-s diagram, stage work. Work done factor – Performance characteristics, efficiency and stage losses – Stalling and Surging – Free and Forced vortex flow.

UNIT –5: AXIAL AND RADIAL FLOW TURBINES (9)

Axial Flow Turbines: Types – Elements – Stage velocity diagrams – h-s diagram, stage work – Impulse and reaction stages – Compounding of turbines – Performance coefficients and losses. **Radial Flow Turbines:** Types – Elements – Stage velocity diagrams – h-s diagram, stage work – Performance coefficients and losses.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Explain the energy transfer in rotor and stator parts of the turbo machines.	**PO1, PO2, PO3, PO4**
CO2	Explain the function of various elements of centrifugal fans and blowers.	**PO1, PO2, PO3, PO4**
CO3	Evaluate the working and performance of centrifugal compressor.	**PO1, PO2, PO3, PO4**
CO4	Analyze flow behavior and flow losses in axial flow compressor.	**PO1, PO2, PO3, PO4**
CO5	Explain the types and working of axial and radial flow turbines.	**PO1, PO2, PO3, PO4**

TEXT BOOKS:

1. Ganesan, V., "Gas Turbines", Tata McGraw Hill, 3/e, 2011.
2. Yahya, S.M., "Turbines, Compressor and Fans", Tata McGraw Hill, 4/e, 2011.

REFERENCE BOOKS:

1. Dixon, S.L., "Fluid Mechanics and Thermodynamics of Turbomachinery", Butterworth-Heinemann, 7/e, 2014.
2. Gopalakrishnan .G and Prithvi Raj .D," A Treatise on Turbomachines", Scitech Publications (India) Pvt. Ltd., 2/e, 2008.
3. Lewis, R.I., "Turbomachinery Performance Analysis" Arnold Publisher, 1/e, 1996.
4. Saravanamutto, Rogers, Cohen, Straznicky., "Gas Turbine Theory" Pearson Education Ltd, 6/e, 2009.
5. Venkanna, B.K., "Fundamentals of Turbomachinery", PHI Learning Pvt. Ltd., 2009.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/104/112104305/
2. https://nptel.ac.in/courses/112/106/112106061/
3. https://nptel.ac.in/courses/101/101/101101058/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	1	-	-	-	-	-	-	-	-
CO.2	3	2	1	1	-	-	-	-	-	-	-	-
CO.3	3	2	1	1	-	-	-	-	-	-	-	-
CO.4	3	2	1	1	-	-	-	-	-	-	-	-
CO.5	3	2	1	1	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

III B.Tech. - VI Semester

20OCIV361	**BUILDING TECHNOLOGY**	**L T P C**
	(OPEN ELECTIVE - 2)	**3 - - 3**

PRE-REQUISITES: A course on building materials their manufacturing process and utilization in low-cost housing techniques

COURSE OUTCOMES:

1. To teach various types of building materials their manufacturing process and utilization in low-cost housing techniques
2. To teach the functions and manufacturing process of glass and plastic materials that are commonly used in building construction
3. To teach various types of thermal and acoustic insulation materials used in building construction
4. To teach the functions and importance of various structural components
5. To teach in detail about the materials like paints and floor finishes meant for interior works

UNIT I : BASICS TERMINOLOGY **(9)**

Overview of the course, basic definitions, buildings-types-components-economy, and design-principles of planning of buildings and their importance. Definitions and importance ofgrouping and circulation-lighting and ventilation-consideration of the above aspects during planning of building.

UNIT II: TERMITE PROOFING **(9)**

Termite proofing: Inspection-control measures and precautions-lighting protection of buildings-general principles of design of openings-various types of fire protection measures to be considered while planning a building.

UNIT III: VERTICAL TRANSPORTATION IN A BUILDING **(9)**

Vertical transportation in a building: Types of vertical transportation-stairs-different forms of stairs-planning of stairs-other modes of vertical transportation –lifts-ramps- escalators.

UNIT IV PREFABRICATION SYSTEMS IN RESIDENTIAL BUILDINGS **(9)**

Prefabrication systems in residential buildings-walls-openings-cupboards-shelves etc., planning and modules and sizes of components in prefabrication. Planning and designing of residential buildings against the earthquake forces, principles, seismic forces and their effect on buildings.

UNIT V: ACOUSTICS **(9)**

Acoustics –effect of noise –properties of noise and its measurements, principles of acoustics of building. Sound insulation-importance and measures

TOTAL HOURS: 45

COURSE OUTCOMES:

On successful completion of this course the student will be able to		POs related to COs
CO1	Understand the principles in planning and design the buildings	**PO1, PO2**
CO2	To get different types of buildings, principles and planning of the building	**PO1, PO2 ,**
CO3	To know the different methods of termite proofing in buildings	**PO1, PO2**
CO4	Know the different methods of vertical transportation in buildings.	**PO1, PO2 , PO3, PO4**
CO5	Know the implementation of prefabricated units in buildings and the effect of earthquakes on buildings.	**PO1, PO2 ,**

Textbooks:

1. "Building construction by Varghese", PHI Learning Private Limited 2nd Edition 2015
2. Punmia.B.C, Jain.A.K and Jain.A.K Laxmi Publications "Building construction" 11th edition 2016

Reference Books:

1. National Building Code of India, Bureau of Indian Standards
2. Building construction-Technical teachers training institute, Madras, Tata McGraw Hill.
3. Building construction by S.P.Arora and S.P.Brndra Dhanpat Rai and Sons Publications, New Delhi 2014.

REFERENCE WEBSITES:

1. https://nptel.ac.in/courses/105102206 https://nptel.ac.in/courses/105103206

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	3	-	-	-	-	-	-	-	-	-	-
CO.2	1	3	-	-	-	-	-	-	-	-	-	-
CO.3	2	3	-	-	-	-	-	-	-	-	-	-
CO.4	1	1	3	3	-	-	-	-	-	-	-	-
CO.5	2	3	-	-	-	-	-	-	-	-	-	-
CO*	**1.6**	**2.6**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

III B.Tech-VI Semester

		L	T	P	C
20OEEE361	**POWER PLANT ENIGINEERING** (Open Elective – 2)	**3**	**-**	**-**	**3**

Pre-Requisites: NIL

COURSE OBJECTIVES:

1. To understand the working principles of steam power plants.
2. To understand the working principles of diesel and gas turbine power plant
3. To explain the working of nuclear power plant and safety measures.
4. To know the working of hydroelectric power plant and other energy sources
5. To learn the economics, Energy management and environmental issues.

UNIT –1: STEAM POWER PLANT (9)

Introduction to the sources of energy – Resources and development of power in India. **Steam Power Plant:** Plant layout – Working of different circuits – Types of coal – Properties of coal – Coal handling system – Ash handling system – Feed water treatment. **Combustion Process:** Stages of combustion – Overfeed and underfeed stoker firing – Stoker firing of coal – Pulverized coal firing system – Cyclone furnace – Fluidized bed combustion system – Cooling towers and heat rejection.

UNIT –2: DIESEL AND GAS TURBINE POWER PLANT (9)

Diesel Power Plant: Introduction – IC Engines, types, construction – Plant layout with auxiliaries – Fuel supply system, air starting equipment, lubrication and cooling system – Super charging. **Gas Turbine Power Plant:** Introduction – Classification – Construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines – Combined cycle power plants and comparison.

UNIT –3: NUCLEAR POWER PLANT (9)

Basics of nuclear engineering– Fuels and nuclear reactions – Layout and subsystems – Reflectors – Pressurized water reactor (PWR) – Boiling water reactor (BWR) – Canada Deuterium Uranium reactor (CANDU) – Gas cooled and liquid metal fast breeder reactor – Heavy water reactor – Working and comparison – Safety measures for nuclear plants.

UNIT –4: HYDROELECTRIC POWER PLANT AND RENEWABLE ENERGY SOURCES (9)

Hydroelectric Power Plant: Water power – Hydrological cycle – Hydrographs – Storage and pondage – Classification of dams and spill ways – Hydroelectric typical plant layout and components – Pumped storage power plants – Selection of turbines. **Renewable Energy Sources:** Construction and working principle of wind, tidal, solar photo voltaic, solar thermal, geo thermal, biogas and fuel cell systems.

UNIT –5: ENERGY MANAGEMENT, ECONOMICS AND ENVIRONMENTAL ISSUES (9)

Energy Management: Types of loads – Load distribution and sharing – Load curve – Demand factor – Average load – Load factor – Diversity factor – Cost of electrical energy – General arrangement of power distribution – Economics in power plant selection and power generation. **Environmental Issues:** Effluents from power plants – Impact on environment – Pollutants – Pollution standards – Methods of Pollution control – Control of waste disposal and recovery – Waste disposal options for coal and nuclear power plants.

TOTAL HOURS: 45

COURSE OUTCOMES:

On successful completion of course, student will be able to		POs and COs Mapping
CO1	Know the working principles of steam power plants and analyzes its performance.	**PO1, PO2**
CO2	Explain the working of diesel and gas turbine power plant	**PO1, PO2**
CO3	Understand the working principles of nuclear power plant and safety measures	**PO1, PO2, PO7,PO12**
CO4	Explain the working of hydroelectric power plant and other renewable energy sources	**PO1, PO2, PO7,PO12**
CO5	Describe the economics, Energy management environmental issues of power generation	**PO1, PO2, PO7, PO11, PO12**

TEXT BOOKS

1. P.K.Nag, "Power Plant Engineering", McGraw-Hill Education Pvt. Ltd., New Delhi,4/e, 2014.
2. R.K Hegde, "Power Plant Engineering", Pearson Education, India, 1/e, 2015.

REFERENCE BOOKS

1. M. M. El-Wakil, "Power Plant Technology", Tata McGraw-Hill, New Delhi, 1/e, 2010.
2. Arora and S. Domkundwar, "A Course in Power Plant Engineering", Dhanpat RaiPublishing Company (P) Ltd., New Delhi, 6/e, 2012.
3. G.D.Rai, "Introduction to Power Plant Technology", Khanna Publishers, New Delhi, 3/e, 2012.
4. G.R. Nagpal and S.C. Sharma, "Power Plant Engineering", Khanna Publisher, NewDelhi, 16/e, 2004.
5. R.K.Rajput, "A Text Book of Power Plant Engineering", Laxmi Publications (P) Ltd.,New Delhi, 5/e, 2016.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/107/112107291/
2. https://nptel.ac.in/courses/112/103/112103277/
3. https://nptel.ac.in/courses/112/107/112107216/
4. https://nptel.ac.in/courses/103/103/103103206/
5. https://nptel.ac.in/courses/112/103/112103243/

CO-PO MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	1	-	-	-	-	-	-	-	-	-	-
CO.2	3	1	-	-	-	-	-	-	-	-	-	-
CO.3	3	1	-	-	-	-	1	-	-	-	-	1
CO.4	3	1	-	-	-	-	1	-	-	-	-	1
CO.5	3	1	-	-	-	-	1	-	-	-	1	1
CO*	**3**	**1**	-	-	**-**	**-**	**1**	**-**	**-**	**-**	**1**	**1**

III B.Tech. - VI Semester

20OECE361	**COMMUNICATION NETWORKS** (Open Elective - 2)	**L T P C** **3 - - 3**

PRE-REQUISITES: NIL

COURSE EDUCATIONAL OBJECTIVES:

1. Build an understanding of the fundamental concepts of computer networking.
2. Familiarize the student with the basic taxonomy and terminology of the computer networking area.
3. Introduce the student to advanced networking concepts.
4. Preparing the student for entry Advanced courses in computer networking.
5. Allow the student to gain expertise in some specific areas of networking.

UNIT –1: INTRODUCTION TO DATA COMMUNICATION (9)

Introduction: Network Topologies, Protocols & Standards, Layered Architecture LAN, WAN, MAN. OSI Reference Model, TCP/IP Reference Model, Guided and Unguided Media

UNIT –2: DATA LINK LAYER (9)

Data Link Layer: Design Issues, Framing – Error Control – Flow Control, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols, ARQ schemes, HDLC-PPP-Ethernet- IEEE 802.3,4,5 Protocols, Wireless LAN- the 802.11 Architecture and ProtocolStack-The802.11 Physical Layer- The802.11 MAC Sub layer Protocol-The 805.11 Frame Structure-Services.

UNIT –3: MAC LAYER AND ROUTING ALGORITHM (9)

The Medium Access Control Sub layer - The Channel Allocation Problem - Static Channel Allocation Assumptions for Dynamic Channel Allocation, Multiple Access Protocols-Aloha-CSMA Protocols Collision - Free Protocols, Need for Internetworking, Design Issues, Addressing, Internet Protocol (IPv4/IPv6), Virtual Circuit and Datagram Networks, Routing Algorithms, Congestion Control Algorithms.

UNIT –4: TRANSPORT LAYER (9)

Transport layer: UDP, TCP, Congestion Control mechanisms, QOS, Techniques to improve QOS.

UNIT –5: COMMUNICATION INTERFACE AND COMMUNICATION BUSES (9)

Application Layer: Cryptography and network security, DNS, Electronic Mail, FTP, HTTP, SNMP,DHCP.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, Students will be able to		POs
CO1	Independently understand basic computer network technology.	**PO1, PO2,PO3**
CO2	Understand and explain Data Communications System and its components.	**PO1, PO2, PO3, PO4**
CO3	Analysis the different types of network topologies and protocols and Enumerate the layers of the OSI model and TCP/IP.	**PO1, PO2, PO3,**
CO4	Identify the different types of network devices and their functions within a network.	**PO1, PO2, PO4**
CO5	Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.	**PO1, PO2, PO4**

TEXT BOOKS:

1. Tanenbaum and David J Wetherall, "Computer Networks", Pearson Edu., 5th Edition, 2010.
2. Behrouz A. Forouzan, Firouz Mosharraf, "Computer Networks: Top Down Approach" McGraw Hill Education, 1st Edition.

REFERENCE BOOKS:

1. Larry L. Peterson and Bruce S. Davie, "Computer Networks - A Systems Approach", Morgan Kaufmann/Elsevier, 5th Edition, 2011.
2. William Stallings, "Data & Computer Communication", Pearson Education India, 10/e, 2014.
3. James F. Kurose, Keith W. Ross, "Computer Networking: A Top–Down Approach Featuring the Internet", Pearson Education, 6th Edition, 2013.

REFERENCE WEBSITE:

1. https://www.javatpoint.com/computer-network-tutorial
2. https://www.sciencedirect.com/topics/computer-science/data communication - network

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	-	-	-	-	-	-	-
CO2	2	3	2	3	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	2	-	3	-	-	-	-	-	-	-	-
CO5	3	2	-	3	-	-	-	-	-	-	-	-
CO*	**2.8**	**2.6**	**2.3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

III B.Tech - VI Semester

		L	T	P	C
20OCSE361	**DATA COMMUNICATIONS AND COMPUTER NETWORKS** (OPEN ELECTIVE – 2)	**3**	**0**	**0**	**3**

PRE-REQUISITES: NIL

COURSEEDUCATIONALOBJECTIVES:

1. Build an understanding of the fundamental concepts on different Layer models.
2. Familiarize the student with different protocols and its services in the MAC.
3. Introduce the student to routing algorithms and internet.
4. Familiarize the student with Elements of Transport protocols.
5. Have knowledge on application layer protocols.

UNIT– 1 PHYSICAL LAYER (9)

Introduction: Network Topologies-Protocols & Standards-Layered Architecture-LAN, WAN, MAN-OSI Reference Model - TCP/IP Reference Model – ATM Protocol Reference Model-Transmission Media.

UNIT– 2 DATA LINK LAYER (10)

Data Link Layer: Design Issues-Elementary Data Link Protocols- Example of Data Linkprotocols.

MACSUBLAYER: The Channel Allocation Problem – Multiple Access Protocols -IEEE803, 4,5 Protocols – wireless LANS – Bridges – Internet Protocols.

UNIT-3 NETWORK LAYER (8)

Design Issues- Virtual Circuit and Datagram Networks - Routing Algorithms-Congestion Control Algorithms – Internetworking – the Network Layer in the internet.

UNIT– 4 TRANSPORT LAYER (9)

Design Issues - Transport Service-Elements of Transport protocols - The internet Transport protocols – Congestion Control mechanisms – QOS – Techniques to improve QOS.

UNIT– 5 APPLICATION LAYER (9)

Domain Name System - Electronic Mai l- File Transfer Protocol – WWW – FTP – HTTP – SNMP – Multi - Media.

Network Security: Cryptography – Secret and Public Key Algorithm.

Total Hours: 45

COURSEOUTCOMES:

On successful completion of the course, students willbe able to		POs
CO1	Demonstrate knowledge on the basic computer network technology and Enumerate the layers of the OSI, TCP/IP and ATM reference models.	**PO1**
CO2	Demonstrate knowledge and carryout investigation on Data Link Protocols & Multiple access protocols and Wireless LANS technology.	**PO1, PO4**
CO3	Investigate and analyze the Network layer design issues, Routing algorithms and Congestion control algorithms.	**PO1,PO2, PO4**
CO4	Demonstrate knowledge on Transport layer services and various designs of the transport protocols.	**PO1, PO4**
CO5	Demonstrate knowledge on Domain Name System, World Wide Web, and Multimedia & Cryptography.	**PO1**

TEXTBOOKS:

1. Tanenbaum and David J Wetherall, " ComputerNetworks" , 5th Edition, Pearson Edu, 2010.
2. Behrouz A.Forouzan, FirouzMosharraf, " ComputerNetworks" A Top Down Approach, McGraw Hill Education.

REFERENCEBOOKS:

1. Larry L.Peterson and Bruce S.Davie, "Computer Networks-A Systems Approach" Morgan Kaufmann /Elsevier, (5th edt.), 2011
2. William Stallings, "Data & Computer Communication", Pearson Education India, 10th Edition, 2014.
3. James F.Kurose, KeithW. Ross, "Computer Networking: A Top–Down Approach Featuring the Internet", Pearson Education, 6th Edition, 2013.

REFERENCEWEBSITE:

1. https://www.tutorialspoint.com/data_communication_computer_network/index.htm
2. https://www.slideshare.net/pawan1809/computer-networks-a-tanenbaum-5th-editionee

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	-	-
CO.2	3	-	-	2	-	-	-	-	-	-	-	-
CO.3	3	2	-	2	-	-	-	-	-	-	-	-
CO.4	3	-	-	2	-	-	-	-	-	-	-	-
CO.5	3	-	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

III B.Tech-VI SEMESTER

20OHSM361	**LASERS AND FIBER OPTICS**	**L**	**T**	**P**	**C**
	(OPEN ELECTIVE - 2)	**3**	**1**	**0**	**3**

PRE-REQUISITES: NIL

COURSEEDUCATIONALOBJECTIVES:

1. To acquire knowledge on fundamentals of LASERS
2. To study the working of different types of LASERS
3. To develop knowledge on applications of LASERS in various fields
4. To gain knowledge in fundamentals of Optical fiber, construction, types, and attenuations
5. To develop knowledge on applications of Optical fibers in various fields

UNIT- I: LASER INTRODUCTION (10)

Introduction- Spontaneous and stimulated emission of radiation- Properties of lasers (monochromacity, directionality, coherence and brightness) - Conditions for laser action: population inversion- Pumping and different pumping mechanisms- Einstein coefficients and relation among the coefficients.

UNIT – II: TYPES OF LASERS (8)

Nd-YAG laser- He: Ne laser- Semiconductor laser (GaAs)- Argon Ion Laser-CO_2 Laser

UNIT – III: APPLICATIONS OF LASERS (9)

Lasers in Holography- Laser in fusion reaction- Lasers in Raman spectroscopy- Lasers in industry -Lasers in isotope separation- Lasers in medicine.

UNIT – IV: OPTICAL FIBERS (9)

Introduction- Construction of fiber – Working principle of optical fiber (total internal reflection)- Propagation of light through the fibers- Numerical aperture , Acceptance angle and Acceptance cone -Fiber types: Refractive index profile and ray propagation-Step and graded index fibers -Attenuation in fibers: Attenuation coefficient and different loss mechanisms.

UNIT – V: APPLICATIONS OF FIBERS (9)

Fiber optic communication system(block diagram)- Sensing applications of fibers: Pressure sensor, Liquid level sensor, Displacement sensor, Chemical sensor – Optical fibers inmedicine (endoscopes) - Optical fibers in computer networks (block diagram).

TOTAL HOURS: 45

COURSE OUTCOMES

On successful completion of the course the student will be able to,		POs related to COs
CO1	Acquire the basic knowledge on LASERS	PO1, PO12
CO2	Understand different types of LASERS	PO1, PO12
CO3	Develop knowledge on different applications of LASERS	PO1, PO12
CO4	Acquire the basic knowledge on Optical Fibers	PO1,PO12
CO5	Develop knowledge on different applications of Optical Fibers	PO1,PO12

REFERENCE BOOKS:

1. K.Thyagarajan and A.K.Ghatak "Lasers Theory and Applications " Macmillan India Limited, New Delhi.
2. B.BLaud "Lasers And non-Linear Opics" second edition,NewAge International(P) limited,Publishers,New Delhi.
3. John Powers,Richard D Irwin "An Introduction to Fiber Optic Systems" ,Second Edition.
4. M.R.Srinivasan" Physics for Engineers" -, New Age International, 2009

CO-PO MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	1
CO2	3	-	-	-	-	-	-	-	-	-	-	1
CO3	3	-	-	-	-	-	-	-	-	-	-	1
CO4	3	-	-	-	-	-	-	-	-	-	-	1
CO5	3	-	-	-	-	-	-	-	-	-	-	1
CO	3	-	-	-	-	-	-	-	-	-	-	1

IV B.Tech. - VII Semester

20HSM472	UNIVERSAL HUMAN VALUES AND ETHICS	L	T	P	C
		3	-	-	3

PRE-REQUISITES: Nil.

COURSE EDUCATIONAL OBJECTIVES:

1. To develop a holistic perspective based on self-exploration about themselves (Human being), family, society and nature/existence
2. To understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. To Strengthening of self-reflection.
4. To d evelop of commitment and courage to act.
5. To study the holistic understanding of harmony on professional ethics.

UNIT –1: BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION (9)

Purpose and motivation for the course, recapitulation from Universal Human Values – Self-exploration–what is it? - its content and process; 'natural acceptance' and experiential validation- as the process for self-exploration – continuous happiness and prosperity- a look at basic human aspirations – Right understanding, relationship and physical facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority – Right understanding, relationship and physical facility-the basic requirements for fulfilment of aspirations of every human being with their correct priority – Right understanding, relationship and physical facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.

Activities: Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

UNIT –2: UNDERSTANDING HARMONY IN THE HUMAN BEING (9)

Understanding human being as a co-existence of the sentient 'I' and the material 'Body' – Understanding the needs of Self ('I') and 'Body' - happiness and physical facility – Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) – Understanding the characteristics and activities of 'I' and harmony in 'I'– Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail – Programs to ensure Sanyam and Health.

Activities: Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

UNIT –3: UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY (9)

Understanding values in human-human relationship; meaning of justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; trust and respect as the foundational values of relationship – Understanding the meaning of trust; difference between intention and competence – Understanding the meaning of respect, difference between respect and differentiation; the other salient values in relationship – Understanding the harmony in the society (society being an extension of family): resolution, prosperity, fearlessness (trust) and co-existence as comprehensive human goals – Visualizing a universal harmonious order in society-undivided society, universal order-from family to world family.

Activities: Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

UNIT –4: UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE (9)

Understanding the harmony in the nature – Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and self-regulation in nature – Understanding existence as co-existence of mutually interacting units in all-pervasive space – Holistic perception of harmony at all levels of existence.

Activity: Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology.

UNIT –5: UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS (9)

Natural acceptance of human values – Definitiveness of Ethical Human Conduct – Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order – Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems – Case studies of typical holistic technologies, management models and production systems – Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations – Sum up.

Activity: Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**Pos**
CO1	Students are expected to become more aware of themselves, and their surroundings (family, society, nature)	**PO6, PO7, PO8, PO9, PO12**
CO2	They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.	**PO6, PO7, PO8, PO9, PO12**
CO3	They would have better critical ability.	**PO6, PO7, PO8, PO9, PO12**
CO4	They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).	**PO6, PO7, PO8, PO9, PO12**
CO5	It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.	**PO6, PO7, PO8, PO9, PO12**

TEXT BOOKS:

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

REFERENCE BOOKS:

1. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
2. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
3. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
4. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
5. Vivekananda - Romain Rolland(English)
6. Gandhi - Romain Rolland (English)

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/109104068
2. https://nptel.ac.in/courses/110105097
3. https://nptel.ac.in/courses/109106117
4. https://nptel.ac.in/courses/109103142

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	-	-	-	-	-	2	2	3	2	-	-	3
CO.2	-	-	-	-	-	2	2	3	2	-	-	3
CO.3	-	-	-	-	-	2	2	3	2	-	-	3
CO.4	-	-	-	-	-	2	2	3	2	-	-	3
CO.5	-	-	-	-	-	2	2	3	2	-	-	3
CO*	-	**-**	-	-	**-**	2	2	3	2	**-**	**-**	3

IV B.Tech. - VII Semester

20HSM471A	**INDUSTRIAL ENGINEERING AND PSYCHOLOGY**	**L T P C**
		3 - - 3

PRE-REQUISITES: Nil.

COURSE EDUCATIONAL OBJECTIVES:

1. To learn the concepts and characteristics of personnel Management.
2. To understand the organizational structures and plant layout.
3. To know the basic need of work and method study and industrial psychology.
4. To learn the Forecasting and process planning concepts.
5. To study the inventory control and personnel management in an industry.

UNIT –1: CONCEPTS OF MANAGEMENT (9)

Management: Importance of administration and organization – Managerial skills, policies, and objectives – Management contribution of FW Taylor, Henry Foyal and Gilberth – Principles, types, process, levels and functions of management – Management chart – Concepts in project management and MIS – Industrial ownership – Responsibilities of supervisor/foreman – Leadership concepts. **Personnel Management:** Concepts, recruitment, selection, training, job evaluation, merit rating, wage plans, incentives, safety, housekeeping, welfare measures, promotion, lay-off, transfer and discharge.

UNIT –2: ORGANIZATIONAL STRUCTURES AND PLANT LAYOUT (9)

Organization: Concept, importance, characteristics and process of organization – Organization theory, principle, structure, chart and committees – Project, matrix and informal organization – Departmentation – Authority and delegation – Group dynamics – Organizational change, development and conflict – Leadership and communication system. **Plant Layout:** Types, flow pattern, work station, storage, layout and factory design.

UNIT –3: WORK STUDY AND INDUSTRIAL PSYCHOLOGY (9)

Work and method study – Ergonomics principles – Process chart symbols – Flow process, activity chart, flow and string diagram – Operation analysis and motion and economy – Design and layout of work place – Therbligs – SIMO chart – Time study – Standard data – Analytical estimating – Performance Rating – Allowances – PMTS. **Industrial Psychology:** Concept, individuals and group – Motivation theories – Hawthorne experiment – Morale and motivation – Environmental condition – Industrial fatigue.

UNIT –4: PRODUCTION PLANNING AND CONTROL (9)

Productivity: I/O model – Factors affecting the productivity – Productivity resources and measures. **Production Planning:** Continuous and intermittent production –Job, open and closed job shop – Large projects – Forecasting – Process planning – Batch quantity – Tool control and production – Loading, scheduling, dispatching and routing and flow control.

UNIT –5: MATERIALS MANAGEMENT AND INVENTORY CONTROL (9)

Materials Management: Concepts – Procurement – Purchase and order – Buying techniques. **Inventory Control:** Classification – Objectives – Functions – Economic order quantity (EOQ) – Inventory models – ABC analysis – Material requirements planning (MRP) – Manufacturing resource planning (MRP-II).

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Understand the concepts of management and characteristics of Administration and organization	**PO1, PO2, PO12**
CO2	Explain the organizational structures and plant layout for productivity Improvements	**PO1, PO2, PO12**
CO3	Describe the basic need of work study, method study, time study and industrial psychology	**PO1, PO2, PO12**
CO4	Explain the Forecasting, Process planning and control of manufacturing a product	**PO1, PO2, PO12**
CO5	Demonstrate the inventory control and personnel management in an industry	**PO1, PO2, PO11, PO12**

TEXT BOOKS:

1. O.P. Khanna, "Industrial Engineering and Management", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 17/e, 2010.
2. Pravin Kumar, "Industrial Engineering and Management", Pearson Education, New Delhi, 1/e, 2015.

REFERENCE BOOKS:

1. S. N. Chary, "Production and Operations Management", Tata McGraw-Hill Education Pvt. Ltd., Noida, 6/e, 2019.
2. William J Stevenson, "Operations Management", Tata McGraw-Hill Education Pvt. Ltd., Noida, 12/e, 2018.
3. Shailendra Kale, "Production and Operations Management", Tata McGraw-Hill Education Pvt. Ltd., Noida, 1/e, 2013.
4. Kanishka Bedi, "Production and Operations Management", Oxford University Press, India, 3/e, 2013.
5. Harold T Amrine, John A Ritchey, Colin L Moodie and Joseph F Kmec, "Manufacturing Organization and Management", Pearson Education, New Delhi, 6/e,2004.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/107/112107292/
2. https://nptel.ac.in/courses/112/107/112107142/
3. https://nptel.ac.in/courses/112/107/112107143/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	2
CO.2	3	2	-	-	-	-	-	-	-	-	-	2
CO.3	3	2	-	-	-	-	-	-	-	-	-	2
CO.4	3	2	-	-	-	-	-	-	-	-	-	2
CO.5	3	2	-	-	-	-	-	-	-	-	1	2
CO*	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**

IV B.Tech. - VII Semester

20HSM471B	INTELLECTUAL PROPERTY RIGHTS AND PATENTS	L	T	P	C
		3	-	-	3

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To introduce the fundamental aspects of intellectual property Rights.
2. To disseminate knowledge on fundamentals of patent, transfer and infringement.
3. To introduce the fundamental aspects of copyrights and trademarks.
4. To acquire knowledge on geographical indication, industrial design and IC layout.
5. To disseminate knowledge on intellectual property management.

UNIT –1: INTRODUCTION TO INTELLECTUAL PROPERTY (9)

Definitions and importance of intellectual property – Introduction and history of WTO – Structure of WTO agreements and dispute settlements – Principles of trading system – Trade policy reviews – Agreement on TRIPS – Ministerial conferences – Emerging issues in IPR – Protection of plant varieties – Patent sharks – Open-source movement – Bio-piracy.

UNIT –2: FUNDAMENTALS OF PATENT, TRANSFER AND INFRINGEMENT (9)

Fundamentals of Patent: History of patents in India – Grant of patent – Inventions those are not patentable – Process and product patent – Specification and procedure of patent – e-filling – Temporal and spatial – Opposition to grant of patent – Rights and PCT of patents – Marketing rights – Milestones in Indian patent. **Transfer and Infringement:** Transfer and Infringement of patent rights – Surrender of patents – Challenges in patents.

UNIT –3: COPYRIGHT AND TRADE MARKS (9)

Copyright: Definition – Copyright board registration in India – Ownership of copyright – Rights of the owner – Terms of copyright – Registration of copyright – Convention and UCC – Rights of broadcasting – International copyright – Infringement of copyright – Copyright Act, Amendment and Issues. **Trade Marks:** Developing a Trademark – Trademark registration – Trademark applications – Procedure for trademark registration in India – Terms, assignment, transmission, certification, infringement of trademarks.

UNIT –4: GEOGRAPHICAL INDICATION, INDUSTRIAL DESIGN AND IC LAYOUT (9)

Geographical Indications: Concept, historical perspective, potential benefit, renewal and status of Geographical Indications – Geographical Indications in India – Infringement of GI – Status of GI registration in India. **Industrial Designs and IC Layouts:** Registration of Industrial Designs – Copyrights in Industrial designs – Terms, procedure and conditions for Industrial Designs – Infringement of ID – Integrated circuit layout design – Trade secrets.

UNIT –5: INTELLECTUAL PROPERTY MANAGEMENT (9)

Creating Intellectual Property: Need for creating intellectual property – Development of IP and Knowledge – Types of innovations – Behavioral aspects**. Intellectual Property Management:** Need and importance of IP management – IP management activities – 5Cs model of managing IP – Research and Developments in India (Case Study).

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Understand fundamental aspects of intellectual property Rights.	**PO1, PO12**
CO2	Demonstrate knowledge on fundamentals of patent, transfer and infringement.	**PO1, PO3, PO12**
CO3	Understand fundamental aspects of copyrights and trademarks.	**PO1, PO3, PO12**
CO4	Demonstrate knowledge on geographical indication, industrial design and IC layout.	**PO1, PO3, PO12**
CO5	Demonstrate knowledge on intellectual property management.	**PO1, PO3, PO12**

TEXT BOOKS:

1. Intellectual Property Rights, Pandey Neeraj and Dharni Khushdeep, 2014, PHI Learning Ltd., India.
2. Intellectual Property Rights and Copyrights, S.P. Satarkar, Ess Ess Publications, 2003.

REFERENCE BOOKS:

1. Intellectual Property in the New Technological Age, 2016: Vol. I Perspectives, Trade Secrets and Patents, Peter S. Menell, Mark A. Lemley, and Robert P. Merges. 2016
2. Intellectual Property in the New Technological Age, 2016: Vol. II Copyrights, Trademarks and State IP Protections, Peter S. Menell, Mark A. Lemley, and Robert P. Merges. 2016.
3. Intellectual Property Rights Law in India, T. Ramappa, 2/e, 2016, Asia Law House.
4. Resisting Intellectual Property, Debora J. Halbert, 2006, Taylor & Francis Ltd ,2007
5. Law Relating to Intellectual Property Rights, V K Ahuja, 3/e, 2017, Lexis Nexis.

REFERENCE WEBSITE:

1. https://onlinecourses.swayam2.ac.in/cec22_lw12/preview
2. https://onlinecourses.nptel.ac.in/noc22_mg98/preview

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	-	3
CO.2	3	-	1	-	-	-	-	-	-	-	-	3
CO.3	3	-	1	-	-	-	-	-	-	-	-	3
CO.4	3	-	1	-	-	-	-	-	-	-	-	3
CO.5	3	-	1	-	-	-	-	-	-	-	-	3
CO*	**3**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

IV B.Tech. - VII Semester

		L	T	P	C
20HSM471C	**MANAGING INNOVATION AND ENTREPRENEURSHIP**	**3**	**-**	**-**	**3**

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To the scope of innovation management principles.
2. To study the characteristics of innovation with in firms.
3. To study the technological entrepreneurship and innovation practices.
4. To study the concepts in entrepreneurship for engineers.
5. To understand the financial requirements for starting new venture.

UNIT –1: IMPORTANCE OF INNOVATION AND MANAGEMENT (9)

Importance of innovation – Innovation in an organizational context – Development activities and design environment – Innovation and invention – Successful and unsuccessful innovation – Types and models of innovation – DUI mode of innovation – Disruptive innovations – Cyclic model of innovation with interconnected cycles.

UNIT –2: MANAGING INNOVATION WITHIN FIRMS (9)

Organizations and innovation – The dilemma of innovation management – Innovation dilemma in low technology sectors – Dynamic capabilities – Managing uncertainty – Managing innovation projects – Organizational characteristics that facilitate the innovation process – Industrial firms – Organizational structures and innovation – The role of the individuals in innovation – IT systems and their impact on innovation – Management tools for innovation. **Operations and Process Innovation:** Design and innovation in the context of operations – Process design and innovation – Innovation in the management of the operations process – Design of the organization and its suppliers – Lean innovation.

UNIT –3: TECHNOLOGICAL ENTREPRENEURSHIP AND INNOVATION PRACTICES (9)

Types of entrepreneurships – Sustainable entrepreneurship – Learning lifecycle and the learning strategy – Incubators – Technology management and transfer – Technology transfer mechanisms and models – Technology transfer obstacles – Success factors for technology transfer – Spin offs – Strategic alliances and commercialization metrics.

UNIT –4: ENTREPRENEURSHIP FOR ENGINEERS (9)

Industrial Evolution: Necessity of industrial viewpoints – Entrepreneurial mind. **How to Commercialize Invention:** Discovery of a new functi on or material – Performance improvement – Product planning creativity – Marketing creativity. **Start-Up:** The Founder and team – Entrepreneurial process – Legal procedure. **Business Plan:** Executive summary – Management and organization – Product/service – Marketing plan – Administrative policies, procedures, and controls – Growth plan – Financial plan.

UNIT –5: BUSINESS PLAN TO FUNDING VENTURE (9)

How to Find Financial Resources: Debt and equity — Internal and external funds including loans – Financial resources at the start-up stage – Government grants and Research funds – Private financing. **Financial Management:** Sales and payroll – Daily accounting – Financial statements – Demand, supply, and market equilibrium.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		Pos
CO1	Describe the scope of importance in innovation and management	**PO1, PO6, PO8, PO9, PO11, PO12**
CO2	Understand the concepts of managing innovation within firms.	**PO1, PO6, PO8, PO9, O11, PO12**
CO3	Illustrate the concept of technological entrepreneurship and innovation practices	**PO1, PO6, PO8, PO9, O11, PO12**
CO4	Summarize the systematic approach to entrepreneurship for engineers	**PO1, PO6, PO8, PO9, O11, PO12**
CO5	Understand the business plan to funding venture.	**PO1, PO6, PO8, PO9, O11, PO12**

TEXT BOOKS:

1. Paul Trott, "Innovation Management and New Product Development" 6/e, Pearson Education Ltd.,
2. Elias G. Carayannis, Elpida T. Samara & Yannis L. Bakouros "Innovation and Entrepreneurship - Theory, Policy and Practice" Springer International Publishing Switzerland, 2015.
3. Kenji Uchino, "Entrepreneurship for engineers" 2010 by Taylor and Francis Group, LLC.

REFERENCE BOOKS:

1. Robert D. Hisrich, Michael P. Peters, Dean A. "Entrepreneurship" 10/e, McGraw-Hill, 2017.
2. Michael G. Luchs, K. Scott Swan and Abbie Griffin., "Design Thinking - New Product Development Essentials from the PDMA", John Wiley & Sons, Inc., 2016.
3. Clayton M. Christensen and Clayton M. Christensen "The Innovator's Solution - Creating and Sustaining Successful Growth", Harvard Business School Press.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/127105007
2. https://nptel.ac.in/courses/109105176
3. https://nptel.ac.in/courses/107101086

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	1	-	-	-	-	1	-	1	1	-	3	1
CO.2	1	-	-	-	-	1	-	1	1	-	3	1
CO.3	1	-	-	-	-	1	-	1	1	-	3	1
CO.4	1	-	-	-	-	1	-	1	1	-	3	1
CO.5	1	-	-	-	-	1	-	1	1	-	3	1
CO*	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**1**	**-**	**3**	**1**

IV B.Tech. - VII Semester

20MEC471A	AUTOMATION AND ROBOTICS	L	T	P	C
		3	-	-	3

PRE-REQUISITES: Nil.

COURSE EDUCATIONAL OBJECTIVES:

1. To study the various fundamental and advanced concepts of automation in industry
2. To understand the line balancing and flow lines in automated industry
3. To learn about basic concepts of drives, sensors used in robots
4. To study about the kinematics and dynamics analysis of robots
5. To gain knowledge in robot programming and application.

UNIT –1: BASICS OF AUTOMATION (9)

Basic elements of an automated system – Advanced automation function – Levels of automation – Hardware components for automation and process control – Overview of material handling – Material transport equipments – Analysis of material transport system – Introduction to automated storage and retrieval system – Conventional storage methods and equipments – Analysis of storage system – Over view of automated identification technique – Bar code technology – Radio frequency techniques – AIDC technologies.

UNIT –2: AUTOMATED FLOW LINES AND LINE BALANCING (9)

Automated Flow Lines: Work part transport – Storage buffers – Control of theproduction line – Applications of flow line in machining system – System design consideration of flow lines. **Assembly Line Balancing:** Line balancing methods – Ways of improving line balance and flexible assembly lines – Automated assembly system and configuration – Parts delivery at work station and applications.

UNIT –3: INDUSTRIAL ROBOTICS AND DRIVE SYSTEM (9)

Introduction – Robot anatomy – Robot configuration and motions – Robot specifications – Pitch, yaw, roll, joint notations, speed of motion, pay load – Work volume. **Robot Drive System:** Pneumatic, hydraulic drives, mechanical and electrical drives – Servo motors and stepper motor. **Grippers:** Mechanical, pneumatic and hydraulic grippers, magnetic grippers and vacuum grippers – Two fingered and three fingered grippers – Internal and external grippers. **Robot Sensors:** Position and velocity sensor – Tactile sensor – Proximity and range sensor – Touch sensor – Force and torque sensor – Usesof sensors in robotics.

UNIT –4: ROBOT MOTION ANALYSIS AND CONTROL (9)

Robot Kinematics: Manipulator kinematics – Position representation – Forward and reverse transformation – Adding orientation – Homogeneous transformations – D-H notation – Forward and inverse kinematics. **Robot Dynamics:** Differential transformation – Compensating for gravity – Robot arm dynamics. **Trajectory Planning:** Trajectory planning and avoidance of obstacles – Path planning – Skew motion – Joint integrated motion – Straight line motion.

UNIT –5: ROBOT PROGRAMMING AND APPLICATIONS (9)

Robot Programming: Lead through programming – Robot language structure – Motion commands of move, speed control, workplace, path, frames, end effecter operation,sensor operation and react statement – Program sequence and subroutine – Teach pendant programming – VAL II programming. **Robot Applications:** Material transfer and machine loading / unloading – Processing applications in spray coating, spot and arc welding – Assembly and inspection automation – Selection of robots in industry applications.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Summarize the various fundamental and advanced concepts of automation in industry	**PO1, PO2, PO3, PO4, PO5**
CO2	Understand the line balancing and flow lines of robotics in automated industry	**PO1, PO2, PO3, PO4, PO5**
CO3	Demonstrate the basic concepts of drives, sensors used in robots	**PO1, PO2, PO3, PO4, PO5**
CO4	Compare and analyze the kinematics and dynamics of robots	**PO1, PO2, PO3, PO4, PO5**
CO5	Explain about robot programming and applications	**PO1, PO2, PO3, PO4, PO5**

TEXT BOOKS:

1. Automation, Production Systems and Computer-Integrated Manufacturing, Mikell.P.Groover, 4/e, 2016, Pearson Education, New Delhi.
2. Industrial Robotics: Technology, Programming and Applications, Mikell P Groover, Mitchell Weiss, Roger N. Nagel, Nicholas G Odrey and Ashish Dutta 2/e, 2012, Tata McGraw-Hill Education Pvt. Ltd.,

REFERENCE BOOKS:

1. Robotics Technology and Flexible Automation, S.R.Deb and Sankha Deb, 2/e, 2009, Tata McGraw-Hill Education Pvt. Ltd., Noida.
2. Robots and Robotics - Principles, Systems, and Industrial Applications, Mark R Miller & Rex Miller 2017, McGraw-Hill Education.
3. Introduction to Robotics: Mechanics and Control, John J. Craig, 3/e, 2005, Pearson Education, New Delhi.
4. Robotics: Fundamental Concepts and Analysis, Ashitava Ghosal, 1/e, 2006, Oxford University Press, New Delhi.
5. Robotics: Control, Sensing, Vision and Intelligence, K.S. Fu, R.C.Gonzales and C.S.G.Lee, 1/e, 2008, Tata McGraw-Hill Education Pvt. Ltd., Noida.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/101/112101099/
2. https://nptel.ac.in/courses/112/101/112101098/
3. https://nptel.ac.in/courses/112/108/112108093/
4. https://nptel.ac.in/courses/112/105/112105249/
5. https://nptel.ac.in/courses/112/107/112107289/
6. https://nptel.ac.in/courses/107/106/107106090/
7. https://nptel.ac.in/courses/112/104/112104298/
8. https://nptel.ac.in/courses/112/105/112105249/
9. https://nptel.ac.in/courses/112/103/112103293/
10. https://nptel.ac.in/courses/112/104/112104288/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	2	2	-	-	-	-	-	-	-
CO.2	3	2	2	2	2	-	-	-	-	-	-	-
CO.3	3	2	2	2	2	-	-	-	-	-	-	-
CO.4	3	2	2	2	2	-	-	-	-	-	-	-
CO.5	3	2	2	2	2	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

IV B.Tech. - VII Semester

20MEC471B	**PRODUCTION AND OPERATIONS MANAGEMENT**	**L T P C**
		3 - - 3

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To Understand the scope of operations management and it's functional areas
2. To study the requirement and selection of good forecasting methods and techniques
3. To understand the concept of aggregate planning and material requirement planning
4. To study the systematic approach to capacity planning and capacity management techniques
5. To understand the production activity control and lean manufacturing in an operational management

UNIT –1: INTRODUCTION (9)

Overview of production system – Objectives of operation management – Scope of operations management – Operations management frame work – Relationship of operations with other functional areas – Manufacturing Vs service sector – Operations decision making – Production design process and process choices

UNIT –2: FORECASTING (9)

Need – Determinants of demand – Demand patterns – Measures of forecast error – Qualitative forecasting methods – Delphi techniques – Market research – Nominal group technique quantitative forecasting methods – Moving average methods – Exponential smoothing methods – Regression methods – Monitoring and control of forecasts – Requirements and selection of good forecasting methods.

UNIT –3: AGGREGATE PLANNING AND MATERIAL REQUIREMENT PLANNING (9)

Role of aggregate product planning – Managerial inputs to aggregate planning – Pure and mixed strategies, Mathematical models for aggregate planning – Transportation method – Linear programming formulation – Linear decision Rues – Master Production Schedule (MPS) – Procedure for developing MPS – MRP – Lot sizing methods – Implementation issues – MRP-II – Introduction to ERP.

UNIT –4: CAPACITY MANAGEMENT (9)

Measures of capacity – Factors affecting capacity – Capacity planning – Systematic approach to capacity planning – Long-term and short-term capacity decisions – Tools for capacity planning – Capacity requirement planning – Business process outsourcing – Introduction TOC.

UNIT –5: PRODUCTION ACTIVITY CONTROL AND LEAN MANUFACTURING (9)

Objectives – Activities of Production Activity Control – JIT – Kanban – Introduction to Scheduling in different types of Production Systems – Lean Manufacturing – Principles – Activities – Tools and techniques – Case studies.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Describe the scope of operations management and it's functional areas	**PO1, PO11, PO12**
CO2	Understand the requirement and selection of good forecasting methods and techniques.	**PO1, PO2, PO11, PO12**
CO3	Illustrate the concept of aggregate planning and material requirement planning	**PO1, PO2, PO11, PO12**
CO4	Summarize the systematic approach to capacity planning and capacity management techniques	**PO1, PO2, PO11, PO12**
CO5	Understand the production activity control and lean manufacturing in an operational management	**PO1, PO2, PO11, PO12**

TEXT BOOKS:

1. S.N.Chary, "Production and Operations Management", Tata Mcgraw Hill, New Delhi, 6/e, 2012.
2. William J. Stevenson, "Operations Management", Tata Mcgraw Hill, New Delhi, 12/e, 2002.

REFERENCE BOOKS:

1. Alan Muhlemann, Keith Lockyer and J.S. Oakland, "Production and Operations Management", Pearson Edcation, India, 6/e, 2007.
2. Panneerselvam. R, "Production and Operations Management", PHI Learning, New Delhi, 3/e, 2012.
3. Kanishka Bedi, "Production and Operations Management", Oxford University Press, 2013.
4. Nigel Slack and Alistair Brandon-Jones, "Operations Management", Pearson Education India, 9/e, 2019.
5. K.Aswathappa, K.Shridhara Bhat, "Production and Operations Management", Himalaya Publishing House, New Delhi, 2/e, 2010.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/110/107/110107141/
2. https://nptel.ac.in/courses/112/102/112102106/
3. https://nptel.ac.in/courses/112/102/112102107/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	-	-	-	-	-	-	-	-	1	1
CO.2	3	2	-	-	-	-	-	-	-	-	1	1
CO.3	3	2	-	-	-	-	-	-	-	-	1	1
CO.4	3	2	-	-	-	-	-	-	-	-	1	1
CO.5	3	2	-	-	-	-	-	-	-	-	1	1
CO*	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**

IV B.Tech. - VII Semester

20MEC471C	INDUSTRIAL SAFETY MANAGEMENT	L	T	P	C
		3	-	-	3

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To explain the fundamental concept and principles of industrial safety
2. To apply the functions and principles of maintenance engineering
3. To analyse the wear, corrosion and its reduction.
4. To evaluate faults in various tools, equipments and machines
5. To apply the periodic maintenance procedures and preventive maintenance.

UNIT –1: INDUSTRIAL SAFETY (9)

Accident – Causes – Types – Results and control – Mechanical and Electrical hazards – Types Causes and preventive steps/procedure – Describe salient points of factories act 1948 for health and safety – Wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, – Safety color codes. – Fire prevention and firefighting – Equipment and methods.

UNIT –2: MAINTENANCE ENGINEERING (9)

Definition and aim of maintenance engineering – Primary and secondary functions and responsibility of maintenance department –Types of maintenance – Types and applications of tools used for maintenance – Maintenance cost & its relation with replacement economy – Service life of equipment.

UNIT –3: WEAR, CORROSION AND THEIR PREVENTION (9)

Wear – Types – Causes and effects –Wear reduction methods – Lubricants-types and applications – Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle andfactors affecting the corrosion. Types of corrosion – Corrosion prevention methods.

UNIT –4: FAULT TRACING (9)

Fault tracing-concept and importance – Decision tree concept, need and application – Sequence of fault finding activities, show as decision tree, and draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internalcombustion engine, v. Boiler, vi. Electrical motors –Types of faults in machine tools and their general causes.

UNIT –5: PERIODIC AND PREVENTIVE MAINTENANCE (9)

Periodic inspection, concept and need, degreasing – Cleaning and repairing schemes – Overhauling of mechanical components – Overhauling of electrical motor – Common troubles and remedies of electric motor – Repair complexities and its use, need, steps and preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps iii. Air compressors, iv. Diesel generating (DG) sets, – Program and schedule of preventive maintenance – Advantages – Repair cycle concept.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Explain the fundamental concept and principles of industrial safety	**PO1, PO2, PO3, PO6, PO7, PO12**
CO2	Apply the principles of maintenance engineering.	**PO1, PO2, PO3, PO6, PO7, PO12**
CO3	Analyze the wear, corrosion and its reduction.	**PO1, PO2, PO3, PO6, PO7, PO12**
CO4	Evaluate faults in various tools, equipments and machines.	**PO1, PO2, PO3, PO6, PO7, PO12**
CO5	Apply periodic maintenance procedures in preventive maintenance	**PO1, PO2, PO3, PO6, PO7, PO12**

TEXT BOOKS:

1. L M Deshmukh, "Industrial Safety Management", Tata McGraw-Hill Education, 2005.
2. M. P. Poonia and S. C. Sharma, "Industrial Safety and Maintenance Management", Khanna Publisher, 2019.

REFERENCE BOOKS:

1. Sushil Kumar Srivastava, "Maintenance Engineering", S. Chand Publishing, New Delhi.
2. Mishra, R. C. and Pathak, K., "Maintenance Engineering and Management", PHI Learning, India, 2/e, 2012.
3. Charles D. Reese, "Occupational Health and Safety Management: A Practical Approach", CRC Press, 3/e, 2012.
4. Keith Mobley, "Maintenance Engineering Handbook", Tata McGraw-Hill Education, 8/e, 2014.
5. Edward Ghali, V. S. Sastri, M. Elboujdaini, "Corrosion Prevention and Protection: Practical Solutions", John Wiley & Sons, 2007.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/110/105/110105094/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	-	-	1	1	-	-	-	-	1
CO.2	3	2	1	-	-	1	1	-	-	-	-	1
CO.3	3	2	1	-	-	1	1	-	-	-	-	1
CO.4	3	2	1	-	-	1	1	-	-	-	-	1
CO.5	3	2	1	-	-	1	1	-	-	-	-	1
CO*	**3**	**2**	**1**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**1**

IV B.Tech. - VII Semester

20MEC472A	PRODUCT DESIGN AND DEVELOPMENT	L	T	P	C
		3	-	-	3

PRE-REQUISITES: A Course on Design Thinking for Innovation

COURSE EDUCATIONAL OBJECTIVES:

1. To develop the Characteristics of successful product design and development in an organization
2. To evaluate the product planning and product specification of a product
3. To understand the generation, selection and testing of a concept in the product design.
4. To develop product architecture and design for manufacturing new product
5. To understand the principles of prototypes, economics and project management.

UNIT –1: INTRODUCTION TO PRODUCT DESIGN AND INNOVATION (9)

Characteristics, duration, challenges and cost of successful product development – Product development process – Generic development process – Concept development – Adaptation of the generic product development – Product development process flow and organization – Structure of opportunity identification – Opportunity identification process – Establish a charter – Generate and sense many opportunities – Screening of opportunities – Develop promising opportunities – Select exceptional opportunities – Reflect on the results and the process.

UNIT –2: PRODUCT PLANNING AND PRODUCT SPECIFICATION (9)

Product planning process – Identification of opportunities – Evaluation and prioritization of projects – Allocation of resources and plan timing – Completion of pre-project planning – Reflect on the results and process – Identification of customer needs – Collection and Interpretation of raw data from customers – Organization of the needs – Establishment of relative importance of needs – Product specifications – Establishment of target specifications – Setting-up of final specifications.

UNIT –3: CONCEPT GENERATION, SELECTION, TESTING (9)

Concept generation – Clarification of the problem – Searching externally and internally – Systematic exploration and reflect on the solutions – Concept selection – Steps for concept screening and concept scoring – Concept testing – Purpose of concept test – Survey population and format – Communicating the concept – Measuring the customer response – Interpretation of results.

UNIT –4: PRODUCT ARCHITECTURE AND DESIGN FOR MANUFACTURE (9)

Product architecture – Modularity – Implications – Establishing the architecture – Delayed differentiation – Platform planning – System-level design issues – Need, impact, management and quality of industrial design – Design for environment process – Setting the DFE agenda – Identify potential environmental impacts – Select and apply the DFE guidelines to the product design – Assessing and elimination of environmental impacts – Reflect on the DFE process – Design for manufacturing – Estimation of manufacturing costs – Reduction of costs of components, assembly, supporting production – Impact decisions of DFM.

UNIT –5: PRODUCT DEVELOPMENT ECONOMICS AND MANAGING PROJECTS (9)

Planning of prototypes – Robust design process – Identify the performance metrics, and noise factors – Objective function and experimental plan – Run the experiment, select, reflect and repeat and confirm factor – Overview, formulation, strategy and utility of patents – Study prior inventions – Outline and refine claims – Description of the invention – Pursue application and reflect on the results – Product development economics and elements analysis – Financial model – Perform and use of sensitivity analysis – Qualitative factors on project success – Managing projects – Baseline project planning – Project execution.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Describe the Characteristics of successful product development in an organization	**PO1, PO2, PO3**
CO2	Evaluate the product planning and product specification of a product	**PO1, PO2, PO3**
CO3	Understand the generation, selection and testing of a product concept	**PO1, PO2, PO3**
CO4	Develop product architecture and design for manufacturing new product	**PO1, PO2, PO3**
CO5	Understand the principles of prototypes, economics and project management	**PO1, PO2, PO3, PO11**

TEXT BOOKS:

1. Ulrich K.T. and Eppinger S.D., "Product Design and Development", McGraw-Hill Education, 6/e, 2015.
2. Kevin Otto and Kristin Wood, "Product Design: Techniques in Reverse Engineering and New Product Development", Pearson Education, 1/e, 2003.

REFERENCE BOOKS:

1. Paul Trott, "Innovation Management and New Product Development", Pearson Education, 6/e, 2016.
2. Chitale.A.K and Gupta.R.C, "Product Design and Manufacturing", Prentice Hall of India, New Delhi, 2011.
3. Mukesh Chaturvedi, Aseem Kumar and Rahul Manmohan, "Managing Innovations and New Product Development: Concepts and Cases", PHI Learning, 2009.
4. James M. Morgan and Jeffrey K. Liker, "Designing the Future", McGraw-Hill Education, 1/e, 2019.
5. James M. Morgan and Jeffrey K. Liker, "Designing the Future", McGraw-Hill Education, 1/e, 2019.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/107/112107217/
2. https://nptel.ac.in/courses/112/104/112104230/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	-	-	-	-	-	-	-	-	-
CO.2	3	2	1	-	-	-	-	-	-	-	-	-
CO.3	3	2	1	-	-	-	-	-	-	-	-	-
CO.4	3	2	1	-	-	-	-	-	-	-	-	-
CO.5	3	2	1	-	-	-	-	-	-	-	1	-
CO*	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	-

IV B.Tech. - VII Semester

20MEC472B	**DESIGN OF HEAT EXCHANGERS**	**L T P C**
		3 - - 3

PRE-REQUISITES: Heat and Mass Transfer

COURSE EDUCATIONAL OBJECTIVES:

1. To learn the various methods and forms of design in engineering fields.
2. To evaluate Basic modules in design process by Scientific method and design method
3. To develop the creativity and innovation in design to solve problems by vertical and lateral thinking.
4. To study the design in human machine interface for developing the product.
5. To understand the selection of material for performance characteristics for new design

UNIT –1: INTRODUCTION (9)

Types of heat exchangers shell and tube heat exchangers – Regenerators and recuperators – Temperature distribution and its implications – Parts description – Classification as per tubular exchanger manufacturers association (TEMA).

UNIT –2: PROCESS DESIGN OF HEAT EXCHANGERS (9)

Heat transfer correlations, overall heat transfer coefficient, analysis of heat exchangers – LMTD and effectiveness method – Sizing of finned tube heat exchangers, U tube heat exchangers –Design of shell and tube heat exchangers, fouling factors, pressure drop calculations.

UNIT –3: STRESS ANALYSIS, DESIGN OF COMPACT & PLATE HEAT EXCHANGER (9)

Stress Analysis: Stress in tubes – Header sheets and pressure vessels – Thermalstresses, shear stresses – Types of failures, buckling of tubes, flow induced vibration. **Design of Compact and Plate Heat Exchanger:** Types – Merits and demerits – Design of compact heat exchangers, plate heat exchangers, performance influencing parameters and limitations.

UNIT –4: HUMAN AND SOCIETAL ASPECTS IN PRODUCT DEVELOPMENT (9)

Design of Condensers: Overall heat transfer coefficients – Temperature distribution and heat flow in condenser – Pressure drop in condenser – Extended fin surfaces – Fouling factor – Correction factor – Design of surface and evaporative condensers.

UNIT –5: DESIGN OF COOLING TOWERS AND SPRAY PONDS (9)

Design of Cooling Towers and Spray Ponds: Classification – Performance – Analysis of counter flow – Cross flow cooling towers – Temperature diagram of air and water – Cooling ponds – Types of cooling ponds – Procedure for Calculation of Outlet Conditions – Cooling tower – Performance characteristics.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Understand the fundamental principles of heat exchanger and classifications	**PO1, PO2, PO3, PO4**
CO2	Analyze heat exchanger correlations and overall heat transfer coefficient of heat exchanger	**PO1, PO2, PO3, PO4**
CO3	Illustrate the thermal and stress analysis on various parts of the heat exchangers	**PO1, PO2, PO3, PO4**
CO4	Understand the design of condenser, surface and evaporative condensers	**PO1, PO2, PO3, PO4**
CO5	Develop a design of evaporative condensers and Cooling towers.	**PO1, PO2, PO3, PO4**

TEXT BOOKS:

1. SadikKakac, Hongtan Liu, Anchasa Pramuanjaroenkij, "Heat Exchangers Selection, Rating and Thermal Design", CRC Press, 3/e, 2012.
2. Ramesh K. Shah and Dusan P. Sekulic, "Fundamentals of Heat Exchanger Design", John Wiley & Sons, Inc., 2003,.

REFERENCE BOOKS:

1. T. Kuppan, Marcel Dekker, "Heat Exchanger Design Hand Book", New York, 2009.
2. John E. Hesselgreaves, "Compact Heat Exchangers: Selection, Design and Operation", Elsevier science Ltd., 2001.
3. C. Ranganayakulu and K.N. Seetharamu, "Compact Heat Exchangers Analysis,Design and Optimization Using FEM and CFD Approach", John Wiley & Sons Ltd., 2018.
4. Robert W. Serth, "Process Heat Transfer Principles and Applications", Academic press, Elesevier, 2010.
5. Eric M. Smith, "Advances in Thermal Design of Heat Exchangers: A Numerical Approach: Direct-sizing, Step-wise Rating and Transients", John Wiley & Sons, 2005.

CODES/TABLES: Data book is permitted in the examinations.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/105/112105248/
2. https://nptel.ac.in/courses/103/105/103105052/
3. https://nptel.ac.in/courses/112/101/112101097/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	-	-	-	-	-	-	-	-
CO.2	3	2	2	-	-	-	-	-	-	-	-	-
CO.3	3	2	2	-	-	-	-	-	-	-	-	-
CO.4	3	2	2	-	-	-	-	-	-	-	-	-
CO.5	3	2	2	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

IV B.Tech. - VII Semester

20MEC472C	INDUSTRIAL TRIBOLOGY	L	T	P	C
		3	-	-	3

PRE-REQUISITES: Nil.

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the principles of friction between different surfaces and materials.
2. To explain the phenomenon of wear between surfaces in contact and its implications.
3. To understand the principles, methods, purpose and selection of lubricants.
4. To know the lubrication theory and the flow of film lubricants with different applications.
5. To brief the surface treatment methods to improve the wear resistance and friction properties.

UNIT –1: SURFACES AND FRICTION (9)

Topography of engineering surfaces – Contact between surfaces – Sources of sliding friction – Adhesion-Ploughint – Energy dissipation mechanisms friction characteristics of metals – Friction of non metals – Friction of lamellar solids – Friction of ceramic materials and polymers – Rolling friction – Source of rolling friction – Stick slip motion – Measurement of friction.

UNIT –2: WEAR (9)

Types of wear – Simple theory of sliding wear mechanism of sliding wear of metals – Abrasive wear – Materials for adhesive and abrasive wear situations – Corrosive wear – Surface fatigue wear situations – Brittle fracture – Wear – Wear of ceramics and polymers – Wear measurements.

UNIT –3: LUBRICANTS AND LUBRICATION TYPES (9)

Types and properties of lubricants – Testing methods – Hydrodynamic lubrication – Elasto hydrodynamic lubrication – Boundary lubrication – Solid lubrication – Hydrostatic lubrication.

UNIT –4: FILM LUBRICATION THEORY (9)

Fluid film in simple shear – Viscous flow between very close parallel plates – Shear stress variation Reynolds equation for film lubrication – High speed unloaded journal bearings – Loaded journal bearings – Reaction torque on the bearings – Virtual co-efficient of friction – The Sommerfield diagram.

UNIT –5: MATERIALS AND PROCESSES IN DESIGN (9)

Surface Engineering: Surface modifications – Surface properties – Transformation Hardening, surface fusion – Hydrophobic – Super hydrophobic – Hydrophilic – Surface coating Techniques – PVD – CVD – Physical CVD – Ion implantation – Thermo chemical processes – Plating and anodizing – Fusion processes. **Materials for Bearings:** Materials for rolling element bearings – Materials for fluid film bearings – Materials for marginally lubricated and dry bearings –Biomaterials – Bio Tribology – Nano tribology.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Describe the importance of friction between different surfaces and should know to calculate the friction	**PO1, PO2, PO3**
CO2	Evaluate the phenomenon of wear between surfaces in contact and its implications	**PO1, PO2, PO3**
CO3	Understand the principles, methods, purpose and selection of lubricants for the reduction of friction.	**PO1, PO2, PO3**
CO4	Summarize the lubrication theory and the flow of film lubricants with different applications	**PO1, PO2, PO3**
CO5	Brief the surface treatment methods to improve the wear resistance and friction properties.	**PO1, PO2, PO3**

TEXT BOOKS:

1. R.B.Patil, "Industrial Tribology", Tech-Max Publications, Pune, 1/e, 2012.
2. Michael M. Khonsari and E. Richard Booser, "Applied Tribology: Bearing Design and Lubrication", John Wiley & Sons Ltd, 3/e, 2017.

REFERENCE BOOKS:

1. Harnoy, Avraham Harnoy, "Bearing Design in Machinery", Marcel Dekker Publishers, New York, 1/e, 2002.
2. Gwidon W. Stachowiak and Andrew W. Batchelor, "Engineering Tribology", Elsevier Butterworth-Heinemann, 3/e, 2005.
3. Bharat Bhushan, "Modern Tribology Handbook: Principles of Tribology - Volume I", CRC Press LLC.
4. Bharat Bhushan, "Principles and Applications of Tribology", John Wiley & Sons, Ltd, 2/e, 2013.
5. Sahoo Prasantha, "Engineering Tribology", Prentice-Hall of India, Pvt, Ltd., New Delhi, 1/e, 2009.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/102/112102015/
2. https://nptel.ac.in/courses/112/102/112102014/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	-	-	-	-	-	-	-	-	-
CO.2	3	2	2	-	-	-	-	-	-	-	-	-
CO.3	3	2	2	-	-	-	-	-	-	-	-	-
CO.4	3	2	2	-	-	-	-	-	-	-	-	-
CO.5	3	2	2	-	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

IV B.Tech. - VII Semester

20MEC473A	MODERN MANUFACTURING PROCESSES	L	T	P	C
		3	-	-	3

PRE-REQUISITES: Nil.

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the working principles of mechanical energy based machining process.
2. To learn electric discharge machining and wire cut EDM process for machining
3. To understand the working of Laser beam and Electron machining process.
4. To know the chemical based and electro chemical based machining process.
5. To learn advanced finishing processes and recent developments in the non-traditional machining.

UNIT –1: MECHANICAL ADVANCED MACHINING PROCESS (9)

Introduction: Need for non-traditional machining methods – Classification of modern machining processes – Considerations in process selection materials and applications. **Abrasive Jet:** Basic principles, equipments, process variables and mechanics of metal removal, MRR, application and limitations. **Abrasive Water Jet Machining and Water Jet Cutting:** Basic principles, equipments, process variables and mechanics of metal removal, MRR, application and limitations. Ultrasonic machining: Elements, mechanics of metal removal, process parameters, economic considerations, applications, limitations andrecent development.

UNIT –2: THERMO ELECTRIC ADVANCED MACHINING PROCESS (9)

Electric Discharge Machining: Principle of working – Power supply, dielectric system, electrodes and servo system – Circuit analysis – Material removal rate – Process variables and characteristics – Applications. **Wire-Electric Discharge Machining:** Principle of working, process variables and characteristics and applications – Principle and working of Electric Discharge grinding, electric discharge diamond grinding and micro electric discharge machining. **Electric Discharge Grinding:** Principle of working and applications.

UNIT –3: LASER BEAM AND ELECTRON BEAM MACHINING PROCESS (9)

Laser Beam Machining: General principle and application of laser beam machining – Thermal features, cutting speed and accuracy of cut. **Electron Beam Machining:** Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes. **Plasma Arc Machining:** Principle and working – Metal removal mechanism, process parameters, accuracy and surface finish and Applications.

UNIT –4: ELECTRO CHEMICAL AND CHEMICAL MACHINING PROCESS (9)

Electro Chemical Machining: Principle, ECM system, advantages, limitations and applications. **Electro Chemical Grinding:** Principle and working, process characteristics and applications. **Chemical Machining:** Fundamentals of chemical machining – Principle – Maskants – Etchants – Advantages and applications. **Electro Chemical Streaming and Deburring:** Principle, process characteristics and applications.

UNIT –5: OTHER ADVANCED MACHINING PROCESS (9)

Magnetic Abrasive Finishing: Principle and working, material removal and surface finish and applications. **Abrasive Flow Finishing:** Principle and working – Process performance. **Electro Stream Drilling:** Principle and working – Process performance. **Shaped Tube Electrolytic Machining:** Principle and working, applications.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Understand the working principles of mechanical energy based machining process	**PO1, PO2, PO3**
CO2	Explain electric discharge machining and wire cut EDM process for machining	**PO1, PO2, PO3**
CO3	Understand the working of Laser beam and Electron machining process	**PO1, PO2, PO3**
CO4	Explain the chemical based and electro chemical based machining process.	**PO1, PO2, PO3**
CO5	Summarize the advanced surface finishing processes and recent developments in the non-traditional machining processes.	**PO1, PO2, PO3**

TEXT BOOKS:

1. V. K. Jain, "Advanced Machining Processes", Allied Publishers Pvt. Ltd., New Delhi, 2007.
2. M Adithan, "Unconventional Machining Process", Atlantic Publications, New Delhi, 2014.

REFERENCE BOOKS:

1. Golam Kibria, B. Bhattacharyya and J. Paulo Davim, "Non-traditional Micromachining Processes: Fundamentals and Applications", Springer, 2017.
2. V. K. Jain, "Micro Manufacturing Processes", CRC Press, Taylor & Francis Group, 2013.
3. Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology (SI Edition)", Pearson Education, India, 7/e, 2018.
4. Hassan El-Hofy, "Advanced Machining Processes: Nontraditional and Hybrid Machining Processes", McGraw Hill, 2005.
5. Pandey P.C. and Shan H.S., "Modern Machining Processes", Tata McGraw Hill, New Delhi, 1980.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/103/112103202/
2. https://nptel.ac.in/courses/112/104/112104028/
3. https://nptel.ac.in/courses/112/107/112107078/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	1	1	-	-	-	-	-	-	-	-	-
CO.2	3	1	1	-	-	-	-	-	-	-	-	-
CO.3	3	1	1	-	-	-	-	-	-	-	-	-
CO.4	3	1	1	-	-	-	-	-	-	-	-	-
CO.5	3	1	1	-	-	-	-	-	-	-	-	-
CO*	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

IV B.Tech. - VII Semester

20MEC473B	PROCESS PLANNING AND COST ESTIMATION	L	T	P	C
		3	-	-	3

PRE-REQUISITES: Nil.

COURSE EDUCATIONAL OBJECTIVES:

1. To know the basics principles of process planning and methods of material selection process
2. To understated the fundamental principles of cost estimation and elements of cost.
3. To evaluate the concepts of allocation of overhead charges and depreciation cost
4. To estimation of production cost for all manufacturing Process
5. To estimate the machining time and cost in different machining operations, in machine shop

UNIT –1: PROCESS PLANNING (9)

Defining process planning – Drawing interpretation – Material selection process and methods – Selection of production processes from tables – Selection of process parameters from tables – Factors to be considered in selecting the processes, process sequencing, operation sequencing, equipment, tool selection, tool holding devices and measuring instruments – Computer Aided Process Planning – Retrieval / variance CAPP and generative CAPP – Case study in process planning.

UNIT –2: FUNDAMENTAL OF ESTIMATING AND ELEMENTS OF COST (9)

Concept and purpose of estimating – Functions of estimating department – Concept of costing – Costing versus Estimating – Types of estimates – Importance of estimates – Estimating procedure – Cost estimators and their qualifications – Principal constituents in a cost estimate – Elements of cost – Material cost – Labour cost – Expenses and cost of product (Ladder Cost).

UNIT –3: OVERHEADS AND DEPRECIATION (9)

Cost Estimation: Overheads – Allocation or distribution of overhead cost. **Depreciation:** Depreciation and Methods to calculate the interest on capital, idleness costs, repair and maintenance cost.

UNIT –4: ESTIMATION OF CASTING, FORGING & WELDING COSTS (9)

Estimation of cost for casting processes, welding processes and forging processes.

UNIT –5: ESTIMATION OF MACHINING TIME AND COST (9)

Cost estimation and machining time for lathe operations, drilling operations, milling operations, shaping operations, planning operations and grinding operations – Overhead expenses – Types of overhead costs – Allocation of overhead expenses.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Understand the process planning and Material selection process and methods	**PO1, PO2, PO3, PO11**
CO2	Explain the fundamental principles of cost estimation and elements of cost.	**PO1, PO2, PO3, PO11**
CO3	Evaluate the concepts of allocation of overhead charges and depreciation.	**PO1, PO2, PO3, PO11**
CO4	Estimate the production cost for all the manufacturing Process	**PO1, PO2, PO3, PO11**
CO5	know the machining time and cost of lathe Operations, in a machine shop	**PO1, PO2, PO3, PO11**

TEXT BOOKS:

1. R. Panneerselvam and P. Sivasankaran, "Process Planning and Cost Estimation", PHI Learning, India.
2. Sinha.B.P, "Mechanical Estimating and Costing", Tata McGraw-Hill, 1995.

REFERENCE BOOKS:

1. T.R Banga and S.C.Sharma, "Mechanical Estimating and Costing: Including Contracting", Khanna Publishers, 2003.
2. G.B.S. Narang, V. Kumar, "Production and Costing", Khanna Publishers, 2000.
3. Robert Creese, and M. Adithan, "Estimating and Costing for the Metal Manufacturing Industries", CRC Press, 1/e, 2019.
4. M. Adithan, "Process Planning and Cost Estimation", New Age International Publishers, 2007.
5. Phillip F. Ostwald and Jairo Munoz, "Manufacturing Processes and Systems", Wiley student edition, 9/e, 2002.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/104/112104304/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	1	-	-	-	-	-	-	-	2	-
CO.2	3	2	1	-	-	-	-	-	-	-	2	-
CO.3	3	2	1	-	-	-	-	-	-	-	2	-
CO.4	3	2	1	-	-	-	-	-	-	-	2	-
CO.5	3	2	1	-	-	-	-	-	-	-	2	-
CO*	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	-

IV B.Tech. - VII Semester

20MEC473C	SUSTAINABLE AND GREEN MANUFACTURING	L	T	P	C
		3	-	-	3

PRE-REQUISITES: Nil.

COURSE EDUCATIONAL OBJECTIVES:

1. To learn concept of triple bottom line, environmental, economic and social dimensions of sustainability.
2. To evaluate the performance and environmental impact assessments of Sustainability
3. To know the concepts of competitive strategy and manufacturing strategies
4. To learn the basics involved in Green manufacturing,
5. To study the importance of recycling and life cycle assessment

UNIT –1: INTRODUCTION TO SUSTAINABLE MANUFACTURING (9)

Sustainable manufacturing – Concept of triple bottom line – Environmental, economic and social dimensions of sustainability – Sustainable product development – Various phases.

UNIT –2: EVALUATING SUSTAINABILITY (9)

Sustainability performance evaluators – Frameworks and techniques – Environmental management systems – Life cycle assessment – Strategic and environmental impact assessments – Carbon and water foot-printing.

UNIT –3: MANUFACTURING STRATEGY FOR SUSTAINABILITY (9)

Concepts of competitive strategy – Manufacturing strategies and development of a strategic improvement program – Manufacturing strategy in business success strategy formation and formulation – Structured strategy formulation – Sustainable manufacturing system design options – Approaches to strategy formulation – Realization of new strategies/system designs.

UNIT –4: GREEN MANUFACTURING (9)

Green manufacturing – Definition, motivation and barriers to green manufacturing – Environmental impact of manufacturing – Waste generation – Energy consumption – Strategies for green manufacturing – Green manufacturing by design – Life cycle assessment.

UNIT –5: RECYCLING (9)

Reclamation and recycling of waste – Recycling as universal resource policy – Innovation towards environmental sustainability – Systematic framework for conscious design – International green manufacturing standards and compliance.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able To		POs
CO1	Understand concept of triple bottom line, environmental, economic and social dimensions of sustainability.	**PO1, PO3, PO6, PO7, PO12**
CO2	Evaluate the performance and Strategic environmental impact assessments of sustainability	**PO1, PO3, PO6, PO7, PO12**
CO3	Understand the concepts of competitive strategy and manufacturing strategies	**PO1, PO3, PO6, PO7, PO12**
CO4	Explain the basics involved in Green manufacturing	**PO1, PO3,PO6, PO7, PO12**
CO5	Summarize the importance of recycling and life cycle assessment	**PO1, PO3, PO6, PO7, PO12**

TEXT BOOKS:

1. Davim, J.P., "Sustainable Manufacturing", John Wiley & Sons, 2010.
2. Dornfield David, "Green Manufacturing: Fundamentals and Applications", Springer, 2012.

REFERENCE BOOKS:

1. Seliger, G, "Sustainable Manufacturing: Shaping Global Value Creation", Springer, 2012.
2. Günther Seliger, Marwan M.K. Khraisheh and I.S. Jawahir, "Advances in Sustainable Manufacturing", Springer-Verlag Berlin Heidelberg, 2011.
3. Rainer Stark, Günther Seliger and Jérémy Bonvoisin, "Sustainable Manufacturing: Challenges, Solutions and Implementation Perspectives", Springer, 2017.
4. Davim.J.Pauls, "Green Manufacturing Processes and Systems", Springer, 2013.
5. Davim, J.P, "Green Manufacturing Processes and Systems", Springer, 2012.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/110/104/110104119/
2. https://nptel.ac.in/courses/112/104/112104225/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	-	2	-	-	2	2	-	-	-	-	2
CO.2	3	-	2	-	-	2	2	-	-	-	-	2
CO.3	3	-	2	-	-	2	2	-	-	-	-	2
CO.4	3	-	2	-	-	2	2	-	-	-	-	2
CO.5	3	-	2	-	-	2	2	-	-	-	-	2
CO*	**3**	**-**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**

IV B.Tech. - VII Semester

20OCIV471	**DISASTER MANAGEMENT AND MITIGATION** (OPEN ELECTIVE - 3)	**L**	**T**	**P**	**C**
		3	**-**	**-**	**3**

PRE-REQUISITES: A Course on Environmental Studies.

COURSE OUTCOMES:

6. To explain the disaster phenomenon and disaster preparedness.
7. To demonstrate the roles and responsibilities of different agencies.
8. To explain the disaster management techniques
9. To explain concept of disaster mitigation strategies
10. To demonstrate the different case studies on disaster management

UNIT I: INTRODUCTION TO DISASTER PREPAREDNESS (9)

Disaster Management- Prevention-Preparedness and Mitigation-Disaster Preparedness-Concept & Nature-Disaster Preparedness Plan-Disaster Preparedness for People and Infrastructure · Community based Disaster Preparedness Plan. Mitigation process- disaster management techniques, disaster management aspects.

UNIT II: ROLES & RESPONSIBILITIES OF DIFFERENT AGENCIES (9)

Roll of Information-Education-Communication & Training-Role and Responsibilities of Central-State-District and local administration-Role and Responsibilities of Armed Forces-Police-Paramilitary Forces-Role and Responsibilities of International Agencies-NGOs-Community Based Org. (CBO s), disaster management quality control.

UNIT III: TECHNOLOGIES FOR DISASTER MANAGEMENT (9)

Role of IT in Disaster Preparedness-Remote Sensing-GIS and GPS-Use and Application of Emerging Technologies-Application of Modern Technologies for the Emergency Communication-Application and use of ICST for different disasters

UNIT IV: DISASTER MITIGATION (9)

Meaning and concept-Disaster Mitigation Strategies-Emerging Trends in Disaster Mitigation · Mitigation Management-Role of Team and Coordination

UNIT V: DISASTER MANAGEMENT (9)

Applications and case studies and field works-Landslide Hazard Zonation-Case Studies-Earthquake Vulnerability Assessment of Buildings and Infrastructure-Case Studies-Drought Assessment-Case Studies-Coastal Flooding-Storm Surge Assessment-Floods-Fluvial and Pluvial Flooding-Case Studies-Forest Fire-Case Studies-Man Made Disasters-Case Studies-Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL HOURS: 45

COURSE OUTCOMES:

On successful completion of the course the student will be able to,		POs related to Cos
CO1	Explain the disaster phenomenon and disaster preparedness	**PO1**
CO2	Demonstrate the roles and responsibilities of different agencies	**PO6**
CO3	Analyse the techniques for disaster management	**PO2**
CO4	Demonstrate the disaster mitigation strategies	**PO6 PO7**
CO5	Apply the knowledge gained to manage the disasters.	**PO1, PO12**

TEXTBOOKS:

1. Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.
2. Roy, P.S "Space Technology for Disaster management" A Remote Sensing & GIS Perspective, Indian Institute of Remote Sensing (NRSA) Dehradun,. (2000)

REFERENCES:

1. Singh B.K., 2008, "Handbook of Disaster Management", Techniques & Guidelines, Rajat Publication.
2. Ghosh G.K., 2006, "Disaster Management", APH Publishing Corporation
3. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June2003
4. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

REFERENCE BOOKS:

1. https://nptel.ac.in/courses/105/104/105104183/

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	-	-	-	-	-	-	-	-	-	-	-
CO.2	-	-	-	-	-	3	-	-	-	-	-	-
CO.3	-	3	-	-	-	-	-	-	-	-	-	-
CO.4	-	-	-	-	-	3	2	-	-	-	-	-
CO.5	2	-	-	-	-			-	-	-	-	2
CO*	**2**	**3**	-	**2**	-	**3**	**2**	**-**	**-**	**-**	**-**	**2**

IV B.Tech-VII Semester

		L	T	P	C
20OEEE471	**PLC AND APPLICATIONS (Open Elective-3)**	**3**	**-**	**-**	**3**

Pre-Requisites: NIL

COURSE EDUCATIONAL OBJECTIVES:

On successful completion of the course, students will be able to,

1. Gain the Knowledge of various skills necessary for Industrial applications of Programmable logic controller (PLC).
2. Understand the basic programming concepts and various logical Instructions used in Programmable logic controller (PLC).
3. Gain the Knowledge on PLC Timers and Counters.
4. Solve the problems related to I/O module, Data Acquisition System and Communication Networks using Standard Devices.
5. Provide knowledge on DLC and its applications.

UNIT-1: INPUT AND OUTPUTMODULES (9)

PLC Basics: PLC system - I/O modules and interfacing - CPU processor - programming Equipment - programming formats - construction of PLC ladder diagrams - Devices connected to I/O modules.PLC Programming: Input instructions - outputs - operational procedures - programming examples using contacts and coils. Drill press operation.

UNIT-2: DESIGN AND PROGRAMMING (9)

Digital logic gates - programming in the Boolean algebra system - conversion examples. Ladder Diagrams for process control: Ladder diagrams & sequence listings - ladder diagram construction and flowchart for spray process system.

UNIT-3: PLC REGISTERS (9)

PLC Registers: Characteristics of Registers - module addressing - holding registers - Input Registers - Output Registers.PLC Functions: Timer functions & Industrial applications - counter function & industrial applications - Arithmetic functions -Number comparison functions - number conversion functions

UNIT-4: PLC APPLICATIONS (9)

Data handling functions: SKIP - Master control Relay - Jump - Move - FIFO - FAL - ONS - CLR & Sweep functions and their applications. Bit Pattern and changing a bit shift register - sequence functions and applications - controlling of two-axis & three axis Robots with PLC - Matrix functions.

UNIT-5: DCS AND ITS APPLICATIONS (9)

Distributed Control System (DCS) – Evolution – Different Architectures – Logical Control Unit – Operator Interface – Display – Engineering Interface.DCS Applications to Power Plant – Iron and Steel Plants – Chemical Industries – Paper and Pulp Industries.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Have knowledge of Programmable Logic Controller domain on various Logical Operation and Various Advanced Logical Instruction, I/O Module, Sensor, Actuator, Communication and Measurement System.	**PO1,PO2**
CO2	Understand the basic programming concepts and various logical Instructions used in Programmable logic controller (PLC).	**PO1,PO2,PO3**
CO3	Understand the operation of Timers and Counters in Programmable logic controller (PLC).	**PO1,PO2,PO3**
CO4	Compute the extent and nature of electronic circuitry in Programmable logic controller (PLC) and SCADA including monitoring and control circuits for Communication and Interfacing.	**PO1,PO2,PO3**
CO5	Provide knowledge on DLC and its applications	**PO1,PO2,PO3**

TEXT BOOKS

1. W. Bolton "Programmable Logic Controllers" - 5th Edition - Elsevier - 2010
2. John W. Webb & Ronald A. Reiss "Programmable Logic Controllers- Principles and Applications" - Fifth Edition - PHI

REFERENCE BOOKS

1. Programmable Logic Controllers- Programming Method and Applications –JR. Hackworth &F.D Hackworth Jr. –Pearson - 2004.
2. Distributed Computer Control of Industrial Automation by Popovic D and Bhatkar V. P - Marcel Dekkar Inc. - 1990.
3. Distributed Control Systems by Michal P. Lucas - Vann strand - Reinhold Co. - 1986.

REFERENCE WEBSITE LINK:

https://nptel.ac.in/courses/117/106/117106086/

"CO-PO MAPPING"

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	-	-	-	-	-	-	-	-	-	-
CO.2	3	3	2	-	-	-	-	-	-	-	-	-
CO.3	3	3	2	-	-	-	-	-	-	-	-	-
CO.4	3	3	2	-	-	-	-	-	-	-	-	-
CO.5	3	3	2	-	-	-	-	-	-	-	-	-
CO*	3	3	2	-	-	-					-	-

IV B.Tech. - VII Semester

20OECE471	**MEDICAL ELECTRONICS** (Open Elective – 3)	**L T P C** **3 - - 3**

PRE-REQUISITES: NIL

COURSE EDUCATIONAL OBJECTIVES:

1. To gain knowledge and analyze the various physiological parameters and its recording methods, signal characteristics.
2. To understand the respiratory, Blood pressure, temperature measurements etc.
3. To study about the various assist devices used in the hospitals.
4. To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.
5. To know the recent trends in Tele-medicine and laser in medicine.

UNIT –1: ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING (9)

The origin of Bio-potentials; bio potential electrodes, biological amplifiers, ECG, EEG, EMG,PCG, lead systems and recording methods, typical waveforms and signal characteristics.

UNIT –2: BIO-CHEMICALANDNONELECTRICALPARAMETERMEASUREMENT (9)

pH, PO2, PCO2, colorimeter, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse, Blood cell counters.

UNIT –3: ASSIST DEVICES (9)

Cardiac pacemakers, DC Defibrillator, Dialyzer, Heart lung machine

UNIT –4: PHYSICAL MEDICINE AND BIOTELEMETRY (9)

Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy Telemetry principles, frequency selection, biotelemetry, radiopill, electricalsafety

UNIT –5: RECENT TRENDS IN MEDICAL INSTRUMENTATION (9)

Thermograph, endoscopy unit, Laser in medicine, cryogenic application, Introduction to Tele-medicine.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Distinguish and analyze the various physiological parameters and its recording methods, signal characteristics.	**PO1, PO2**
CO2	Describe the respiratory, Blood pressure, temperature measurements etc.	**PO1, PO2**
CO3	Analyze function of various assist devices used in the hospitals.	**PO1, PO2**
CO4	Demonstrate knowledge about equipment used for physical. Medicine and the various recently developed diagnostic and therapeutic techniques.	**PO1, PO2**
CO5	Extend knowledge on recent trends in telemedicine and laser in medicine.	**PO1, PO2**

TEXT BOOKS:

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007.
2. John G.Webster, "Medical Instrumentation Application and Design" Wiley India 3rd, Edition, 2007.

REFERENCE BOOKS:

1. Khandpur, R.S, "Handbook of Biomedical Instrumentation" TATA McGraw-Hill, New Delhi, 2003.
2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical equipment Technology", John Wiley and Sons, New York, 2004.

REFERENCE WEBSITE:

1. https://onlinecourses.nptel.ac.in/noc21_ee105

CO-PO MAPPING

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	3	-	-	-	-	-	-	-	-	-	-
CO.2	3	3	-	-	-	-	-	-	-	-	-	-
CO.3	3	3	-	-	-	-	-	-	-	-	-	-
CO.4	3	3	-	-	-	-	-	-	-	-	-	-
CO.5	3	3	-	-	-	-	-	-	-	-	-	-
CO*	**3**	**3**	**-**	**-**	-	-	-	-	-	-	-	-

IV B.Tech - VII Semester

		L	T	P	C
20OCSM471	**FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE** (Open Elective - 3)	**3**	**0**	**0**	**3**

PRE-REQUISITES: NIL

COURSE EDUCATIONAL OBJECTIVES:

1. To study the concepts of Artificial Intelligence.
2. To understand the search strategies and Problem solving using Artificial Intelligence.
3. To gain insight information about Logical Agents and Reasoning patterns in propositional logic
4. To study the Uncertain Knowledge and Reasoning
5. To study the Application of Robotics and predictive analytics using Rapid Miner

UNIT I: INTRODUCTION TO ARTIFICIAL INTELLIGENCE, PROBLEMS, PROBLEM SPACES AND SEARCH (9)

The AI Problems - The underlying assumption - The AI technique - The levels of the model - Criteria of success - Some general references - Defining the problem as a State space search - Production systems - Problem characteristics - Production system characteristics

UNIT II: PROBLEM SOLVING, UN-INFORMED SEARCH STRATEGIES, INFORMED SEARCH AND EXPLORATION (9)

Uninformed search strategies - Avoiding repeated states - Informed (Heuristic) search strategies - Heuristic functions - Local search algorithms and optimization problems - Local search in continuous spaces - Backtracking search for CSPs.

UNIT III: KNOWLEDGE AND REASONING (9)

Logical agents – Knowledge based agents - The wumpus world – Logic - Propositional logic - a very simple logic - Reasoning patterns in propositional logic - Effective propositional inference - Agents based on propositional logic

UNIT IV: UNCERTAIN KNOWLEDGE AND REASONING, LEARNING (9)

Uncertainty - Acting under uncertainty - Baye's rule and its use - Learning from observations - Forms of learning - Inductive learning - Learning decision trees

UNIT V: ROBOTICS AND PREDICTIVE ANALYTICS (9)

Robotics: Introduction-Robot hardware - Robotic perception - Planning to move-Robotic software Architectures - Application Domains

TOTAL HOURS: 45

COURSE OUTCOMES:

On successful completion of the course the student will be		POs related to COs
CO1	Gain the basic Knowledge about AI technique and Production systems	**PO1**
CO2	Comprehend the Un informed and Informed Search Strategies.	**PO1, PO2, PO3**
CO3	Analyze and Implement Reasoning patterns in propositional logic	**PO1, PO2, PO3**
CO4	Formulate the Knowledge and Reasoning techniques in solving problems	**PO1, PO2, PO4**
CO5	Apply Robotics to Solve Real world Problems	**PO1, PO2, PO4, PO5**

TEXT BOOKS:

1. Wolfgang Ertel, "Introduction to Artificial Intelligence", 2nd Edition, Springer International Publishing, 2017.
2. David L.Poole, Alan K.Mackworth, "Artificial Intelligence , Foundations of Computational Agents", 1st Edition, Cambridge University Press, 2010

REFERENCE BOOKS:

1. Stuart J.Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", 4th Edition,
Pearson Education, 2020.
2. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill, 2017.

REFERENCE WEBSITE:

1. http://peterindia.net/AILinks.html
2. https://nptel.ac.in/courses/106/102/106102220/

CO-PO MAPPING

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-
CO4	2	3	-	2	-	-	-	-	-	-	-	-
CO5	2	2	-	2	2	-	-	-	-	-	-	-
CO*	**2.4**	**2.25**	**3**	**2**	**2**	-	-	-	-	-	-	-

IV B.Tech-VII SEMESTER

20OHSM471	**NANO SCIENCE AND TECHNOLOGY** (Open Elective - 3)	**L T P C** **3 0 0 3**

PRE-REQUISITES: NIL

COURSEEDUCATIONALOBJECTIVES:

1. To Understand the basic scientific concepts of Nanoscience, and various types of Nano materials.
2. To study various methods of synthesising Nanomaterials
3. To identify different characterisation techniques for Nanomaterials
4. To Understand the properties of Nanomaterials and the applications of Nano materials in various fields
5. To study various carbon Nanomaterials

UNIT-I: INTRODUCTION TO NANO SCIENCE AND TECHNOLOGY (9)

Definition of nano scale,-Significance of nano scale–Surface to volume ratio-Quantum confinement effect-Types of Nano materials: Zero, one and two dimensional nano materials with examples.

UNIT-II: PREPARATION OF NANOMATERIALS (9)

Top-Down and Bottom-Up approaches- Methods of preparation: Sol-gel method - Chemical vapour deposition- Plasma arching - Ball milling - Electro-chemical deposition.

UNIT-III: STRUCTURE AND SURFACE CHARACTERIZATION OF NANO MATERIALS (9)

X- Ray diffraction - Ultraviolet–Visible Spectroscopy – Fourier Transform Infrared Spectroscopy –Scanning Electron Microscopy **–** Transmission electron microscopy – Scanning Tunneling Microscope -Atomic force microscopy.

UNIT-IV: PROPERTIES AND APPLICATIONS OF NANO MATERIALS (9)

Physical Properties - Chemical Properties - Mechanical properties - Electrical properties - Thermal properties - Magnetic properties - Optical Properties - Applications in Material science, Biology and Medicine, Surface science, Energy, Environment, Industry, Sports& Consumer products.

UNIT-V : CARBON NANOTUBES (9)

Allotropes of carbon **-** Graphene- Fullerences **-** Types of Carbon Nanotubes -Single walled carbon nanotubes- Multiwalled carbon nanotubes- Fabrication of carbon nanotubes using Plasma Arching Method- Properties and Applications of Carbon nanotubes.

TOTAL HOURS: 45

COURSE OUTCOMES:

On successful completion of the course the student will be able to,		POs related to COs
CO1	**Acquire** the basic knowledge on Nanoscience, and various types of Nano materials.	PO1, PO12
CO2	**Identify** appropriate method for the preparation of Nano materials	PO1, PO12
CO3	**Develops** skill to characterize Nanomaterials by various techniques	PO1, PO4, PO12
CO4	**Analyze** the different properties of Nanomaterials and identify their applications in various fields	PO1, PO12
CO5	**Develop** Knowledge on carbon Nano materials	PO1, PO12

TEXT BOOKS:

1. M.R. Srinivasan, New Age International, "Engineering Physics", Chennai 2011
2. K. Thyagarajan, "Engineering Physics", Mc Graw Hill Publishers, First Edition, New Delhi, 2014.
3. Er. Rakesh Rathi, S. Chand, "Nanotechnology-Technology Revolution" of 21st Century Publications

REFERENCE BOOKS:

1. Nanotechnology- A Gentle Introduction to the Next Big Idea. Kindersely, India. Pvt., New Delhi, 2003,Dorling
2. Nano- The Essentials Understanding Nano Science and Nanotechnology), Tata McGraw - Hill Publication 2010,

CO-PO MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	1
CO2	3	-	-	-	-	-	-	-	-	-	-	1
CO3	3	-	-	2	-	-	-	-	-	-	-	1
CO4	3	-	-	-	-	-	-	-	-	-	-	1
CO5	3	-	-	-	-	-	-	-	-	-	-	1
CO*	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

IV B.Tech. - VII Semester

		L	T	P	C
20OCIV472	**INDUSTRIAL WASTE TREATMENT AND DISPOSAL** (OPEN ELECTIVE - 4)	**3**	**-**	**-**	**3**

PRE-REQUISITES: A Course on Environmental Engineering

COURSE OUTCOMES:

1. To make the students understand about industrial waste characteristics and effects on sewer land and streams.
2. To provide knowledge about waste management approach through cleaner production
3. To make the students understand about pollution from major industries
4. To gain knowledge about various treatment technologies regarding industrial wastewater.
5. To provide knowledge about hazardous waste management and disposal

UNIT I:INTRODUCTION **(9)**

Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer,land, sewage treatment plants and human health – Environmental legislations related to prevention and control of industrial effluents and hazardous wastes

UNIT II:CLEANER PRODUCTION **(9)**

Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications.

UNIT III:POLLUTION FROM MAJOR INDUSTRIES **(9)**

Sources, Characteristics, waste treatment flow sheets for selected industries such asTextiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertiliser, thermal power plants – Wastewater reclamation concepts

UNIT IV:TREATMENT TECHNOLOGIES **(9)**

Equalisation – Neutralisation – Removal of suspended and dissolved organic solids -Chemical oxidation – Adsorption - Removal of dissolved inorganics – Combined treatmentof industrial and municipal wastes – Residue management – Dewatering - Disposal

UNIT V:HAZARDOUS WASTE MANAGEMENT **(9)**

Hazardous wastes - Physico chemical treatment – solidification – incineration – Secured landfills

TOTAL HOURS: 45

COURSE OUTCOMES:

On successful completion of the course the student will be able to		POs related to COs
CO1	Understand the nature and characteristics of industrial wastewater	**PO1, PO2**
CO2	Understand the waste management approach adopting cleaner production technology	**PO1, PO2**
CO3	Analyse the pollution from major industries	**PO1, PO2, PO3**
CO4	Understand the various treatment technologies regarding industrial wastewater	**PO3, PO6**
CO5	Understand the hazardous waste management and disposal	**PO1, PO2, PO3**

TEXTBOOKS:

1. M.N.Rao&A.K.Dutta, "Wastewater Treatment", Oxford - IBH Publication, 1999.
2. W .W. Eckenfelder Jr., "Industrial Water Pollution Control", McGraw-Hill Book Company, New Delhi, 2000.

REFERENCES:

1. T.T.Shen, "Industrial Pollution Prevention", Springer, 1999.
2. R.L.Stephenson and J.B.Blackburn, Jr., "Industrial Wastewater Systems Handbook", Lewis Publisher, New Yark, 1998

REFERENCE WEBSITES:

1. https://nptel.ac.in/courses/105/106/105106056/https://nptel.ac.in/courses/105/105/105105169/

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	-	-	-	-	-	-	-	-
CO.2	2	3	-	-	-	-	-	-	-	-	-	-
CO.3	1	2	3	-	-	-	-	-	-	-	-	-
CO.4	-	-	2	-	-	2	-	-	-	-	-	-
CO.5	1	2	3	-	-	-	-	-	-	-	-	-
CO*	**1.66**	**2.25**	**2.66**		**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**

IV B.Tech-VII Semester

		L	T	P	C
20OEEE472	**ELECTRIC VEHICLE TECHNOLOGY (Open Elective-4)**	**3**	**-**	**-**	**3**

COURSE EDUCATIONAL OBJECTIVES:

On successful completion of the course, students will be able to,

1. Understand Electric and Hybrid Electric Vehicles
2. Study and analyze the Energy Storage for EV and HEV
3. Study and understand the concept of Electric Propulsion
4. Analyze and design the Electric and Hybrid Electric Vehicles
5. Study operation of Power Electronic Converter for Battery Charging.

UNIT-I: ELECTRIC AND HYBRID ELECTRIC VEHICLES (9)

Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics,TractiveeffortandTransmissionrequirement,Vehicleperformance,Tractiveeffortinnormaldriving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid ElectricDriveTrains,SeriesHybridElectricDriveTrains,Parallelhybridelectricdrivetrains.

UNIT-II: ENERGY STORAGE FOR EV AND HEV (9)

Energy storage requirements, Battery parameters, Types of Batteries, Modeling of Battery, Fuel Cellbasic principle and operation, Types of Fuel Cells,PEMFCanditsoperation,SuperCapacitors.

UNIT-III: ELECTRICPROPULSION (9)

EV consideration, DC motor drives and speed control, Induction motor drives, Permanent MagnetMotor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control ofDrives.

UNIT-IV: DESIGN OF ELECTRIC AND HYBRID ELECTRIC VEHICLES (9)

Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of majorcomponents,powerratingoftractionmotor,powerratingofengine/generator,anddesignofPPS. Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train,design of engine power capacity, design of electric motor drive capacity, transmission design, andenergystoragedesign.

UNIT-V: POWER ELECTRONIC CONVERTER FOR BATTERY CHARGING (9)

Charging methods for battery, Termination methods, charging from grid, The Z-converter, Isolated bidirectional DC-DC converter, Design of Z-converter for battery charging, High-frequency transformer based isolated charger topology, Transformer less topology.

TOTAL HOURS: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs
CO1	Understand Electric and Hybrid Electric Vehicles	PO1,PO2,PO3
CO2	Study and analyze the Energy Storage for EV and HEV	PO1,PO2,PO3
CO3	Study and understand the concept of Electric Propulsion	PO1,PO2,PO3
CO4	Analyze and design the Electric and Hybrid Electric Vehicles	PO1,PO2,PO3
CO5	Study operation of Power Electronic Converter for Battery Charging.	PO1,PO2,PO3

TEXTBOOKS:

1. M.Ehsani, Y.Gao,S.Gayand AliEmadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles″ Fundamentals, Theory and Design″, CRC Press, 2005
2. Iqbal Husain, Electric and Hybrid Vehicles″ Design Fundamentals″, CRC Press, 2003.

REFERENCES:

1. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.
2. C.C.Chanand K.T. Chau, Modern Electric Vehicle Technology, OXFORD University Press,2001. ChrisMi, M.Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles Principles and Applications With Practical Perspectives, Wiley Publication, 2011.

CO-PO MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-
CO	**3**	**2**	**2**									

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES
(Autonomous)
DEPARTMENT OF MECHANICAL ENGINEERING
(Accredited by NBA)

IV B.Tech. - VII Semester

20OECE472	**PATTERN RECOGNITION**	**L T P C**
	(Open Elective – 4)	**3 - - 3**

PRE-REQUISITES: NIL

COURSE EDUCATIONAL OBJECTIVES:

1. To provide knowledge on Basics Pattern Recognition.
2. To acquire knowledge on various methods of statistical Pattern Recognition.
3. To be able to solve dimensionality problem.
4. To understand the linear discriminant functions and neural network classifier.
5. To gain the principle of time varying pattern recognition and unsupervised classification.

UNIT –1: INTRODUCTION TO PATTERN RECOGNITION (9)

Linear Discriminant, Multiple Discriminant Analysis, Feature extraction and Pattern Representation Concept of Supervised and Unsupervised classification Introduction to Application Areas.

UNIT –2: STATISTICAL PATTERN RECOGNITION (9)

Bayes Decision Theory, Minimum Error and Minimum Risk Classifiers, Discriminant Function and Decision Boundary Normal Density, Discriminant Function, Discrete Features,Parameter estimation.

.

UNIT –3: DIMENSIONALITY PROBLEM (9)

Dimension and accuracy, Computational Complexity, Dimensionality Reduction, Fisher Density Estimation, Nearest Neighbor Rule, Fuzzy Classification.

UNIT –4: LINEAR DISCRIMINANT FUNCTIONS (9)

Separability, Two Category and Multi Category Classification, Linear Discriminators, Perceptron Criterion, Relaxation Procedure, Minimum Square Error Criterion, Widrow-Hoff Procedure, Ho-Kashyap Procedure, Kesler"s Construction.

Neural Network Classifier:
Single and Multilayer Perceptron, Back Propagation Learning, Hopfield Network, Fuzzy Neural Network

UNIT –5:TIME VARYING PATTERN RECOGNITION (9)

First Order Hidden Markov Model, Evaluation, Decoding, Learning.

Unsupervised Classification:
Clustering, Hierarchical Clustering, Graph Based Method, Sum of Squared Error Technique Iterative Optimization.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs and COs Mapping
CO1	Demonstrate knowledge on Basics of pattern recognition and analysis of unsupervised classification with application areas.	**PO1, PO2**
CO2	Demonstrate the knowledge on statistical pattern recognition with analytical skills.	**PO1, PO2, PO4**
CO3	Ability to understand the dimensionality problem	**PO1, PO2, PO4**
CO4	Acquire the basic knowledge on linear discriminant function and neural network classifier.	**PO1, PO2**
CO5	Understand the need for and use of time varying pattern recognition and unsupervised classification	**PO1, PO2, PO4**

TEXT BOOKS:

1. Robert J.Schalkoff, "Pattern Recognition Statistical, Structural and Neural Approaches", John Wiley & Sons Inc., New York, 1992.
2. Tou and Gonzales, " Pattern Recognition Principles", Wesley Publication Company, London, 1974.

REFERENCE BOOKS:

1. Duda R.O and Har P.E., "Pattern Classification and Scene Analysis", Wiley, New York, 1973.
2. Morton Nadier and Eric Smith P, "Pattern Recognition Engineering", John Wiley & Sons, New York, 1993.

REFERENCE WEBSITE:

1. https://en.wikipedia.org/wiki/Pattern_recognition
2. https://www.journals.elsevier.com/pattern-recognition
3. https://www.sciencedirect.com/journal/pattern-recognition

CO-PO MAPPING:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	1	-	-	-	-	-	-	-	-	-	-
CO.2	3	3	-	2	-	-	-	-	-	-	-	-
CO.3	3	3	-	2	-	-	-	-	-	-	-	-
CO.4	3	3	-	-	-	-	-	-	-	-	-	-
CO.5	3	3	-	1	-	-	-	-	-	-	-	-
CO*	**3**	**2.6**	**-**	**1.67**	-	-	-	-	-	-	-	-

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES
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IV B.Tech - VII Semester

20OCSM472	**FOUNDATIONS OF MACHINE LEARNING**	**L T P C** **3 0 0 3**

PRE-REQUISITES: A course on Probability and Statistics

COURSE EDUCATIONAL OBJECTIVES:

1. To learn the theoretical foundations of machine learning.
2. To understand various supervised learning algorithms.
3. To understand the support vector machine.
4. To learn different types of unsupervised learning algorithms.
5. To introduce the basic applications of machine learning.

UNIT 1: INTRODUCTION **(9)**

Review of Linear Algebra, Definition of learning systems,Designing a learning system, Learning Paradigms – PAC learning – Basics of Probability – Version Spaces, Goals and applications of machine learning; Classification of learning system, Basic concepts in Machine Learning.

UNIT 2: SUPERVISED LEARNING ALGORITHMS **(9)**

Linear and Non-Linear examples, Multi–Class & Multi-Label classification, Linear Regression, Multilinear Regression, Naïve Bayes Classifier, Decision Trees, K-NN classifier, Logistic regression, Perceptrons.

UNIT 3: UNSUPERVISED LEARNINGALGORITHMS **(9)**

Clustering basics (Partitioned, Hierarchical and Density based), K-Means clustering, K-Mode clustering, Self organizing maps, Expectation maximization, Principal Component Analysis.

UNIT 4: ENSEMBLE LEARNING AND EVALUATION METRICS **(9)**

Bagging and Boosting (Random forests, Adaboost, XG boost inclusive), ROC Curves, Evaluation Metrics, Significance tests – Error correction in Perceptrons.

UNIT 5: MACHINE LEARNING IMPLEMENTATION **(9)**

Data collection – Preprocessing (Missing values, Normalization, Adopting to chosen algorithm etc.,) – Outlier Analysis (Z-Score) - Model selection & evaluation – Optimization of tuning parameters – Setting the environment – Visualization of results.

COURSE OUTCOMES:

On successful completion of the course the student will be		**POs related to COs**
CO1	Understand the basics of machine learning.	**PO1, PO2**
CO2	Identify the suitable supervised learning algorithm for problem solving.	**PO1, PO2**
CO3	Understand the concept of support vector machine.	**PO1,PO2, PO3**
CO4	Apply appropriate unsupervised learning algorithm for solving real-world problems.	**PO1,PO2,PO3,PO4,PO5**
CO5	Explore the applications of machine learning.	**PO1, PO2, PO3, PO4, PO5**

TEXT BOOKS:

1. Ethem Alpaydin,"Introduction to Machine Learning", fourth Edition, MIT Press, Prentice Hall of India, 2020.
2. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", MIT Press, 2018.

REFERENCES:

1. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2015.
2. Jeremy Watt, Reza Borhani, and Aggelos K. Katsaggelos, "Machine Learning Refined Foundations, Algorithms, and Applications", Cambridge University Press, 2016.
3. Miroslav Kubat, "An Introduction to Machine Learning", Second Edition, Springer International Publishing, 2017.

REFERENCE WEBSITE:

1. AndrewNg,"MachineLearning",StanfordUniversityhttps://www.coursera.org/learn/machi ne-learning/home/info.
2. https://nptel.ac.in/courses/106105152/1
3. https://nptel.ac.in/courses/106106139/1

"CO-PO MAPPING"

CO- PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	2	2	2	2	2	-	-	-	-	-	-	-
CO5	3	2	2	2	2	-	-	-	-	-	-	-
CO*	**2.6**	**2.4**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

IV B.TECH. - VII SEMESTER

		L	T	P	C
20OHSM472	**TOTAL QUALITY MANAGEMENT** (OPEN ELECTIVE – 4)	**3**	**-**	**-**	**3**

PRE-REQUISITES: NIL

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the concepts of total quality management, and Contributions of TQM
2. To learn TQM principles and impact of 5s, Kaizen, PDSA cycles in continuous process improvement.
3. To study the basic need of quality control and process control in an organization
4. To learn the traditional and modern TQM tools and techniques
5. To study the quality standard, requirements and elements in Quality management system

UNIT –1: INTRODUCTION ON TOTAL QUALITY MANAGEMENT (9)

Introduction – Need for quality – Evolution of quality – Definition of quality – Dimensions of manufacturing and service quality – Basic concepts of TQM – Definition of TQM – TQM frame work – Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT –2: TQM PRINCIPLES (9)

Leadership – Strategic quality planning – Quality statements – Customer focus, customer orientation, customer satisfaction, customer complaints and retention – Employee involvement – Motivation – Empowerment – Teams and teamwork – Recognition and reward – Performance appraisal – Continuous process improvement – PDSA cycle, 5s, Kaizen – Supplier partnership, partnering, supplier selection and supplier rating.

UNIT –3: QUALITY CONTROL (9)

Control chart for attributes – Control chart for non-conforming – p chart and np chart – Control chart for nonconformities: C and U charts – Control chart for variables: X chart, R chart and σ chart – State of control and process out of control identification in charts, pattern study and process capability studies.

UNIT –4: TQM TOOLS AND TECHNIQUES (9)

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector – Bench marking – Bench marking process – FMEA – Stages – Types – Quality circles – Quality function development (QFD) – Taguchi quality loss function – TPM – Reliability fundamentals and concepts.

UNIT –5: QUALITY SYSTEMS AND STANDARDS (9)

Need for ISO 9000 – ISO 9001-2008 Quality System – Benefits of ISO registration – ISO 9000 standards – AS 9100, TS16949 and TL 9000 – ISO 9001 Requirements – Implementation – Documentation – Internal and external audits – Registration – TQM implementation in manufacturing and service sectors. **Environmental Management System:** ISO 14000 Series Standards – Concepts and Requirements of ISO 14001.

Total Hours: 45

COURSE OUTCOMES:

On successful completion of the course, students will be able to		POs and COs Mapping
CO1	Describe the concepts of total quality management, and Contributions of TQM	**PO1, PO11, PO12**
CO2	Understand the TQM principles and impact of 5s,Kaizen, PDSA cycles in continuous process improvement.	**PO1, PO11, PO12**
CO3	Illustrate the basic need of quality control and process control in an organization	**PO1, PO2, PO11, PO12**
CO4	Summarize the traditional and modern TQM tools and techniques	**PO1, PO3, PO11, PO12**
CO5	Realize the quality standard, requirements and elements in Quality management system	**PO1,PO11, PO12**

TEXT BOOKS:

1. Bester field Dale H, Bester field Carol, Bester field Glen H, Bester field Mary, Urdhwareshe Hemant and Urdhwareshe Rashmi, "Total Quality Management", Pearson Education,5/e, 2018, New Delhi.
2. Douglas.C. Montgomery, John Wiley, "Introduction to Statistical Quality Control", 7/e, 2013,.

REFERENCE BOOKS:

1. D.R. Kiran, Butterworth-Heinemann, "Total Quality Management", 1/e, 2016, .
2. Poornima M. Charantimath, "Total Quality Management", Pearson Education, New Delhi, 3/e, 2017,
3. Tapan K. Bose,"Total Quality of Management", Pearson Education India 2010,.
4. Bedi Kanishka, "Quality Management", Oxford University Press, India 2006,.
5. Ramasamy Subbura, "Total Quality Management", McGraw Hill Education 2011,

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/110/104/110104085/
2. https://nptel.ac.in/courses/110/104/110104080/
3. https://nptel.ac.in/courses/112/107/112107259/
4. https://nptel.ac.in/courses/110/101/110101150/

CODES/TABLES:

1. Use of approved statistical table permitted in the examination.

CO-PO MAPPING

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	2	2	-	-	-	-	-	-	-	-
CO.2	3	2	2	2	-	-	-	-	-	-	-	-
CO.3	3	2	2	2	-	-	-	-	-	-	-	-
CO.4	3	2	2	2	-	-	-	-	-	-	-	-
CO.5	3	2	2	2	-	-	-	-	-	-	-	-
CO*	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-

IV B.Tech. - VII Semester

20MEC474	COMPUTER AIDED MANUFACTURING (SAC)	L	T	P	C
		-	1	2	2

PRE-REQUISITES: Computer Aided Design and Manufacturing Engineering

COURSE EDUCATIONAL OBJECTIVES:

1. To introduce the evolution, types and principles of CNC machine tools.
2. To familiarize the students with constructional features of CNC machine tools.
3. To familiarize the students with various tooling used in CNC machine tools
4. To gain knowledge on CNC programming using CAM packages
5. To obtain the concepts of Computer integrated manufacturing.

UNIT –1: INTRODUCTION TO CNC MACHINE TOOLS (12)

CNC Technology: Evolution of CNC – Fundamentals of NC and CNC – CNC controllers – Interpolators – Types of CNC Machines – Principles, features and specification of turning centre, milling centre, CNC-EDM, CNC grinding machine, vertical turret lathe, turn-mill centre and multitask machines. **Adaptive Control:** Configuration of adaptive control – Reasons for process change – Example for feedback and adaptive control.

UNIT –2: CNC MACHINE TOOL STRUCTURE AND DRIVES (12)

CNC Structure: CNC systems configuration – Interfacing, monitoring and diagnostics – Machine data – Compensations for machine accuracies – PLC in CNC – Types of loads and guide ways – Transmission elements – Elements for rotary motion to linear motion – Ball screw, roller screw and types – Rack and pinion – Torque transmission elements – Requirements of feed and spindle drive – Flexible couplings and bearings. **Drives:** Spindle assembly – Spindle and feed drives – Functions of stepper, servo and linear motor – Axis measuring system – Open and closed loop control – Resolver – Gratings – Encoders.

UNIT –3: CNC TOOLING AND FEED-BACK SYSTEM (12)

Tooling: Cutting tool materials – Hard metal inserts – Inserts and tool holders – Preset, qualified and semi qualified tools – Silent tool – Tooling for machining and turning center – Work holding devices for rotating and fixed work parts – ATC – APC – Tool magazine – Tool identification – Tool coding – Tool locking mechanism – Fixtures requirements – Unified and modular fixtures – Use of probes in CNC – Economics and maintenance of CNCmachines. **Feed-Back System:** Feedback Devices – Velocity Feedback – Position Feedback – Rotary and linear – Sensors in CNC – Tool condition monitoring in indirect and direct Methods – Contact pressure monitoring – Identification and gauging of work piece.

UNIT –4: CNC PROGRAMMING (12)

Coordinate system – Cutter motion – Structure of a CNC part program – G&M Codes – ISO 6983 standards – Machine axes identification – Tool length compensation – Cutter radius and tool nose radius compensation – Offset in milling – Mirror image – Manual CNC programming – – Computer assisted programming in APT – Programming for machining center and turning center – Canned cycles – Fixed cycles – Repetitive Programming– Loops, Sub Programs and Macros CNC controllers – generation of CNC codes from CAM packages – Postprocessor Statements – Generation and Execution of APT Programs.

UNIT –5: COMPUTER INTEGRATED MANUFACTURING (12)

Concepts of CAD/CAM/CIM – CIM elements – CASA/SME model – Principle of networking. Group Technology: Role of G.T in CIM – Part families and coding – OPTIZ, VUOSO- PRAHA, MICLASS, KK-3, DCLASS and MDSI coding's – Production flow analysis. Cellular Manufacturing: Composite part concept – Machine cell design. Process Planning: Process planning in CAD/CAM – Variant approach and generative approaches. FMS: FMS workstation and components – Tool management system – FMS layouts and controls.

Total Hours: 60

LIST OF EXERCISES/EXPERIMENTS:

1. Study of different CNC machine tool systems and its controller.
2. Study of CNC programming and its codes.
3. Programming and simulation for
    - Various operations (Straight, Taper, Radial Turning, Thread Cutting, Rough and Finish Turning Cycle) using canned cycle for CNC turning Centre.
    - Machining of internal surfaces in CNC turning Centre.
    - 3D profile milling, circular milling and rectangular pocket milling.
4. Exercise on
    - CNC Lathe: Facing, Plain Turning and Step turning.
    - CNC Lathe: Taper turning, Threading and Grooving.
5. CNC Milling program involving linear motion and circular interpolation.
6. Canned cycle for drilling, rigid tapping, boring operation.
7. CNC code generation using
    - Machine simulation / CAM software packages – CNCLathe.
    - Machine simulation / CAM software packages - CNCMilling machine / Machining centre.
8. Generate CL Data and Post process data using CAM packages for Machining andTurning Centre.
9. Route sheet generation using CAM software.
10. Diagnosis and trouble shooting in CNC machine.

COURSE OUTCOMES:

On successful completion of the course, students will be able to		**POs**
CO1	Recognize the evolution, types and principle of CNC machinetools	**PO1, PO3, PO5**
CO2	Acquire knowledge on constructional features of CNC machine tools	**PO1, PO3, PO5**
CO3	Elaborate various tooling and work holding devices used in CNC machine tools	**PO1, PO3, PO5**
CO4	Demonstrate competency in manual part program andgeneration of CNC part program using CAM packages	**PO1, PO3, PO5**
CO5	Obtain the concepts, applications and components of Computer integrated manufacturing.	**PO1, PO3, PO5**

TEXT BOOKS:

1. Mike Mattson, "CNC Programming: Principles & Applications: Principles and Applications", Cengage Learning, 1/e, 2013.
2. T C Chang, R A Wysk and H P Wang, "Computer-Aided Manufacturing", Pearson Education, India, 3/e, 2008.

REFERENCE BOOKS:

1. P. Radhakrishnan, "Computer Numerical Control Machines and Computer Aided Manufacture", New Age International Publishers.
2. Ken Evans, "Programming of CNC Machines", INDUSTRIAL PRESS, INC., 4/e, 2016.
3. R Ibrahim Zeid, "Mastering CAD/CAM", McGraw Hill Education, India, 2018.
4. P.N. Rao, "CAD/CAM-Principles and Applications", Tata McGraw-Hill Education Pvt. Ltd., Noida, 3/e, 2010.
5. P. Radhakrishnan, S.Subramanyan and V.Raju, "CAD/CAM/CIM", New Age International Publishers, 1/e (Revised), 2018.

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/104/112104031/
2. https://nptel.ac.in/courses/112/102/112102101/
3. https://nptel.ac.in/courses/112/102/112102102/
4. https://nptel.ac.in/courses/112/102/112102103/

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	3	2	-	-	2	-	-	-	-	-	-	-
CO.2	3	2	-	-	2	-	-	-	-	-	-	-
CO.3	3	2	-	-	2	-	-	-	-	-	-	-
CO.4	3	2	-	-	2	-	-	-	-	-	-	-
CO.5	3	2	-	-	2	-	-	-	-	-	-	-
CO*	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	-

IV B.Tech. - VII Semester

20MEC475	**INDUSTRIAL / RESEARCH INTERNSHIP EVALUATION**	**L**	**T**	**P**	**C**
		-	**-**	**-**	**2**

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

1. To give an opportunity to the student to get hands on training from industry / research and development center.
2. The course is designed so as to expose the students to industry environment / research environment and to take up on-site assignment as trainees or interns.

INTERNSHIP SCHEME:

1. At the end of the Industrial / Research Internship, the candidate shall submit a certificate from the organization where he/she has undergone industrial / research internship and also a brief report.
2. An industrial / research internship report to be submitted by the individual and along with the internship certificate provided by the organization, which will be reviewed and evaluated by a Committee constituted by the Head of the Department.
3. The evaluation for 100 marks will be carried out internally based on this internship report and a Viva-Voce Examination will be conducted by a Departmental Committee constituted by the Head of the Department/Institution.

COURSE OUTCOMES:

On successful completion of the course, students will be able to		Pos
CO1	Demonstrate in-depth knowledge on the research / industry environment	**PO1**
CO2	Identify, analyze and formulate complex problem chosen for internship study to attain substantiated conclusions.	**PO2**
CO3	Design solutions to the chosen internship domain.	**PO3**
CO4	Undertake investigation of internship study problem to provide valid conclusions	**PO4**
CO5	Use the appropriate techniques, resources and modern engineering tools necessary for internship work.	**PO5**
CO6	Apply internship study results for sustainable development of the society.	**PO6**
CO7	Understand the impact of internship study in the context of environmental sustainability.	**PO7**
CO8	Understand professional and ethical responsibilities while executing the internship study.	**PO8**
CO9	Function effectively as individual and a member in the internship.	**PO9**
CO10	Develop communication skills, both oral and written for preparing and presenting during internship.	**PO10**
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the internship.	**PO11**
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the internship study.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	3	-	-	-	-	-	-
CO7	-	-	-	-	-	-	3	-	-	-	-	-
CO8	-	-	-	-	-	-	-	3	-	-	-	-
CO9	-	-	-	-	-	-	-	-	3	-	-	-
CO10	-	-	-	-	-	-	-	-	-	3	-	-
CO11	-	-	-	-	-	-	-	-	-	-	3	-
CO12	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

IV B.Tech. - VIII Semester

20MEC481	**PROJECT WORK**	**L T P C** **- - - 12**

PRE-REQUISITES: Project Skills Lab

COURSE EDUCATIONAL OBJECTIVES:

1. Discovering potential research areas in the field of Mechanical Engineering.
2. Comparing and contrast the several existing solutions for the problem identified.
3. Formulating and propose a plan for creating a solution for the research plan identified.
4. Conducting the experiments as a team and interpret the results.
   Reporting and presenting the findings of the work conducted.

PROJECT WORK SCHEME:

1. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design / fabrication / analysis for a specific application, a research project with a focus on anapplication needed by the industry / society, a computer project, a management project or a design and analysis project. A project topic must be selected by the students in consultation with their guides.

2. A candidate may, however, in certain cases, be permitted to work on projects in an Industrial / Research Organization, on the recommendations of the Head of the Department Concerned. In such cases, the Project work shall be jointly supervised by a supervisor of the department and an expert, as a jointsupervisor from the organization and the student shall be instructed to meetthe supervisor periodically and to attend the review committee meetings for evaluating the progress.

3. To train the students in preparing project reports and to face reviews and viva voce examination. The progress of the project is evaluated based on a minimum of three reviews.

4. As per the guidelines given the project report must be prepared and submitted to the Head of the department before the Viva-Voce Examination.

5. The Student shall make presentation on the progress made before the Committee.

6. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

COURSE OUTCOMES:

On successful completion of the course, students will be able to		Pos
CO1	Demonstrate in-depth knowledge on the project topic	**PO1**
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	**PO2**
CO3	Design solutions to the chosen project problem.	**PO3**
CO4	Undertake investigation of project problem to provide valid conclusions	**PO4**
CO5	Use the appropriate techniques, resources and modern engineering tools necessary for project work	**PO5**
CO6	Apply project results for sustainable development of the society.	**PO6**
CO7	Understand the impact of project results in the context of environmental sustainability.	**PO7**
CO8	Understand professional and ethical responsibilities while executing the project work.	**PO8**
CO9	Function effectively as individual and a member in the project team	**PO9**
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	**PO10**
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	**PO11**
CO12	Engage in lifelong learning to improve knowledge and competence in the chosen area of the project.	**PO12**

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	3	-	-	-	-	-	-	-
CO6	-	-	-	-	-	3	-	-	-	-	-	-
CO7	-	-	-	-	-	-	3	-	-	-	-	-
CO8	-	-	-	-	-	-	-	3	-	-	-	-
CO9	-	-	-	-	-	-	-	-	3	-	-	-
CO10	-	-	-	-	-	-	-	-	-	3	-	-
CO11	-	-	-	-	-	-	-	-	-	-	3	-
CO12	-	-	-	-	-	-	-	-	-	-	-	3
CO	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**