VISION AND MISSION OF THE INSTITUTE

Vision:

To ignite the minds of the students through academic excellence so as to bring about social transformation and prosperity.

Mission:

- To expand the frontiers of knowledge through Quality Education.
- To provide value added Research and Development.
- To embody a spirit of excellence in Teaching, Creativity, Scholarship and Outreach.
- To provide a platform for synergy of Academy, Industry and Community.
- To inculcate high standards of Ethical and Professional Behavior.

VISION AND MISSION OF THE DEPARTMENT

Vision:

To impart quality education in the field of Mechanical Engineering and to serve the ever-changing industrial demands and societal needs.

Mission:

- To provide strong foundation in both the principles and applications of Mechanical Engineering through effective teaching-learning practices.
- To groom the students with qualities of leadership, team-building, problem-solving and effective communication.
- To promote research, innovation and entrepreneurship with emphasis on needs of the industry and society.
- To mould the students as professionals with a consciousness of ethics and moral values.

PROGRAM OUTCOMES (POs)

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.
12. **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO 1: Graduates apply a deep working knowledge of technical fundamentals in areas such as Design, Thermal, Production, Industrial and related fields to address needs of the customer and society.

PEO 2: Graduates pursue advanced education, Research and Development in Engineering, Technology and other professional careers.

PEO 3: Graduates possess good communication skills, leadership qualities, ethical values and able to work in teams.

PROGRAM SPECIFIC OUTCOMES (PSOS)

PSO 1: Able to apply the knowledge learned as a part of the curriculum to provide solutions for problems related to Mechanical Engineering.

PSO 2: Think innovatively, design and develop products with modern CAD/CAM tools and with optimized manufacturing processes.

B.Tech. FOUR YEAR DEGREE COURSE

R20 Regulations

(Applicable for the batches admitted from 2020-2021)

VISHNU INSTITUTE OF TECHNOLOGY: BHIMAVARAM

(Autonomous)

Approved by AICTE & Affiliated to JNTUK, Kakinada

Accredited with NBA, A++ Grade by NAAC

Vishnupur, Bhimavaram, West Godavari Dist., Andhra Pradesh, India. PIN - 534202

Email: info@vishnu.edu.in, Website: www.vishnu.edu.in

THE DEGREE OF BACHELOR OF TECHNOLOGY - REGULAR
(With effect from 2020-21)

RB 0.0	**TITLE AND DURATION OF THE COURSE**
	The course shall be called the degree course in Bachelor of Technology, abbreviated as B.Tech.
	The course shall be of four academic years duration divided into eight semesters, each semester having duration of minimum 16 weeks.
	The calendar of events in respect of the course shall be fixed by the Institute from time to time.
	The external examination in all the subjects shall be conducted at the end of each semester for all the eight semesters.
	Students joining the B.Tech. programme shall have to complete the programme in a stipulated time frame of 8 years from the date of joining and students joining the B.Tech. Programme in the third semester directly through Lateral Entry Scheme (LES) shall have to complete the programme in a stipulated time frame of 6 years from the date of joining. Otherwise, they shall forfeit their seat in B.Tech. Programme and their admission shall stand cancelled.
	When a student is detained for lack of credits / shortage of attendance, he/she may be readmitted into the same semester / year in which he/she has been detained. However, the academic regulations under which he/she was first admitted shall continue to be applicable.
RB 1.0	**ELIGIBILITY FOR ADMISSION**
RB 1.1	Admissions are done as per the norms prescribed by the Government. The Government orders issued from time to time in this regard shall prevail.
RB 1.2	The Candidate shall be an Indian National.
RB 1.3	The Candidate should have passed the qualifying examination, i.e., Intermediate or equivalent on the date of admission.
RB 1.4	Seats in each programme in the college are classified into CATEGORY-A (70% of intake) and CATEGORY – B (30% of intake) besides lateral entry.
RB 1.5	Category 'A' Seats shall be filled by the Convener, EAMCET Admissions. Category 'B' Seats shall be filled by the College as per the guidelines of Andhra Pradesh State Council of Higher Education. 'Lateral Entry' candidates shall be admitted into the Third semester directly based on the rank secured by the candidate in Engineering Common Entrance Test (ECET) in accordance with the instructions given by the Convener, ECET and the Government of Andhra Pradesh.

RB 2.0	**AWARD OF B.TECH. DEGREE**
RB 2.1	A Regular Student shall be declared eligible for the award of the B.Tech. Degree, if he/she pursues a course of study in not less than four and not more than eight academic years. A Lateral Entry Student admitted into III semester shall be declared eligible for the award of the B.Tech. Degree, if he/she pursues a course of study in not less than three and not more than six academic years.
RB 2.2	Each discipline of the B.Tech. programme is designed to have a total of 160 credits and the student shall have to complete the courses and earn all credits as per the requirements for award of the degree. Students joining the B.Tech. programme in the third semester directly through Lateral Entry Scheme (LES) shall have to complete the courses, excluding first year courses and credits as per the requirements for award of the degree.
RB 2.3	The B.Tech. Degree shall be conferred on a candidate who has satisfied the following requirements. A Regular student (four year programme) should register for 160 credits. In order to become eligible for the award of B.Tech. Degree, the student must obtain 160 credits. A Lateral Entry student should register for [160 Minus (first Year credits)] credits and should obtain all the credits. However, it is mandatory for the students to complete the noncredit courses
RB 3.0	**MINIMUM INSTRUCTION DAYS**
RB 3.1	The minimum instruction days for each semester shall be 90 working days.
RB 4.0	**COURSES OF STUDY**
	Branch Code- Branch Abbreviation 01-CE (Civil Engineering) 02-EEE (Electrical and Electronics Engineering) 03-ME (Mechanical Engineering) 04-ECE (Electronics and Communication Engineering) 05-CSE (Computer Science and Engineering) 12-IT (Information Technology) 54-AI&DS (Artificial Intelligence and Data Science) 48-CS&BS (Computer Science and Business System)
RB 4.1	**Groups of Courses: The Group of courses is as per APSCHE Revised Engineering Curriculum (B.Tech. Regular/Honors/Minor) 2020.** The Courses in the B.Tech. Programme are of these following kinds: Basic Science, Engineering Science, Professional Core, Professional Elective,

	Open Elective/Job Oriented elective, Humanities and Social Science, Humanities and Social Science Elective, Skill Oriented, Skill Advanced Course/Soft Skill Course, Summer Internship, Industrial/Research internship, Mandatory Course and Project.
RB 5.0	**DISTRIBUTION AND WEIGHTAGE OF MARKS**
RB 5.1	The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory and 100 marks for practical subject. The Project evaluated for 200 marks and internship for 100 marks.
RB 5.2	For theory subjects, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End Examinations.
RB 5.3	The Internal evaluation 30 marks shall be awarded as follows: 15 marks for Descriptive, 10 marks for Quiz and 5 marks for Assignment. The descriptive examination is for 90 minutes duration conducted for 30 marks. Each descriptive examination question paper consists of three questions (either - or type) from 2½ units (Mid-1: Q1 from Unit-1 for 12 marks, Q2 from Unit-2 for 12 marks, and Q3 from first-half of Unit-3 for 6 marks) (Mid-2: Q1 from second-half of Unit-3 for 6 marks, Q2 from Unit-4 for 12 marks, and Q3 from Unit-5 for 12 marks). All the questions shall be answered. The descriptive examination conducted for 30 Marks is to be brought down to total marks of 15. The quiz examination is for 20 minutes duration (Conducted with 20 objective questions with a weightage of ½ Mark each). Thought provoking questions shall be covered in Quiz examination. After every 2 ½ Units, one Assignment/Tutorial shall be assigned/conducted. Assignment/Tutorial consists of Theory, Design, Analysis, Simulation, Algorithms, Drawing, etc. as the case may be. Out of the two Assignments / tutorials, average of the two Assignments shall be considered for awarding of marks. Average of two Mid tests (descriptive, quiz and assignment) shall be considered as final marks of the MID. Eg: A student got 12 marks out of 15 marks in Descriptive-1, 7 marks out of 10 marks in Quiz-1 and 8 marks out of 15 marks in Descriptive-2 and 2 marks out of 10 marks in Quiz-2. Assignment-1 = 3 out of 5 and Assignment-2 = 5 out of 5. The student Internal marks are = ((19+10)/2 + (3+5)/2) = 18.5 is rounded off to 19 marks out of 30 marks. If a student is absent from any one MID examination, he/she can appear for a Grand Test after MID-2. The Grand Test will be conducted with questions covering the entire syllabus. The

	marks in the grand test is reduced to 25 marks and to be considered for the respective MID.
RB 5.4	The end semester examination is conducted for 70 marks. The Question Paper consists of two parts (Part-A for 10 Marks and Part-B for 60 marks). Part A consists of 5 questions for 2 marks each, where five questions shall be from each unit. In Part-A the student has to answer all 5 Questions. Part-B consists of 5 Questions (either - or type) from each unit with 12 marks each. In Part-B the student has to answer all 5 Questions. For design subjects (like Design Drawing Concrete Structures, Steel Structures, Building Planning and Drawing), the pattern will consist of 2 parts (part-A and B), where in part-A two questions will be given with each question carrying 25 marks, out of which the student has to answer one question and part-B consists of 5 questions with each question carrying 15 marks, out of which the student has to answer 3 questions.
RB 5.5	For practical subjects, there shall be continuous evaluation during the semester for 15 internal marks. Out of the 15 marks for internal, day-to-day work 5 marks, Record 5 marks and 5 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted for 35 marks by the internal examiner and the external examiner.
RB 5.6	For the subjects having design and/or drawing (such as Engineering Graphics, Engineering Drawing, Machine Drawing, Design Drawing Concrete Structures, Steel Structures, Building Planning and Drawing), the distribution shall be 30 marks for internal evaluation (15 marks for day–to–day work, and 15 marks for MID tests) and 70 marks for end examination. The average of 2 MIDs shall be considered as final marks of the MID.
RB 5.7	For the seminar, the student shall collect the information on a specialized topic and prepare a technical report showing his/her understanding over the topic, and submit to the department, which shall be evaluated by the Departmental Committee consisting of the Head of the Department, a seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.
RB 5.8	Out of a total of 200 marks for the Project, 60 marks shall be for Internal Evaluation and 140 marks for the End Semester Examination. The End Semester Examination (Viva – Voce) shall be conducted by the

	Committee. The Committee consists of an external examiner, Head of the Department and Supervisor of the Project. The evaluation of project work shall be conducted at the end of the Eighth semester. The Internal Evaluation marks shall be on the basis of two seminars given by each student on the topic of his/her project and evaluated by an Internal Committee, consisting of Head of the department, the supervisor of the project and a senior faculty member.
RB 5.9	Laboratory marks and the internal marks awarded by the department are not final. The marks are subjected to be scrutinized and scaled by the Institute wherever it is felt desirable. The internal and laboratory marks awarded by the department shall be referred to a Committee if required. The Committee shall arrive at a scaling factor and the marks shall be scaled as per the scaling factor. The recommendations of the Committee are final and binding. The laboratory records and internal test papers shall be preserved for two years after the final examinations of that semester in the respective departments as per the norms of the Institute and shall be produced to the Committees as and when they ask for.
RB 6.0	**PROGRAMME STRUCTURE**
	The programme structure is as per APSCHE Revised Engineering Curriculum (B.Tech Regular/Honors/Minor) 2020.
	Basic Science Courses
	Engineering Science Courses
	Professional Core Courses
	Professional Elective Courses
	Humanities and Social Science Courses
	Humanities and Social Science Elective
	Internship
	Industrial /Research internship
	Skill Oriented Course
	Skill Advanced Course/Soft Skill Course
	Open Elective/Job Oriented elective
	Mandatory Courses
	Project
RB 7.0	**SCHEME OF INSTRUCTION FOR I, II, III AND IV YEARS**
RB 7.1	The Schemes of Instruction and syllabi of all B.Tech. programmes are given separately, which are approved by the BOS concerned and the Academic Council.

RB 8.0	**CONTACT HOURS AND CREDITS**
RB 8.1	One hour of lecture/Tutorial is equivalent to one credit and one hour of practical work/field work is equivalent to 0.5 credit**.**
RB 8.2	**THEORY / TUTORIAL CLASSES** Each course is prescribed with a fixed number of lecture periods per week. During lecture periods, the course instructor shall deal with the concepts of the course. For certain courses, tutorial periods are prescribed in order to give exercises to the students and to closely monitor their learning abilities and achievements.
RB 8.3	**LABORATORY / DRAWING COURSES** A minimum prescribed number of experiments/drawings/jobs/programmes have to be performed by students, who shall complete these in all aspects and get each experiment evaluated by the teacher concerned and certified by the Head of the Department concerned at the end of the semester.
RB 9.0	**MEDIUM OF INSTRUCTION**
	The Medium of Instruction and examination is in English.
RB 10.0	**ATTENDANCE REQUIREMENTS**
RB 10.1	In each semester, the candidate has to put in a minimum attendance of 75% with at least 40% attendance in each subject and with a provision of condonation of 10% of the attendance by the Principal on the specific recommendation of the HOD, showing some reasonable cause such as medical grounds, participation in University level sports, cultural activities, seminars, workshops, paper presentation etc.
RB 10.2	Students, having shortage of attendance and got condonation for attendance, shall have to pay requisite fee towards condonation.
RB 10.3	Shortage of attendance below 65% in aggregate shall not be condoned.
RB 10.4	Students whose shortage of attendance is not condoned will be detained and the student has to re-register for that semester when it is offered by the department.
RB 10.5	Rules for calculation of attendance for the re-admitted candidates who were detained for want of attendance or who had break–in study for various reasons: a) No. of classes conducted shall be counted from the day one of the semester concerned, irrespective of the date of payment of tuition fee. b) They should submit a written request to the Principal, along with a challan paid towards tuition and other fee, for re-admission before the commencement of class-work. c) Student should come to know about the date of commencement of

	class-work of the semester into which he/she wishes to get re-admission. The information regarding date of commencement of class-work for each semester is available in the college notice boards/ website.
RB 11.0	**CONDITIONS FOR PASS AND AWARD OF CREDITS FOR A COURSE**
RB 11.1	A candidate shall be declared to have passed in individual theory/drawing course if he/she secures a minimum of 40% aggregate marks (40 marks out of 100, Internal and semester end examination marks put together), subject to a minimum of 35% marks (24 marks out of 70) in semester end examination. For successful completion of mandatory course, the student must get a satisfactory grade from the department offering the course. If fails, he/she has to reappear whenever the course is offered.
RB 11.2	A candidate shall be declared to have passed in individual lab/project course if he/she secures a minimum of 40% aggregate marks (Internal and semester end examination marks put together), subject to minimum of 35% marks in semester end examination.
RB 11.3	The student has to pass the failed course by appearing the supplementary examination as per the requirement for the award of degree.
RB 11.4	On passing a course of a programme, the student shall earn assigned credits in that course.
RB 12.0	**TRANSITORY REGULATIONS**
RB 12.1	A candidate, who is detained or discontinued in the semester, on readmission shall be required to pass all the courses in the curriculum prescribed for such batch of students in which he/she joins subsequently. However, exemption shall be given to those candidates who have already passed in such courses in the earlier semester(s) and substitute subject may be offered as approved by College Academic Committee and ratified by the Academic Council.
RB 12.2	A student shall be eligible for promotion to the next semester of B.Tech. programme, if he/she satisfies the conditions as stipulated in Regulation RB10.0
RB 12.3	A student will be promoted from II year to III year if he fulfills the academic requirement of 40% of the credits up to either II year I semester or II year II semester from all the examinations, whether or not the candidate takes the examinations and secures pre scribed minimum attendance in II year II semester. A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to either III year I

	semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester. For Lateral Entry Candidates A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.
RB 13.0	**COURSE CODE AND COURSE NUMBERING SCHEME:** The subject codes shall be given by the Department teaching the subject. Each subject code contains 8 characters. The 8 Characters for each subject shall be coded as per the following guidelines. 20 CS 1 T 01 20 – Regulation Year CS – **Code of the Dept teaching the subject** IT – IT CS – CSE EC – ECE EE – EEE ME – Mech CE – Civil MB – MBA BS – Basic Sc. AD-AI & DS CB-CS&BS 1 – Semester Number 1/2/3/…/8 T – **Type of subject** T – Theory-Core/Elective P – Practical S – Seminar J – Project A – Mandatory course M – MOOC I – Internship/certification course/Yoga/Foreign Languages 01 – Unique Number of the course in the semester 01/02/03/….
	While giving the subject codes the Departments can follow the following steps. i. Collect the requirements from various Departments.(subjects which they have to teach for other Departments) ii. Prepare a list of all the subjects the Departments have to teach in that semester (for their Department as well as the other Departments based

	on the requirements they have collected in point i.) iii. Give subject codes to all these subjects following the guidelines given. iv. Communicate these subject codes(identified in point i) to various Departments. v. Use the subject codes identified in point iii to the subjects in their course structure.
RB 14.0	**CONSOLIDATED GRADE CARD**
	A consolidated grade card containing credits and grades obtained by the candidate shall be issued after completion of the four year B.Tech. Programme.
RB 15.0	**METHOD OF AWARDING LETTER GRADES AND GRADE POINTS FOR A COURSE**
RB 15.1	A letter grade and grade point shall be awarded to the student in each course based on his/her performance as per the grading system given below

Marks Range Theory/Lab (Max – 100)	Marks Range for subjects with Max – 50	Letter Grade	Level	Grade Point
≥ 90	≥ 45	O	Outstanding	10
≥ 80 < 90	≥ 40 < 45	S	Excellent	9
≥ 70 < 80	≥ 35 < 40	A	Very Good	8
≥ 60 < 70	≥ 30 < 35	B	Good	7
≥ 50 < 60	≥ 25 < 30	C	Fair	6
≥ 40 < 50	≥ 20 < 25	D	Satisfactory	5
< 40	< 20	F	Fail	0
			Absent	0

RB 15.2	**Calculation of Semester Grade Points Average(SGPA)* for semester: The Performance of each student at the end of each semester is indicated in terms of SGPA. The SGPA is calculated as below:** SGPA (S_i) = $\sum(C_i \times G_i) / \sum C_i$ (for all courses passed in that semester) Where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course. * SGPA is calculated for the candidates who passed all the courses in that semester
RB 15.3	**Calculation of Cumulative Grade Points Average (CGPA)**
	The CGPA is calculated as below: CGPA $=\sum(C_i \times S_i) / \sum C_i$ (for entire programme) Where S_i is the SGPA of the i^{th} semester and C_i is the total number of credits

	in that semester. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts
RB 16.0	**REVALUATION** As per the notification issued by the Controller of Examination, the student can submit the application for revaluation, along with the fee receipt for revaluation of his/her answer script(s) of theory course(s), if he/she is not satisfied with the Grade obtained. The Controller of Examination shall arrange for revaluation of those answer script(s).
RB 16.1	For Revaluation, a new external examiner, other than the first examiner, shall re-evaluate the answer script(s). If there is any change in marks (below 15% of the maximum External marks) the highest of the two marks will be considered and if there is any change in marks (Equal or above 15% of the maximum External marks), the script will be evaluated by the third valuator. The marks of all the three valuators are compared and the average of two nearer marks will be awarded to the student.
RB 17.0	**SUPPLEMENTARY EXAMINATIONS.** Supplementary examinations shall be conducted twice in an academic year, along with regular semester end examinations.
RB 18.0	**READMISSION CRITERIA.** A candidate, who is detained in a semester due to lack of attendance/ credits, has to obtain written permission from the Principal for readmission in the same semester after duly fulfilling all the required norms stipulated by the college in addition to paying an administrative fee of Rs.1,000/-
RB 19.0	**BREAK IN STUDY.** Student, who discontinues his/her studies for whatsoever may be the reason, can get readmission into appropriate semester of B.Tech. programme after break-in study only with the prior permission of the Principal of the College provided. Such candidate shall follow the transitory regulations applicable to such batch in which he/she joins. An administrative fee of Rs.1000/- per year of break in study in addition to the prescribed tuition fee and special fee has to be paid by the candidate to condone his/her break in study.
RB 20.0	**AWARD OF DIVISION.** The award of division for the candidates who admitted into respective B.Tech. programmes in the year 2020-2021 and onwards should be as per JNTUK regulations.

	For the purpose of awarding First Class with Distinction, the student must get CGPA within 4 years in case of candidates admitted through EAMCET & Management Quota or within 3 years in case of Lateral Entry candidates admitted through ECET, without appearing for any supplementary examinations. Detained candidates are not eligible for the award of First Class with Distinction. For the purpose of awarding First, Second and Pass Class, CGPA obtained in the examinations appeared within the maximum period allowed for the completion of course shall be considered.
RB 21.0	**BETTERMENT /IMPROVEMENT OF CUMULATIVE GRADE POINT AVERAGE**
RB 21.1	A candidate, after becoming eligible for the award of the Degree, may reappear for the external Examination in any of the theory courses as and when conducted, for the purpose of improving the CGPA. But this reappearance shall be within a period of two academic years after becoming eligible for the award of the Degree, subject to fulfillment of Regulation RB 2.0.
RB 21.2	However, this facility shall not be availed by a candidate to reappear either for Internal Examination or for Semester End Examinations in Practical courses (including Project Viva- voce) and also for Semester End Examinations evaluated internally for the purpose of improvement.
RB 21.3	Modified Grade Card and New Consolidated Grade Card shall be issued after incorporating new Grades and Credits.
RB 22.0	**ADVANCED SUPPLEMENTARY EXAMINATIONS**
	Candidate(s), who fails in Theory or Lab courses of 4th year second semester, can appear for advanced supplementary examinations conducted within one month after declaration of the revaluation results. However, those candidates who fail in this advanced supplementary examinations of IV year second semester shall appear for subsequent examination along with regular candidates in the examinations conducted at the end of the respective academic year.
RB 23.0	**MALPRACTICES** The Principal/chief superintendent shall refer the cases of malpractices in internal assessment tests and Semester End Examinations to a Malpractice Enquiry Committee, constituted for the purpose. The Principal shall take necessary action, against the erring students based on the recommendations of the Committee as per JNTUK Malpractice regulations.

RB 24.0	The physically challenged candidates who have availed additional examination time and a scribe during their Intermediate/EAMCET examinations shall be given similar concessions on production of relevant proof/documents.
RB 25.0	The students who are suffering from contagious diseases are not allowed to appear either internal or Semester end examinations with other students. A separate room will be allotted for such type of students.
RB 26.0	The students who participate in coaching/tournaments held at State/National/International levels through University / Indian Olympic Association during Semester end external examination period shall be promoted to subsequent semesters till the entire course is completed as per the guidelines of University Grants Commission Letter No. F. 1-5/88 (SPE/PES), dated 18-08-1994.
RB 27.0	The Principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the Heads of the Departments in an appropriate manner, and subsequently such actions shall be placed before the Academic Council for ratification. Any emergency modification of Regulation, approved in the Heads of the Departments meetings, shall be reported to the Academic Council for ratification.
RB 28.0	The Academic Council, from time to time, may revise or amend or change the Regulations, schemes of examination and/or syllabi.
RB 29.0	**ELECTIVES** Minimum 20% of intake of students is compulsory for offering regular electives.
RB 30.0	**INTERNSHIP** For internship, minimum period shall be one month. However, it can be completed in 3 to 4 slots /intervals which shall be a minimum of five day slot.

MALPRACTICES RULES

Disciplinary Action for / Improper Conduct in Examinations

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

		impersonated, shall be cancelled in all the subjects of the examination (including practicals 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 Institution examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all Institution examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.

6	Refuses to obey the orders of the 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 of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-incharge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two

		consecutive semesters from class work and all Institution examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the Performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and

		shall not be permitted for the remaining examinations of the subjects of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Institution for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.

2. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractices)
   (i) A show cause notice shall be issued to the college.
   (ii) Impose a suitable fine on the college.
   (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

* * * *

VISHNU INSTITUTE OF TECHNOLOGY

(AUTONOMOUS)

(Approved by AICTE & Affiliated to JNTU-Kakinada)

(Accredited by NBA& NAAC 'A' Grade)

Vishnupur, BHIMAVARAM – 534 202

Ragging

Prohibition of ragging in Educational institutions Act 26 of 1997

Salient Features

- Ragging within or outside any educational institution is prohibited.
- Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student.

	Imprisonment upto		Fine Upto
Teasing, Embarrassing & Humiliation	6 Months	+	Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing hurt	2 Years	+	Rs. 5,000/-
Causing gri evous hurt, kidnapping or Abducts or rape or committing unnatural offence	5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	10 Months	+	Rs. 50,000/-

LET US MAKE VIT A RAGGING FREE COLLEGE

VISHNU INSTITUTE OF TECHNOLOGY

(AUTONOMOUS)

(Approved by AICTE & Affiliated to JNTU-Kakinada)

(Accredited by NBA& NAAC 'A' Grade)

Vishnupur, BHIMAVARAM – 534 202

Ragging

ABSOLUTELY NOT TO RAGGING

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1. **Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.**
2. **Ragging entails heavy fines and/or imprisonment.**
3. **Ragging invokes suspension and dismissal from the College.**
4. **Outsiders are prohibited from entering the College and Hostel without permission.**
5. **Girl students must be in their hostel rooms by 7.00 p.m.**
6. **All the students must carry their Identity Cards and show them when demanded.**
7. **The Principal and the Wardens may visit the Hostels and inspect the rooms any time.**

LET US MAKE VIT A RAGGING FREE COLLEGE

VISHNU INSTITUTE OF TECHNOLOGY:: BHIMAVARAM

(Autonomous)

Approved by AICTE, Accredited by NBA, NAAC & Affiliated to JNTUK, Kakinada

COURSE STRUCTURE & DETAILED SYLLABUS

For UG-R20

B. Tech- Mechanical Engineering

(Applicable for batches admitted from 2020-2021)

VISHNU INSTITUTE OF TECHNOLOGY (Autonomous)

BHIMAVARAM

VISHNU INSTITUTE OF TECHNOLOGY:: BHIMAVARAM
(Autonomous)
Approved by AICTE, Accredited by NBA, NAAC & Affiliated to JNTUK, Kakinada

MECHANICAL ENGINEERING DEPARTMENT

I-Year I-Semester

S.No	Category	Course Title	Hours per week			Credits
			L	**T**	**P**	**C**
1	BSC	Mathematics-I (Linear Algebra & Calculus)	3	0	0	3
2	BSC	Engineering Physics	3	0	0	3
3	HSS	Communicative English	3	0	0	3
4	ESC	Engineering Graphics	2	0	2	3
5	ESC	Computational Thinking & Programming	3	0	0	3
6	HSMC	English Communication Skills Lab	0	0	3	1.5
7	BSC lab	Engineering Physics Lab	0	0	3	1.5
8	ESC lab	Computational Thinking & Programming Lab	0	0	3	1.5
		Total				19.5

I-Year II-Semester

S.No	Category	Course Title	Hours Per week			Credits
			L	**T**	**P**	**C**
1	BSC	Mathematics – II (Vector Calculus & Transform Calculus)	3	0	0	3
2	BSC	Engineering Chemistry	3	0	0	3
3	ESC	Engineering Mechanics	3	0	0	3
4	ESC	Elements of Electrical & Electronics Engineering	3	0	0	3
5	ESC	Computer Programming Lab	1	0	4	3
6	ESC lab	Electrical & Electronics Engineering Lab	0	0	3	1.5
7	BSC lab	Engineering Chemistry Lab	0	0	3	1.5
8	ESC lab	Engineering Workshop	0	0	3	1.5
9	Mandatory course	Environmental Science	2	0	0	0
		Total				19.5

II-Year I-Semester

S.No	Category	Course Title	Hours per week			Credits
			L	**T**	**P**	**C**
1	BSC	Mathematics – III (Complex variables & PDE)	3	0	0	3
2	PCC	Thermodynamics	3	0	0	3
3	PCC	Materials Science and Metallurgy	3	0	0	3
4	PCC	Mechanics of Solids	3	0	0	3
5	PCC	Manufacturing Processes	3	0	0	3
6	PCC (LAB)	Machine Drawing	0	0	3	1.5
7	PCC (LAB)	Metallurgy & Mechanics of Solids Lab	0	0	3	1.5
8	PCC (LAB)	Manufacturing Processes Lab	0	0	3	1.5
	SOC*	Computer Aided Engineering Modelling	1	0	2	2
	Mandatory course	Constitution of India	2	0	0	0
		Total credits				**21.5**

II-Year II-Semester

S.No	Category	Course Title	Hours			Credits
			L	**T**	**P**	**C**
1	BSC	Mathematics-IV (Numerical Methods, Probability & Statistics)	3	0	0	3
2	PCC	Fluid Mechanics and Hydraulic Machines	3	0	0	3
3	PCC	Kinematics of Machines	3	0	0	3
4	PCC	Applied Thermodynamics	3	0	0	3
5	HSS	Universal Human Values II	3	0	0	3
6	PCC (LAB)	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
7	PCC (LAB)	Applied Thermodynamics Lab	0	0	3	1.5
8	PCC (LAB)	Structural Analysis Lab	0	0	3	1.5
	Skill oriented course*	Advanced Solid Modelling	1	0	2	2
	Mandatory course	Critical Reading and Creative Writing	3	0	0	0
		Total credits				**21.5**
		Honors/Minors	**4**	0	**0**	**4**
		Internship 2 months (Mandatory) during summer vacation				

III-Year I-Semester

S.No	Category	Course Title	Hours Per Week			Credits
			L	**T**	**P**	**C**
1	PCC	Dynamics of Machinery	3	0	0	3
2	PCC	Metal Cutting and Machine Tools	3	0	0	3
3	PCC	Design of Machine Members	3	0	0	3
4	PEC-1	1. Gas Dynamics and Jet Propulsion 2. Green Engineering Systems 3. Refrigeration & Air-Conditioning 4. Automobile Engineering	3	0	0	3
5	OEC/JOE	Open Elective I	3	0	0	3
6	PCC Lab	Theory of Machines Lab	0	0	3	1.5
7	PCC Lab	Machine Tools Lab	0	0	3	1.5
8	SAC/SSC	Advanced English Communication Skills Lab	0	0	4	2
9	Mandatory Course	Engineering Exploration Project	0	0	2	0
10		Summer Internship	0	0	0	1.5
		Total				**21.5**
Honors/Minors			4	0	0	4

III-Year II-Semester

S.No	Category	Course Title	Hours Per Week			Credits
			L	**T**	**P**	**C**
1	PCC	Design for smart manufacturing	3	0	0	3
2	PCC	Heat Transfer	3	0	0	3
3	PCC	Mechanical Measurements & Metrology	3	0	0	3
4	PEC-2	1. Industrial Robotics 2. Finite Element Analysis 3. Machine Tool Design 4. Advanced Machining Processes	3	0	0	3
5	OEC/JOE	Open Elective II	3	0	0	3
6	PCC Lab	Design Thinking Lab	0	0	3	1.5
7	PCC Lab	Heat Transfer Lab	0	0	3	1.5
8	PCC Lab	Measurements & Metrology Lab	0	0	3	1.5
9	SAC/SSC	Programming for Mechanical systems	0	0	4	2
10	Mandatory Course	Intellectual Property Rights & Patents	2	0	0	0
		Total				**21.5**
Industrial/Research Internship (Mandatory) 2 Months during summer vacation						
Honors/Minors			4	0	0	4

IV-Year I-Semester

S.No	Category	Course Title	Hours Per Week			Credits
			L	**T**	**P**	**C**
1	PEC-3	1. Operations Research 2. Mechatronics 3. Computational Fluid Dynamics 4. Production Planning and Control	3	0	0	3
2	PEC-4	1. Advanced Machine Design 2. CAD/CAM 3. Advanced Materials 4. Automation in Manufacturing	3	0	0	3
3	PEC-5	1. Power Plant Engineering 2. Non-Destructive Testing 3. Mechanical Vibrations 4. Additive Manufacturing Processes	3	0	0	3
4	OEC / JOE	Open Elective III	3	0	0	3
5	OEC / JOE	Open Elective IV	3	0	0	3
6	HSSE	1. Managerial Economics & Management Science 2. Business Environment 3. Fundamentals of Entrepreneurship	3	0	0	3
7	SAC/SSC	Mechatronics Lab	0	0	4	2
Industrial/Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester			0	0	0	3
		Total				**23**
		Honors/Minors	4	0	0	4

IV-Year II-Semester

S. No.	Category	Course Title	Hours per week			Credits
			L	**T**	**P**	**C**
1	Major Project	Project work	0	4	16	8
		Total				**8**

Community Service Project @ 4 Credits

Student can complete Project work @ Industries/Higher Learning Institutions/APSSDC

List of Open Electives

Elective	Course Title	Offered by
Open Elective I	Basics of Electronic and Digital Circuits	ECE
	Principles of Communication Systems	ECE
	Data Structures	CSE/IT
	Object Oriented Programming through Java	CSE/IT
	Fundamentals of Power Generation & Transmission	EEE
	Non-Conventional Energy Sources	EEE
	Elements of civil Engineering	CIVIL
	Advanced Concrete Technology	CIVIL
Open Elective II	Data Communications	ECE
	Fundamentals of Microprocessors and Microcontrollers.	ECE
	Data Base Management Systems	CSE/IT
	Design and Analysis of Algorithms	CSE/IT
	Programmable Logic Controllers and Applications	EEE
	Power Electronic Convertors	EEE
	Basics of Environmental Engineering	CIVIL
	Innovative Construction Materials	CIVIL
Open Elective III	Principles of Signals and Systems	ECE
	IOT and Applications	ECE
	Cryptography and Network Security	CSE/IT
	Operating Systems	CSE/IT
	Battery Management Systems and Charging Stations	EEE
	Electric & Hybrid Vehicles	EEE
	Repair & Rehabilitation of structures	CIVIL
	Disaster Management & Mitigation	CIVIL
Open Elective IV	VLSI Design	ECE
	Information Theory and Coding	ECE
	Software Engineering	CSE/IT
	Cloud Computing	CSE/IT
	Cyber Security	CSE/IT
	Fundamentals of utilization of Electrical Energy	EEE
	Concepts of Smart Grid	EEE
	Smart City Planning & Development	CIVIL
	Green Building Technologies	CIVIL

SUBJECTS FOR B. Tech. (HONORS) IN MECHANICAL ENGINEERING

HONORS COURSES OF MECHANICAL ENGINEERING		
S.No	**Course Title**	**Pre- requisites**
	POOL 1 (II-II)	
1	Composite Materials Manufacturing	Materials Science and Metallurgy
2	Advanced Welding Processes	Manufacturing Processes
3	Advanced Mechanics of Solids	Mechanics of Solids
4	Advanced Thermodynamics	Thermodynamics
	POOL 2 (III-I)	
1	Tribology	NIL
2	Micro Electro Mechanical Systems	NIL
3	Mechanics of Composites	Engineering Mechanics
4	Fuel Cell Technology	Thermodynamics and Chemistry
	POOL 3 (III-II)	
1	CNC Machines	Manufacturing Processes
2	Material Characterization Techniques	Materials Science and Metallurgy
3	Experimental Stress Analysis	Mechanics of Solids
4	Electric & Hybrid Vehicles	Applied Thermodynamics
	POOL 4 (IV-I)	
1	Micro Manufacturing	NIL
2	Advanced Metrology and Sensing Systems	Metrology
3	Product Design	NIL
4	Vehicle Dynamics	Kinematics of Machines, Dynamics of Machines

SUBJECTS FOR B. Tech. (MINOR) in MECHANICAL ENGINEERING

B. Tech. (GENERAL MINOR) in MECHANICAL ENGINEERING (Offered to Other Branches)		
S.No	**Course Title**	**Pre- requisites**
1	Applied Mechanics	NIL
2	Engineering Materials	NIL
3	Basic Thermal Engineering	NIL
4	Manufacturing Processes	Engineering Materials
5	Basics of Engineering Design	Applied Mechanics
6	Product Design	Basics of Engineering Design

SPECIALIZED MINOR TRACK B. Tech. (MINOR: ADVANCEMENT IN AUTOMOBILE ENGINEERING) in MECHANICAL ENGINEERING		
S.No	**Course Title**	**Pre- requisites**
1	Advanced Manufacturing Techniques for automobile Components	Manufacturing Processes
2	Vehicle Ergonomics and Styling	NIL
3	Automated, Connected, and Intelligent Vehicles	Elements of Electrical & Electronics Engineering, Automobile Engineering
4	Automotive Aerodynamics	Computational Fluid Dynamics
5	Vehicle Testing and Automotive Standards	Automobile Engineering
6	Noise, Vibration and Harshness	Kinematics of Machines, Dynamics of Machines

OPEN ELECTIVES

OFFERED BY MECHANICAL ENGINEERING DEPARTMENT

III B.Tech I Semester

Open Elective I:

1. Principles of Mechanics
2. Turbo Machines
3. Essentials of Mechanical Engineering
4. Operations Management

III B.Tech II Semester

Open Elective II:

1. Computer Aided Design and Analysis
2. Smart Materials
3. Mechatronics
4. Operations Research

IV B.Tech I Semester

Open Elective III:

1. Introduction to Automobile Engineering
2. Nano Technology
3. Industrial Robotics
4. Smart Manufacturing

Open Elective IV:

1. Basics of Power Plant Engineering
2. Advanced Manufacturing Processes
3. Introduction to Finite Element Analysis
4. Industrial Engineering and Management

Syllabus

I B.Tech. I - Semester

MATHEMATICS-I
(Linear Algebra & Calculus)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To enable the students to

- know the importance of matrices to solve linear equations using matrices.
- identify and solve various differential equations using corresponding methods.
- apply methods of solving higher order linear differential equations.
- comprehend the theory of maxima and minima of a function of two variables.
- analyze the techniques of tracing the curves and evaluate the lengths, areas, volumes of objects using multiple integrals.

UNIT I

Matrices - Linear system of equations

Introduction, Different types of matrices, Rank-Echelon form - Normal form, Solution of a System of Linear Equations – Non-homogeneous and homogeneous equations, Gauss- Jordan method, Gauss – Elimination Method, LU Decomposition, Applications of electric circuits.

UNIT II

Eigen values - Eigen vectors

Eigen values - Eigen vectors – Properties– Cayley-Hamilton Theorem - finding inverse and power of a matrix by using Cayley-Hamilton theorem, Diagonalization of matrices, Spectral Decomposition, Singular Value Decomposition and Principal Component Analysis.

UNIT III

Differential Equations

Differential equations of first order and first degree–Exact and Non– exact differential equations, Linear and Bernoulli differential equations. Orthogonal trajectories, Newton‘s Law of cooling, Law of natural growth and decay.

Higher order homogenous and non - homogenous linear differential equations with constant coefficients - Particular integrals for the functions of type e^{ax}, sin(ax+b), cos(ax+b), Polynomial of x , e^{ax} V(x), L-C-R Circuits.

UNIT IV

Partial Differentiation

Functions of several variables- Partial derivatives, Total derivative, Chain rule, Change of variables, Jacobians, Functional dependence. Generalized Mean Value theorem –Taylor's theorem and Maclaurin's theorem (without proof) for a function of two variables, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.

UNIT V

Multiple Integrals and Applications

Review of Curve tracing-Cartesian-Polar and Parametric curves.

Multiple integrals - double integrals - change of variables (Cartesian and Polar coordinates), Change of order of integration and Evaluation of triple integrals, computing area and volume.

COURSE OUTCOMES:

After completing this course, the students will be able to:

1. solve linear system of equations in engineering problems.
2. find Eigen-values and Eigen vectors of a matrix in engineering studies.
3. model engineering problems as differential equations and solve analytically. .
4. find out local /global optimum of functions of several variables.
5. compute areas and volumes by integrals.

TEXT BOOKS:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.
2. Erwin. Kreyszig, Advanced Engineering Mathematics, Wiley, 9th Edition, 2012.

REFERENCE BOOKS:

1. T.K.V. Iyengar, B. Krishna Ghandhi, S. Ranganathan and M.V.S.S.N. Prasad, Engineering Mathematics, Volume-I, S. Chand Publishers, 12th Edition, 2014.
2. B. V. Ramana, Engineering Mathematics, Tata McGraw Hill, 4th Edition, 2009.
3. D. S. Chandrashekharaiah, Engineering Mathematics, Volume 1, Prism Publishers, 2010.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, reprint, 2008.

I B.Tech. I - Semester

ENGINEERING PHYSICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization related to its Engineering applications.
- Understand the mechanism of emission of light, utilization of lasers as coherent light sources for low and high energy applications. Study of propagation of light through optical fibers and their implications in optical communications.
- To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
- Familiarize the concepts of theoretical acoustics for their practical utility in engineering acoustics. Explanation for the significance of ultrasound and its application in NDT application.
- Enlighten the periodic arrangement of atoms in Crystalline solids by Bragg's law – Learning the structural analysis through X-ray diffraction.

UNIT I

Wave Optics

Interference:

Introduction - Principle of Superposition-Coherence-Conditions for Sustained Interference -Interference in thin films (reflected Geometry)-Newton's Rings-Determination of Wavelength and Refractive Index-Applications of Interference.

Diffraction:

Introduction- Fresnel and Fraunhofer diffraction-Fraunhofer Diffraction due to Single slit, Double slit –N – slits (Qualitative)-Diffraction Grating -Determination of Wavelength-Applications of Diffraction.

Polarization:

Introduction- types of polarized light, Polarization by reflection, refraction and double refraction- Nicol's prism-Half wave and Quarter wave plates.

UNIT II

Lasers:

Introduction-Characteristics of Laser–Spontaneous and Stimulated emissions of radiation-Einstein's coefficients & Relation between them and their significance – population inversion - Ruby laser – Helium Neon laser –Semiconductor diode laser(Qualitative)- Applications of Lasers.

Fiber Optics:

Introduction to Optical Fibers-Total Internal Reflection- Construction of optical fibers -Acceptance angle-Numerical Aperture-Classification of fibers based on Refractive index profile, modes -Block Diagram of Fiber optic Communication-Applications of optical fibers.

UNIT III

Magnetic Materials:

Introduction -Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment -Classification of Magnetic materials-Weiss theory of ferromagnetism (qualitative)-Hysteresis-soft and hard magnetic materials-Magnetic device applications.

Dielectrics:

Introduction to Dielectrics - Electric polarization - Dielectric polarizability, Susceptibility and Dielectric constant- Types of polarizations with derivations for polarisabilities (Qualitative)–Lorentz (internal) field -Claussius -Mosotti equation, orthogonal trajectories, Newton‘s Law of cooling, Law of natural growth and decay.

UNIT IV

Acoustics:

Introduction – Reverberation - Reverberation time -Classification of Sound waves- Weber–Fechner law - Sabine’s formula- derivation using growth and decay method – Absorption coefficient and its determination –factors affecting acoustics of buildings and their remedies.

Ultrasonics:

Introduction -Production of ultrasonics by Magnetostriction and piezoelectric methods - Detection of ultrasonics -acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes – applications.

Unit V

Crystallography:

Introduction-Space lattice, Basis, Unit Cell and Lattice Parameters-, Bravais lattices,-Crystal Systems (3D)-coordination number-Packing fraction of SC, BCC and FCC structures.

X-ray Diffraction:

Introduction - Miller indices-Separation between successive (hkl) planes. Bragg’s Law-X-ray Diffractometer-Crystal Structure determination by Laue’s and Powder Mehods (Qualitative).

COURSE OUTCOMES:

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

1. Explain the need of coherent sources and the conditions for sustained interference. Identify the applications of interference in engineering. Analyze the differences between interference and diffraction with applications. Illustrate the concept of polarization of light and its applications.
2. Explain various types of emission of radiation. Identify the role of laser in engineering applications. Describe the construction and working principles of various types of lasers. Explain the working principle of optical fibers. Classify optical fibers based on refractive index profile and mode of propagation. Identify the applications of optical.
3. Explain the concept of dielectric constant and polarization in dielectric materials. Summarize various types of polarization of dielectrics. Classify the magnetic materials based on susceptibility and their temperature dependence. Explain the applications of dielectric and magnetic materials. Apply the concept of magnetism to magnetic devices.
4. Explain sound waves and its propagation/absorption of construction material used in design of buildings. Analyze acoustic parameters of typical materials used in buildings. Recognize sound level disruptors and their application in architectural acoustics. Identify the use of ultrasonics in diversified fields of NDT.
5. Interpret various crystal systems and Analyze the characterization of materials by XRD. Identify the important properties of crystals like the presence of long-range order and periodicity, structure determination using X-ray diffraction technique. Analysis of structure of the crystals by Laue and Powder techniques.

TEXT BOOKS:

1. M.N. Avadhanulu, P.G.Kshirsagar, A Text book of Engineering Physics, S.Chand Publications, 2017.
2. H.K.Malik & A.K.Singh, Engineering Physics, McGraw Hill Publishing Company Ltd, 2018.
3. P.K. Palanisamy, Applied Physics, SciTech Publications, 2018.

REFERENCE BOOKS:

1. Gerd Keiser, Optical Fiber Communications, Tata Mc GrawHill, 4th Edition, 2008.
2. Charles Kittel, Introduction to Solid State Physics, Wiley Publications, 2011.
3. S.M.Sze, Semiconductor devices-Physics and Technology, Wiley, 2008.
4. Halliday, Resnick and Walker, Fundamentals of Physics, John WileySons, 10th Edition, 2013.

I B.Tech. I - Semester

COMMUNICATIVE ENGLISH

L	T	P	C
3	0	0	3

Introduction

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts. The shift is from learning about the language to using the language. On successful completion of the compulsory English language course/s in B.Tech., learners would be confident of appearing for international language qualification/proficiency tests such as IELTS, TOEFL, or BEC, besides being able to express themselves clearly in speech and competently handle the writing tasks and verbal ability component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

COURSE OBJECTIVES:

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers.
- Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials.
- Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations.
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information.
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing.

METHODOLOGY:

1. The classes are to be learner-centered where the learners are to read the texts to get a comprehensive idea of those texts on their own with the help of the peer group and the teacher.
2. Integrated skill development methodology has to be adopted with focus on individual language skills as per the tasks/exercise.
3. The tasks/exercises at the end of each unit should be completed by the learners only and the teacher intervention is permitted as per the complexity of the task/exercise.

4. The teacher is expected to use supplementary material wherever necessary and also generate activities/tasks as per the requirement.
5. The teacher is permitted to use lecture method when a completely new concept is introduced in the class.

Detailed Textbook:

Infotech English by Maruthi Publications

Non-Detailed Textbook:

Wings of Fire: APJ Abdul Kalam by University Press

UNIT I

Detailed: A Drawer Full of Happiness

Non-detailed: APJ Abdul Kalam's Wings of Fire 1-5 Chapters

Reading: Skimming text to get the main idea. Scanning to look for specific pieces of information.

Reading for Writing: Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.

Writing: Writing **S**entences with proper word order - Basic Sentence Structures.

Vocabulary: Technical vocabulary from across technical branches (20) GRE Vocabulary (20) Antonyms and Synonyms, Word applications, Verbal reasoning and sequencing of words.

Grammar: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural, pronouns, basic sentence structures; simple question form - wh-questions; word order in sentences.

UNIT II

Detailed: Nehru's letter to his daughter Indira on her birthday

Non-detailed: APJ Abdul Kalam's Wings of Fire 6-10 Chapters

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Paragraph writing (specific topics) using suitable cohesive devices; linkers, sign posts and transition signals; mechanics of writing - punctuation, capital letters.

Vocabulary: Technical vocabulary from across technical branches (20 words). GRE Vocabulary Analogies (20 words) Antonyms and Synonyms, Word applications.

Grammar: Use of articles and zero article; prepositions.

UNIT III

Detailed: Stephen Hawking-Positivity 'Benchmark'

Non-detailed: APJ Abdul Kalam's Wings of Fire 10-15 Chapters

Reading: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. Critical reading.

Reading for Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.

Vocabulary: Technical vocabulary from across technical branches (20 words). GRE Vocabulary (20 words) Antonyms and Synonyms, Word applications, Association.

Grammar: Verbs - tenses; Subject-verb agreement

UNIT IV

Detailed: Liking a Tree, Unbowed: Wangari Maathai's Biography

Non-detailed: APJ Abdul Kalam's Wings of Fire 16-20 Chapters

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicative process or display complicated data.

Reading for Writing: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables.

Vocabulary: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) Antonyms and Synonyms, Word applications.

Grammar: Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison.

UNIT V

Detailed: Stay Hungry-Stay foolish from "Infotech English", Maruthi Publications

Non-detailed: APJ Abdul Kalam's Wings of Fire 21-24 Chapters by University Press

Reading: Reading for comprehension. RAP Strategy Intensive reading and Extensive reading techniques.

Reading for Writing: Letter writing, E mail writing, email etiquette.

Vocabulary: Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) Antonyms and Synonyms, Word applications.

Grammar: Direct and indirect speech, reporting verbs for academic purposes, Active Voice- Passive Voice; editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement and conjunctions).

COURSE OUTCOMES:

At the end of the course, the learners will be able to

1. Appreciate a piece of prose; employ suitable strategies for skimming and scanning to get the general idea of a text; recognize paragraph structure and formulate sentences using proper grammatical structures and correct word forms of nouns and pronouns and GRE Words.
2. Study a piece of prose; write well structured paragraphs and understand applying cohesive devices and use articles and prepositions accurately and learn good vocabulary.
3. Analyze a text in detail and summarize and employ verbs, tenses and subject verb agreement appropriately; apply vocabulary and word associations.
4. Understand a text, and learn and apply information transfer and apply the use of adjectives and adverbs and vocabulary.
5. Interpret ideas from reading comprehension and write formal letters and emails, use voice and reported speech properly and edit short texts by correcting common errors and learn vocabulary.

REFERENCE BOOKS:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Jennifer Wilkin, Dorothy Zemach, Skillful Level 2 Reading & Writing Student's Book, Macmillan Educational, 2013.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.

Sample Web Resources

Grammar/Listening/Writing

1-language.com

http://www.5minuteenglish.com/

https://www.englishpractice.com/

Grammar/Vocabulary

English Language Learning Online

http://www.bbc.co.uk/learningenglish/

http://www.better-english.com/

http://www.nonstopenglish.com/

https://www.vocabulary.com/

BBC Vocabulary Games

Free Rice Vocabulary Game

Reading

https://www.usingenglish.com/comprehension/

https://www.englishclub.com/reading/short-stories.htm

https://www.english-online.at/

Listening

https://learningenglish.voanews.com/z/3613

http://www.englishmedialab.com/listening.html

Speaking

https://www.talkenglish.com/

BBC Learning English – Pronunciation tips

Merriam-Webster – Perfect pronunciation Exercises

All Skills

https://www.englishclub.com/

http://www.world-english.org/

http://learnenglish.britishcouncil.org/

Online Dictionaries

Cambridge dictionary online

MacMillan dictionary

Oxford learner's dictionaries

I B.Tech. I - Semester

ENGINEERING GRAPHICS

L	T	P	C
2	0	2	3

COURSE OBJECTIVES:

- To introduce the students to use drawing instruments and to draw polygons, Engg. Curves and use scales.
- To introduce the students orthographic projections, projections of points & lines.
- The objective is to make the students draw the projections of the plane inclined to both the planes.
- The objective is to make the students draw the projections of the various types of solids in different positions inclined to one of the planes.
- The objective is to represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa.

UNIT I

Introduction to Graphics

Curves: Ellipse, Parabola and Hyperbola by general methods, Tangent & Normal, Cycloids, Involutes, tangent & normal for the curves.

Scales: Plain scale, Diagonal scale and Vernier scale.

UNIT II

Orthographic Projections: Introduction to Projections, Horizontal plane, Vertical plane, Profile plane, importance of reference lines.

Projections of points in various quadrants.

Projections of straight lines inclined to one plane, inclined to both the planes, traces.

UNIT III

Projections of planes: inclined to one reference plane; inclined to both the reference planes.

UNIT IV

Projections of Solids – Projections of Prisms, Pyramids, Cones and Cylinders simple positions, the axis inclined to one of the reference planes and axis inclined to both the reference planes.

UNIT V

Conversion of isometric views to orthographic views;

Conversion of orthographic views to isometric views.

COURSE OUTCOMES:

Students will be able to:

- construct Engg. Curves and scales.
- understand orthographic projections, projections of points & lines.
- draw the projections of a plane inclined to both the planes.
- draw the projections of various types of solids in different positions inclined to one or both the planes.
- visualize and convert the isometric view to orthographic view and vice versa.

TEXT BOOKS:

1. N.D. Bhatt, Engineering Drawing, Charotar Publishing House Pvt. Ltd, 1ST Edition, 2012.
2. Bansal Agarwal & C.M. Agarwal, Engineering Drawing, Tata McGraw Hill, 3rd Edition, 2019.

REFERENCE BOOKS:

1. K.L. Narayana & P. Kannaiah, Engineering Drawing, Scitech Publications, Revised Edition, 2010.
2. K.C. John, Engineering Graphics for Degree, PHI Learning, 1st Edition, 2009.
3. PI Varghese, Engineering Graphics, McGraw-Hill Publishers, 1st Edition, 2017.
4. P.S. Gill, Engineering Drawing, S.K. Kataria & Sons, 1st Edition, 2013.

I B.Tech. I - Semester

COMPUTATIONAL THINKING & PROGRAMMING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To teach problem solving through Algorithms and Flowcharts.
- To elucidate problem solving through Python programming language.
- To train in the development of solutions using modular concepts.
- To explain the role of data structures in programming.
- To introduce object oriented programming paradigm through Python.

UNIT I

Knowing the Computer

Definition and Block Diagram of a Computer. Basic parts of a computer (Memory, CPU, Input, and Output), Memory hierarchy, Circuits and Logic, Hardware vs Software, Representation of Data in memory (integer (including negative), floating points etc. to text, images, audio and video), Principle of Abstraction, Operating System, Language Hierarchy - Machine Language to High Level Language, Compiler, Interpreter, The Command Line Interface (basic Linux commands).

UNIT II

Computational Thinking and Introduction to Python

Simple logic building through flowcharting. Flowchart symbols, conditional and repetition blocks.

Computational Thinking, Algorithm, Pseudocode, Time/Space complexity. Only Big O notation.

Basic structure of a Python program, Elements of Python programming Language: token, literals, identifiers, keywords, expression, type conversions, Numbers, Variables, Input/Output statements, basic data types. Operators and their types and precedence, expressions. Control structures in Python - conditionals and loops.

UNIT III

Python Data Structures and Modularization

List and List Operations, Using Lists to represent Matrices, Strings, String operations, Tuples, Dictionaries, Sets, Iterators and generators, comprehensions.

Basic math functions, User defined Functions, parameters to functions, positional, keyword and default arguments, Lambda Functions, recursion. Packages, modules and namespaces.

UNIT IV

File Handling

Files, Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

UNIT V

Object Oriented Programming

Object Oriented Design. Classes and Objects. Polymorphism, Abstraction, Inheritance, Encapsulation. Constructors. Function and operator overloading. Exception Handling.

COURSE OUTCOMES:

Student should be able to

1. Understand the working principles of various components of a computer.
2. Develop computational thinking and be able to use Python constructs to solve basic problems.
3. Understand modularization and data structures concepts in Python.
4. Apply file handling concepts in problem solving.
5. Solve Real world problems by applying Object Oriented Concepts.

TEXT BOOK:

1. Think Python: How to Think Like a Computer Scientist , Allen B. Downey, 2nd Edition, 2015. (https://www.greenteapress.com/thinkpython/thinkCSpy.pdf)

REFERENCE BOOKS:

1. Core python programming, W Chun PHI, 2nd Edition, 2007. (http://emixam.sevla.free.fr/books/2.PythoProg_softarchive.net.pdf)
2. Vamsi Kurama, Python programming a modern approach, pearson, 2017.

WEB RESOURCES:

1. http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
2. https://snakify.org

I B.Tech. I - Semester

ENGLISH COMMUNICATION SKILLS LAB

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To sensitize the students nuances of English speech sounds.
- To bring about a consistent accent and intelligibility in students‘pronunciation of English by providing an opportunity for practice in speaking.
- To improve the fluency in spoken English in different contexts.
- To demonstrate the synchronization of verbal and non verbal communication.
- To speak with clarity and confidence.
- To enrich the persuasive skills.

MODULE I

Listening: Listening to short audio texts and identifying the topic, context and specific pieces of information to answer a series of questions both in speaking and writing.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests. Self-introduction and introducing others.

Non Verbal Communication

Pronunciation: Introduction to Phonetics-Sounds of English-Phoneme.

MODULE II

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts, both in speaking and writing.

Functional English: Greetings and leave taking, Complaining and Apologizing.

Pronunciation: Vowels and Consonants**,** Past tense markers, Plural markers.

MODULE III

Listening: Listening for global comprehension and summarizing what is listened to, both in speaking and writing.

Functional English: Permissions, Requesting, Inviting.

Pronunciation: Syllable, Word Stress: Weak and Strong forms, Stress in compound words, Contrastive Stress.

MODULE IV

Speaking: Just a Minute **(**JAM)

Functional English Asking for and giving Information/Directions; Suggesting/Opinion giving.

Pronunciation: Rhythm & Intonation.

MODULE V

Functional English: Dialogues/Role Plays.

Speaking: Formal oral presentations on topics from Science and Technology - with the use of PPT slides.

Pronunciation: Accent Neutralization.

INFRASTRUCTURE:

1. 60 computer systems for a class of 60 students.
2. LAN facility and English Language Software for self-study by learners.
3. Audio System
4. Projector

SYSTEM REQUIREMENT: Hardware Component

5. P – IV Processor
6. Speed – 2.8 GHZ
7. RAM – 512 MB minimum
8. Hard Disk – 80 GB
9. Headphones of high quality

SUGGESTED SOFTWARE:

1. Cambridge Advanced Learners‘English Dictionary with CD.
2. Grammar Made Easy by Darling Kindersley
3. Punctuation Made Easy by Darling Kindersley
4. Clarity Pronunciation Power – Part I
5. Clarity Pronunciation Power – part II
6. Oxford Advanced Learner‘s Compass, 7th Edition
7. DELTA‘s key to the Next Generation TOEFL Test: Advanced Skill Practice.
8. MELL - K Van Solutions Software
9. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
10. English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge
11. English Pronunciation in Use, Cambridge University Press
12. Technical Communication, OUP
13. Communication Skills, OUP

COURSE OUTCOMES:

The students will be able to:

1. Understand Non Verbal Communication and Identify the topic, the context, specific questions and overall idea by listening to short audio texts and answering a series of questions and will also be able to introducing themselves and others.
2. Articulate Vowels and Consonants properly and answer a series of questions about main idea and supporting ideas after listening to audio texts and will be able to use expressions for Greetings and Leave takings, Complaining and Apologizing.
3. Understand stress and listen for global comprehension and summarize what is listened to and will be able to use expressions for Permissions, Requesting, and Inviting.
4. Apply the rules of stress and intonation while reading a text; will be able to speak on short topics and will also be able to use expressions for Asking for and giving Information/Directions; Suggesting/Opinion giving.
5. Write and enact Dialogues/Role Plays and practice topics from Science and Technology - using PPT slides and neutralize accent.

SUGGESTED READING:

1) Infotech English, Maruthi Publications (with Compact Disc).
2) Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
3) English Pronunciation in use- Mark Hancock, Cambridge University Press.
4) English Phonetics and Phonology-Peter Roach, Cambridge University Press.
5) English Pronunciation in use- Mark Hewings, Cambridge University Press.
6) English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
7) English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.

I B.Tech. I - Semester

ENGINEERING PHYSICS LAB

L	T	P	C
0	0	3	1.5

List of Experiments

Conduct 10 out of 15 experiments

1. Determination of wavelength of a source-Diffraction Grating-Normal incidence.
2. Newton's rings –Radius of Curvature of Plano Convex Lens.
3. Determination of thickness of a thin object using parallel interference fringes.
4. Determination/ of Rigidity modulus of a material- Torsional Pendulum.
5. Determination of Acceleration due to Gravity and Radius of Gyration – Compound Pendulum.
6. Melde's experiment – Transverse and Longitudinal modes.
2. Verification of laws of stretched string – Sonometer.
3. Determination of velocity of sound – Volume resonator.
4. L C R Series Resonance Circuit.
5. Study of I/V Characteristics of Semiconductor diode.
6. I/V characteristics of Zener diode.
7. Thermistor characteristics – Temperature Coefficient.
8. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
9. Energy Band gap of a Semiconductor p.n junction.
10. Hall Effect for semiconductor.

REFERENCE BOOKS:

1. Engineering Physics Lab Manual by Dr. Y. Aparna & Dr. K.Venkateswarao (V.G.S.Book links).
2. Physics Practical Manual, Lorven Publication.

I B.Tech. I - Semester

COMPUTATIONAL THINKING & PROGRAMMING LAB

L	T	P	C
0	0	3	1.5

Laboratory Experiments

Objectives:

- Get acquainted with fundamentals of writing **Python** scripts.
- Master core **Python** scripting elements by solving more number of problems.
- Able to identify right data structure to solve the problem.
- Design **Python** functions to facilitate code reuse.
- Gaining familiarity in Python file I/O.

Week 1-3

- ➢ Design algorithms and flowcharts for given problems.
- ➢ Python programs on decision and loop control statements.
  - Whether the given number is even or odd.
  - Maximum of three numbers.
  - Sum of digits, Palindrome.
  - Factorial of a number.
  - GCD of given numbers.
  - Sum of first n natural numbers.
  - Evaluate Cosine and Sine Series etc.

Week 4-6

- ➢ Exercise programs on lists and functions
  - Finding the sum and average of given numbers using lists.
  - To display elements of list in reverse order.
  - Finding the minimum and maximum elements in the lists.
  - Using functions to calculate power, factorial etc.
  - Passing lists as function arguments.
  - Call by value and call by reference.
  - Recursion

Week 7-9

- Exercise programs on Strings.
  - Palendrome Checking.
  - Count the number of characters, number of vowels etc in the given line of text etc.
- Exercise programs on Tuples, Dictionaries.

Week 10-12

- Exercise programs on file handling.
- Exercise programs on regular expressions.
- Exercise programs on exception handling.

I B.Tech. II - Semester

MATHEMATICS-II

(Vector Calculus & Transform Calculus)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- find the vector differentiation and Integration.
- apply the techniques of Laplace transforms in engineering studies.
- learn the Fourier series of periodic functions and expand a function in sine and cosine series.
- solve problems related to engineering applications using integral transform techniques.
- evaluate the problems to engineering applications using Z- transform techniques.

UNIT I

Vector Differentiation

Vector Differentiation - Scalar and Vector Fields, Level surfaces, Directional Derivative, Gradient of a Scalar Field, Divergence, Curl of a vector field and applications, Vector Identities.

UNIT II

Vector Integration

Vector Integration - Line integral, work done, areas, Surface integrals.

Vector integral theorems - Green's theorem, Stokes theorem and Gauss Divergence theorem (All theorems without proof) and applications areas, surface areas and volumes.

UNIT III

Laplace Transforms

Laplace transform-Definition-conditions for existence– Linear Property - Shifting Theorems, Laplace transforms of Standard Functions-Transforms of derivatives and integrals–Unit step function–Dirac delta function.

Inverse Laplace transforms by Partial fractions–Convolution theorem (without proof) – inverse by convolution, Solving ordinary differential equations with constant coefficients.

UNIT IV

Fourier series

Introduction, Periodic function, Dirichlet's conditions, Fourier series of periodic function, Fourier series at the point of discontinuity, Fourier series of even and odd functions, Half-range Fourier Sine and Cosine series. Fourier series in an arbitrary interval.

UNIT V

Fourier Transforms and Z-Transforms

Fourier integral theorem (only statement) – sine and cosine integrals, Fourier transforms – sine and cosine transforms –Inverse Formulae-Properties- Finite Fourier Transforms.

Z-transform – properties – Damping rule – Shifting rule – Initial and final value theorems – Inverse Z –transform - Convolution theorem – solving difference equations by using Z-transforms.

COURSE OUTCOMES:

After completing this course, the students will be able to:

- understand gradient, divergence, curl and their physical significance.
- compute line, surface and volume integrals and evaluate the work done, flux, potential functions.
- make use of Laplace transforms in solving the differential equations with the initial and boundary conditions.
- compute Fourier series of periodic functions.
- solve problems related to engineering applications using transform techniques.

TEXT BOOKS:

1. B. S. Grewal, Higher Engineering Mathematics, 42nd Edition, Khanna Publishers, New Delhi, 2012.
2. Erwin. Kreyszig, Advanced Engineering Mathematics, 9th Edition, Wiley, 2012.

REFERENCE BOOKS:

1. T.K.V. Iyengar, B. Krishna Ghandhi, S. Ranganathan and M.V.S.S.N. Prasad, Engineering Mathematics, Volume-I, 12th Edition, S. Chand Publishers, 2014.
2. B. V. Ramana, Engineering Mathematics, 4th Edition, Tata McGraw Hill, New Delhi, 2009.
3. D. S. Chandrashekharaiah, Engineering Mathematics, Volume 1, Prism Publishers, 2010.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, reprint, 2008.

I B.Tech. II - Semester

ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To gain the knowledge on Polymer based materials in household appliances, aerospace and automotive industries.
- Relate the need of fuels as a source of energy to industries like thermal power stations, steel, fertilizer industry etc., and hence introduced.
- To learn the basic principles and applications of Electrochemistry. To understand the mechanism of corrosion and how it can be prevented.
- Explain the importance and usage of water as basic material in almost all the industries; interpret drawbacks of steam boilers and also how potable water is supplied for drinking purposes.
- To train the students on the principles and applications of Cement, Refractories and Lubricants.

UNIT I

Polymer Chemistry

Introduction to polymers, functionality of monomers, co-polymerization, Stereospecific polymerization with specific examples.

Plastics - Thermoplastics and Thermo settings, Preparation, Properties and Applications of – Bakelite, Urea-Formaldehyde, Nylon-6,6, Carbon fibres.

Elastomers–Buna-S, Buna-N– Preparation, Properties and Applications.

Conducting polymers – poly acetylene, polyaniline, polypyrroles – Mechanism of conduction and Applications.

UNIT II

Fuel Technology

Fuel - Introduction – Calorific value - HCV and LCV – Bomb calorimeter – Numerical problems – Coal — Proximate and Ultimate analysis –Significance of the analysis.

Liquid fuels – Petroleum- Refining – Cracking – Petrol knocking – Diesel knocking - Octane and Cetane ratings – Anti-knock agents.

Gaseous fuels – Natural gas, LPG and CNG.

Bio-fuels- Bio-diesel and Power alcohol.

UNIT III

Electrochemistry and Corrosion

PART-A: Electrochemistry And Its Applications: Electrodes –Reference electrodes (Hydrogen electrode and Calomel electrode), Electrochemical cell, Nernst equation. Concept of pH, pH meter and applications of pH metry, Potentiometry- Potentiometric titrations (Redox titrations), Concept of Conductivity, Conductivity cell, Conductometric titrations (acid-base titrations).Primary cells – Dry cell - Zinc-air battery, Secondary cells – Lead acid battery, Lithium-ion batteries- working of the batteries including cell reactions, and button cells.

Fuel cells - Hydrogen-Oxygen and Methanol-Oxygen fuel cells – working of the cells.

PART-B: Chemistry of Corrosion: Corrosion: Introduction to corrosion, Chemical and Electrochemical theory of corrosion, Pilling- Bedworth ratio rule, Differential aeration corrosion, Waterline corrosion and Galvanic corrosion.

Environmental factors (pH, temperature, Dissolved Oxygen) affecting the rate of corrosion.

Protection – Galvanizing, Tinning, Electroplating and Electro less plating (Nickel and Copper). Organic coatings - Paints (constituents and functions).

UNIT IV

Water Technology

Introduction –Soft Water and Hardness of water, Estimation of hardness by EDTA Method - Boiler troubles - scale and sludge, Industrial water treatment – Specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, Zeolite and Ion-exchange processes. Municipal water treatment –Break point of chlorination. Deflouridation technique.

Desalination of Brackish water- Reverse Osmosis (RO) and Electro dialysis.

UNIT V

Chemistry of Materials

Cement: Introduction to Building materials – Portland cement, constituents, manufacturing process- raw materials for manufacturing process, reactions below 1300^{o}C and reactions between 1300 and 1450^{o}C, reactions during cooling, grinding or storage, chemical equations, Chemistry of setting and hardening of cement (hydration, hydrolysis, equations).

Lubricants: Definition, Properties and Applications.

Refractories: - Definition, Classification, Properties and Applications.

COURSE OUTCOMES:

After completing the course, Students will be able to:

- Recall the information related to polymers and their application. (Remembering)
- Classify the different types of fuels and its applications.(Understanding)
- Distinguish between different parts in electrochemical cell, batteries and fuel cells. (Analyzing)
    a. Solve the corrosion related problems. (Applying)
- Use the information related to water treatment methods. (Applying)
- Design manufacturing process of cement. (Creating)

TEXT BOOKS:

1. Engineering Chemistry by Jain and Jain; Dhanpat Rai Publication Co., 17^{th} Edition, 2015.
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015.

REFERENCE BOOKS:

1. Engineering Chemistry by Prasanth Rath, Cengage Learning, 2015.
2. A text book of Engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition, 2004.
3. A text book of Engineering Chemistry by SashiChawla, Dhanpat Rai & Co. 2017.

I B.Tech. II - Semester

ENGINEERING MECHANICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Understand particle, body, rigid body, concept of force, analysis of forces acting on a rigid body.
- Understand moment and the principle of moments.
- Understand the laws of friction and its applications.
- Analyzing trusses for its member forces.
- Understand the concept of centre of gravity and area moment of inertia.
- Understanding principles of kinematics and kinetics applied to rigid bodies.

UNIT I

STATICS OF PARTICLES AND RIGID BODIES

Introduction: Fundamental concepts and principles of engineering mechanics – Forces on particles – Concurrent forces in a plane – Resolution of forces – Resultant of several concurrent forces.

Equilibrium of Particles: Free body diagram – Equilibrium of rigid bodies in two dimensions- Equilibrium of a two, three force body.

Moment of a force – Varignon's theorem – Equivalent system of forces – Reduction of system of forces into single force and couple.

UNIT II

FRICTION AND TRUSSES

Friction: Introduction-Types of friction – laws of Friction – Limiting friction – Cone of friction-static and Dynamic Frictions. Applications of Friction: Wedges – Ladder friction.

Analysis of trusses – statically determinate and indeterminate structures – Method of Joints.

UNIT III

PROPERTIES OF SURFACES AND VOLUMES

Centre of Gravity: Centroids of lines, areas, and volumes – Determination of centroids by integration – Theorem of Pappu's.

Area Moment of Inertia: Second moment or Moment of inertia of an area – Determination of moment of inertia of area by integration – Radius of gyration – Parallel and perpendicular axis theorems.

UNIT IV

KINEMATICS

Rectilinear motion: **U**niform velocity and uniformly accelerated motion – Rectangular components of velocity and acceleration, Variable acceleration.

Curvilinear motion: Normal and tangential components – Radial and transverse components – Motion of Projectile.

UNIT V

KINETICS

Newton second law – D. Alembert‘s principle, Principle of work and energy for a rigid body – connected bodies – Principle of impulse and momentum – connected bodies.

COURSE OUTCOMES:

The students will be able to:

1. Simplify the system of forces and moments to equivalent systems and construct free body diagrams and develop appropriate equilibrium equations.
2. Analyze systems with friction and for member forces.
3. Determine centroids of simple and composite areas and moment of inertia.
4. Apply the fundamental concepts of kinematics of particles and rigid bodies along with equilibrium condition in solving engineering problems.
5. Analyze the problems of simple systems and connected bodies for displacement, velocity and acceleration.

TEXT BOOKS:

1. Engineering Mechanics, Timoshenko and Young, McGraw Hill Publishers, 5th Edition by, 2017.

2. Engineering Mechanics, S. S. Bhavakatti, New age international, 7th Edition, 2019.

REFERENCE BOOKS:

1. Engineering Mechanics: Statics and Dynamics, James L. Meriam, L. Glenn Kraige, John Wiley & Sons, 7th Edition, 2017.
2. Engineering Mechanics -Statics and Dynamics, A K Tayal, Umesh Publications, 14th Edition, 2011.
3. Engineering Mechanics, R. S. Kurmi, S. Chand, 22nd Edition, 2018.

I B.Tech. II - Semester

ELEMENTS OF ELECTRICAL & ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn the basic principles of electrical law's and analysis of DC circuits and AC circuits.
- To understand the principles of operation and characteristics of DC machines.
- To understand the principle of operation of Transformer and Induction motor.
- To study the operation of PN junction diode, half wave, full wave rectifiers and OP-AMPs.
- To learn the operation of PNP and NPN transistors and various amplifiers.

UNIT I

DC Circuits: Basic definitions, Electrical circuit elements (R - L and C), Ohm's-Law, Kirchhoff laws, Series and parallel connection of resistances with DC excitation, Mesh Analysis and Nodal Analysis.

AC Circuits: Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor. Introduction to three phase, phase sequence, relation between line and phase voltages and currents.

UNIT II

DC Machines: Principle and operation of DC Generator, EMF equation, Applications. Principle and operation of DC Motor, Back EMF, Types of DC machines, Speed- Torque Characteristics of DC Motors, Speed control of DC Motors, Applications.

UNIT III

AC Machines: Classification of AC machines, Principle and operation of 3-phase Induction Motor and 3-phase Synchronous Generator.

Transformers: Principle of operation and construction of Single Phase Transformer, OC and SC test on transformer, efficiency.

UNIT IV

Rectifiers & Linear ICs: PN junction diodes, Applications - Half wave and Bridge rectifiers. Characteristics of Operation Amplifiers (OP- AMPs), Applications of OP-AMPs -Inverting, Non-Inverting, Integrator and Differentiator.

UNIT V

Transistors : PNP and NPN junction transistor, transistor as an amplifier, Transistor Configurations-CE,CB,CC configurations, CE Amplifier Characteristics, Application of Transistors.

COURSE OUTCOMES:

1. Able to analyze the various DC networks and AC circuits.
2. Able to understand the operation and Applications of DC Generators and DC Motor.
3. Able to analyze the performance of Transformer and Induction motor and Synchronous generator.
4. Able to analyze the operation of half wave, full wave rectifiers and OP- AMPs.
5. Able to explain the operation of transistors and its applications.

TEXT BOOKS:

a. R.L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits, PEI/PHI, 10th Edition, 2006.
b. J.B.Gupta, Kataria, Theory and performance of Electrical Machines, S.K & Sons, 3rd Edition, 2013.
c. John Bird Routledge, Electrical Circuit Theory and Technology, Taylor & Francis Group , 6th Edition, 2017.

REFERENCE BOOKS:

1. Rajendra Prasad, Fundamentals of Electrical Engineering, PHI Publications, 3rd Edition, 2014.
2. Basic Electrical Engineering by Nagsarkar, Sukhija, Oxford Publications, 2nd Edition, 2007.

I B.Tech. II - Semester

COMPUTER PROGRAMMING

L	T	P	C
1	0	4	3

COURSE OBJECTIVES:

- To design & develop C programs using selection and repetition control statements.
- To design & develop C programs using arrays and strings.
- To design & develop C programs using structures, unions, pointers.
- To design & develop modular programs using functions.
- To design & develop C programs using the concepts – user defined datatypes, preprocessor directives, storage classes.

UNIT I

Introduction to the C Language: C Programming Basics: Identifiers, Types, Variable, Constants,

Input/output, Operators, Expression Evaluation, Control Statements - Decision Control, Repetition Control, break, continue, Exercise programs covering these concepts.

UNIT II

Derived Datatypes: Arrays, Two Dimensional Arrays, Multidimensional Arrays, Programming Examples, Strings: String Concepts, C String, String Input / Output Functions, Predefined string handling functions, Exercise programs covering these concepts.

UNIT III

Structures: Definition, Variable declaration and initialization, Programming Examples, Nested Structures, Unions, Difference between Structure and Union, Pointers - Declaration & initialization, Operations on pointers, Exercise programs covering these concepts.

UNIT IV

Functions: Definition, Declaration, Function call, Predefined vs. User defined Functions, return statement, Types of functions, Parameter passing techniques – Call by value and Call by reference, Recursion, Tail recursion, Exercise programs covering these concepts.

UNIT V

User defined datatypes: typedef, enum, Preprocessor directives: #include, #define, Conditional compilation directives, Global vs. Local variables, Storage classes, Scope and lifetime of a variable, Exercise programs covering these concepts.

COURSE OUTCOMES:

By the end of the course, the students should be able to:

- Use the appropriate control statements to write programs for the given task.
- Write programs using arrays and strings.
- Use structures, unions and pointers in programming.
- Write programs using modular programming.
- Write programs using user defined datatypes, preprocessor directives, storage classes.

TEXT BOOKS:

1) Behrouz A. Forouzan, Richard F.Gilberg, Programming for Problem Solving, CENGAGE, 2011.
2) Brian W.Kernighan, Dennis M. Ritchie, The C Programming Language, Pearson, 2nd Edition, 1988.
3) E Balagurusamy, Programming in ANSI C, Mcgraw Hill, 8th Edition, 2019.

I B.Tech. II - Semester

ELECTRICAL & ELECTRONICS ENGINEERING LAB

L	T	P	C
0	0	3	1.5

Course Objectives:

- To learn the application of DC and AC circuits.
- To understand the tests of a transformer.
- To understand the tests and speed control of a DC machine.
- To learn the operation and characteristics of PN junction diode and Full wave rectifier.
- To learn the operation and characteristics of a Transistor.
- To learn the operation and applications of CE amplifier and OP-AMP.

Any 10 experiments are to be conducted as compulsory experiments.

Section A: Electrical Engineering

1. Verification of Kirchoff's Laws.
2. Analysis of series RLC circuits.
3. Measurement of Active, Reactive and Apparent power in a single phase circuit.
4. OC and SC Tests on single phase transformer.
5. Speed control of DC Shunt motor by Armature voltage control & Field flux control.
6. Brake test on DC Shunt Motor.
7. Brake test on three phase Induction motor.

Section B: Electronics Engineering

1. Characteristics of PN Junction diode.
2. Characteristics of transistor in CE configuration.
3. Full wave rectifier with and without filters.
4. Frequency Response of CE Amplifier.
5. Applications of OP-AMP (any two applications).

COURSE OUTCOMES:

The student will be:

1. Able to analyze DC and AC circuits.
2. Able to test the performance of a transformer.
3. Able to test and analyze various speed control methods of a DC machine.
4. Able to analyze the operation and characteristics of PN junction diode and Full wave rectifier.
5. Able to analyze the operation and characteristics of a Transistor.
6. Able to analyze the operation and applications of CE amplifier and OP-AMP.

I B.Tech. II - Semester

ENGINEERING CHEMISTRY LAB

L	T	P	C
0	0	3	1.5

Conduct 10 out of 16 experiments

1. Trial experiment - Determination of HCl using standard Na_2CO_3 solution.
2. Determination of alkalinity of a sample containing Na_2CO_3 and NaOH.
3. Determination of $KMnO_4$ using standard Oxalic acid solution.
4. Estimation of MnO2 in Pyrolusite.
5. Determination of Copper using standard $K_2Cr_2O_7$ solution.
6. Determination of temporary and permanent hardness of water using standard EDTA solution.
7. Determination of Vitamin – C.
8. Determination of P^H of the given sample solution using P^H meter.
9. Conductometric titration between strong acid and strong base.
10. Potentiometric titration between strong acid and strong base.
11. Estimation of copper by Colorimetry.
12. Photo Chemical Reduction of Ferric Salt (Blue-Printing).
13. Adsorption of acetic acid on charcoal.
14. Determination of rate of corrosion.
15. Preparation of a polymer.
16. Thin layer chromatography.

REFERENCE BOOKS

1. Arthur J. Vogel, A Textbook of Quantitative Chemical Analysis, Pearson Education, 6th Edition, 2009.
2. Dr. Jyotsna Cherukuri, Laboratory Manual of engineering chemistry-II, VGS, Techno Series, 2012.
3. K. Mukkanti, Practical Engineering Chemistry, B.S. Publication, 2009.

COURSE OUTCOMES: The students entering into the professional course have practically very little exposure to lab classes. The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis.
Thus, at the end of the lab course, the student:

1. exposed to different methods of chemical analysis.
2. able to use of some commonly employed instruments.
3. acquire some experimental skills.

I B.Tech. II - Semester

ENGINEERING WORKSHOP

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To develop a skill in dignity of labour, precision, safety at work place, team working and development of right attitude.
- To identify the hand tools and instruments used in the fitting, carpentry, black smithy and tin smithy trades.
- To acquire skills in basic engineering practices like fitting, carpentry, black smithy and tin smithy etc.
- To gain measuring and marking skills.
- To gain basic knowledge in electrical wiring and assembly and disassembly of computer.

Note: At least two exercises to be done from first five trades & experiment from last trade is compulsory.

TRADES:

Carpentry

1. T-Lap Joint
2. Cross Lap Joint
3. Dovetail Joint
4. Mortise and Tenon Joint

Fitting

1. Vee Fit
2. Square Fit
3. Half Round Fit
4. Dovetail Fit

Black Smithy

1. Round rod to Square
2. S-Hook
3. Round Rod to Flat Ring
4. Round Rod to Square headed bolt

House Wiring

1. Parallel / Series Connection of three bulbs
2. Stair Case wiring
3. Florescent Lamp Fitting
4. Measurement of Earth Resistance.

Tin Smithy

1. Taper Tray
2. Square Box without lid
3. Open Scoop
4. Funnel

System Assembly

1. Assembly & Disassembly of computer

COURSE OUTCOMES:

The student will be able to

- Identify the basic tools and equipment's used in carpentry, fitting, black smithy, house wiring and tin smithy.
- Produce different joints in carpentry trade such as lap and dove tail joint.
- Produce various fittings in the trade of fitting such as sqaure fit and V fit.
- Make various objects in tin smithy trade such as open scoop and square box.
- Perform various basic house-wiring connections.
- Produce various shapes in black smithy trade such as round rod to square rod and S hook.
- Assemble & Disassemble of computer.

TEXT BOOKS:

1. S K Hajra Choudhury, A K Hajra Choudhury, N. Roy, Workshop Technology Vol I & II, Media Promoters & Publishers Pvt. Ltd., 2008.
2. H S Bawa, Workshop Practice, McGraw Hill Education, 2nd Edition, 2017.

REFERENCE BOOKS:

1. P. Kannaya and K.L. Narayana, Engineering Practices Laboratory, Scitech Publications (India) Pvt Ltd, 3rd Edition, 2015.
2. S Gowri T Jeyapoovan, Engineering Practices Lab Manual, Vikas publishing house, 5th Edition, 2009.
3. PN RAO, Manufacturing Technology – Vol, McGraw Hill Education, 4th Edition, 2017.

I B.Tech. II - Semester

ENVIRONMENTAL SCIENCE

L	T	P	C
2	0	0	0

COURSE OBJECTIVES:

- To make the student to get awareness on environment.
- to understand the important of protecting natural recourses, ecosystems for futures generations and pollution causes due to the day to day activates of human life.
- to save Earth from the inventions by the engineers.

UNIT I

Multidisciplinary nature of Environmental Science and Ecosystems

Definition, Scope and Importance – Sustainability: Need for public awareness- Human population and Environment.

Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem. -Types of Ecosystem-Forest, Grassland, Desert and Aquatic Ecosystems– Food chains, food webs and ecological pyramids.

UNIT II

Natural Resources

Forest resources: Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.

Water resources: Conflicts over water, Dams – benefits and problems.

Mineral resources: Use and exploitation, Environmental effects of extracting and using mineral resources.

Energy resources: Growing energy needs, renewable and non-renewable energy sources

Food resources: World food problems.

Land resources: Wasteland reclamation.

Role of an individual in conservation of natural resources.

UNIT III

Biodiversity and its conservation

Definition, Genetic, species and ecosystem diversity- classification - Value of biodiversity: Consumptive use, Productive use, Social use, Biodiversity at national and local levels. Hot-spots of biodiversity - Threats to biodiversity - Endangered and Endemic species of India – Conservation of biodiversity.

UNIT IV

Environmental Pollution

Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. Pollution case studies.

Solid Waste Management: Sources, effects and control measures of urban and industrial solid wastes. Bio- medical and e-waste management.

Global Environmental Challenges: Global warming and climate change-Acid rains, Ozone layer depletion.

UNIT V

Social Issues and Environmental Management

Urban problems related to energy -Water conservation, Rain water harvesting-Resettlement and rehabilitation of people. Environmental Protection Act –Air Act –Water Act - Wildlife Protection Act -Forest Conservation Act-Public awareness.

International protocols: Stockholm and Rio Summit, Kyoto protocol and Montreal Protocol.

Impact Assessment and its significance various stages of EIA, Environmental audit, Ecotourism. The student should Visit an Industry / Ecosystem.

COURSE OUTCOMES: Students will be able to

- Articulate the basic structure, functions, and processes of key social systems affecting the Environment.
- Explain how Natural Recourses should be used.
- Identify the threats to biodiversity.
- Understand causes, effects and control measures of Environmental pollution.
- Gain knowledge about Watershed management and Environmental ethics. Gain a rigorous foundation in various scientific disciplines as they apply to environmental science, such as ecology, evolutionary biology, hydrology, and human behavior.

TEXT BOOKS:

1. Shashi Chawla, A Textbook of Environmental Studies, TMH, 2017.
2. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses, University Grants Commission, 3rd Edition, 2021.

REFERENCE BOOKS:

1. K. V. S. G. Murali Krishna, Environmental Studies, VGS Publishers, 2015.
2. Anubha Kaushik, C P Kaushik, Environment Studies, New Age International Publishers, 2014.

II B.Tech. I - Semester

MATHEMATICS III (COMPLEX VARIABLES& PDE)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To enable the students to:

- Make use the significance of differentiability and analyticity for complex variable functions and be familiar with the Cauchy-Riemann equations.
- Find integrals along a path in the complex plane using the Cauchy's theorem and Residue theorem.
- Solve the singularities of complex variable function by expanding them into Taylor's and Laurent's series and finding residues.
- Make the students learn modeling various physical phenomena as first and higher order PDE and applications.

UNIT I

Functions of Complex Variables

Continuity and differentiability, Analyticity, properties, Cauchy Riemann equations in Cartesian and polar coordinates, harmonic and conjugate harmonic functions, Milne – Thompson method.

UNIT II

Complex Integration

Integration of complex functions – Line Integrals, Cauchy's Integral theorem, Cauchy's Integral Formula - Generalized Cauchy's Integral formula (without proofs).

UNIT III

Complex power series and Residues

Complex power series-Taylor's Series and Laurent's Series, Singularities, Poles and Residues-Cauchy Residues theorem (without proof),evaluation of integrals of type $\int_{-\infty}^{\infty} f(x)dx$ and $\int_{0}^{2\pi} f(cos\theta, sin\theta)d\theta$ using Residue theorem.

UNIT IV

First Order Partial Differential Equations

Formation of Partial differential equations by elimination of arbitrary constants and arbitrary functions– solutions of first order linear (Lagrange) equations and nonlinear equations-standard types.

UNIT V

Higher Order Partial Differential Equations and Applications

Solutions of Linear Partial differential equations with constant coefficients. RHS terms of the type e^{ax+by}, Sin(ax+by), Cos (ax+by), $x^m y^n$. Classification of second order partial differential equations-parabolic, elliptical and hyperbolic.

Method of Separation of Variables, Applications to wave equation, heat conduction equation in one dimensions and Laplace equation in two dimensions.

COURSE OUTCOMES:

After undergoing this course, students will be able to

1. Understand the differentiability and analyticity for complex variable functions and learn sufficient conditions for analyticity.
2. Evaluate the integration of complex valued functions.
3. Expand the functions in power series, classify the singularities of complex function.
4. Model first order linear and non-linear partial differential equations and solve analytically.
5. Model higher order partial differential equations and solve analytically and physical problems of engineering like steady and unsteady heat conduction, vibration of string, etc.

TEXT BOOKS:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42^{nd} Edition, 2012.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley, 9^{th}Edition, 2012.

REFERENCES:

1. T.K.V. Iyengar, B. Krishna Ghandhi, S. Ranganatham and M.V.S.S.N. Prasad, Engineering Mathematics, Volume-I, S. Chand Publishers, 12^{th} Edition, 2014.
2. B. V. Ramana, Engineering Mathematics, Tata McGraw Hill, 3^{rd} Edition, 2018.
3. S. Kalesha Valli, G. VenkataRao and A.V. Papa Rao, Engineering Mathematics-I, Cengage Publications, 1^{st} Edition, 2018.

II B.Tech. I - Semester

THERMODYNAMICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basic concepts of thermodynamics, heat and work interactions between system and its surroundings.
- To learn the applications of first and second law of thermodynamics to thermal engineering devices.
- To learn the significance of Carnot cycle and to understand the concept of entropy.
- To understand the properties of pure substances and gases.
- Apply the knowledge of thermodynamics to air power cycles.

UNIT I

Basic Concepts : System, boundary, Surrounding, Universe, control volume, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process: Reversible, Quasi static & Irreversible Processes, cycle, Causes of Irreversibility. Energy in State and in Transition: Types, Work and Heat, Point and Path function. Zeroth Law of Thermodynamics, Concept of Temperature, Principles of Thermometry, Reference Points, Const. Volume gas Thermometer, Scales of Temperature.

UNIT II

First law of thermodynamics: Joule‘s Experiment, equivalence of heat and work, Statement of first law of thermodynamics, first law applied to a system undergoing a cyclic process and a change of state.

Corollaries; First law applied to a flow system: general energy equation, steady flow energy equation and important applications (boiler, turbine, heat exchangers, pumps & nozzles), Limitations of the First Law of Thermodynamics, PMM 1.

UNIT III

Second law of thermodynamics:, Definitions: Thermal reservoir, Heat Engine, Heat pump, refrigerator, Parameters of performance (thermal efficiency and the coefficient of performance), statement of the second law of thermodynamics (Kelvin planck & Clausius), equivalence of two statements.PMM2, Carnot cycle and its specialties, Carnot’s theorem, Thermodynamic scale of Temperature. Entropy, Clausius Inequality, Principle of Entropy Increase. Concept of Availability, Unavailability and Irreversibility (Theory), Elementary Treatment of the Third Law of Thermodynamics.

UNIT IV

Properties of Pure Substances and Gases

Properties of Pure Substance: Introduction, Phases of pure substance, p-v, p-T, T-s and h-s diagrams for pure substance, p-v-T Surface, Properties of steam, quality or dryness fraction, phase change processes, Mollier diagram for a pure substance.

Properties of Ideal Gases: Equation of state of a gas, Avogadro's law, Ideal gas, perfect gas, real gas, properties of mixture of gases: Dalton's law and Amagat's law of partial pressures, Internal energy, enthalpy and specific heats of gas mixtures, Entropy of gas mixtures.

UNIT V

Power Cycles: Assumptions of air standard cycles, Analysis of Otto, Diesel, Dual combustion, Joule/Brayton cycles, Atkinson Cycle, Ericson Cycle, Lenoir Cycle and Miller Cycle.

COURSE OUTCOMES:

Students will be able to:

1. Apply energy balance to systems and control volumes, in situations involving heat and work interactions.
2. Apply first law of thermodynamics to energy conversion devices.
3. Apply second law of thermodynamics to energy conversion devices and analyze the entropy on thermal energy devices.
4. Evaluate the properties of pure substance and mixture of perfect gases.
5. Analyze the performance of gas power cycles.

TEXT BOOKS:

1. P K Nag, Engineering Thermodynamics, Tata Mcgraw Hill, 6th Edition, 2017.
2. Yunus Cengel and Boles, Thermodynamics-An Engineering Approach, Tata Mcgraw Hill, 18thEdition, 2017.

REFERENCE BOOKS:

1. R.K Rajput, A Text book of Engineering Thermodynamics, Laxmi Publications, 5th Edition, 2016.
2. J. P. Holman, Thermodynamics, McGraw-Hill, 4th Edition, 1987.
3. Moran, M. J. Shapiro, Daisie D. Boettner and Margaret B. Bailey, Fundamentals of Engineering Thermodynamics, Wiley and sons, 7th Edition, 2010.

II B.Tech. I - Semester

MATERIALS SCIENCE AND METALLURGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To acquire the knowledge of different crystal structures and constitution of alloys.
- To understand rules to form solid solution and different reactions in a phase diagram.
- To be able to correlate the concepts of phase structures and properties of different types of steels and their heat treatment methods.
- To understand the microstructure and properties of cast irons and non-ferrous alloys.
- To exemplify different types of ceramics and composite materials.
- To identify various advanced materials and their importance.

UNIT I

Structure of Metals: Crystallography, Miller Indices for Directions and Planes, Atomic Packing Efficiency for Cubic and Hexagonal Close Packed Structures, Grains and Grain Boundaries, Effect of Grain Size on the Properties, Determination of Grain Size by various methods.

Constitution of Alloys: Necessity of Alloying, Types of Solid Solutions, Hume - Rothery Rules, Intermediate Alloy Phases.

UNIT II

Phase Diagrams: Construction and Interpretation of Phase Diagrams, Phase Rule, Lever Rule, Binary Phase Diagrams, Isomorphous, Eutectic and Eutectoid Transformations with examples, Study of Fe-Fe_3C Phase Diagram.

UNIT III

Engineering Materials–I (Steels): Classification of Steels, Structure, Properties & Applications of - Plain Carbon Steels, Low Alloy Steels, Hadfield Manganese Steels, Tool and Die Steels.

Engineering Materials–II (Cast Irons): Classification of Cast Irons, Structure, Properties & Applications of White Cast Iron, Malleable Cast Iron, Grey Cast Iron and Nodular Cast Iron.

UNIT IV

Engineering Materials-III (Non-Ferrous Metals and Alloys): Structure, Properties and Applications of - Copper and its Alloys, Aluminum and its Alloys, Titanium and its Alloys. Al-Cu Phase Diagram.

Heat Treatment: Annealing, Normalizing, Hardening and Tempering of Steels, Construction of TTT Diagrams, Hardenability, Surface-Hardening Methods.

UNIT V

Engineering Materials-IV (Ceramics & Composites): Ceramics: Structure, Properties and Applications of Crystalline Ceramics, Glasses, Cermets. Composites: Classification, Properties & Applications.

Advanced Materials: Cryogenic Materials, Shape Memory Alloys, Smart Materials and Nanomaterials.

COURSE OUTCOMES:

Students will be able to:

1. Know different crystal structures and the importance of alloying.
2. Construct different phase diagrams, understand microstructures and reactions with examples.
3. Acquire the knowledge of engineering materials – steels, cast irons.
4. Analyze various heat treatment processes, non-ferrous metals & alloys and their properties.
5. Characterize different non-metals such as ceramics and composites for engineering applications. Identify the need for some advanced materials and understanding their properties.

TEXT BOOKS:

1. V. D. Kodgire, Material Science and Metallurgy for Engineers, Everest Publishing House, 39th Edition, 2017.
2. Sidney H. Avner, Introduction to Physical Metallurgy, McGraw Hill, 2nd Edition, 2017.
3. Donald R. Askeland and Pradeep P Fulay, Essentials of Materials Science and Engineering, Cengage Learning, 2nd Edition, 2013.

REFERENCE BOOKS:

1. William D Callister & R. Balasubramaniam, Materials Science & Engineering, Wiley Publishing, 1st Edition, 2007.
2. V. Raghavan, Materials Science & Engineering, Eastern Economy Edition, 6th Edition, 2015.
3. A.K. Bandyopadhyay, Nanomaterials, New Age International, 1st Edition, 2009.

II B.Tech. I - Semester

MECHANICS OF SOLIDS

L	T	P	C
3	0	0	3

PREREQUISITES: Engineering Mechanics

COURSE OBJECTIVES:

- To provide the basic concepts and principles of mechanics of solids.
- Understand the principles of Mechanics, Stress and Strain, principal stresses applied to solid structural members under different types of loads.
- To give an ability to calculate stresses and deformations of objects under bending, shear and torsion loadings.

UNIT I

Simple Stresses & Strains: Elasticity and plasticity, Types of stresses & strains, Hooke's law, stress, strain diagram for mild steel, Working stress, Factor of safety, Lateral strain, Poisson's ratio & volumetric strain, Elastic moduli & the relationship between them, Bars of varying section, composite bars, Temperature stresses. Strain energy, Resilience, Gradual, sudden, impact and shock loadings.

UNIT II

Shear Force and Bending Moment: Definition of beam, Types of beams, Concept of shear force and bending moment, S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l., uniformly varying loads and combination of these loads, Point of contra flexure, Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT III

Flexural Stresses: Theory of simple bending, Assumptions, Derivation of bending equation: $M/I = f/y = E/R$ Neutral axis, Determination bending stresses, section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections, Design of simple beam sections.

Shear Stresses: Derivation of formula, Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT IV

Principal Stresses and Strains: Introduction, Stresses on an inclined section of a bar under axial loading, compound stresses, Normal and tangential stresses on an inclined plane for biaxial stresses, two perpendicular normal stresses accompanied by a state of simple shear, Mohr's circle of stresses, Principal stresses and strains, Analytical and graphical solutions.

COLUMNS: Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula.

UNIT V

Torsion of Circular Shafts: Theory of pure torsion, Derivation of Torsion equations, Assumptions made in the theory of pure torsion, Torsional moment of resistance, Polar section modulus, Power transmitted by shafts, Combined bending and torsion (Principle stress and Max. shear stress theory).

Thin Cylinders: Thin seamless cylindrical shells, Derivation of formula for longitudinal and circumferential stresses. Hoop, longitudinal and volumetric strains, changes in diameter, and volume of thin cylinders, Thin spherical shells.

COURSE OUTCOMES:

At the end of course the student will be able to:

1. Discuss the basic properties of materials and analyze the behavior of the solid bodies subjected to various types of stresses.
2. Compute the shear force and bending moment for different types of beams with various load condition and also sketch the SF and BM diagram.
3. Determine the bending and shear stresses developed in beams and shafts.
4. Use the appropriate method to determine critical load for column with various end conditions.
5. Determine the different types of stresses involved in thin cylinders.

TEXT BOOKS:

1. Egor P. Popov, Engineering Mechanics of Solids, PHI, 2nd Edition, 2015.
2. R. K. Bansal, Strength of Materials (Mechanics of Solids), Laxmi Publication, 6thEdition, 2015.

REFERENCE BOOKS:

1. Stephen Timoshenko, Strength of Materials, CBS, 3rd Edition, 2002.
2. S. Ramamrutham, Strength of Materials, DhanapatRai, 16th Edition, 2011.
3. B. C. Punmia, Mechanics of Materials, Laxmi Publications, 10th Edition, 2019.
4. R.K Rajput, Strength of Materials, S. Chand, 7th Edition, 2018.

II B.Tech. I - Semester

MANUFACTURING PROCESSES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand casting principles and different tools used for creating a sound casting.
- To specify various casting processes and gating systems.
- To demonstrate different types welding principles, welding defects - causes and remedies, testing of welds.
- To state various metal working and rolling processes.
- To study various metal forming processes such as forging, extrusion and drawing.
- To get familiarize with the sheet metal working, processing of plastics by injection moulding and blow moulding.

UNIT I

Casting: Steps involved in making a casting, Types of Patterns**,** Materials used for Patterns, Pattern Allowances and their Construction, Cores: Types of Cores, Merits, Demerits & Applications of Casting, Casting Defects.

Gating System: Elements of Gating System, Principles of Gating, Gating Ratio, Design of Gating Systems, Risers – Function, Types and Design, Special Casting Processes - Die Casting, Centrifugal Casting and Investment Casting.

UNIT II

Welding: Classification of Welding Processes, Types of Welds and Welded Joints, Their Characteristics, Edge Preparation, Gas Welding, Arc Welding, Submerged Arc Welding, Inert Gas Welding, TIG & MIG Welding, Thermit Welding, Resistance Welding, Friction Welding, Friction Stir Welding, Explosive Welding, Laser Welding, Welding Defects Causes, and Remedies, Oxy Acetylene Gas Cutting, Soldering & Brazing.

UNIT III

Bulk Deformation Processes - I: Fundamentals on Metal Forming Processes, Hot Working, Warm Working and Cold Working, Strain Hardening, Recovery, Recrystallization and Grain Growth, Comparison of Properties of Cold and Hot Worked Parts. Rolling: Fundamentals, Theory of Rolling, Types of Rolling Mills and Products, Rolling Defects.

UNIT IV

Bulk Deformation Processes - II: **Forging Processes:** Principles of Forging, Tools and Dies**,** Types of Forging: Smith Forging, Drop Forging, Roll Forging, Rotary Forging, Forging Defects.

Bulk Deformation Processes - III: **Extrusion of Metals**: Basic Extrusion Process and its Characteristics, Hot Extrusion and Cold Extrusion, Forward Extrusion and Backward Extrusion, Impact Extrusion, Hydrostatic Extrusion, Extrusion Defects, Wire Drawing and Tube Drawing.

UNIT V

Sheet Metal Working & Plastics: Blanking and Piercing, Estimation of Blank Size, Deep Drawing, Stretch Forming, Bending, Coining, Spinning, Types of Presses and Press Tools.

Processing of Plastics: Injection Moulding and Blow Moulding.

COURSE OUTCOMES:

At the end of course, the students will be able to:

1. Illustrate the importance of casting and various pattern and cores used for making a sound casting, design a gating system and study various special casting processes.
2. Evaluate the role of metal joining processes, welding principles, welding defects, causes and remedies.
3. Illustrate the necessity of metal working and forming processes, rolling mills.
4. Relate the bulk deformation processes such as forging, extrusion and drawing processes on metals.
5. Infer sheet metal operations and plastic processing to develop engineering components.

TEXT BOOKS:

1. Kalpakjian Sand Steven R Schmid, Manufacturing Engineering and Technology, Pearson Publishing, 7th Edition, 2018.
2. P.N. Rao, Manufacturing Technology –Vol. I, Tata McGraw Hill Publishers, 4th Edition, 2017.

REFERENCE BOOKS:

1. Philip C Rosenthal, Principles of Metal Casting, McGraw-Hill Education, 2nd Edition, 2017.
2. P. L. Jain, Principles of Foundry Technology, Tata McGraw Hill Publishers, 5th Edition, 2017.
3. Amitabha Ghosh, Asok Kumar Mallik, Manufacturing Science, East West Press Pvt. Ltd, 2nd Edition, 2010.
4. R.S. Parmar, Welding Processes & Technology, Khanna Publishers, 1st Edition, 1996.

II B.Tech. I - Semester

MACHINE DRAWING

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears.
- Able to draw various Keys, Cotters, Joints and Couplings with proper standards.
- To familiarize in drawing assembly, orthographic and sectional views of various machine components.
- Able to Create 2-D and 3-D models by standard CAD software.

PART 1

Preparation of 2D views for Machine Elements and simple parts

1. Conventional representation of materials, standard machine elements and parts such as screws, nuts, bolts, keys, gears, etc.
2. Screw joints, bolted joints and Riveted joints for plates.
3. Keys, cotter joints and knuckle joint.
4. Shaft coupling, spigot and socket pipe joint.
5. Journal, pivot and collar and foot step bearings.

PART II

Assembly modelling: top-down approach, bottom-up approach, applying constraints to parts in assembly, Explode & Manipulation.

Developing orthographic views of assembled product from the given individual part drawings.

1. Engine parts:
   a. Stuffing box
   b. Steam engine cross head
   c. Eccentric
   d. Piston.
2. Machine Tool Parts:
   a. Lathe Tail-stock
   b. Machine Vice
   c. Clapper block
3. Other machine parts:
   a. Screw jack
   b. Machine vice
   c. Plummer block

4. Valves:
    a. Steam stop valve
    b. Spring loaded safety valve
    c. Feed check valve

COURSE OUTCOMES:

At the end of the course, the student will be able to:

1. Conventional representation of different materials and mechanical components.
2. Model a part, joints and couplings using Computer-Aided Design software.
3. Create complex engineering assemblies using appropriate assembly constraints.
4. Developing different views for assembled products using drafting in CAD software.

TEXT BOOKS:

1. N. Sidheshwar, Shastry, Kanhaiah, Machine Drawing, McGraw Hill Education, 1st Edition, 2017.
2. N.D.Bhatt, Machine Drawing, Charotar, 50th Edition, 2016.

REFERENCES BOOKS:

1. P.S.Gill, Machine Drawing, S.K. Kataria& Sons, 18th Edition, 2020.
2. K.L.Narayana, P. Kannaiah & K. Venkata Reddy, Machine Drawing, New Age International, 6th Edition, 2019.

II B.Tech. I - Semester

METALLURGY & MECHANICS OF SOLIDS LAB

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To provide practical understanding on mechanical properties of materials through various tests.
- To estimate practical strength of given material and compare it with actual value.
- To know the procedure of specimen preparation for performing microstructure study.
- To study and identify the microstructures of various metals and alloys.
- To understand the effect of heat treatment on the microstructure and hardness of low-carbon steel.

LIST OF EXPERIMENTS

(A) MECHANICS OF SOLIDS LAB:

1. Direct tension test
2. Bending test on a) Simple supported b) Cantilever beam
3. Torsion test
4. Hardness test a) Brinells hardness test b) Rockwell hardness test
5. Test on springs
2. Compression test on cube
3. Impact test
4. Punch shear test

(B) METALLURGY LAB:

1. Preparation and study of the microstructure of pure metals like Iron, Copper and Aluminum.
2. Preparation and study of the microstructure of mild steel, medium-carbon steel and high-carbon steel.
3. Preparation and study of the microstructure of cast irons.
4. Preparation and study of the microstructure of non-ferrous alloys.
5. Preparation and study of the microstructure of heat treated steels.
6. To find out the hardness of the heat treated and untreated steels.
7. Hardenability of steels by Jominy End Quench Test.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

1. Estimate tensile, compressive and shear strengths of given material using UTM.
2. Conduct deflective tests on beams and springs for finding mechanical constants of materials.
3. To find mechanical properties like Hardness, resilience, toughness, etc. by conducting various tests.
4. Know the procedure of specimen preparation for performing microstructure study.
5. Study and identify the microstructures of given metal / alloys.
6. Understand the influence of heat treatment on the microstructure and hardness of low-carbon steel.

II B.Tech. I - Semester

MANUFACTURING PROCESSES LAB

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To prepare a wooden pattern using carpentry tools.
- To make a sand mold using pattern.
- To perform various operations done on press tools.
- To prepare simple welded joints like T-joint, butt joint, lap joint using arc, oxy-acetylene, MIG, TIG welding.
- To fabricate a bottle and cap using blow and injection molding machines.

Structured Enquiry

1. Determining sand properties – a) Grain Size, b) Permeability c) Hardness and d) Compressive strength of moulding sand.
2. Preparation of a welded joint by TIG welding.
3. Preparation of plastic bottle using blow moulding.
4. Preparation of a wooden pattern as per the given dimensions of the casting considering all the possible allowances.
5. Joining of sheet metal joint by Spot Welding.
6. Performing blanking and piercing operations using a fly-press attachment.
7. Performing ‘V’ bend in a sheet metal by using a hydraulic press.
8. Performing pipe bending operation using a hydraulic press.
9. Preparation of an air tight plastic bottle cap using injection moulding.
10. Making a metal joint using brazing process.
11. Making an aluminium casting for a given pattern using a moulding process.

Open ended

1. Preparation of sand mould cavity.
2. Preparation of i) Butt joint ii) Lap joint and iii) T-joint by Arc Welding.

COURSE OUTCOMES:

At the end of the course, students able to:

1. Make the wooden pattern using carpentry tools.
2. Use the pattern for creating mould cavity.
3. Perform blanking and piercing operations on press tools.
4. Fabricate welded structures for engineering applications.
5. Prepare components using blow and injection molding.

II B.Tech. I - Semester

COMPUTER AIDED ENGINEERING MODELLING

L	T	P	C
1	0	2	2

COURSE OBJECTIVES:

- To enhance the student's engineering drawing knowledge by introduce Computer Aided Design software (CAD).
- To understand steps involved in creating and editing a solid part.
- Creating a component by joining different parts using assembly tools.
- To generate projection drawings from a solid part or from a assembled part.

COURSE CONTENT

Introduction to CAD software for modelling: Understanding the interface, tools and workbenches available.

2D Sketch: Basic 2D sketch tools (line, rectangle, circle etc.), Sketch editing operations (Trim, split, mirror….) and dimensioning.

3D Modelling: Creating solids from 2d Sketches using extrusion, revolve, sweep etc. Various operations solid parts.

Part Assembly: Creating assembled components by joining individual parts using assembly tools.

Drafting: Developing 2D projection drawings from solid parts and assembled components.

LIST OF EXPERIMENTS

1. Producing 2D drawings with dimensions using CAD.
2. Developing a solid using Extrude operation.
3. Developing a solid using Revolve operation.
4. Developing a solid using Sweep operation.
5. Developing a hollow solid using Shell operation.
6. Use of chamfer, fillet and ribs in solid body.
7. Developing solids with pattern and mirror tools.
8. Assembly of Beam engine.
9. Assembly of Quick return mechanism.

10. Assembly of Electric blower.
11. Developing 2D projections of Given solid.
12. Developing 2D projections (Including Sectional projections) of given assembled component.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

1. Draw complex geometries of machine components in sketcher mode.
2. Model a Solid using different 3D tolls in CAD software.
3. Create complex engineering assemblies using appropriate assembly constraints.
4. Develop 2D projections of solids and assembled elements using CAD software.

II B.Tech. I - Semester

CONSTITUTION OF INDIA

L	T	P	C
2	0	0	0

COURSE OBJECTIVES:

- To train students in understanding the basic structure of Indian Constitution.
- To prepare students to live better and happily with other fellow beings through the application of Fundamental Rights in their lives.

UNIT I

Introduction to Indian Constitution

Meaning of the term Indian Constitution –Preamble- Constituent Assembly- Salient Features of Indian Constitution.

UNIT II

Fundamental Rights

Fundamental Rights -Fundamental Duties -The Directive Principles of State Policy.

UNIT III

Union Government

Union Government -Union Legislature (Parliament) -Lok Sabha and Rajya Sabha (with Powers and Functions) -Union Excecutive -President of India (with Powers and Functions) -Prime Minister of India (with Powers and Functions) -Union Judiciary (Supreme Court) -Jurisdiction of the Supreme Court.

UNIT IV

State Government

State Government -State Legislature (Legislative Assembly / Vidhan Sabha, Legislative Council/ Vidhan Parishad) -Powers and Functions of the State Legislature -State Executive-Governor of the State (with Powers and Functions) -The Chief Minister of the State (with Powers and Functions) -State Judiciary (High Courts).

UNIT V

Local Self Governance

Powers and functions of Municipalities – Panchyats - ZP’s and Co – Operative Societies.

COURSE OUTCOMES:

Upon the completion of the course, the student will be able to:

1. Examine salient features of Indian Constitution and live accordingly in society.
2. Interpret the meaning of Fundamental Rights and Directive Principles of State Policy and, develop an attitude which paves the way for better living conditions.
3. Discover various aspects of Union Government legislation and live up to the expectations of the rules.
4. Critically examine State Government legislation and improve your living standards by

   following the rules strictly.
5. Examine powers and functions of local bodies such as Municipalities and Panchayats and, take advantage of available resources for better living.

BOOKS:

1. Durga Das Basu, Introduction to constitution of India, Lexis Nexis Publications, 22nd Edition, 2015.
2. Constitution of India by professional book publishers.
3. Arun K Tiru vengadam, The Constitution of India, Blooms bury publishers, 1st Edition, 2017.
4. PM Bakshi, The constitution of India, Universal law publishing, 14th Edition, 2017.

II B.Tech. II - Semester

MATHEMATICS-IV (NUMERICAL METHODS, PROBABILITY & STATISTICS)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To enable the students to:

- know the standard numerical methods to find roots of functions in practical engineering problems and identify the concepts of interpolation, to estimate the unknown functional values.
- identify the methods for finding the values of derivatives and finite integrals using numerical techniques.
- understand various statistical distributions.
- decide the null or alternative hypotheses using the suitable test statistic.

UNIT I

Solution of Algebraic and Transcendental Equations & Interpolation

Introduction- algebraic function and transcendental function, Bisection method, Regula –Falsi Method, Iteration Method, Newton- Raphson method.

Introduction, Finite Differences, Forward, Backward- Newton's forward and backward formulae –Lagrange's Interpolation Formula.

UNIT II

Numerical Integration and Solution of Ordinary Differential Equations

Numerical Integration**,** Trapezoidal rule, Simpson's $1/3^{rd}$ Rule, Simpson's $3/8^{th}$ Rule.

Solution by Taylor's method, Euler's & Modified Euler's method, Runge- Kutta Method (4^{th} order).

UNIT III

Probability Distributions

Basic concepts on probability, random variables (discrete and continuous)**,** probability distribution- Binomial, Poisson and Normal distributions and their properties.

Tests of Hypothesis – Large sample Tests

Null and Alternative Hypothesis, One tail and two tailed tests, Type I and Type II errors. Large Sample tests- Test for Single mean and difference of means, Test for single proportion and difference of proportions.

UNIT V

Tests of Hypothesis - Small Sample Tests

Tests of hypothesis using Student 's t-distribution - test for single mean, two means, F-test and χ^{2-} test for goodness of fit, χ^{2-} test for independence of attributes.

COURSE OUTCOMES:

After undergoing this course, students will be able to:

1. apply standard numerical methods to solve fundamental and practical engineering problems and understand the concepts of interpolation to estimate the unknown functional values.
2. evaluate finite integrals and solving differential equations using numerical techniques.
3. understand the discrete and continuous probability distributions and apply relevant engineering problems.
4. perform inferential statistics to test hypothesis for large samples.
5. apply the concept of testing hypothesis for small samples to draw the inferences and estimate the goodness of fit.

TEXT BOOKS:

3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 9th Edition, 2016.
4. B. V. Ramana, Higher Engineering Mathematics, Revised Edition, Tata McGraw Hill, New Delhi, 2017.
5. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics a Modern Approach, Sultan Chand & Sons, 12th Edition 2000.

REFERENCE BOOKS:

4. T.K.V.Iyengar, B. Krishna Ghandhi, S. Ranganathan and M.V.S.S.N. Prasad, Engineering Mathematics, Volume-I, 12th Edition, S. Chand Publishers, 2014.
5. S.S. Sastry, Introductory methods of Numerical Analysis, Prentice Hall of India Pvt. Ltd., 5th Edition, 2012.

II B.Tech. II - Semester

FLUID MECHANICS AND HYDRAULIC MACHINES

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

To learn fundamentals of fluids, flow measuring devices, losses in pipes, performance of turbines and pumps.

UNIT I

FLUID STATICS: Properties of fluids (density, specific volume, specific gravity, viscosity, compressibility, surface tension, vapor pressure), Newton's law of viscosity, Classification of Fluids, Pascal's law, Hydrostatic law, Pressure & Measurement: Atmospheric, Gauge and Vacuum Pressure, Measurement of Pressure (Piezometer, U-Tube and Differential Manometers).

FLUID KINEMATICS: Stream line, streak line and path line, Classification of flows (steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational, irrotational, compressible, incompressible), velocity potential function, stream function, continuity equation (3D).

UNIT II

FLUID DYNAMICS: Surface and body forces, Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend. Reynold's experiment, Darcy Weisbach equation, Moody's diagram, Minor losses in pipes, Pipes in series and pipes in parallel, total energy line, hydraulic gradient line. Measurements of flows: Pitot tube, Venturimeter and Orifice meter.

DIMENSIONAL ANALYSIS: Introduction, Principle of dimensional homogeneity, Rayleigh's method, Buckingham's Pi theorem method. Dimensionless numbers (Eulers, Mach number, Reynolds number, weber number).

UNIT III

BOUNDARY LAYER CONCEPTS: Flow over a Flat Plate, Displacement Thickness, Momentum Thickness and Energy Thickness, Laminar and Turbulent boundary layers (No derivation), boundary layer in transition, Laminar Sub-Layer, Boundary Layer Separation.

BASICS OF TURBO MACHINERY: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip for Symmetrically and Un-symmetrically vanes, velocity diagrams at inlet and outlet, work done and efficiency.

UNIT IV

HYDRAULIC TURBINES: Classification of turbines: Pelton wheel turbine, Francis turbine and Kaplan turbine, working principle, work done, efficiencies, Draft tube theory- functions and efficiency.

PERFORMANCE OF HYDRAULIC TURBINES: Geometric similarity, Unit and specific quantities, performance characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT V

CENTRIFUGAL PUMPS: Classification ,working, work done, manometric head, losses and efficiencies, specific speed-pumps in series and parallel, performance characteristic curves, NPSH, cavitation.

RECIPROCATING PUMPS: Main component parts and working, discharge and slip-Indicator diagrams.

COURSE OUTCOMES:

At the end of course students will be able to:

1. Apply fundamentals of fluid mechanics and its applicable laws to solve problems in engineering applications.
2. Formulate and solve different Types of Fluid Flows and its Velocity Potential.
3. Analyze surface forces and losses in pipe flows.
4. Compute drag & lift forces using the boundary layer concepts.
5. Design & formulate the working parameters of Hydraulic machines.

TEXT BOOKS:

1. P.N. Modi and S.M. Seth, Hydraulics, fluid mechanics and Hydraulic Machinery, Standard Book Company, 21st Edition , 2018.
2. R. K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publications, 10th Edition, 2018.

REFERENCE BOOKS:

1. Frank White, Fluid Mechanics, McGraw-Hill, 8th Edition, 2015.
2. S. Ramamrutham, Hydraulics Fluid Mechanics and Fluid Machines, DhanpatRai, 9th Edition, 2014.

II B.Tech. II - Semester

KINEMATICS OF MACHINES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Understand mechanisms for motion transmission.
- Understand the principles in analyzing the assembly with respect to the displacement, velocity and acceleration at any point in a link of a mechanism.
- Design engineering applications involving in selection, sizing of mechanism to accomplish motion.
- To analyze Steering gear mechanisms and to understand the working principles in power drives.
- To understand the basic concepts, terminologies and kinematics of gears and gear trains.

UNIT I

Mechanisms: Elements or links, classification, rigid, flexible and fluid link. Types of kinematic pairs, sliding, turning, rolling, screw and spherical pairs, lower and higher pairs, closed and open pairs, constrained motions, completely, partially or successfully constrained and incompletely constrained, Degrees of freedom.

Machines: Mechanism and machines, classification of machines, kinematic chain, inversion of mechanism, inversions of quadric cycle chain, single and double slider crank chains.

UNIT II

Straight line motion mechanisms: Exact and approximate copiers and generated types, Peaucellier, Hart and Scott Russel, Grasshopper, Watt, Tchebicheff and Robert Mechanisms and straight line motion, Pantograph.

Steering Mechanism: Conditions for correct steering, Davis Steering gear, Ackerman‘s steering gear, velocity ratio.

Hooke’s joint: Single and double Hooke‘s joint, Universal coupling, applications.

UNIT III

Kinematics: Velocity and acceleration, Motion of link in machine, Determination of Velocity and acceleration diagrams, Graphical method, Application of relative velocity method four bar chain.

Analysis of Mechanisms: Analysis of slider crank chain for displacement, velocity and acceleration of slider, Acceleration diagram for a given mechanism, Klein's construction, Coriolis acceleration, determination of Coriolis component of acceleration.

Plane motion of body: Instantaneous center of rotation, relative motion between two bodies, three centres in line theorem, graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

UNIT IV

Cams: Definitions of cam and followers, their uses, Types of followers and cams, Terminology, Types of follower motion, Uniform velocity, Simple harmonic motion and uniform acceleration. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

Analysis of motion of followers: Roller follower, circular cam with straight and convex flanks.

UNIT V

Gears: Higher pairs, friction wheels and toothed gears, types, law of gearing, condition for constant velocity ratio for transmission of motion, forms of teeth: cycloidal and involute profiles. Velocity of sliding, phenomena of interferences, Methods of interference, condition for minimum number of teeth to avoid interference, expressions for arc of contact and path of contact, Introduction to Helical, Bevel and worm gearing.

Gear Trains: Introduction, Train value, Types, Simple and reverted wheel train, Epicyclic gear train. Methods of finding train value or velocity ratio, Epicyclic gear trains. Selection of gear box, Differential gear for an automobile.

COURSE OUTCOMES:

At the end of course the students will be able to:

1. Able to describe the principles of kinematic pairs, links, and their classification, DOF, simple mechanisms, and inversions.
2. Interpret different concepts of mechanisms like straight line motion mechanisms, Steering gear mechanisms and universal joint.
3. Analyze the planar mechanisms for position, velocity and acceleration.
4. Draw the cam profiles for appropriate motions of the follower.
5. Select appropriate gears by evaluating gear tooth geometry, applications and understand different types of gear trains for specific applications.

TEXT BOOKS:

1. Thomas Bevan, Theory of Machines, Pearson Education India, 3rd Edition, 2009.
2. Rattan .S.S, Theory of machines, TMH, 4th Edition, 2014.

REFERENCE BOOKS:

1. R.K Bansal, Theory of Machines, Lakshmi Publications, 5th Edition, 2012.
2. R.S Khurmi & J.K Gupta, Theory of Machine, S Chand, 14th Edition, 2005.

II B.Tech. II - Semester

APPLIED THERMODYNAMICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study different types of IC engines, working & their performances.
- To learn about combustion stages and factors affecting the combustion in SI and CI engines.
- To study different types of boilers and their mountings and accessories.
- To learn about steam nozzles, steam turbines, and their performance.
- To analyze the performance of ideal and practical gas turbines.

UNIT I

Introduction: Introduction to IC engines, Working principles of 4-Stroke and 2-Stroke Spark Ignition and Compression Ignition Engines, Differences between 2-s and 4-s cycle engines, Differences between SI and CI engines, Valve and Port Timing Diagrams, effect of operating variables, comparison of air standard and actual cycles, effect of time loss, heat loss and exhaust loss in Petrol and Diesel engines.

Engine Testing And Performance: Introduction, Parameters of performance-measurement of cylinder pressure, Measurement of Fuel consumption, Air intake, Brake power, Determination of Frictional power and Indicated power, Performance tests, Heat Balance sheet.

UNIT II

Combustion in SI and CI Engines: Stages of combustion in SI engines, abnormal combustion and knocking in SI engines, factors affecting knocking, effects of knocking, control of knocking, Fuels for SI and CI engine, important qualities of IC engine fuels, rating of fuels, Stages of combustion in CI engines, detonation in C.I. engines, factors affecting detonation, controlling detonation, combustion chamber for SI and CI engine.

UNIT III

Basic Concepts: Rankine cycle, Schematic layout, Thermodynamic Analysis, Methods to improve cycle performance; Regeneration and Reheating.

Boilers: Classifications, Working principle of critical boilers with sketches, Mountings and Accessories, Boiler horse power, Draught, classification, Height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney.

UNIT IV

Steam Nozzles: Steam Nozzles, Introduction, Area, velocity relationship, Mass flow rate, Choking of Nozzles, Performance characteristics of Nozzles.

Steam Turbines: Steam Turbines, Impulse and reaction Turbines, Compounding of steam turbines, multistage reaction Turbines, Reheat factor and Efficiency.

UNIT V

Ideal Gas Turbine Cycles: Analysis of Ideal Gas Turbine Cycles, Simple Cycle, Regeneration Cycle, Reheat Cycle, Inter cooling Cycle.

Practical Gas Turbine Cycles: Analysis of Practical Gas Turbine Cycles, Methods of accounting for component losses, Efficiencies, changes in the composition of the working fluid.

COURSE OUTCOMES:

After completing this course, the students will able to:

1. Understand the types of IC engines, working and their performance.
2. Understand the combustion stages, factors affecting the combustion in SI and CI engines.
3. Describe the working of a vapour power cycles and Identify the need of various boilers, draught systems for a thermal power plant.
4. Apply thermodynamic analysis to study the characteristics of steam nozzles and evaluate the performance characteristics of an impulse and reaction turbines.
5. Analyze the performance of Ideal and practical gas turbines.

TEXT BOOK:

1. V Ganesan, Internal Combustion Engines, McGraw-Hill, 4th Edition, 2017.
2. R.K. Rajput, Applied Thermodynamics, Lakshmi Publications, 2nd Edition, 2016.

REFERENCE BOOKS:

1. Mahesh M. Rathore, Thermal Engineering, McGraw-Hill, 1st Edition, 2010.
2. R. Yadav, Thermodynamics and Heat Engines, Central Book Depot, 1st Edition, 2003.

II B.Tech. II - Semester

UNIVERSAL HUMAN VALUES

L	T	P	C
3	0	0	3

Pre-requisites: None. Universal Human Values 1 (desirable)

COURSE OBJECTIVES:

The objective of the course is four fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.
- Strengthening of self-reflection.
- Development of commitment and courage to act.

COURSE TOPICS:

The course has 28 lectures and 14 practice sessions in 5 modules:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

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

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

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

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

13. 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
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

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

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

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 etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. 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.
26. Case studies of typical holistic technologies, management models and production systems
27. 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
28. Sum up.

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.

TEXT BOOK

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

REFERENCE BOOKS

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

II B.Tech. II - Semester

FLUID MECHANICS AND HYDRAULIC MACHINES LAB

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- Measure the losses in pipes and coefficient of discharge using Venturimeter and orifice meter.
- To verify Bernoulli's theorem.
- Apply the impulse momentum equation and determine the force exerted by jet on vanes.
- Study the performance of hydraulic machines viz. turbines and pumps.

EXPERIMENTS:

Minimum of 10 experiments needs to be performed

1. Calibration of Venturimeter.
2. Calibration of Orificemeter.
3. Determination of friction factor for a given pipeline.
4. Determination of loss of head due to sudden contraction in a pipeline.
5. Verification of Bernoulli's theorem.
6. Impact of jet on Vanes.
7. Performance Test on Pelton Wheel Turbines.
8. Performance Test on Francis Turbine.
9. Performance Test on Kaplan Turbine.
10. Performance Test on Single Stage Centrifugal Pump.
11. Performance Test on Multi Stage Centrifugal Pump.
12. Performance Test on Reciprocating Pump.

COURSE OUTCOMES:

At the end of course the student will be able to:

1. Estimate minor and major losses in the pipelines.
2. Measure the coefficient of discharge of a flow measuring devices.
3. Evaluate the performance of centrifugal pumps, reciprocating pumps and hydraulic turbines.
4. Evaluate the force exerted by a jet on different vanes.

II B.Tech. II - Semester

APPLIED THERMODYNAMICS LAB

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- Interpret the basic concepts in the area of IC engines and other power input devices of thermal engineering field.
- Evaluate the performance of various types of petrol, diesel engines and reciprocating air compressor.
- To study the boilers used in steam turbines and locomotives.

EXPERIMENTS:

Minimum of 10 Experiments need to be performed

1. Valve Timing Diagram of a four stroke Engine & Port timing diagram of a two stroke Engine.
2. Testing of Fuels – Viscosity, flash point/fire point, carbon residue & calorific value.
3. Performance test on 4 stroke diesel engine.
4. Performance Test on 4 -Stroke SI engines.
5. Heat Balance Sheet on 4 stroke CI engine.
6. Exhaust gas emission measurements of 4-stroke petrol engine.
7. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrol engine.
8. Determination of FP by retardation test on IC engine.
9. Determination of FP by motoring test on IC engine.
10. Performance test on variable compression ratio engines.
11. Performance test on reciprocating air compressor unit.
12. Study of Boilers.
13. Dis-assembly / Assembly of Engines.
14. Study the P-Ɵ and P-V diagram for 4 stroke diesel engine at different loads.
15. Economical speed test of an IC engine.

COURSE OUTCOMES:

At the end of course students will be able to:

1. Evaluate the performance of petrol engine and diesel engines at different operating conditions.
2. Determine the performance of compressors.
3. Study the properties of the fuel.
4. Discuss the different types of boilers.
5. Draw Valve Timing and Port timing diagrams of an IC engine.

II B.Tech. II - Semester

STRUCTURAL ANALYSIS LAB

L	T	P	C
0	0	3	1.5

PREREQUISITES:

Knowledge of any Modelling Software, Knowledge of Coordinate Systems and Geometric Transformations etc.

COURSE OBJECTIVES:

The course is intended to provide basic understanding of basic modelling and Analysis techniques students with following aspects:

- To acquire basic understanding of Analysis software.
- To understand the different kinds of analysis and apply the basic principles to find out the stress and other related parameters of bars, beams loaded with the loading conditions.
- To learn to apply the basic principles to carry out dynamic analysis to know the natural frequency of different kind of beams.

LABORATORY WORK

Study of ANSYS Lab contains:

1. Stress analysis of bars of constant crosssection area.
2. Stress analysis of bars of tapered cross section area.
3. Stress analysis of a stepped bar.
4. Analysis of trusses.
5. Stress analysis of beams.
6. Stress analysis of rectangular plate with a circularhole.
7. Thermal analysis.
8. Dynamic analysis.

COURSE OUTCOMES:

At the end of the course the students are able to:

1. Demonstrate the basic features of an analysis package.
2. Use the modern tools to formulate the problem and to create geometry, discretize, apply boundary condition to solve problems of bars and truss to find stress with different loading conditions.
3. Demonstrate the stress analysis of beams and plates.
4. Carry out dynamic analysis and finding natural frequencies for various boundary conditions.

REFERENCE BOOKS:

1. Daryl L Logan, A first course in the Finite element method, CL Engineering, 5th Edition, 2010.
2. David V Hutton, Fundaments of Finite Element Analysis, McGraw Hill, Rev Edition, 2017.

II B.Tech. II - Semester

ADVANCED SOLID MODELLING

L	T	P	C
1	0	2	2

COURSE OBJECTIVES:

To provide students with advanced training in solid modelling and improve their machine designing skills using assembly, kinematics and surface design.

COURSE CONTENT

Solid modelling using CATIA: Solid part from 2D sketches, Boolean operations, Solid remastering.

Assembly Design: Creating assembled components by joining individual parts using assembly tools, assembly for kinematics with DOF, Different types of joints (Spherical joint, Screw Joint, cylindrical joint, etc.), Assembly of components with sub-assemblies.

Kinematics: Creating and applying motion to different mechanisms, finding DOF of given mechanism, Kinematics for machine parts and engine parts.

Surface Design: Introduction to surface design, tools in surface design, sweep operations, surface to solid and surface remastering.

LIST OF EXPERIMENTS:

1. Creating 3D solids using boolean operations.
2. Creating a given solid body using solid remastering.
3. Assembly of Engine components.
4. Assembly of Machine components.
5. Assembly involving sub-assemblies.
6. Assembly with DOF.
7. Applying motion to given mechanism and machine parts.
8. Creating a complex surface using surface tools.
9. Creating a solid body from the surface.
10. Creating a given solid body using surface remastering.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

1. Model a Solid using different 3D tools in CAD software.

2. Create complex engineering assemblies using appropriate assembly constraints.
3. Develop a mechanism and be able to apply motion using kinematics.
4. Create, modify complex surfaces and be able to perform remastering techniques for creating duplicate bodies.

II B.Tech. II - Semester

CRITICAL READING AND CREATIVE WRITING

L	T	P	C
3	0	0	0

COURSE OBJECTIVES:

The students will have the ability to:

- Understand how to identify, analyze, interpret and describe critical ideas, themes,
  and values in literary texts.
- List the elements of a Short Story.
- Apply critical and theoretical approaches to the reading and analysis of literary texts in multiple genres.

UNIT I

Essentials of Good Writing

1. Focus, Development, Unity, Coherence and Correctness.
2. Imagery
   A. Figurative Language- Simile, Metaphor, Personification, Hyperbole,Oxymoron, Paradox, Alliteration, Assonance.
   B. Sensory details.
3. Point of View

UNIT II

Elements of a Short story

1. Plot, Setting, Character, Theme
2. Analysis of given short stories: 2 stories
   A. Good Sees the Truth but Waits by Leo Tolstoy.
   B. The Cop and the Anthem by O. Henry.

UNIT III

Prose Writing:

Reflective Writing – Personal Essay
Descriptive Writing: Person/Place/Thing

UNIT IV

Reading Comprehension

Reading for facts, contextual vocabulary, tone and inference.

UNIT V

Speech Analysis

A. Tryst with Destiny- https://www.youtube.com/watch?v=lrEkYscgbqE
B. Stay Hungry, Stay Foolish – https://www.youtube.com/watch?v=UF8uR6Z6KLc

COURSE OUTCOMES:

Upon the completion of the course, the student will be able to:

1. Understand and explain the characteristics of a literary text.
2. Critically analyze the quality of a Shorty Story.

3 Produce essays like personal essay or descriptive essay applying the principles of good writing.
4.Identify facts, themes and critical ideas in a passage.
5. Articulate an awareness of the basic elements of a speech.

REFERENCES:

1. The Cambridge Companion to Creative Writing (South Asian Edition).
2. Creative Writing: A Beginner's Manual (Paper Back Edition).
3. Teaching and Developing Reading Skills: Cambridge Handbooks for Language Teachers.

WEB REFERENCES:

https://www.skillsyouneed.com/learn/critical-reading.html
https://englishforeveryone.org
http://sixminutes.dlugan.com/speech-evaluation-1-how-to-study-critique-speech/
http://www.homeofbob.com/literature/genre/fiction/ficElmnts.html

III B.Tech. I - Semester

DYNAMICS OF MACHINERY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Use the concepts of friction for clutches, brakes and dynamometers.
- Know about the turning moment diagrams and the design of flywheels.
- Develop understanding of gyroscopic forces and moments, and their applications.
- Develop the understanding of the governor and their working.
- Develop knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses.
- Develop understanding of vibrations and its significance on engineering design.

UNIT I

CLUTCHES: Friction clutches- single disc or plate clutch, multiple disc clutch, cone clutch, centrifugal clutch.

BRAKES AND DYNAMOMETERS: Simple block brakes, internal expanding brake, band brake of vehicle. General description and operation of dynamometers: Prony, Rope brake, Epicyclic, Bevis Gibson and belt transmission.

UNIT II

STATIC AND DYNAMIC FORCE ANALYSIS: Dynamic force analysis of slider crank mechanism, inertia torque, angular velocity and acceleration of connecting rod, crank effort.

TURNING MOMENT DIAGRAMS: Turning moment diagrams – fluctuation of energy – fly wheels and their design.

UNIT III

PRECESSION: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

GOVERNORS: Watt, porter and proell governors, spring loaded governors, Hartnell and Hartung with auxiliary springs, Sensitiveness, isochronism and hunting.

UNIT IV

BALANCING: Balancing of rotating masses single and multiple, single and different planes, use analytical and graphical methods. Primary, secondary, and higher balancing of reciprocating masses. analytical and graphical methods, unbalanced forces and couples: examination of “V” multi cylinder in line and radial engines for primary and secondary balancing, locomotive balancing, hammer blow, swaying couple, variation of tractive effort.

UNIT V

VIBRATIONS: Free Vibration of spring mass system – Natural frequency-types of damping – damped free vibration, Simple problems on forced damped vibration, vibration isolation and transmissibility transverse loads, vibrations of beams with concentrated and distributed loads. Dunkerly’s methods, Raleigh’s method, whirling of shafts, critical speeds, torsional vibrations, two and three rotor systems.

COURSE OUTCOMES:

Upon successful completion of this course the student should be able to:

1. To compute frictional transmission in clutches, brakes and dynamometers.
2. Analyse dynamic forces of slider crank mechanism and perform design of flywheel.
3. Analyse stabilization of sea vehicles, aircrafts, automobile vehicles and perform basic analysis of governors.
4. Know about the static and dynamic balance of reciprocating and rotary masses.
5. To determine the natural frequencies of discrete systems undergoing longitudinal, torsional and transverse vibrations.

TEXT BOOKS:

1. S.S Rattan, Theory of Machines, Mc. Graw Hill, 5th Edition, 2019.
2. Ashok G. Ambedkar, Mechanism and machine theory, PHI Publications, 1st Edition2007.

REFERENCE BOOKS:

1. JS Rao and RV Dukkipati, Mechanism and Machine Theory, New Age, 1992.
2. Shigley, Theory of Machines, Mc. Graw Hill, 4th Edition, 2014.
3. Dr. R. K. Bansal, Theory of Machines, Laxmi Publications, 5th Edition, 2016.
4. G K Grover, Mechanical Vibrations, Nem Chand & Bros, 8th Edition, 2018.

III B.Tech. I - Semester

METAL CUTTING AND MACHINE TOOLS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- The course provides students with fundamental knowledge and principles in material removal processes.
- To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.
- To give an insight on conventional machining principles and operations.
- To design jigs and fixtures for simple parts.
- To get familiarity about CNC programming and about CNC machine tools.

UNIT I

Metal Cutting: Introduction, elements of cutting process, geometry of single point tool, tool angles, chip thickness ratio, chip formation and types of chips, built-up edge & its effects, chip breakers, tool materials – types and properties, types of tool wear, tool life consideration, coolants.

UNIT II

Lathe: Working principle, specifications, lathe - types, parts, operations, taper turning - methods, lathe – accessories & attachments, cutting speed, feed, depth of cut, machining time estimation, capstan and turret lathe – comparison.

Shaper, Slotter & Planer: Working principle, parts, Shaper - whitworth quick return mechanism, crank & slotted ink mechanism and automatic table feed mechanism, machining time estimation in a shaper.

UNIT III

Drilling & Boring Machines: Working principle, specifications, types, parts, operations performed, twist drill – nomenclature, machining time calculations.

Milling Machines: Working principle, types, up milling *vs* down milling, milling operations, types of milling cutters, geometry of milling cutter, indexing methods, machining time estimation.

UNIT IV

Grinding: Working principle, operations & applications of surface, cylindrical & centreless grinding processes, specification & selection of a grinding wheel, dressing, truing & balancing of grinding wheels, types of abrasives and bonds.

Finishing Processes: Introduction to lapping, honing, polishing and buffing operations.

UNIT V

Jigs & Fixtures: Introduction, classification of jigs & fixtures, basic principles of location and clamping, typical examples of jigs and fixtures.

CNC Machine Tools: NC, CNC machine tools, structure of CNC machine tools, fundamentals of CNC part programming and applications of CNC machines.

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to:

1. Understand the basic metal cutting principles, select cutting tool materials for different materials.
2. Identify various operations performed on a lathe, get familiarity with lathe attachments.
3. Acquire knowledge of machining processes such as shaping, slotting, planning, drilling and milling.
4. Identify various finishing techniques such as grinding, lapping, honing and broaching.
5. Write simple CNC programs and conduct CNC machining.

TEXT BOOKS:

1. B.S. Raghuwanshi, A Course in Workshop Technology - Vol - II (Machine Tools), Dhanpat Rai & Co. 15th Edition, 2017.

2. P.N. Rao, Manufacturing Technology - Vol – II, Tata McGraw-Hill, 4th Edition, 2018.

REFERENCE BOOKS:

1. B. L. Juneja, G. S. Sekhon and Nitin Seth, Fundamentals of Metal Cutting and Machine Tools, New Age International (P) Limited, Publishers, Revised 2nd Edition, 2017.

2. Serope Kalpakjian and Steven Schmid, Manufacturing, Engineering and Technology, Pearson, 8th Edition, 2020.

III B.Tech. I - Semester

DESIGN OF MACHINE MEMBERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Enable students to attain the basic knowledge required to understand, analyze, design and select machine elements required in transmission systems.
- Reinforce the philosophy that real engineering design problems are open-ended and
applications.
- Understand the principles of stress, strain and Principal stresses as applied to Solid bodies or structural and machine elements under loads Procedure for challenging.
- Impart design skills to the students to apply these skills for the problems in real life industrial the different machine elements such as fasteners, shafts, couplings, keys, axially loaded joints etc.
- Develop a holistic design approach to find out pragmatic solutions to realistic domestic and industrial problems.

UNIT I

INTRODUCTION: General considerations in the design of Engineering Materials and their properties, selection, Manufacturing consideration in design, BIS codes of steels.

STRESSES IN MACHINE MEMBERS: Simple stresses, combined stresses, torsional and bending stresses, impact stresses, stress strain relation, various theories of failure, factor of safety, design for strength and rigidity, preferred numbers. The concept of stiffness in tension, bending, torsion.

UNIT II

STRENGTH OF MACHINE ELEMENTS: Stress concentration, theoretical stress concentration factor, fatigue stress concentration factor notch sensitivity, design for fluctuating stresses, endurance limit, estimation of endurance strength, Goodman’s line, Soderberg’s line, modified Goodman’s line.

UNIT III

Riveted Joints: Introduction, Methods of riveting, Materials of rivets, Types of riveted joins, Lap joint, Butt joint, Failures of riveted joints, Strength of riveted joints, Caulking and Fullering, Design of joints with initial stresses – eccentric loading.

Welded Joints: Advantages and disadvantages over riveted joints, Types of welded joints, Lap joint and butt joint, Strength of parallel fillet welded joints, Strength of the transverse welded joints.

UNIT IV

SHAFTS: Design of solid and hollow shafts for strength and rigidity, design of shafts for combined bending and axial loads, shaft sizes. Use of internal and external circlips, gaskets and seals (stationary & rotary).

KEYS, COTTERS AND KNUCKLE JOINTS: Design of keys, stresses in keys, cotter joints, spigot and socket, sleeve cotter joints and knuckle joints.

UNIT V

MECHANICAL SPRINGS: Types of springs, Terms used in springs, Applications of springs, Stresses and deflections of helical springs, Design of helical springs, energy storage capacity, leaf springs and construction of multi-leaf springs, nipping and shot peening.

Note: Design data book is NOT Permitted for examination

COURSE OUTCOMES:

Students will be able to:

1. Select the proper material for the machine component based on theories of failure and estimate the factor of safety.
2. Determine the sizes under different types of fatigue loads and estimate the life of the components.
3. Study the type of failure and estimate the efficiency of welded and riveted joints.
4. Calculate the size of shaft for transmitting torque and design of various type of joints and fasteners required for a given application.
5. Analyse the forces and design of helical, torsion and leaf springs and forces.

TEXT BOOKS:

1. Joseph E. Shigley, Mechanical Engineering Design, McGraw Hill, 9th Edition, 2010.
2. Dr. C. S. Shah, Dr. N. C. Pandya, Machine Design, Charotar Publishing House Pvt. Ltd, 20th Edition, 2015.

REFERENCE BOOKS:

1. V. B. Bandari, Machine Design, Tata McGraw Hill Publishers, 5th Edition, 2020.
2. R. L. Norton, Machine Design, McGraw Hill, 5th Edition, 2013.

III B.Tech. I - Semester

GAS DYNAMICS AND JET PROPULSION
(PROFESSIONAL ELECTIVE - I)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basic difference between incompressible and compressible flow.
- To understand the phenomenon of shock waves and its effect on flow.
- To gain some basic knowledge about propulsion systems.

UNIT I

FUNDAMENTALS OF COMPRESSIBLE FLOW: Basic equations of compressible flow, stagnation states, Mach wave and Mach cones, effect of Mach number on compressibility.

UNIT II

FLOW THROUGH VARIABLE AREA DUCT: One dimensional isentropic flow in duct of varying cross sectional area; nozzles and diffusers; critical properties and choking.

UNIT III

SHOCK WAVES: Governing equations, Variation of flow parameters across the normal and oblique shocks, Prandtl relation, Rankine- Hugoniot relation.

UNIT IV

FLOW THROUGH DUCTS: Fanno flow equation and its solution, relation of flow properties with length, experimental coefficient of friction.

Rayleigh flow equations, variation of flow properties, maximum heat transfer.

UNIT V

THEORY OF JET PROPULSION: Operating principle of Propulsive systems; Propulsive, Thermal and Overall efficiency, specific fuel consumption, thrust equation and cycle analysis; performance of ram jet, turbojet, turbofan and turboprop engines.

COURSE OUTCOMES:

At the end of this course students will be able to:

1. Outline governing equations of compressible fluid flow.
2. Analyze one dimensional compressible flow through variable area duct.
3. Analyze compressible flow having shock.
4. Apply governing equations to compressible flow through constant area duct with friction and with heat transfer.
5. Interpret propulsive systems for their working and application.

TEXT BOOKS:

1. E. Rathakrishnan, Gas Dynamics, Pvt PHI Learning Ltd, 5th Edition, 2014.
2. V Ganesan, Gas Turbines, McGraw Hill Education, 3rd Edition, 2017.

REFERENCE BOOKS:

1. J. D. Anderson, Modern Compressible Flow, McGraw Hill, 3rd Edition, 2017.
2. MJ Zucrow, Aircraft & Missile propulsion Vol:II , Wiley, 1958.

III B.Tech. I - Semester

GREEN ENGINEERING SYSTEMS
(PROFESSIONAL ELECTIVE - I)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce solar energy, collection, and working of solar power plants.
- To introduce the wind energy, bio mass energy, geo thermal energy and ocean energy as alternative energy sources.
- To understand about different equipment's used in generation of energy using renewable sources.
- Understand the key factors to select suitable site and materials for green building.

UNIT I

Introduction to solar power: Role and potential of new and renewable sources, the solar energy option, environmental impact of solar power.

Solar Energy Collection: Working principal of flat plate and concentrating collectors, classifications of solar collectors, orientation and thermal analysis.

Solar Thermal Power plant: Recent developments in solar power plants, power generation through solar central receiver power plant, solar chimney.

UNIT II

Wind Energy: Sources and potentials, Classification of wind mills, horizontal and vertical axis wind mills, performance characteristics, betz criteria, types of winds, wind data measurement, site evaluation.

Bio-Mass: Principle of bio-conversion, anaerobic and aerobic digestion- types of bio-gas digesters, gas yield, Combustion characteristics of bio-gas, utilization for cooking.

UNIT III

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

Ocean energy: OTEC, Principles of utilization, classification of OTEC plants, thermodynamic cycles.

Tidal energy: Working principle, tidal power plant, classification of tidal plants, operational methods of tidal energy, site selection.

UNIT IV

Energy efficient systems: (A) Electrical systems: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management. (B) Mechanical systems: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, Environmental friendly and Energy efficient compressors and pumps.

UNIT V

Green Buildings: Definition, features and benefits. Sustainable site selection and planning of buildings for maximum comfort. Environmental friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste, Ferro cement and Ferro-concrete, alternate roofing systems, paints to reduce heat gain of the buildings. Energy management.

COURSE OUTCOMES:

After Completion of this course students will be able to:

1. Student can acquire the knowledge of role and potential of new and renewable sources, working principle of solar collection devices and their applications.
2. Explore the concepts involved in wind & bio-mass energy conversion system by studying its components, types and performance.
3. Understand the technologies to harness power from geo thermal, ocean, wave and tidal energies.
4. Understand the working principle and operation of energy efficient systems.
5. Select the suitable site selection and their materials for green buildings.

TEXT BOOKS:

1. G.D.Rai, Non- Conventional Energy sources, Khanna publication, 5th Edition, 2017.
2. John Twidell and Anthony D Weir, Renewable Energy Sources, Taylor & Francis, 2nd Edition, 2015.

REFERENCE BOOKS:

1. Suhas P. Sukhatme, Solar energy, Tata McGraw-Hill, 4th Edition, 2017.
2. Dr. R.K. Singal, Non- Conventional Energy sources, S.K.Kataria & Sons, 3rd Edition, 2021.

III B.Tech. I - Semester

REFRIGERATION & AIR CONDITIONING (PROFESSIONAL ELECTIVE - I)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To obtain the basic knowledge of refrigeration, refrigerants and its applications in engineering practice.
- To demonstrate basic knowledge of simple vapour compression refrigeration system, their components and got idea about cryogenic refrigeration system.
- To explain the vapour Absorption refrigeration and non conventional refrigeration systems.
- To acquire the basic knowledge on various psychometric processes, estimating air conditioning loads.
- To learn different types of air refrigeration systems, heat pumps and their applications.

UNIT I

Fundamentals Of Refrigeration: Introduction: Necessity and applications, unit of refrigeration and C.O.P; Heat Engine, Refrigerator and Heat pump.

Refrigerants: Classification of refrigerants, Desirable properties, Nomenclature, Greenhouse effect, global warming.

Air Refrigeration System: Introduction: Air refrigeration system working on Reversed Carnot cycle, Air refrigeration system working on Bell Coleman cycle, COP, Open and Dense air systems, Applications.

UNIT II

Vapour Compression Refrigeration System: Working principle: Simple vapour compression refrigeration cycle, Representation of cycle on T-s and P-h charts, COP, Effect of Sub cooling and Superheating.

VCR System components: Actual vapour compression cycle, System components: Compressors, Condensers, Expansion devices and Evaporators.

UNIT III

Cryogenic Refrigeration: Liquefaction of air and hydrogen.

Vapor Absorption System: Working principle and components of NH_3 - water and Li Br- water System, Three Fluid absorption system.

Steam Jet Refrigeration System: Working Principle and Basic Components; Thermoelectric and Vortex tube refrigeration system (working principle).

UNIT IV

Psychometry: Psychometric properties and processes, Psychometric chart.

Air Conditioning systems: Introduction, summer, winter and year round A/C systems. Classification of equipment: humidifiers and dehumidifier, filters, grills, registers, fans and blowers, different heat pump circuits.

UNIT V

Design of Air Condition Systems

Human Comfort: Thermodynamics of Human body-Effective temperature – Comfort chart.

Cooling Loads: Sensible and latent heat loads, RSHF, GSHF, ESHF & ADP, air conditioning load calculations.

COURSE OUTCOMES:

After Completion of this course students will be able to

1. Understand the basic concepts of refrigeration and their applications.
2. Evaluate the performance parameters of different types of VCR systems.
3. Identify the desirable refrigerant and its use in various refrigeration systems.
4. Analyze the psychometric properties and processes used in Air Conditioning systems.
5. Design of Air Conditioning systems for human comfort conditions.

TEXT BOOKS:

1. C.P. Arora, Refrigeration and Air Conditioning, Tata McGraw Hill, 4th Edition, 2020.
2. S.C. Arora & S. Domkundwar, A Course in Refrigeration and Air conditioning, Dhanpatrai publications, 8th Edition, 2016.

REFERENCE BOOKS:

1. Manohar Prasad, Refrigeration and Air Conditioning, New Age International, 3rd Edition, 2015.
2. R.F Barron, Cryogenic Systems, Oxford University Press, 2nd edition, 1985.
3. R.S. Khurmi & J.K. Gupta, Refrigeration and Air Conditioning, S.Chand, 5th Edition, 2019.

III B.Tech. I - Semester

AUTOMOBILE ENGINEERING
(PROFESSIONAL ELECTIVE - I)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Understand the automobile components and their classification.
- Acquire knowledge of automobile engine auxiliary systems.
- Interpret construction, working and functions of transmission and Suspension systems.
- To understand the need of braking systems in an automobile and interpret construction, working and functions of steering system.
- To understand emissions from automobile and alternatives to reduce pollution.

UNIT I

Introduction: Types of Automobile, Automobile Layout, Chassis and Body Components, Rear Wheel Drive, Front Wheel Drive, Four Wheel Drive.

Engine: Construction Details and Materials of Cylinder Head, Piston, Piston Rings, Fly Wheel, Valve & Valve Trains, Firing Order.

Fuel Intake System: Fuel Injection Systems for Diesel and Petrol, MPFI, GDI, CRDI, Fuel Pump, Filters, Turbo Charging and Super Charging.

Cooling System: Purpose, Methods of Cooling, Air Cooling, Water Cooling, Coolants.

UNIT II

Lubrication System: Objective & Requirements of Lubricant, Types of Lubricants, Various Systems of Engine Lubrication, Oil Additives.

Ignition System: Functions, Battery Ignition System, Magneto Coil Ignition System, Electronic Ignition Systems, Spark Advance and Retard Mechanism.

Electrical System: Starting Systems, Bendix Drive, Solenoid Switch, Various Accessories - Horn, Wiper, Fuel Gauge, Oil Pressure Gauge.

UNIT III

Transmission System: Clutches: Principle, Types, Single Plate Clutch, Multi Plate Clutch, Magnetic and Centrifugal Clutches. Gear Boxes: Types, Sliding Mesh, Constant Mesh, Synchro Mesh Gear Boxes. Automatic Transmission: Epicyclic Gear Box, Torque Converter, Continuously Variable transmission

(CVT). Propeller Shaft: Hotchkiss Drive, Torque Tube Drive, Universal Joint, Differential Rear Axles.

Suspension System: Rigid Axle Suspension System, Independent Suspension System, Leaf Spring, Coil Spring, Torsion Bar, Dampers, Shock Absorber, MacPherson Strut, Air Suspension System.

UNIT VI

Braking System: Mechanical Brake System, Hydraulic Brake System, Pneumatic and Vacuum Brakes, Brake System Components: Drum and Disc Brakes, Master Cylinder, Wheel Cylinder, Tandem Master Cylinder, Requirement of Brake Fluid, Antilock Brake System (ABS).

Steering System: Steering Geometry**:** Camber, Castor, King Pin Rake, Combined Angle Toe-In, Toe-Out. Steering Gears: Types, Steering Linkages, Rack and Pinion Steering Gear, Power Steering. Types of Steering Mechanism: Ackerman Steering Mechanism, Davis Steering Mechanism. Slip Angle, Cornering Power, Under Steer and Over Steer, Wheel Alignment and Balancing. Introduction to Advanced Driver Assistance Systems (ADAS).

UNIT V

Vehicle Pollution Control: Components of Exhaust Gas, National and International Pollution Standards, Pollution Control Techniques: Catalytic Converter, Selective Catalytic Reduction (SCR), Diesel particulate filters (DPF), Exhaust Gas Recirculation (EGR), Crank Case Ventilation and Homogeneous Charge Compression Ignition (HCCI).

Alternative Prime Movers: Introduction to Hybrid Vehicles, PHEV, Battery Electric Vehicles (BEV), Fuel Cell Electric Vehicle (FCEV).

COURSE OUTCOMES:

At the end of course the students will be able to:

1. Identify the different types of Automobiles and their components.
2. Discuss the working of auxiliary systems of Automobile Engine.
3. Illustrate the concepts of transmission systems and identify the suitable suspension system based on application.
4. Choose suitable steering and braking system based on application.
5. Explain the pollutions norms and technologies available to reduce pollution.

TEXT BOOKS:

1. Kripal Singh, Automobile Engineering (Volume 1 & 2), Standard Publishers, 14th Edition, 2018.
2. William H. Crouse, Automotive Mechanics, Tata McGraw-Hill Education, 10th Edition, 2017.

REFERENCE BOOKS:

1. T. K. Garrett, Kenneth Newton, William Steeds, The Motor Vehicle, SAE International, 13th Edition, 2001.
2. Ehsani, Mehrdad, Modern electric, hybrid electric, and fuel cell vehicles, CRC press, 3rd Edition, 2018.
3. G.B.S. Narang, Automotive Mechanics, Khanna Publications, 17th Edition, 2011.

III B.Tech. I - Semester

THEORY OF MACHINERY LAB

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- Study of damped and undamped free and forced vibrations of spring mass system.
- Know about gyroscopic couple and static and dynamic balancing of reciprocating and rotating masses.
- Practically study about various governors, cams and followers, demonstration of various types of gears.
- Hands on experience of the concepts of friction and their applications.

EXPERIMENTS:

Any 10 experiments are to be conducted.

1. To determine whirling speed of shaft theoretically and experimentally.
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
3. To analyse the motion of a motorized gyroscope when the couple is applied along its spin axis.
4. To determine the frequency of undamped free vibration of an equivalent spring mass system.
5. To determine the frequency of damped force vibration of a spring mass system.
6. To study the static and dynamic balancing using rigid blocks.
7. To find the moment of inertia of a flywheel.
8. To plot follower displacement vs cam rotation for various Cam Follower systems.
9. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism/Four bar mechanism.
10. To find coefficient of friction between belt and pulley.
11. To study simple and compound screw jack and determine the mechanical advantage, velocity ratio and efficiency.
12. To study various types of gears- Spur, Helical, Worm and Bevel Gears.

COURSE OUTCOMES:

1. Experimental study of Undamped, damped free and forced vibrations and determine the whirling speed of the shaft.
2. Determine the controlling force of Hartnell Governor.
3. Identify the significance of friction in belt &pulley and study the efficiency of simple and compound screw jacks.
4. Know the application of Gyroscope and understand the concept of balancing of rotating masses by experiment.
5. Study of different types of Gears and Four bar mechanism with the help of functional models.
6. Practical determination of moment of inertia of the flywheel and know the relative motion between the cam & follower.

REFERENCE BOOKS:

1. Hamilton H. Mabie & Charles F. Reinholtz, Mechanisms and Dynamics of Machinery, Wiley Edition, 4th Edition, 1991.

2. Dr. V. P. Singh, Theory of Machines, Dhanpat Rai & Co., 6th Edition, 2017.

III B.Tech. I - Semester

MACHINE TOOLS LAB

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- The course provides students with fundamental knowledge and principles in material removal processes.
- To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.
- To give an insight on conventional machining principles and operations.
- To get familiarity about CNC programming and about CNC machine tools mechanisms.

Perform any 10 experiments from the following list of experiments.

List of Experiments:

1. To perform plain turning & facing on a lathe machine.
2. To perform step turning and chamfering on lathe machine.
3. To perform taper turning and knurling on lathe machine.
4. To cut multi-start square/metric threads on lathe machine.
5. Performing drilling and tapping operations.
6. Machining a flat surface using a shaper.
7. Machining a key-way using a slotting machine.
8. Performing indexing operation on a milling machine.
9. Prepare and check the dimensions of the sample by surface grinding machine.
10. Perform grinding of tool angles on a tool and cutter grinder.
11. Perform plain turning operation on a CNC lathe.
12. Perform step turning operation using a CNC lathe.
13. Perform drilling operation on a CNC lathe.

COURSE OUTCOMES:

At the end of course, the students will be able to:

1. Demonstrate knowledge of different machine tools used in machine shop.
2. Perform step turning, taper turning, knurling and threading operations.
3. Produce flat and inclined surfaces using shaper, keyway using slotting, indexing using milling machine and finishing using grinding machine.
4. Understand geometry of single point cutting tool using tool & cutter grinder.
5. Perform machining operations on a CNC lathe.

III B.Tech. I - Semester

ADVANCED ENGLISH COMMUNICATION SKILLS LAB

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To expose students to different contexts through right vocabulary.
- To inculcate the habit of reading and understanding any text.
- To enable students to acquire the ability of writing for business purposes.
- To enable students to acquire interview skills and group discussion dynamics.

UNIT I

Selected High GRE Words, Idioms & Phrases – Discourse Skills – using visuals – Synonyms and antonyms, word roots, one word substitutes, prefixes and suffixes, study of word origin, analogy, idioms and phrases, collocations.

UNIT II

Reading Comprehension – General Vs Local Comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning.

UNIT III

Writing Skills – Structure of Resume writing —Short Report Writing (Business/Technical).

UNIT IV

Presentation Skills -- Group Discussion – Dynamics of Group Discussion.

UNIT V

Interview Skills – Concept and process – pre-interview planning, opening strategies, answering strategies, interview through teleconference & video-conference and mock interviews.

COURSE OUTCOMES:

Upon the completion of the course, the student will be able to:

1. Choose vocabulary contextually.
2. Comprehend, analyze and interpret the text in a definite time frame.
3. Write resumes cohesively and coherently.
4. Construct and elaborate on a given topic and Comprehend and practice the dynamics of group discussion.
5. Comprehend the concept and process of interview; answering through mock interviews.

SUGGESTED SOFTWARE:

1. K-Van solutions Software with CD.
2. Oxford advanced learner's compass, 7^{th} Edition.

SUGGESTED READING:

1. Meenakshi Raman & amp; Sangeeta Sharma, Technical Communication, Oxford University Press, 2009.
2. Kelly M. Quintanilla & Shawn T. Wahl, Business and Professional Communication: Keys for Workplace Excellence.. Sage South Asia Edition. Sage Publications, 2011.
3. English Vocabulary in Use Series, Cambridge University Press, 2008.

III B.Tech. I - Semester

ENGINEERING EXPLORATION PROJECT

L	T	P	C
0	0	2	0

COURSE OBJECTIVES:

- To develop skills to identify, define and solve industry-oriented problems.
- Work individually and in teams effectively and cohesively.
- Understand ethical principles and commitment to professional ethics.

Engineering Exploration Project, is a skill-oriented project mainly focused to make students ready for the industry needs. This project is to be taken up during fifth semester. Students come with a problem statement and solve the problem by using the acquired engineering skills. The project shall be submitted in a report form and presented before the committee. The committee consists of Head of the Department, Supervisor and senior faculty members of the department. There will be no marks, however, approval of the project by the committee is mandatory.

COURSE OUTCOMES:

The student will be able to:

1. Analyse and apply current techniques and tools to solve a problem.
2. Function effectively as an individual and as a responsible member of a team.
3. Gain knowledge in technical report writing.
4. Engage in lifelong activity.
5. Define and analyse a problem to assess health, safety and legal issues.
6. Apply ethical principles.

III B.Tech. II - Semester

DESIGN FOR SMART MANUFACTURING

L	T	P	C
3	0	0	3

Prerequisites: Manufacturing processes

COURSE OBJECTIVES:

To provide students with the concepts of

- planning manufacturing systems.
- computer integrated manufacturing and enterprise integration.
- group Technology.
- knowledge-based systems.

UNIT I

Introduction to Smart Manufacturing: What is “smart manufacturing” really and how does it differ from conventional/legacy manufacturing, Computer Integrated Manufacturing Systems Structure and functional areas of CIM system, - CAD, CAPP, CAM, CAQC, ASRS. Advantages & Disadvantages of CIM.

UNIT II

Smart Design/Fabrication: Smart Design/Fabrication - Digital Tools, Product Representation and Exchange Technologies and Standards, Agile (Additive) Manufacturing Systems and Standards. Mass Customization, Smart Machine Tools, Robotics and Automation (perception, manipulation, mobility, autonomy), Smart Perception.

UNIT III

Smart Applications: Online Predictive Modelling, Monitoring and Intelligent Control of Machining/Manufacturing and Logistics/Supply Chain Processes; Smart Energy Management of manufacturing processes and facilities, introduction to digital twin.

UNIT IV

Smart and Empowered Workers: Eliminating Errors and Omissions, Deskilling Operations, Improving Speed/Agility, Improving Information Capture/Traceability, Improving Intelligent Decision Making under uncertainty Assisted/Augmented Production, Assisted/Augmented assembly, Assisted/Augmented Quality, Assisted/Augmented Maintenance, Assisted/Augmented Warehouse Operations and Assisted Training.

UNIT V

The Internet of Things: An overview; Design Principles for Connected Devices; Internet Principles. Thinking about Prototyping – Costs versus ease of prototyping, prototyping and Production,

Prototyping Embedded devices – Electronics, Embedded Computing Basics, Arduino/Raspberry Pi/ Beagle Bone Black, Prototyping of Physical Design, Introduction to Prototyping online Components.

COURSE OUTCOMES:

1. Understand the terminology associated with smart manufacturing.
2. Identify the principles behind smart fabrication/design and the applications of smart manufacturing.
3. Engage in empowered work to understand smart industry requirements.
4. Understand concepts of IoT including design principles, prototyping, embedded devices, and physical design.

TEXT BOOKS:

1. N. Vengurlekar and P. Bagal, Database Cloud Storage: The Essential Guide to Oracle Automatic Storage Management, McGraw-Hill Education, 1st Edition, 2013.
2. M. Kuniavsky, Smart Things: Ubiquitous Computing User Experience Design, Morgan Kaufmann, 1st edition, 2010.

REFERENCE BOOKS:

1. A. McEwen and H. Cassimally, Designing the Internet of Things, Wiley, 1st Edition. 2013.
2. Mikell P. Groover, Automation, Production Systems and Computer Integrated Manufacturing, 8th Edition, PHI, 2008.

III B.Tech. II - Semester

HEAT TRANSFER

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

To understand different modes of heat transfer and apply these basics in the design of thermal systems.

UNIT I

Introduction: Basic Modes of Heat Transfer, Basic laws of Heat transfer, Steady and Unsteady Heat Transfer.

Heat Conduction: Fourier‘s equation, Thermal resistance, Thermal conductivity: General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates and its simplification-Initial and boundary conditions.

One- Dimensional Steady State Conduction: Conduction through a single and multi-layered plane, cylindrical and spherical walls with constant, conduction with uniform heat generation: plane wall and cylinder, critical thickness of insulation. Types of fins: Long fin, short fin with or without insulated tip, fin effectiveness and fin efficiency.

UNIT II

One Dimensional Transient Heat Conduction: Systems with negligible internal resistance, Lumped Heat analysis: Significance of Biot and Fourier Numbers, systems with finite surface and internal resistance using Heisler Chart.

Dimensional Analysis: Dimensional analysis, Buckingham Pi Theorem for forced and Natural convection, significance of Reynolds, Prandtl and Nusselt numbers.

UNIT III

Forced Convection: Concepts of hydrodynamic and thermal boundary layer, use of empirical correlations for forced convective heat transfer: Internal flows and External flows.

Natural Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate, Use of empirical relations for Vertical plates and cylinders.

UNIT IV

Radiation Heat Transfer: Basic concepts, Emission characteristics, concept of black body, laws of black-body radiation - Planck's law, Wien's displacement law, Stefan Boltzmann law, radiation incident on a surface, solid angle and radiation intensity, lambert's cosine law, heat exchange between two black surfaces, shape factor, heat exchange between non-black surfaces, radiosity, electrical analogy for radiation networks, radiation shields.

UNIT V

Boiling And Condensation: Regimes of saturated pool boiling of water, dropwise and film wise condensation, Nusselt's analysis for laminar film wise condensation on a vertical plate.

Heat Exchangers: Introduction, Classification of heat exchangers, Flow arrangement, Temperature distribution, Overall heat transfer coefficient, Fouling factor, LMTD method of Heat exchanger analysis, Correction for LMTD for use with Multi pass and Cross flow Heat Exchangers, Effectiveness, NTU method of Heat Exchanger analysis, Applications of Heat Exchangers.

COURSE OUTCOMES:

Upon successful completion of the course, the students will be able to

1. Explain different modes of heat transfer, 1-D steady state heat conduction and fin heat transfer.
2. Analyze transient heat conduction using Heisler's charts and apply dimensional analysis to forced and natural convection.
3. Compute convective heat transfer coefficients in forced and natural convection,
   both for internal and external flows.
4. Calculate the radiation heat exchange between the surfaces and interpret the significance of radiation shields.
5. Explain pool boiling and condensation phenomena, and apply LMTD and ϵ-NTU methods for design of heat exchangers.

TEXT BOOKS:

1. R. C. Sachdeva, Fundamentals of Engineering Heat and Mass Transfer, New age publication, 5th Edition, 2017.
2. Yunus A. Cengel & Afshin J. Ghajar, Heat and Mass Transfer - Fundamentals and Applications, Tata McGraw Hill, 6th Edition, 2020.

REFERENCE BOOKS:

1. N. Ozisik, Heat Transfer - A Basic Approach, Tata McGraw Hill, 1985.
2. P. K. Nag, Heat and Mass Transfer, Tata McGraw Hill, 3rd Edition, 2011.
3. J. P. Holman, Heat Transfer, Tata McGraw Hill, 10th Edition, 2017.

III B.Tech. II - Semester

MECHANICAL MEASUREMENTS & METROLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the measurement systems and its performance.
- Concept of interference of light and working of interferometers.
- To acquire knowledge about various measuring equipment’s.
- Design of part, tolerances and fits & Evaluation and inspection of surface inspection of engineering parts and gears with various precision instruments roughness.

UNIT I

Measurement system and basic concepts of measurement methods:

Definition, Significance of measurement, Generalized measurement system, Accuracy, Precision, Static characteristics- Calibration, Threshold, Sensitivity, Hysteresis, Repeatability. Dynamic characteristics- System response, Time delay. Errors in measurement, Classification of errors.

Measurement of Displacement: Transducers-Piezo electric, Inductive, capacitance transducers, Photo conductive cell.

Measurement of Speed: Tachogenerator, Stroboscope.

Measurement of Acceleration and Vibration: Seismometer, Laser Doppler Vibrometer and Accelerometer.

UNIT II

Measurement of Pressure: Bourdon pressure gauge– Diaphragm gauges – McLeod pressure gauge - Pirani thermal conductivity gauge – Ionization pressure gauge.

Measurement of Flow: Rotameter, Magnetic flow meter, Ultrasonic flow meter.

Measurement of Temperature: Thermocouple - Resistance Thermometer – Thermistor – Optical Pyrometer.

Measurement of Strain: Theory of strain gauges, Types, Electrical resistance strain gauge, Preparation and mounting of Strain gauges, Gauge factor, Methods of strain measurement, temperature compensation.

UNIT III

Introduction to Metrology:

Definition, objectives of metrology, Material Standards, Wavelength Standards, Classification of standards, Line and End standards, Calibration of End bars. Numerical examples.

System of Limits, Fits, Tolerance and Gauging:

Definitions, Tolerance, Tolerance analysis (addition & subtraction of tolerances) Inter changeability & Selective assembly. Class &grade of tolerance, Fits, Types of fits, Numerical on limits, fit and tolerance. Hole base system & shaft base system. Taylor's principle, Types of limit gauges, Numerical on limit gauge design.

UNIT IV

Linear measurement and angular measurements:

Slip gauges-Indian standards on slip gauges, Adjustable slip gauges, Wringing of slip gauges,

Dial indicators, micrometers. Measurement of angle - Sine bar, bevel protractor, spirit level and angle dekkor.

Comparators:

Functional requirements, Classification, Mechanical-Johannson Mikrokator, Sigma comparators, Electrical comparators, Pneumatic comparators- Principle of back pressure, Solex comparators, Optical comparators- Zeiss ultra optimeter.

UNIT V

Form Measurement, Optical & Interferometry:

Form measurement – Measurement of tooth thickness – gear tooth vernier - Tools maker's microscope- autocollimators - Interference of light, Michelson's interferometer, NPL flatness interferometer, and NPL gauge interferometer.

Surface Roughness Measurement:

Surface roughness and surface waviness–Numerical assessment of surface finish-CLA, R.M.S. Rz, R10 values, Method of measurement of surface finish, Talysurf, ISI symbols for indication of surface finish.

Advances in Metrology: Laser interferometers, types, applications. Basic concepts of Coordinate Measuring Machines (CMM) - constructional features, applications.

COURSE OUTCOMES:

1. Evaluate the performance of a measuring systems.
2. Describe the working principle and possess knowledge about various measuring instruments.
3. Understand the objectives of metrology, methods of measurement, standards of measurement & various measurement parameters.
4. Understand the working principle of different types of comparators.
5. Understand the standards of length, angles and evaluation of surface finish with various comparators.

TEXT BOOKS:

1. D. S Kumar, Measurement Systems Applications & design, Metropolitan Book Co. (P) Ltd, 5th Edition, 2015.
2. Mahajan, Engineering Metrology, Dhanpat Rai Publishers, 1st Edition, 2012.
3. R. K. Jain, Engineering Metrology, Khanna Publishers, 1st Edition, 2018.

REFERENCE BOOKS:

1. I. C. Gupta, Engineering Metrology, Dhanpat Rai Publishers, 1st Edition, 2018.
2. R. K. Jain, Mechanical and Industrial Measurements, Khanna Publishers, 1st Edition, 1995.

III B.Tech. II - Semester

INDUSTRIAL ROBOTICS
(PROFESSIONAL ELECTIVE - II)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The general objectives of the course are to enable the students to

- Understand the components and their working principles of a robotic system.
- Expand this knowledge into the vast area of robotics.
- The students will be exposed to the concepts of robot kinematics, Dynamics, Trajectory planning.
- Mathematical approach to explain how the robotic arm motion can be described.
- The students will understand the functioning of sensors and actuators.

UNIT I

ROBOT FUNDAMENTALS:

Automation and Robotics, History of robots, Laws of Robotics, Robot Specifications – Precision, accuracy and repeatability, Anatomy of a Robot – Links, Joints, number of degrees of freedom (DOF), Arm and Wrist configurations, classification by coordinate system and control system. Work Volume, An overview of Robotics – present and future prospects.

UNIT II

COMPONENTS OF THE INDUSTRIAL ROBOTS:

Components, Architecture – Requirements and challenges of end effectors, Types of end effectors - Tools & Grippers - Mechanical, Vacuum, Magnetic etc. Considerations in gripper selection and design, Common types of robotic arms – PUMA, SCARA.

MOTION ANALYSIS:

2D and 3D - Homogeneous transformations as applicable to rotation and translation – problems.

UNIT III

MANIPULATOR KINEMATICS:

Kinematic Modeling of Manipulator - Forward kinematics, D-H notation – Kinematic relation between adjacent links– problems, Inverse kinematics.

DIFFERENTIAL MOTION AND DYNAMICS:

Differential transformation, manipulator Jacobian – 2-DOF planar arms, Jacobian singularities.

Dynamics: Lagrange – Euler and Newton – Euler formulations and comparison.

UNIT IV

TRAJECTORY PLANNING AND ROBOT PROGRAMMING:

General considerations in path description and generation: Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion – Robot programming, languages and software packages - VAL programming - description of paths with a robot programming language.

UNIT V

ROBOT ACTUATORS AND FEEDBACK COMPONENTS:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors.

Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

ROBOT APPLICATIONS IN MANUFACTURING:

Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

COURSE OUTCOMES:

Upon successful completion of this course, you should be able to:

1. To learn about knowledge for the design of robotics.
2. Identify various robot configurations and components.
3. Carry out kinematic and dynamic analysis for simple serial kinematic chains.
4. Perform trajectory planning for a manipulator by avoiding obstacles and develop programming principles, languages for a robot control system.
5. Select appropriate actuators and sensors for a robot based on specific application.

TEXT BOOKS:

1. Groover M P, Industrial Robotics, Pearson Edu. 1st Edition, 1987.
2. Mittal R K & Nagrath I J, Robotics and Control, TMH, 2017.

REFERENCE BOOKS:

1. K. S. Fu, , Ralph Gonzalez, C.S.G. Lee, Robotics, McGraw Hill, Rev Edition, 2017.
2. Richard D. Klafter, Robotic Engineering: An Integrated Approach, Prentice Hall, 1st Edition, 1989.

III B.Tech. II - Semester

FINITE ELEMENT ANALYSIS
(PROFESSIONAL ELECTIVE - II)

L	T	P	C
3	0	0	3

Prerequisites: Mechanics of Solids**,** Design of Machine Members & Heat Transfer.

COURSE OBJECTIVES:

- Apply numerical approximate methods as a tool for structural problem solving.
- Implement the basics of FEM to relate stresses and strains.
- Understanding of mechanical engineering design concepts to use the Finite Element Method software correctly and efficiently.
- Solve 1-D, 2-D and dynamic problems using Finite Element Analysis approach.
- Apply the numerical integration technique to model in FEM.
- Use FEA software to study the steady heat transfer and dynamic analysis.

UNIT I

Overview of approximate methods for the solution of the mathematical models.

Basic equations of stresses-equilibrium, boundary conditions, stress–strain, strain- displacement relations, plane stress and plane strain conditions.

Functional approximate methods: Concept of potential energy, Rayleigh- Ritz method, weighted residual methods.

UNIT II

Introduction to FEM, application of FEM. General Description, basic steps of FEM, comparison of FEM with other methods, interpolation functions, coordinate system, shape functions.

One Dimensional analysis: Stiffness matrix for a axial bar element using Potential Energy approach and virtual work, Linear and Quadratic elements, Finite element analysis of uniform, stepped bars subjected to mechanical and temperature effects - Assembly of Global stiffness matrix and load vector - properties of stiffness matrix, Treatment for various boundary conditions by Elimination and Penalty Approach, convergence requirements.

UNIT III

Analysis of Trusses: Stiffness equations for a truss element, Finite Element Analysis of Trusses - Plane Truss elements.

Analysis of beams: shape function for beam element (Hermite shape functions) - Element stiffness matrix by strain energy concept- Load vector – Beam problems related to various loading and boundary conditions.

UNIT IV

Two-dimensional analysis:

Triangular Element (CST): Shape function, Jacobian matrix, strain displacement matrix, stress-strain relationship matrix, and force vector. Iso-Sub-Super parametric formulation.

Quadrilateral Element (Q4): Shape function, Jacobian matrix, strain displacement matrix, stress-strain relationship matrix, force vector. Numerical integration and Higher order elements.

UNIT V

Heat transfer analysis: mode and laws of heat transfer, 1-D steady state heat transfer, thermal forces due to lateral surface heat convection and internal heat generation, 1-D fin elements.

Dynamic Analysis: Dynamic equation of motion - Lumped and consistent mass matrices – Eigenvalues and Eigen Vectors – dynamic equation of motion of bar element by Lagrange equation and Hamilton's principle. Transverse vibration of beam, free vibration analysis.

COURSE OUTCOMES:

On completion of these courses, the students will be able to

1. Understand the numerical methods involved in Finite Element Theory.
2. Demonstrate the general procedure to generate a finite element model and understand the role and significance of shape functions in finite element formulations.
3. Formulate and solve one dimensional structural problem involving bar, beam, and trusses.
4. Understand the formulation of two-dimensional elements. (CST and LST elements) and apply the numerical integration technique to solve the quadrilateral and higher order elements in FEM.
5. Illustrate an ability to identify, formulate, and apply FEA software to solve steady heat transfer and dynamic analysis.

TEXT BOOKS:

1. S.S. Rao, The finite element methods in engineering, Elsevier, 5th Edition, 2011.
2. Tirupathi K. Chandrupatla and Ashok D. Belagundu, Introduction to finite elements in engineering, Prentice –Hall, 4th Edition, 2015.

REFERENCE BOOKS:

1. J. N. Reddy, An Introduction to Finite Element Methods, McGraw-Hill, 4th Edition, 2018.
2. O. C. Zienkowitz, The Finite element method in engineering science, McGraw-Hill, 7th Edition, 2013.
3. S. Md. Jalaludeen, Introduction of Finite Element Analysis, Anuradha publications, Rev. Edition, 2016.

III B. Tech. II - Semester

MACHINE TOOL DESIGN
(PROFESSIONAL ELECTIVE - II)

L	T	P	C
3	0	0	3

Prerequisite: Machine Tools and Metrology, Machine Design.

COURSE OBJECTIVES:

- To know the fundamentals of design in machine tools.
- To understand the classification of drives and mechanisms.
- To get familiarize with the design of machine tool structures.
- Design, develop and evaluate cutting tools for a manufactured product.
- To utilize the knowledge of design in speed transmission elements.

UNIT I

Introduction to Machine Tool: Introduction - Classification of machine tools, Engineering design process applied to machine tools. Working and Auxiliary Motions in Machine Tools, Kinematics of Machine Tools.

UNIT II

Motion Transmission: Various motions introduced in machine tools, Mechanical, hydraulic and electrical transmissions used in machine drives, Regulation of Speeds and Feeds, Stepped Regulation of Speeds, Multiple Speed Motors, Ray Diagrams and Design Considerations, Design of Speed Gear Boxes, Feed Drives, Feed Box Design.

UNIT III

Design of Constructional Elements:

Structural Elements Design for Centre Lathe, Drilling Machine, Knee Type Milling Machine, Planning Machine, Boring Machine, and Grinding Machines.

UNIT IV

Design of Machine Tool Structures: Functions of Machine Tool Structures and their Requirements, Design for Strength and Rigidity considerations, Materials for Machine Tool Structures, Machine Tool Constructional Features, Beds and Housings, Columns and Tables, Saddles and Carriages.

UNIT V

Dynamics of Machine Tools: Machine Tool Elastic System, Static and Dynamic Stiffness Acceptance Tests. Design considerations in CNC machine tools - Special features, constructional details and design, considerations in CNC machines.

COURSE OUTCOMES:

At the end of course, the students will be able to:

1. Understand basic motions involved in a machine tool.
2. Design and analyse systems for specified speeds and feeds.
3. Design structural elements.
4. Design machine tool structures.
5. Understand control strategies for machine tool operations and apply appropriate quality tests for quality assurance.

TEXT BOOKS:

1. N.K. Mehta, Machine Tool Design and Numerical Control, TMH, 3rd Edition, 2017.
2. G.C. Sen and A. Bhattacharya, Principles of Machine Tools, New Central Book Agency, 2nd Rev. Edition, 2009.

REFERENCE BOOKS:

1. D. K Pal, S. K. Basu, Design of Machine Tools, Oxford IBH, 5th Edition, 2008.
2. N. S. Acherkhan, Machine Tool Design, Vol. I, II, III and IV, MIR publications, 1973.

III B.Tech. II - Semester

ADVANCED MACHINING PROCESSES
(PROFESSIONAL ELECTIVE - II)

L	T	P	C
3	0	0	3

PREREQUISITES: Manufacturing Processes. Machine tools and Metrology

COURSE OBJECTIVES: The students are able to

- Know the need for development of advanced machining processes.
- Acquire knowledge in the fundamentals about Electro chemical machining and its types.
- Grasp the basic principles of operation of Thermal metal removal process and their applications.
- Understand various parameters influencing the Electron Beam Machining, Plasma Arc Machining, Chemical Machining processes.
- Understand the Abrasive machining processes and realize the importance of various Micro-manufacturing techniques.

UNIT I

Introduction: Need for non-traditional machining methods, Classification of modern machining processes, considerations in process selection, Materials, Applications.

Ultrasonic Machining (USM): Mechanics of metal removal, process parameters, economic considerations, applications and limitations, recent developments.

UNIT II

Electro – Chemical Machining Processes: Fundamentals of Electro Chemical Machining (ECM), electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy, economic aspects of ECM, Simple problems for estimation of metal removal rate.

UNIT III

Thermal Metal Removal Processes: General Principle and applications of Electric Discharge Machining (EDM), Electric Discharge Grinding and electric discharge wire cutting processes, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, methods of surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM principle, applications.

UNIT IV

Generation and control of Electron beam for machining, theory of Electron beam machining (EBM), General Principle and applications of Laser beam machining (LBM), Application of Plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish. Chemical machining principle, maskants, etchants, applications. Electro-stream drilling, shaped tube electrolytic machining.

UNIT V

Abrasive jet machining (AJM), Water jet machining (WJM) and Abrasive water jet machining (AWJM): Basic principles, equipment, process variables, mechanics of metal removal, MRR, application and limitations. Magnetic abrasive finishing, Abrasive flow finishing.

Micro-manufacturing: Introduction, Challenges in Meso, Micro and Nano-manufacturing, Micro-turning, Micro-grinding, Micro and Nano-manufacturing by focused ion beam.

COURSE OUTCOMES:

At the end of course, the students will be able to:

1. Identify the differences between traditional and non-traditional machining processes and understand details of ultrasonic machining (USM) processes.
2. Interpret Electro Chemical machining (ECM) processes, their economic aspects and estimation of metal removal rate.
3. Understand working principle, identify the process parameters, metal removal rate, economics and applications of electric discharge machining (EDM) processes.
4. Differentiate characteristic features of electron beam machining (EBM), laser beam machining (LBM), plasma machining, and electrolytic machining.
5. Explore mechanics of material removal and applications of various abrasive machining processes and study the importance of various Micro-manufacturing.

TEXT BOOKS:

1. VK Jain, Advanced machining processes, Allied publishers, 1st Edition, 2007.
2. P K Mishra, Unconventional machining processes, Narosa, 1st Edition, 2014.

3. Hassan Abdel –Gawad El-Hafy, Fundamentals of Machining Processes-Conventional and non – conventional processes, CRC Press, 2nd Edition, 2016.

REFERENCE BOOKS:

1. M. K. Singh, Unconventional Machining Processes, New Age International, 1st Edition, 2008.
2. Kalpakjin, Manufacturing Engineering and Technology, Pearson, 6th Edition, 2009.
3. T. Jagadeesha, Unconventional machining processes, I K International Publishing House Pvt. Ltd., Rev. Edition, 2016.

III B. Tech. II - Semester

DESIGN THINKING LAB

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- To provide the basic concepts and techniques of engineering and reverse engineering, Process of design, analytical thinking and ideas, basics and development of engineering Drawing, application of engineering drawing with computer aide.
- To get exposure of exhibiting their creativity in terms of an innovative product development in a structured process through this course.

1. Stepping Stones

Put yourself into the shoes of an inventor. You have become dissatisfied with the solution to some existing problem or daily necessity. You are casting about in your mind for a new idea. Something occurs to you, possibly suggested by reading about other people's attempts in the files of the patent office. You go home and sketch your invention, and then make a model of it.

There are other later stages, of course, but let us stop here. The point is that the model you have reached may well have been suggested by an analogy from nature. Indeed you could look upon nature as a storehouse of models waiting to be used by inventors. In the below exercise, which you might like to attempt to answer now:

Aim: List specific inventions that were (or might have been) suggested to creative thinkers by the following natural phenomena:

i. human arms
ii. cats
iii. seagulls
iv. a frozen salmon
v. spiders
vi. earthworms
vii. a flower
viii. the eye of a fly
ix. conical shells
x. animal bone structures
xi. dew drops on leaves
xii. human skulls
xiii. bamboo
xiv. human foot
xv. human lungs
xvi. larynx

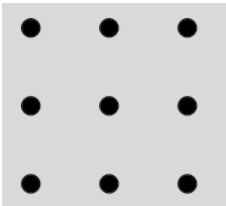
2. Test your assumptions:

Einstein is famous for making one assumption and thinking out its implications. 'Let me assume,' he said to himself, 'that I am riding on the back of a sunbeam, travelling though the universe with the speed of light. How would things look to me?' The eventual result was the General Theory of Relativity. By it Einstein led us to the knowledge that planets and stars move not because they are influenced by forces coming from other bodies in the universe, but because of the special nature of the world of space and time in the neighbourhood of matter. Light-rays may travel straight, for example, in the vast interstellar spaces, but they are deflected or bent when they come within the field of influence of a star or other massive body.

Making conscious assumptions like that one is a key tool in the tool chest of a creative thinker. You are deliberately and temporarily making a supposition that something is true. It is like making a move in a game of chess but still keeping your hand on the piece, so that you can replace it if you do not like the implications of the half-made move. 'No great discovery is made without a bold guess', said Isaac Newton.

For we take on board all sorts of assumptions and preconceptions, often in the form of opinions or common sense, which on examination turn out to be unproven or debatable. They are the main impediments to having new ideas. Take a look at the exercise below:

Aim: On a spare piece of paper draw a square of nine dots like this:



Now see if you can connect up the dots with four consecutive straight lines, that is, without taking your pencil off the paper. You have one minute to complete the task.

PRODUCT DESIGN PROCESS

Introduction

- A Design process is a sequence of steps that transforms a set of inputs into a set of outputs.
- A product development process is the sequence of activities to conceive, design, fabricate and commercialize a product.
- Many of these activities intellectual in nature and requires a lot of iterations.

- The product development process begins with doing advance research and technology development activities, culminating into project's mission statement, moves through concept development process and winds up with the product launch.

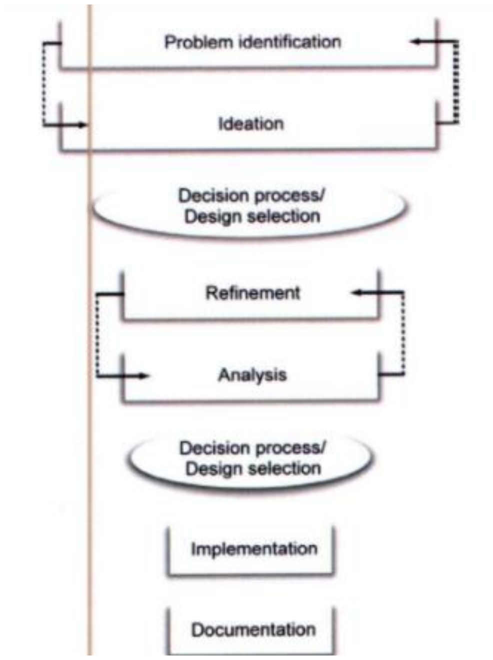


Figure 1 Design process flowchart

Generic Product Development process is categorized in six phases

1. PLANNING
2. CONCEPT DEVELOPME
3. SYSTEM-LEVEL DESIGN
4. DETAIL DESIGN
5. TESTING & REFINEMEN
6. PRODUCTION

(Students to explain the above phase’s w.r.to his/her project with neat and clean sketches and steps)

COURSE OUTCOMES:

Upon the successful completion of the course, students will be able to:

1. Gather deep insights into design thinking and appreciate various design process procedures.
2. Develop design ideas through different techniques and analyse innovative product design.

3. The knowledge gained through DFM and prototyping technologies can apply to make a prototype of models.
4. Understand how to design for robustness and conduct experiment with analysis.
5. Enhance the thinking for design of service with principles.

TEXT BOOKS:

1. Karl T Ulrich, Steven D Eppinger and Anita Goyal, Product Design & Development, Tata McGraw Hill,12th, 2014.
2. Anthony Di Benedetto and Merle Crawford, New Products Management, Tata McGrawHill, 11th Edition, 2014.

REFERENCE BOOKS:

1. Yousef Haik and Tamer M.Shahin, Engineering Design Process, Cengage Learning, 2nd Edition, 2015.
2. Clayton Christensen, Innovators Dilemma, Harper Collins Publishers,1st Edition, 2013.
3. John. R. Karsnitz, Stephen O'Brien and John P. Hutchinson, Engineering Design, Cengage learning, 2nd Edition, 2013.

III B.Tech. II - Semester

HEAT TRANSFER LAB

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- Illustrate basic heat transfer principles and test the thermal conductivity of a metal rod.
- Evaluate overall heat transfer coefficient in case of composite wall and heat exchanger.
- Analyze the efficiency and temperature distribution of a pin fin.
- Compare the emissivity of black and grey body.
- Estimate heat transfer coefficient in case of external flows.

LIST OF EXPERIMENTS

1. Determination of overall heat transfer co-efficient through a composite wall.
2. Determination of thermal conductivity of a metal rod.
3. To find out the efficiency and temperature distribution along the length of a pin-fin under free and forced convection.
4. Determination of heat transfer rate through a concentric sphere.
5. Determination of heat transfer coefficient in forced convection.
6. To determine the natural heat transfer coefficient ‘h’ from the surface of the tube in both vertical and horizontal position.
7. Determination of LMTD and effectiveness of the heat exchanger under parallel and counter flow arrangement.
8. Determine the emissivity of the non – black surface and compare with the black body.
9. Determination of Stefan Boltzman constant for radiation heat transfer.
10. Determination of heat transfer rate in drop and film wise condensation.
11. Determination of critical heat flux.
12. Compare axial heat transfer characteristics of a Heat Pipe and copper pipe with and without wick.
13. To determine heat transfer coefficient and instantaneous heat transfer rate for transient heat conduction and draw the graph of temperature variation with time.

14. Compare the rate of heat transfer and find out the critical thickness of insulation of a given pipe.

ADDITIONAL EXPERIMENTS

1. To demonstrate the working of vapour compression refrigeration system and calculate its capacity and performance.
2. Determination of thermal conductivity of liquids and gases.
3. Determination of heat transfer rate in radiator using radiator test rig.
4. Determination of heat transfer rate in twisted tape inserted co-axial heat exchanger.

COURSE OUTCOMES:

Upon completion of course student able to

1. Perform steady state experiments to understand the heat distribution for various geometries and materials under forced and free convection.
2. Estimate the heat transfer coefficients in forced convection, free convection and correlate with the theoretical values.
3. Compare parallel and counter flow heat exchanger performance characteristics.
4. Estimate heat transfer coefficients in condensation, boiling and effectiveness of heat pipe.
5. Test Emissivity, Stefan Boltzmann Constant and Critical Heat flux.

REFERENCE BOOKS:

1. C.P. Kothandaraman, Heat and Mass Transfer Data Book, New Age International Private Limited, 9th Edition, 2018.

III B.Tech. II - Semester

MEASUREMENTS & METROLOGY LAB

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:

- The Metrology and instrumentation Laboratory course is designed for measuring and gauging instruments for inspection of precision linear, geometric forms, angular and surface finish measurements.
- The student can learn the measurements with and calibration of instruments.
- They also understand the machine tool alignment test.
- Instrumentation lab introduces the students with the theory and methods for conducting experimental work in the laboratory and calibration of various instruments for measuring pressure, temperature, displacement, speed, vibration etc.

Note: The students have to conduct at least 8 experiments from each lab.

MEASUREMENTS LAB

1. Calibration of pressure gauge.
2. Study and calibration of thermistor.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge.
5. Calibration of thermocouple.
6. Study and calibration of capacitive transducer.
7. Study and calibration of photo and magnetic speed pickups.
8. Calibration of resistance temperature detector.
9. Study and calibration of a rotameter.
10. Study and use of a seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.

METROLOGY LAB

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers, vernier height guage.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Angle and taper measurements with bevel protractor, Sine bar, rollers and balls.
4. Thread inspection of pitch, depth, angle bytool maker's microscope.
5. Use of gear tooth vernier caliper for tooth thickness inspection and flange micro meter for checking the chordal thickness of spur gear.
6. Use of spirit level in finding the straightness of a bed and flatness of a surface.
7. Surface roughness measurement with roughness measuring instrument.
8. Machine tool alignment test on the lathe.
9. Machine tool alignment test on drilling machine.
10. Machine tool alignment test on milling machine.

COURSE OUTCOMES:

Measurements Lab:

Students will be able to select proper measuring instrument and know requirement of calibration, errors in measurement etc. They can perform accurate measurements.

Metrology Lab:

Student will become familiar with the different instruments that are available for linear, angular, roundness and roughness measurements they will be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc).

III B.Tech. II - Semester

PROGRAMMING FOR MECHANICAL SYSTEMS

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- Understand the components and their working of different robot configurations.
- Understand the functioning of grippers, sensors and actuators.
- Apply the concepts of robot kinematics, Dynamics, Trajectory planning.
- Evaluate how the robotic arm motion can be described.
- To give exposure to software tools needed to analyse engineering problems and expose to different applications of simulation and analysis tools.

Syllabus

A. ROBOT PROGRAMMING

1. **Classification of Robots –** based coordinate system and control system, Evaluating work space of Robots.
2. **End arm Tooling, Actuators and Sensors** – Different types of end effectors like Grippers- Mechanical, vacuum, Magnetic etc. Tools – Different processing tools like machining, welding, spray painting etc. Actuators – Hydraulic, Pneumatic and Electrical. Sensors – Position, Velocity and Force.
3. **Robot Kinematics and Dynamics** – D-H Notation for 4 DOF Robots and Jacobian matrix formulation. Steps in Trajectory planning.
4. **Robot Programming** – Introduction to Igus Robolink Technology and Igus Robot Control (IRC) simulation software and Programming different industrial tasks.

B. SIMULATION

1. MATLAB basics, dealing with matrices, Graphing-Functions of one variable and two variables.
2. Loop operations in MATLAB.
3. Use of MATLAB to solve differential and partial differential equations by using pre-defined functions and numerical methods.
4. Mechanism Simulation using the MATLAB.

LIST OF EXPERIMENTS:

Any 10 experiments from the following list of experiments.

PART A

1. Robot programming and simulation for picking and placing the object using manual mode.

2. Pick and placing the object programming mode with Igus Robot Control software.
3. Pick and placing objects using loop counting with Igus Robot Control software.
4. Robot programming and simulation for machining of different profiles with Igus Robot Control software.
5. Program for Pick (Matrix) and Place (Stack) operation with Igus Robot Control software.
6. Program for Pick (Stack) and place (Matrix) operation with Igus Robot Control software.
7. Program for Machine tool loading/Unloading operation with Igus Robot Control software.

PART B

8. Drawing ellipse using MATLAB script.
9. Write a program for bisection method in MATLAB.
10. Writing program for Newton Rapson method.
11. Write a programme to solve differential equation.
12. Write a programme for the position analysis of a slider crank mechanism.
13. Write a Program for Forward kinematics of Robotics arm manipulator.
14. Write a Program for four bar mechanism simulation.

COURSE OUTCOMES:

Upon the completion of this course, the students will be able to

1. Carry out kinematic and dynamic analysis for simple serial kinematic chains.
2. Select appropriate grippers, actuators and sensors for a robot based on specific application.
3. Perform trajectory planning for a manipulator by avoiding obstacles and develop programming principles, languages for a robot control system.
4. Apply various numerical tools to solving the problems.
5. Simulate the working principle of mechanisms using MATLAB.

TEXT BOOKS:

1. RK Mittal and I J Nagrath, Robotics and Control, McGraw Hill Education, 2017.
2. Rudra Pratap, Getting started with MATLAB, Oxford University Press, 7th Edition, 2019.

III B.Tech II - Semester

INTELLECTUAL PROPERTY RIGHTS & PATENTS

L	T	P	C
2	0	0	0

COURSE OBJECTIVES:

1. This course seeks to equip students with a broad understanding of the intellectual property rights system.
2. To analyze intellectual property issues in the context of environmental, economic and social development.
3. This includes an introduction to the conceptual foundations for intellectual property protection and the basic relevant treaties in the field.

UNIT I

Introduction to Intellectual Property Law – Intellectual Property Law Basics - Types of Intellectual Property – Agencies Responsible for Intellectual Property Registration – Infringement – Over use or Misuse of Intellectual Property Rights.

UNIT II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Right to prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration– Infringement of Copyright.

UNIT III

Introduction to Patent Law – Rights and Limitations – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation –International Patent Law – New developments in Patent Law.

UNIT IV

Introduction to Trade Mark – Trade Mark Registration Process – Trade Mark maintenance – Transfer of rights – Infringement – Dilution of Ownership of Trade Mark – Trade Mark claims and Litigation –International Trade Mark Law.

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security– Employee Access Limitation – Employee Confidentiality Agreement –Trade Secret Law – Trade Secret Litigation – Breach of Contract.

UNIT V

Introduction to Cyber Law – Information Technology Act - Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy – International aspects of Computer and Online Crime.

COURSE OUTCOMES:

1. Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.
2. Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.
3. Identify activities and constitute IP infringements and the remedies available to the IP owner and describe the precautious steps to be taken to prevent infringement of proprietary rights in products and technology development.
4. Be able to anticipate and subject to critical analysis arguments relating to the development and reform of intellectual property right institutions and their likely impact on creativity and innovation.

TEXT BOOKS:

1. Deborah E. Bouchoux, Intellectual Property, Cengage learning, 2012.
2. Kompal Bansal & Parishit Bansal, Fundamentals of IPR for Engineers, 1st Edition, BS Publications, 2014.

REFERENCE BOOKS:

1. Cyber Law. Texts & Cases, South-Western's Special Topics Collections, 3rd Edition, 2011.
2. Prabhuddha Ganguli, Intellectual Property Rights, Tata Mc-Graw –Hill, 2001.
3. Richard Stim, Intellectual Property, 2nd Edition, Cengage Learning, 2012.
4. R. Radha Krishnan, S. Balasubramanian, Intellectual Property Rights, 1st Edition, Excel Books, 2008.

IV B.Tech. I - Semester

OPERATIONS RESEARCH
(PROFESSIONAL ELECTIVE - III)

L	T	P	C
3	0	0	3

Prerequisite:

1. Knowledge of mathematics at high school level.
2. Knowledge of probability distributions and statistics, and preferably basic calculus, for learning Simulation.

COURSE OBJECTIVES:

- Understand the theoretical workings of the simplex method for linear programming.
- Solve specialized linear programming problems like the transportation and assignment problems.
- Understand the sequencing and replacement applications in engineering.
- Understand the importance of game theory and waiting lines models.
- Understand how to model and solve problems using network analysis.
- Understand the applications of basic methods form and challenges in inventory.

UNIT I

Introduction to Operations Research: Definition of Operations Research, Characteristics and phases of Operations Research, Scope of Operations Research, Operations Research Models, General Methods for Solving Operations Research Models.

Linear Programming: Mathematical Formulation, Graphical solution, Simplex method, artificial variables techniques- Big M method.

UNIT II

Transportation Problems: Mathematical Formulation, Balanced and unbalanced transportation problem, optimal solution - MODI Method, Degeneracy in Transportation problems.

Assignment problem: Mathematical Formulation, Optimal solution, Balanced and unbalanced Assignment problem, Traveling Salesman problem.

UNIT III

Replacement: Introduction, Replacement of items that deteriorate with time, when money value is not counted and counted — Replacement of items that fail completely- Group Replacement.

Job Sequencing — Introduction, Johnson’s Algorithm for n jobs through two machines, n jobs through three machines.

UNIT IV

Theory of Games: Introduction, Terminology, Solution of games with saddle points and without saddle points- 2 x 2 games, Dominance principle to reduce size of game, m x 2 & 2 x n games - graphical method.

Queuing Models: Structure of queuing models, characteristics of Queuing process, Kendall's notation, Single channel systems - (M/M/1:∞/FIFO) model and (M/M/1: N/FIFO) model.

UNIT V

Network Analysis: Introduction, Project Scheduling by CPM and PERT, Network diagram representation, rules for drawing network diagram, Labeling by Fulkerson's rule, Network calculations - EST, EFT, LST, LFT, Float/Slack and critical path, PERT calculations.

Inventory Models: Definition of inventory, costs associated with inventory problems, classification of inventory models, Deterministic inventory models - EOQ model without and with shortages, Production inventory model without and with shortages, Inventory models with price - breaks.

COURSE OUTCOMES:

Students will be able to:

1. Identify and formulate LP problems using various methods for maximization and minimization problems.
2. Apply mathematical techniques in different application areas of operations research like transportation, assignment models.
3. Apply process sequencing and machine replacement of engineering problems.
4. Apply the principles of Game theory and waiting lines to real world Competitive situations.
5. Apply the techniques of Critical Path Method and PERT in project management and quantitative analysis of Inventory.

TEXT BOOKS:

1. S.D. Sharma, Operations Research (Theory Methods & Applications), Kedarnadh & Ramnadh & Co., Meerut, Rev Edition, 2014.
2. Premkumar Gupta and Hira, Operation Research, S Chand Company Ltd., 3rd Edition, 2012.

REFERENCE BOOKS:

1. Handy, A. Taha, Operations Research, Prentice Hall of India, 9th Edition, 2011.
2. Philip and Ravindran, Operational Research‖, John Wiley, 2nd Edition, 2011.

IV B.Tech. I - Semester

MECHATRONICS
(PROFESSIONAL ELECTIVE- III)

L	T	P	C
3	0	0	3

PREREQUISITES: Basics in mechanics, mechanisms, electronics and programming.

COURSE OBJECTIVES:

- Understand key elements of Mechatronics system, representation into block diagram.
- Understand principles of sensors, its characteristics, interfacing with microcontroller.
- Understand the concept of PLC and microcontroller.
- Understand concept of ladder programming in PLC and microcontroller.
- Understand concept of Data Acquisition Systems and its role in Mechatronics.

UNIT I

Mechatronics systems – Elements & levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion, force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT II

Solid state electronic devices - PN junction diode, BJT, FET, DIAC, TRIAC and LEDs. Analog signal conditioning, operational amplifiers, noise reduction, filtering.

UNIT III

Actuating systems - Hydraulic and pneumatic actuating systems - Fluid systems, Hydraulic systems, and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems. Mechanical actuating systems and electrical actuating systems – basic principles and elements.

Control systems - Digital electronics and systems, digital logic control, microprocessors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT IV

System and interfacing and data acquisition – Data Acquisition Systems, Analog to Digital and Digital to Analog conversions; Digital Signal Processing – data flow in DSPs, block diagrams, typical layouts, Interfacing motor drives.

UNIT V

Dynamic models and analogies - System response. Process Controllers – Digital Controllers, Programmable Logic Controllers, Design of mechatronics systems & future trends.

COURSE OUTCOMES:

Students will be able to:

1. Identify key elements of mechatronics system and its representation in terms of block diagram.
2. Understand working of solid-state electronic devices and apply knowledge of the concept of signal processing and signal conditioning.
3. Analyse the requirements for a given industrial process and select the most appropriate Actuators, sensors, design control systems according to applications.
4. Understand the concept of DQA, signal processing and use of interfacing systems such as ADC, DAC, digital I/O.
5. Development of PLC Ladder programming for given applications.

TEXT BOOKS:

1. KP Ramachandran, GK Vijaya Raghavan & MS Balasundaram, MECHATRONICS Integrated Mechanical Electronics Systems, WILEY, 1st Edition, 2008.
2. Newton C Braga, Mechatronics Source Book, Thomson Publications, 1st Edition, 2002.

REFERENCES BOOKS:

1. W. Bolton, Mechatronics, Electronic Control Systems in Mechanical and Electrical Engg., Pearson, 4th Edition, 2012.
2. Godfrey C. Onwubolu, Mechatronics – Principles and Application, Elsevier, 1st Edition, 2005.

IV B.Tech. I - Semester

COMPUTATIONAL FLUID DYNAMICS
(PROFESSIONAL ELECTIVES - III)

L	T	P	C
3	0	0	3

PRE-REQUISITES: Fluid Mechanics and Hydraulic Machines.

Course Objective: The course aims at providing required numerical and software techniques for solving various engineering problems involving fluid flow and heat transfer applications.

UNIT I

Introduction Computational Fluid Dynamics as a Research and Design Tool, Applications of Computational Fluid Dynamics.
Governing Equations of Fluid Dynamics: Introduction, Control Volume, Substantial Derivative, Divergence of Velocity, Continuity Equation, Momentum Equation and Energy Equation, Conservation and Non-conservation forms of governing flow equations.

UNIT II

Mathematical Behavior of Partial Differential Equations

Introduction, Classification of Quasi-Linear Partial Differential Equations, Eigen Value Method, Hyperbolic Equations, Parabolic Equations, Elliptic Equations.

UNIT III

Basics Aspects of Discretization

Introduction, Introduction of Finite Differences, Difference Equations, Explicit and Implicit Approaches, Errors and Stability Analysis, Grid Generation.

UNIT IV

Incompressible Fluid Flow:

Introduction, Implicit Crank-Nicholson Technique, Pressure Correction Method, Computation of Boundary Layer Flows.

UNIT V

Heat Transfer

Finite Difference Applications in Heat conduction and Convention, Heat conduction - steady heat conduction in a rectangular geometry, transient heat conduction in a plane wall, Two-Dimensional transient heat conduction, Finite difference application in convective heat transfer.

COURSE OUTCOMES:

At the end of the course, student will be able to:

1. Formulate the basic fluid dynamics problem mathematically.
2. Analyze the mathematical behaviour of partial differential equations Solve computational problems related to fluid flows and heat transfer.
3. Apply the grid generation principles for different problems.
4. Solve elementary incompressible fluid problems using the CFD techniques.
5. Solve the elementary heat transfer problems using the CFD techniques.

TEXT BOOKS:

1. Anderson, J.D. (Jr), Computational Fluid Dynamics, McGraw-Hill, 6th Edition, 2017.
2. Hoffman, K.A., and Chiang, S.T., Computational Fluid Dynamics, Vol. I,
3. Engineering Education System, 4th Edition, 2000.

REFERENCE BOOKS:

1. Chung, T.J., Computational Fluid Dynamics, Cambridge University Press, 2nd Edition, 2010.
2. Anderson, D.A., Tannehill, J.C., and Pletcher, R.H., Computational Fluid Mechanics and Heat Transfer, McGraw Hill, 3rd Edition, 2012.

IV B.Tech. I - Semester

PRODUCTION PLANNING AND CONTROL
(PROFESSIONAL ELECTIVE - III)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The students will acquire the knowledge:

- To understand the different types of production systems and the internal organization of productionplanning and control.
- To estimate forecasts in the manufacturing and service sectors using selected quantitative andqualitative techniques.
- To understands the importance and function of inventory and to be able to apply for its control andmanagement.
- To apply routing procedures and differentiate schedule and loading and interpret scheduling policiesand aggregate planning.
- To understand dispatching procedure and applications of computers in production planning andcontrol.

UNIT I

Introduction: Definition – objectives and functions of production planning and control – elements of production control – types of production – organization of production planning and control department – internal organization of department.

UNIT II

Forecasting – Importance of forecasting –types of forecasting, their uses – general principles offorecasting – forecasting techniques – qualitative methods and quantitative methods.

UNIT III

Inventory management – functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems Introduction to MRP I, MRP II, ERP, LOB (Line of Balance), JIT and KANBAN system.

UNIT IV

Routing – Definition – Routing procedure –Route sheets – Bill of material – Factors affecting routing procedure. Schedule – definition, Scheduling Policies – Techniques, Standard scheduling methods. Implement various scheduling techniques to schedule shop floor activities of the industry.

Introduction to Aggregate planning, Chase planning and Expediting.

UNIT V

Dispatching – activities of dispatcher – dispatching procedure – follow up – definition – reason for existence of functions – types of follow up, applications of computer in production planning and control.

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to:

1. Understand the different types of production systems and the internal organization of productionplanning and control.
2. Identify forecasts in the manufacturing and service sectors using selected quantitative and qualitativetechniques.
3. Understands the importance and function of inventory and to be able to apply for its control andmanagement.
4. Apply routing procedures and Implement various scheduling techniques, policies andaggregate planning.
5. Interpret dispatching procedure and applications of computers in production planning and control.

TEXT BOOKS:

1. Samuel Eilon, Elements of Production Planning and Control, Universal Book Corp. Rev Edition, 2015.
2. Partik Jonsson Stig-Arne Mattsson, Manufacturing, Planning and Control, Tata McGraw Hill, 2009.

REFERENCE BOOKS:

1. Martin K. Starr and David W. Miller, Inventory Control Theory and Practice, Prentice-Hall, 1st Edition, 1962.
2. Shailendra Kale, Production and Operations Management, McGraw Hill, 1st Edition, 2017.

IV B.Tech. I-Semester

ADVANCED MACHINE DESIGN
(PROFESSIONAL ELECTIVE - IV)

L	T	P	C
3	0	0	3

Prerequisite: Design of Machine Members

COURSE OBJECTIVES:

1. Understand the overview of different types of gears and their applications, force analysis, friction in worm gears etc.
2. Understand different types of bearing and their design.
3. Understand stresses in curved beams, expression for radius of neutral axis for rectangular, circular, trapezoidal and T-section.

UNIT I

Spur gear design: Spur gears, Load concentration factor, Dynamic load factor-Surface compressive strength, Bending strength, Design analysis of spur gears, Estimation of centre Distance, Module and face width, check for plastic deformation. Check for dynamic and wear considerations.

UNIT II

Helical and bevel gear drives: Helical and Bevel gears, Load concentration factor, Dynamic load factor, Surface compressive strength, Bending strength, Design analysis of Helical and Bevel Gears, Estimation of centre distance, module and face width, check for plastic deformation. Check for dynamics and wear Considerations.

UNIT III

Sliding contact bearings: Types of journal bearings, basic modes of Lubrication, Bearing construction–bearing design, bearing materials, selection of lubricants.

Rolling contact bearings: Types of rolling contact bearings- selection of bearing type selection of bearing life, design for cyclic loads and speeds- Static and dynamic loading of ball & roller bearings.

UNIT IV

Curved Beams: Introduction to design, stresses in curved beams, expression for radius of neutral axis for rectangular, circular, trapezoidal and t-section, design of crane hooks, c –clamps.

UNIT V

Design of power screws: Design of screw, Square, ACME, Buttress screws, design of nut, Compound screw, differential screw, ball screw – possible failures.

Design of worm gears: Worm gears, Properties of worm gears, Selection of materials, Strength and wear rating of worm gears, Force analysis, Friction in worm gears, thermal considerations.

COURSE OUTCOMES:

Students will be able to Understand and apply principles of gear design to spur gears and industrial spur gear boxes.

1. Become proficient in design of spur, helical and bevel gear.
2. Develop capability to analyse rolling contact bearing & sliding contact bearing and its selection from manufacturer's catalogue in industrial applications.
3. Inculcate an ability to design curved beams by analysis.
4. Design of power screws and worm gears under strength and wear considerations.

TEXT BOOKS:

1. Joseph E. Shigley, Mechanical Engineering Design, McGraw Hill, 7th Edition, 2016.
2. Pandya and Shah, Machine Design, Charotar, 20th Edition, 2015.

REFERENCE BOOKS:

1. V. B. Bandari, Machine Design, TMH Publishers, 5th Edition, 2020.
2. Timothy H, Wenzell, Machine Design, Cengage Learning,1st Edition, 2004.
3. R. L. Norton, Machine Design, McGraw Hill, 5th Edition, 2013.

DATA BOOK:

1. Mahadevan, Design Data Book- P.S.G. College of Technology, CBS, 2020.
2. S. Md. Jalaudeen, Design Data Handbook, Anuradha Publications, Edition: enlarged, 2016.

IV B.Tech. I - Semester

CAD/CAM
(PROFESSIONAL ELECTIVE - IV)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The Students will acquire the knowledge

1. To understand the basic fundamentals of computer aided design and manufacturing.
2. To learn 2D & 3D transformations of the basic entities like line, circle, ellipse etc.
3. To understand the different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication.
4. To learn the part programming, importance of group technology, computer aided process planning, computer aided quality control.
5. To learn the overall configuration and elements of computer integrated manufacturing systems.

UNIT I

INTRODUCTION: Computers in industrial manufacturing, product cycle, CAD / CAM Hardware, basic structure, CPU, memory types, input devices, display devices, hard copy devices, storage devices.

COMPUTER GRAPHICS: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hiddensurface removal.

UNIT II

GEOMETRIC MODELING: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

DRAFTING AND MODELING SYSTEMS: Basic geometric commands, layers, display controlcommands, editing, dimensioning, and solid modelling.

UNIT III

PART PROGRAMMING FOR NC MACHINES: NC, NC modes, NC elements, CNC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming. Direct Numerical Control, Adaptive Control.

UNIT IV

GROUP TECHNOLOGY: Part family, coding and classification, production flow analysis, types and advantages. Computer aided processes planning – importance, types. FMS-Introduction, Equipment, Tool management systems, Layouts, FMS Control.

UNIT V

COMPUTER AIDED QUALITY CONTROL: Terminology used in quality control, use of computers in Quality control. Inspection methods- contact and noncontact types, computer aided testing, integration of CAQC with CAD/CAM.

COMPUTER INTEGRATED MANUFACTURING SYSTEMS: Types of manufacturing systems, machine tools and related equipment, material handling systems, material requirement planning, computer control systems, human labor in manufacturing systems, CIMS benefits.

COURSE OUTCOMES:

At the end of the course the students shall be able to:

1. Understand the basic fundamentals of computers in industrial manufacturing and applications of computergraphics.
2. Interpret geometric modeling techniques and requirements.
3. Develop part programming for NC and CNC machines.
4. Illustrate the concepts of group technology and computer aided process planning for the productdevelopment.
5. Understand the concepts of computer aided quality control and Computer Integrated ManufacturingSystems.

TEXT BOOKS:

1. A Zimmers & P Groover, CAD / CAM, PE/PHI, 1st Edition, 1984.
2. Groover, Automation, Production systems & Computer integrated Manufacturing, Pearson Education, 4th Edition, 2016.

REFERENCE BOOKS:

1. Ibrahim Zeid, R Sivasubramanian, CAD/CAM: Theory and Practice, McGraw Hill, 2nd Edition, 2009.
2. Rogers and Adams, Mathematical Elements for Computer Graphics, McGraw Hill, 2nd Edition, 2017.

IV B. Tech. I - Semester

ADVANCED MATERIALS (PROFESSIONAL ELECTIVE - IV)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Gain knowledge regarding various classes of advanced materials and its importance.
- Identify various classes of the composites, their properties and applications.
- Understanding various manufacturing process in composite preparation.
- Learn the basic concepts of micro mechanical properties of composite laminates.
- Familiarize the concept of functional graded material and their applications.
- Distinguish various classes of smart materials and their physical properties.
- Expose the concept of nano-material properties and its applications.

UNIT I

Introduction To Composite Materials: Introduction, constituents of composites, Classification: Matrix materials, Functions of a Matrix, Desired Properties of a Matrix, PMC, MMC, CMC, Fiber reinforced composites and nature made composites and its applications.

Reinforcements/Fibers: Role and Selection or reinforcement materials, different types of fibres (Glass, Silica, Carbon, Aramid, Kevlar, Alumina, Boron, Silicon carbide, Quartz, Silica fibers), Mechanical properties of fibres.

UNIT II

Polymer composites, thermoplastics, thermosetting plastics**, Fiber Reinforced Plastic Processing:** Curing and gel time, fabricating process, prepregs, layup techniques, open and closed mould process, structural laminate bag molding, production procedures for bag molding, autoclave molding, injection molding, filament winding, resin transfer molding, pultrusion.

UNIT III

Metal Matrix Composites: Reinforcement materials, types, characteristics and selection base metals selection. Need for production MMC’s and its application.

Fabrication Process For MMC’s: Solid state processing, liquid state processing, In-situ processing, special fabrication techniques.

UNIT IV

Micro Mechanical Analysis of a Lamina: Introduction, Evaluation of the four elastic moduli by Rule of mixture, Numerical problems.

Macro Mechanics of a Lamina: Hooke's law for different types of materials, Number of elastic constants, Two - dimensional relationship of compliance and stiffness matrix.

UNIT V

Functionally Graded Materials: Types of functionally graded materials-classification different systems-preparation-properties and applications of functionally graded materials.

Smart Materials: Introduction, classification, **shape memory alloys:** Introduction-shape memory effect-classification of shape memory alloys composition- properties and applications of shape memory alloys.

Nano Materials: Introduction to nano-materials, Properties (Mechanical, Electrical, Optical and magnetic). Synthesis of nonmaterial (Top-Down and Bottom up, Ball milling, CVD, PVD) applications of nano materials.

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to:

1. Classify composites, Properties of constituents and their suitability for the structural applications.
2. Acquire knowledge on polymer composites and manufacturing of PMC, MMC & CCC.
3. Select the appropriate technique for manufacture of fiber-reinforced composite products.
4. Relate the compliance and stiffness matrix to engineering elastic constants of an orthotropic lamina.
5. Get insight into Functionally graded materials, Shape memory alloys and Nano materials.

TEXT BOOKS:

1. Autar K. Kaw, Mechanics of composite materials, CRC Press, 2nd Edition, 2005.
2. A.K. Bandyopadyay, Nano material, New age Publishers, 1st Edition, 2009.

REFERENCE BOOKS:

1. Mechanics of Composite Materials and Structures, Madhujit Mukhopadhyay, University Press 2009.
2. R. M. Jones, Mechanics of Composite Materials, McGraw Hill Company, New York, 1975.
3. B. D. Agarwal and L. J. Broutman, Analysis and performance of fiber Composites, Wiley- nterscience, New York, 1980.

IV B.Tech. I - Semester

AUTOMATION IN MANUFACTURING
(PROFESSIONAL ELECTIVE - IV)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To understands the types and strategies and various components in Automated Systems.
2. To classify the types of automated flow lines and analyze automated flow lines.
3. To solve the line balancing problems in the various flow line systems with and without buffer storage.
4. To interpret different automated material handling systems, storage and retrieval systems and automated inspection systems.
5. To understand the principles of Adaptive Control systems and recognize the types of automated inspection techniques and their applications.

UNIT I

INTRODUCTION: Types and strategies of automation, pneumatic and hydraulic components, circuits, automation in machine tools, mechanical feeding and tool changing and machine tool control.

UNIT II

AUTOMATED FLOW LINES: Methods of part transport, transfer mechanism, buffer storage, control function, design and fabrication considerations. Analysis of automated flow lines - General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

UNIT III

ASSEMBLY SYSTEM AND LINE BALANCING: Assembly process and systems, assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT IV

AUTOMATED MATERIAL HANDLING and STORAGE SYSTEMS: Types of equipment, functions, analysis and design of material handling systems, conveyor systems and automated guided vehicle systems. Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT V

AUTOMATED INSPECTION: Fundamentals, types of inspection methods and equipment, Coordinate Measuring Machines, Machine Vision.

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to:

1. Understands the types and strategies and various components in Automated Systems.
2. Classify the types of automated flow lines and analyze automated flow lines.
3. Solve the line balancing problems in the various flow line systems with and without buffer storage.
4. Interpret different automated material handling systems, storage and retrieval systems and automatedinspection systems.
5. Understand and recognize the types of automated inspection techniques and their applications.

TEXT BOOKS:

1. M.P. Groover, Automation, Production Systems and Computer Integrated Manufacturing, PE/PHI, 4th Edition, 2016.
2. Geoffrey Boothroyd, Assembly Automation and Product Design, Taylor and Francis, 2nd Edition, 2005.

REFERENCE BOOKS:

1. Morris, S.Brian, Automated Manufacturing Systems, McGraw Hill, 1st Edition, 1994.
2. Radhakrishnan, CAD / CAM/ CIM, New age publishers, 1st Edition, 2007.

IV B. Tech. I - Semester

POWER PLANT ENGINEERING
(PROFESSIONAL ELECTIVE - V)

L	T	P	C
3	0	0	3

Prerequisite: Applied Thermodynamics, Fluid Mechanics & Hydraulic Machines, Internal Combustion Engines and Gas Turbines.

COURSE OBJECTIVES:

- To acquire the knowledge of power generation from steam power plant and to list different types of fuels used in power plants.
- To describe basic working principles of gas turbine and diesel engine power plants.
- To learn the basic concepts in supercritical and ultra-supercritical power plants.
- To learn basic concepts of hydroelectric power plants and working of different hydroelectric power plants and list the principal components and types of nuclear reactors.
- Define terms and factors associated with power plant economics and discussing environmental aspects of power plant operation.

UNIT I

Concept of Power Plants, Classification of Power Plants, Introduction to the Sources of Energy – Resources and Development of Power in India.

Steam Power Plant: Plant Layout, Working of different circuits, Fuel handling equipment- coal handling-choice of handling equipment, coal storage-Ash handling systems.

Combustion Process: Types of coals-Properties of coal**,** overfeed and under feed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components.

UNIT II

Internal Combustion and Gas Turbine Power Plants:

Diesel Power Plant: Introduction**,** Plant layout with auxiliaries**,** fuel supply system, air starting equipment, lubrication and cooling system, super charging.

Gas Turbine Plant: Introduction**,** Classification, Layout with auxiliaries**,** Principles of working of closed and open cycle gas turbines, Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III

Supercritical power plant: Super critical power plant, Super Critical Boilers, FBC Boilers.

Evolution Toward Advanced Ultra-supercritical Thermal Power Plant: Ultra-supercritical Thermal Power Plant, Modification and Developments in Modern Efficient Boilers, Features of Modern Boilers, Tower Type and Two-Pass Type : Optimized Combustion System, Tangential Firing System, Twin Vortex (Tangential) Firing.

UNIT IV

Hydroelectric Power Plant: Selection of site - General layout of the plant, classification, low, medium and high head plants pumped storage plants, Typical layouts, plant auxiliaries, plant operation- spill ways.

Nuclear power plant: Nuclear fuel**,** breeding and fertile materials**,** reactor operation, types of reactors-Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast breeder Reactor, Homogeneous Reactor, Gas cooled Reactor-Radiation hazards and shielding – radioactive waste disposal.

UNIT V

Power plant economics and environmental considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor-related exercises. Effluents from power plants and Impact on environment, pollutants and pollution standards, Methods of Pollution control.

COURSE OUTCOMES:

At the end of course:

1. Student able to understand working of different circuits and combustion processes in steam power plants.
2. Student able to Identify elements in a layout and know their functions of steam, diesel, gas, hydro, nuclear and power plants.
3. Student able to get the knowledge in advancements in supercritical and ultra-supercritical power plant systems.
4. Student able to describe the working principle and reactor operations of the nuclear power plant and their impact on environment.
5. Student able to determine performance of power plants based on load variations and know the pollutant, impacts & pollution standards.

TEXT BOOKS:

1. S.C. Arora and S. Domkundwar, A Course in Power Plant Engineering, DhanpatRai & Sons, 8^{th} Edition, 2016.

2. P. K. Nag, Power Plant Engineering, Tata McGraw-Hill, 4th Edition, 2017.
3. Swapan Basu and Ajay Kumar Debnath, Power Plant Instrumentation and Control Handbook A Guide to Thermal Power Plants, Academic press, 2nd Edition, 2019.

REFERENCE BOOKS:

1. R.K. Rajput, A Text Book of Power Plant Engineering, Laxmi Publications, 5th Edition, 2016.
2. P.C.Sharma, Power Plant Engineering, S. K. Kataria & Son, 9th Edition, 2013.

IV B. Tech. I - Semester

NON - DESTRUCTIVE EVALUATION (PROFESSIONAL ELECTIVE - V)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To impart the significance of non-destructive testing in assuring quality control in engineering components.
- The students will be exposed to the concepts of various NDE techniques using radiography, ultrasonics, liquid penetrates, thermography, magnetic and eddy currents.
- Impart knowledge on various special NDT methods and their applications.

UNIT I

Introduction to non-destructive testing,

Radiographic test: Sources of X and Gamma Rays and Radiographic imaging, Radiographic equipment, Inspection Techniques, Advantages and limitations Screen and Filters, Safety Aspects of Industrial Radiography.

UNIT II

Ultrasonic Testing: Basic properties of sound beam, Piezo-electric Effect , Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing methods, calibration standards, Interpretations and guidelines for acceptance/rejection, Applications, advantages and limitations.

UNIT III

Liquid Penetrant Test: Basic principle of dye penetrant testing, types of dyes and developers, Liquid Penetrant testing procedure, Examination, Interpretation and Evaluation, advantages, limitations and applications.

Eddy Current Test: Principle of Eddy Current testing, factors effecting eddy current testing, Eddy Current Test System, Applications of Eddy Current Testing, advantages and limitations.

UNIT IV

Magnetic Particle Test: Magnetic Materials, Magnetization of Materials, Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, advantages, limitations and its applications.

UNIT V

Thermography: Basic principle, Active and passive techniques, Lock in and pulse thermography, Contact and non contact thermal inspection methods– Heat sensitive paints and papers. IR imaging in aerospace applications and electronic components.

Industrial Applications of NDE: NDT in flaw analysis of castings and welded joints in various industries. Codes and standards widely used in non-destructive testing (NDT) techniques. National and international certifications.

COURSE OUTCOMES:

Upon the successful completion of the course the students will be able to

1. Understand the general principle of radiographic techniques to identifying surface and subsurface defects.
2. Identify the defects using ultrasonic techniques and how to interpret the results.
3. Determine the mechanical properties of a material using Liquid penetrant and Eddy current testing.
4. Understand the process of Magnetic particle testing in identifying defects in engineering materials.
5. Detect the defects and assess the life time of the components using non-destructive testing methods to prevent failures and accidents in the industries.

TEXT BOOKS:

1. J Prasad, G.C.K. Nair, Nondestructive test and evaluation of Materials, Tata McGraw-Hill Education, 2nd Edition, 2011.
2. Wong B Stephen, Non-Destructive Testing-Theory, Practice and Industrial Applications, Lambert Academic Publishing, 1st Edition, 2014.

REFERENCES BOOKS:

1. Ravi Prakash, Nondestructive Testing Techniques, New age international Publishers, 1st rev. Edition 2010.
2. X. P. V. Maldague, Nondestructive evaluation of materials by infrared thermography, Springer-Verlag, 1st Edition, 1993.

IV B. Tech. I - Semester

MECHANICAL VIBRATIONS
(PROFESSIONAL ELECTIVE - V)

L	T	P	C
3	0	0	3

Prerequisite: Dynamics of Machines

COURSE OBJECTIVES:

- Introduce the knowledge about vibrations and their applications.
- Propose the concept of single, double and multi degree freedom systems for un-damped and damped free vibrations.
- Study different types of forced vibrations and vibration measuring instruments.
- Formulate the differential equations of motion of vibratory systems.

UNIT I

Introduction Types of vibrations, Definitions, Simple Harmonic Motion (S.H.M.), Work done by harmonic force, Principle of super position applied to SHM, Beats, Fourier theorem and problems.

UNIT II

Un-damped (Single Degree of Freedom) Free Vibrations: Derivations for spring mass systems, Methods of Analysis, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and Problems.

Damped free vibrations (1DOF)

Types of damping, Analysis with viscous damping: Derivations for over, critical and under damped systems, Logarithmic decrement and Problems.

UNIT III

Forced Vibrations (1DOF): Introduction, Analysis of forced vibration with constant harmonic excitation - magnification factor, rotating and reciprocating unbalances, excitation of support (relative and absolute amplitudes), force and motion transmissibility, Energy dissipated due to damping and Problems.

UNIT IV

System with Multi degrees of Freedom: Principle modes of vibrations, Normal mode and natural frequencies of systems (without damping) – Simple spring mass systems, masses on tightly stretched strings, double pendulum, torsional systems, combined rectilinear and angular systems, geared systems and Problems. Un-damped dynamic vibration absorber and Problems.

UNIT V

Vibration Measuring Instruments and Whirling of shafts: Seismic Instruments

Vibrometers, Accelerometer, Frequency measuring instruments and Problems. Whirling of shafts with and without damping, discussion of speeds above and below critical speeds and Problems.

COURSE OUTCOMES:

At the end of course the students will be able to:

1. Apply principles of mechanical vibrations such as Newton's second law, and the principle of conservation of energy to the mathematical models to obtain their governing equations of motion.
2. Understand the causes and effects of vibration in mechanical systems. Understand the role of damping, stiffness and inertia in mechanical systems.
3. Analyse the vibrating systems and propose methods to reduce vibrations.
4. Solve vibration problems that contain multiple degrees of freedom.
5. Measure the parameters of vibrations in vibrating system.

TEXT BOOKS:

1. Groover G. K, Mechanical Vibrations, Nem Chand and Bros,8th Edition, 2018.
2. Meirovitch, Elements of Vibration Analysis, TMH, 2nd Edition, 2006.

REFERENCE BOOKS:

1. V.P. Singh, Mechanical Vibrations, DanapathiRai & Sons, 4th Edition, 2014.
2. SS Rao, Mechanical Vibrations, Pearson, 6th Edition, 2018.
3. Debabrata Nag, Mechanical Vibrations, Wiley, 3rd Edition, 2011.

IV B.Tech. I - Semester

ADDITIVE MANUFACTURING PROCESSES
(PROFESSIONAL ELECTIVE - V)

L	T	P	C
3	0	0	3

PREREQUISITES: Material Science and Metallurgy, Manufacturing Processes.

COURSE OBJECTIVES:

1. To understand the need of Rapid Manufacturing processes in various industries.
2. To acquire knowledge on various additive manufacturing processes.
3. To able to apply the concept of Additive Manufacturing for various applications through Rapid tooling.
4. To understand the softwares and data formats required in AM generic process.
5. To apply the concept of Reverse Engineering in product development using Additive manufacturing and its applications.

UNIT I

INTRODUCTION TO RAPID MANUFACTURING: Traditional Prototyping vs Rapid Prototyping (RP)**,** fundamentals of rapid prototyping, historical development, advantages and limitations of rapid prototyping, classification of RP process. Materials for AM.

SOLID-BASED RAPID PROTOTYPING SYSTEMS:

Fused deposition modelling (FDM) — models and specifications, working process, applications, advantages and disadvantages, case studies.

Laminated object manufacturing (LOM) — models and specifications, working process, applications, advantages and disadvantages, case studies.

UNIT II

LIQUID-BASED RAPID MANUFACTURING PROCESSES:

Stereo lithography Apparatus (SLA): models and specifications, working process, photo polymerization, applications, advantages and disadvantages, case studies.

Material Jetting (MJ): models and specifications, working process, applications, merits and demerits, case studies.

Solid Ground Curing (SGC): models and specifications, process physics, applications, advantages and disadvantages, case studies.

UNIT III

POWDER BASED RAPID MANUFACTURING PROCESSES: Selective laser sintering (SLS) & Electron Beam Melting (EBM): models and specifications, process physics, applications, advantages and disadvantages, case studies.

Three-dimensional printing (3DP): models and specifications, working process, applications, advantages and disadvantages, case studies.

UNIT IV

RAPID PROTOTYPING DATA FORMATS: STL Format, STL File Problems, and STL file Repairs: Newly Proposed Formats.

RAPID PROTOTYPING SOFTWARE'S: Features of various RP software's like Magics, Mimics.

RAPID TOOLING: Need for Rapid tooling, Conventional tooling vs Rapid tooling, classification of rapid tooling, direct and indirect tooling methods, spray metal deposition, RTV epoxy tools, investment casting, 3D Keltool process, direct AIM, DTM Rapid Tool Process, and Direct Metal Tooling using 3DP.

UNIT V

RAPID PROTOTYPING APPLICATIONS: Applications in engineering, aerospace industry, automotive industry, jewelry industry, architecture.

Medical and bioengineering Applications: planning and simulation of complex surgery, customized implants & prosthesis, design and production of medical devices.

REVERSE ENGINEERING (RE): Concept of RE in view of Rapid Manufacturing, selection of RE systems, RE in product development.

COURSE OUTCOMES:

Students will be able to:

1. Differentiate Additive Manufacturing with other manufacturing processes.
2. Understand different solid, liquid and powder-based RP systems and their applications.
3. Select a suitable AM technique to produce multiple material and colored objects.
4. Use various Softwares and data formats in Additive Manufacturing by 153n corporating Rapid tooling concept for a given application.
5. Apply the concept of Reverse Engineering for complex geometries to develop products using AM.

TEXT BOOKS:

1. Chua Chee Kai, Leong Kah Fai, 3D Printing and Additive Manufacturing: Principles & Applications, World Scientific, 4th Edition, 2015.
2. Rafiq Noorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 1st Edition, 2006.

REFERENCE BOOKS:

1. Ian Gibson, David W Rosen, Brent Stucker, Additive Manufacturing Technologies, Rapid Prototyping to Direct Digital Manufacturing, Springer, 2nd Edition, 2014.
2. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer, Rev. Edition, 2001.

IV B. Tech. I - Semester

MANAGERIAL ECONOMICS & MANAGEMENT SCIENCE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. The purpose of this course is to apply micro economic concepts and techniques in evaluating business decisions.
2. To familiarize with the process of management and to provide basic insight into management practices.

UNIT I

Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting.

UNIT II

Production and Cost Analysis: Concept of Production function- Cobb-Douglas Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts :opportunity costs, explicit and implicit costs- Fixed costs, Variable Costs and Total costs–Cost –Volume-Profit analysis-Determination of Breakeven point(simple problems)Managerial significance and limitations of Breakeven point.

UNIT III

Introduction to Markets & Pricing Policies: Market structures: Perfect competition, Monopoly and Monopolistic and oligopoly – Features -Price-Output Determination. Methods of Pricing- Limit Pricing, Market Skimming Pricing and Internet Pricing Models.

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital – Capitalization – Meaning of Capital budgeting — need for capital budgeting-Techniques of Capital budgeting – Traditional and Modern methods.

UNIT IV

Introduction to Management: Concept –nature and importance of Management –Functions of Management – Henry Fayol's 14 principles of management-F.W.Taylor Management Principles-Theories of Motivation – Decision making process—Types of Organizational structure.

UNIT V

Contemporary Management Practices: Basic concepts of MRP, Total Quality Management (TQM), Six sigma, Business process Re-engineering and Bench Marking, Balanced Score Card.

COURSE OUTCOMES:

1. Gain knowledge in basic economic tools in managerial economics and demand analysis.
2. Analyze the production, cost concepts of a firm.
3. Understand the relationship of pricing, markets and capital budgeting in big industries.
4. Students will acquire the knowledge on management functions.
5. To familiarize with the process of management and to provide basic insights into contemporary management practices.

REFERENCE BOOKS:

1. L. M. Prasad, Principles and Practice of Management, Sultan Chand & Sons, New Delhi, 2019.
2. Koontz & Weihrich, Essentials of management, TMH, 9th Edition, 2011.
3. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH, 2011.
4. Dr. A. R. Aryasri, Management Science, TMH, 4th Edition, 2008.

IV B.Tech. I - Semester

BUSINESS ENVIRONMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

Student should be able to outline how an entity operates in a business environment.

UNIT I

Business Environment: Importance at national and international level – problems and challenges– factors both internal and external influencing business environment, Industrial policies since independence and their significance.

UNIT II

Structure of Indian economy: Nature and significance – Economic systems – structure of Indian industry – nature – challenges – social justice –competition Act 2002.

Fiscal Policy: Nature and significance – public revenues – Critical analysis of the recent fiscal policy of Government of India.

UNIT III

India's Trade Policy: Nature–bilateral and multilateral trade agreements, International business environment: Nature – significance– challenges and mechanisms-Overview of IMF, WTO-disputes settlement mechanism – dumping and antidumping measures.

UNIT IV

Legal Frame: special features of the SICA (special provisions) 1985, BIFR, Consumer protection act 1986, Environmental laws (pertaining to the control and prevention of Air and Water pollution), the Essential Commodities Act 1955 & GST Act 2017.

UNIT V

Disinvestment mechanism: problems and procedures- new industrial policy 1991- NITI Ayog- Balance of Payments – Causes for disequilibrium in Balance of Payments – Correction measures.

COURSE OUTCOMES:

1. To understand the overall business environment and evaluate its various components in business decision making.
2. To improve the students ability in recognizing and managing legal risks in business decision making.
3. The course is designed to expose the student to the career fields in the area of business.

REFERENCES BOOKS:

1. Aswathappa K, Essentials of business environment, Himalaya Publishing House, New Delhi, 12th Edition, 2014.
2. Francis Cherunilam, Business Environment: Text & Cases, HPH, 25th Rev. Edition, 2017.
3. Veena Keshav Pailwar, Economic Environment of Business, PHI Learning, 2nd Edition, 2010.

IV B.Tech. I - Semester

FUNDAMENTALS OF ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

The objective of the course is to make students understand the fundamentals of entrepreneurship and make students to take their career in entrepreneurship.

UNIT I

Fundamentals of Entrepreneurship: Entrepreneurship; Entrepreneurial Traits, Types of Entrepreneurs; Evolution of Entrepreneurship; Myths of Entrepreneurship; Difference between Inventors & Entrepreneurs; Role of Entrepreneurship; Entrepreneurial Ethics & Social Responsibilities & Ease of doing business in India.

UNIT II

Creativity, Innovation& Start-Ups: Introduction; Creativity & Entrepreneurship; Components of Creativity; Characteristics of Creative People; Sources of New Ideas; Techniques for Generating Ideas. Innovation & the Entrepreneur: The innovation Process; Types of Innovation; Major Misconceptions of Innovation; Principles of Innovation.

Start-Ups: Start-Ups; Types of Start-Ups; Start-Ups in India; start-Ups failures & reasons; Managing start-Ups during down turn.

UNIT III

Legal Aspects of Business: Procedures for setting up a Business in India; Legal Aspects governing businesses in India-IP law, labor law, safety law, contract law, corporate law & taxation law.

UNIT IV

Business Plan: Business plan; Drivers of Business plan; Basics of Business plan; Reasons for Failure of Business plans; Growth strategies for Ventures: Franchising, Licensing, Joint Ventures, Mergers & Acquisitions.

UNIT V

Institutions that facilitate Entrepreneurship & Entrepreneurship Development: National Institute for MSME, NIESBUD; Ministry of MSME; EDI; National Entrepreneurship Network (NEN); National science & Technology Entrepreneurship Development Board (NSTEDB); ISB: Wadhwani Centre for Entrepreneurship Development (WCED).

COURSE OUTCOMES:

1. Understand the concept and importance of entrepreneurship.
2. Know the various means of generating business ideas.
3. Know the various legal aspects involved in forming the business.

4. Able to write a business plan.
5. Know the role of Government and Various Agencies in promoting entrepreneurship.

REFERENCE BOOKS:

1. Arya Kumar, Entrepreneurship, Pearson, Publishing House, 1^{st} Edition, 2012.
2. T V Rao, D F Kuratko, Entrepreneurship A South-Asian Perspective, Cengage Learning, New Delhi, 1^{st} Edition, 2012.
3. Rajeev Roy, Entrepreneurship, Oxford University Press, New Delhi, 2^{nd} Edition, 2012.

IV B.Tech. I - Semester

MECHATRONICS LAB

L	T	P	C
0	0	4	2

COURSE OBJECTIVE:

- To get basic knowledge on Mechatronic systems, elements and measurement using sensors.
- To create simple Pneumatic and hydraulic circuits.
- To control different systems using PLCs and Ladder coding.

List of Experiments

1. DYNA 1750 Transducers Kit bb:-
   a. Characteristics of LVDT.
   b. Principle & Characteristics of Strain Gauge.
   c. Characteristics of Summing Amplifier.
   d. Characteristics of Reflective Opto Transducer.

2. PLC PROGRAMMING
   a. Ladder programming on Logic gates, Timers & counters.
   b. Ladder Programming for digital & Analogy sensors.
   c. Ladder programming for Traffic Light control, Water level control and Lift control Modules.

3. AUTOMATION STUDIO software
   a. Introduction to Automation studio & its control.
   b. Draw & Simulate the Hydraulic circuit for series & parallel cylinders connection.
   c. Draw & Simulate Meter-in, Meter-out and hydraulic press and clamping.

4. MATLAB Programming
   a. Sample programmes on Matlab.
   b. Simulation and analysis of PID.

COURSE OUTCOMES:

Upon completion of the course students will able to:

1. Understand various types of sensors and transducers and their applications in measurement.

2. Apply concepts of amplification and able to perform various operations on operational amplifier.
3. Apply PLC programming for various applications.
4. Analyze and create different Hydraulic and Pneumatic circuits.
5. Perform basic simulation and calculations on different mechatronic systems.

IV B. Tech. II - Semester

PROJECT WORK

L	T	P	C
0	4	16	12

COURSE OBJECTIVES:

- To provide students with the opportunity to apply the knowledge and skills acquired in their courses to a specific problem.
- To allow students to extend their academic experience into areas of interest and working with new ideas.
- To take on the challenges of teamwork, prepare a presentation in a professional manner, and document all aspects of work.

Out of a total of 200 marks for the Project, 60 marks shall be for Internal Evaluation and 140 marks for the End Semester Examination. The End Semester Examination (Viva – Voce) shall be conducted by the Committee. The Committee consists of an external examiner, Head of the Department and Supervisor of the Project. The evaluation of project work shall be conducted at the end of the Eighth semester. The Internal Evaluation marks shall be on the basis of two seminars given by each student on the topic of his/her project and evaluated by an Internal Committee, consisting of Head of the department, the supervisor of the project and a senior faculty member.

COURSE OUTCOMES:

The student will be able to:

1. Identify a topic in advanced areas of Mechanical Engineering.
2. Identify the real-world problem (possibly of interdisciplinary nature) through a rigorous literature survey and formulate set relevant aims and objectives.
3. Identify methods and materials to carry out experiments/simulations/development.
4. Reorganize the procedures of design, development & manufacturing with a concern for society, environment and ethics.
5. Analyze and discuss the results to draw valid conclusions, prepare a report as per recommended format and defend the work.

B.Tech HONOR

in

Mechanical Engineering

Syllabus

II B.Tech. II - Semester

COMPOSITE MATERIALS MANUFACTURING (Honors)

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To introduce various types of reinforcements and matrices for composites.
- To impart knowledge on the fundamentals of design of composites and structure property relations.
- To familiarize with suitable tools and methods for manufacturing of composites.
- To understand advance composite materials and processes.

UNIT I

Introduction to Composite Materials: Definition, classification of composite materials based on matrix and reinforcement, functional requirements of matrix and reinforcement, advantages of composites.

Applications of Composites in: aircraft, space, transportation, energy, electronics, sports and medical industries.

UNIT II

Reinforcements: Types of reinforcements, their mechanical properties and functions - ceramics, glass, carbon, boron. silicon carbide, alumina, metal, aramid. Forms of reinforcements - particulate, fibre, filaments, whiskers, flakes. Pre-fabricated forms - preforms, prepegs, fabrics, honeycomb.

Matrix: Type of matrix, its mechanical properties and functions- polymers (thermosets and thermoplastics), metals, ceramics, glass and carbon. Basic principles in the design of composites and selection of matrix and reinforcement.

UNIT III

Polymer Matrix Composites: Polymer Matrix Composites: Types of thermoset and thermoplastic resins. Principles in the selection of matrix and the reinforcements. Process selection criteria. Mould and tool making. Basic manufacturing steps - impregnation, lay-up, consolidation and solidification.

Manufacturing Processes for Polymer Composites: Hand lay-up, compression moulding, extrusion, injection moulding, sheet forming, pultrusion, hot press & autoclave techniques and filament winding.

UNIT IV

Manufacturing Processes for Metal Matrix Composites: Casting methods - gravity & low pressure die, investment, squeeze, spray forming, compression moulding and thixo-moulding.

Manufacturing Processes for Ceramic Matrix Composites: Reaction sintering, electro-deposition, spray forming, infiltration.

UNIT V

Testing of Composites: Mechanical testing of composites, tensile testing, compressive testing, intra-laminar shear testing, inter-laminar shear testing, fracture testing.

Non-Destructive Testing of Composites: Visual inspection, ultrasonic testing, radiography, Thermography, liquid penetrant test, eddy current test.

COURSE OUTCOMES:

, Upon successful completion of this course, the students will be able to:

1. Select appropriate composite materials for real time applications.
2. Select the mould, tool, matrix and reinforcements for composites.
3. Choose suitable processes and parameters for the manufacture of polymer matrix composites.
4. Identify suitable processes and parameters for the manufacture of metal matrix and ceramic matrix composites.
5. Understand the various methods of testing of composites.

TEXT BOOKS:

1. Composite Materials: Engineering and Science, F L Matthews and R D Rawlings, Chapman & Hall, London, 1994.
2. An Introduction to Metal Matrix Composites, T W Clyne and P J Withers, Cambridge University Press, 1993.

REFERENCE BOOKS:

1. Fundamentals of Metal Matrix Composites, S. Suresh, A. Martensen and A. Needleman, Butterworth, Heinemann, 1993.
2. Fibre-reinforced Composites: Materials, Manufacturing & Design, P K Mallick, Marcel Dekker, 1993.
3. Composites Manufacturing-Materials, Product, & Process Engineering, CRC Press, 2002.

II B.Tech. II - Semester

ADVANCED WELDING PROCESSES
(Honors)

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To acquire fundamental knowledge on principles of solid state welding processes.
- To understand the effect of welding parameters on weld quality.
- To study the importance of advanced welding processes.

UNIT I

Electrical Resistance Welding: General principle - heat generation in resistance welding-Electrical Characteristics of Resistance welding; Thermal Characteristics of Resistance Welding, Heat Balance.

Spot Welding: Principle, welding sequence - Solidification in Resistance Spot Welding-applications of spot welding.

UNIT II

Friction Based Processes: Introduction, working principle, difference between friction welding and inertia welding, Operation steps, Metallurgy of friction welded joints, Fibre flow in friction welding, Defect formation, Process parameters, Applications;

Friction Stir Welding: Introduction-working principle, Operation steps, Metallurgy of FSW joints, Defect formation - Process parameters, Tool design, tool geometry and tool materials, Heat generation in FSW process, Variants of FSW process.

UNIT III

Ultrasonic Welding: Principle of operation, welding equipment, welding variables, types of ultrasonic welds, materials ultrasonically welded, advantages, disadvantages and applications of ultrasonic welding.

Diffusion Welding: Principle, types, parameters, materials welded, advantages, limitations and applications of diffusion welding.

UNIT IV

Laser Beam Welding Processes: Basics of Laser, types of Lasers, Gaseous systems: - CO_2 Laser welding; Solid state Laser welding; Laser beam characteristics – Continuous Wave lasers, Pulsed Laser, High power diode lasers (HPDL) and Fibre Lasers; Principles of operation, effect of parameters on weld quality, advantages limitations and applications.

Electron Beam Welding Processes: Fundamentals; Beam characteristics; Different degrees of vacuum, Heat generation and regulation, equipment details in typical set-up, Parameters and its effects on weld quality, advantages and disadvantages, applications, characteristics of electron beam welded joints.

UNIT V

Allied Processes:

Principle and concept of narrow gap welding, under water welding, thermit welding. Process characteristics, advantages and applications of above techniques.

Principles and concepts of Induction brazing, Dip brazing, Resistance brazing, Vacuum brazing; Adhesive Bonding; High Frequency Welding; MIAB welding; Microwave joining.

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to:

1. Understand the concepts of resistance and spot-welding processes.
2. Acquire knowledge on friction-based processes.
3. Utilize advanced joining techniques for critical applications.
4. Select an appropriate welding process for a specific application.
5. Acquire knowledge of brazing processes.

TEXT BOOKS:

1. John Norrish, Advanced welding processes Technologies and process control, Wood
   head Publishing and Maney Publishing, 2006.
2. Hongyan Zhang and Jacek Senkara, Resistance welding: Fundamentals and Applications, CRC Press, 2nd Edition, 2011.

REFERENCE BOOKS:

1. Christopher Davis, Laser Welding- Practical Guide, Jaico Publishing House, 1994.
2. Rajiv S. Mishra, Murray W. Mahoney, Friction Stir Welding and Processing, ASM International, 2007.

II B.Tech. II - Semester

ADVANCED MECHANICS OF SOLIDS
(Honor)

L	T	P	C
4	0	0	4

Prerequisites: Mechanics of Solids

COURSE OBJECTIVES:

1) To gain knowledge about deflection of beams.
2) To understand the principles of failure criteria.
3) To determine the stresses and deflection in unsymmetrical bending of beams.
4) To understand concept about torsion.
5) To analyze the contact stresses.

UNIT I

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 uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams, statically indeterminate Beams and solution methods.

UNIT II:

FAILURE CRITERIA: Modes of failure, Excessive deflections, Yield initiation, fracture, Progressive fracture, High Cycle fatigue for number of cycles N > 10%, buckling. Concept of Creep. Application of energy methods: Elastic deflections and statically indeterminate members and structures: Principle of stationary potential energy, Castiglione's theorem on deflections, Castiglione's theorem on deflections for linear load deflection relations, deflections of statically determinate structures.

UNIT III:

UNSYMMETRICAL BENDING: Bending stresses in Beams subjected to non-symmetrical bending; Deflection of straight beams due to non-symmetrical bending.

UNIT IV:

TORSION: Linear elastic solution; Prandtl elastic membrane (Soap-Film) Analogy; Narrow rectangular cross Section; Hollow thin wall torsion members, multiply connected Cross Section.

UNIT V:

CONTACT STRESSES: Introduction; problem of determining contact stresses; Assumptions on which a solution for contact stresses is based; Expressions for principal stresses; Method of computing contact stresses; Deflection of bodies in point contact; Stresses for two bodies in contact over narrow rectangular area (Line contact), Loads normal to area; Stresses for two bodies in line contact, Normal and Tangent to contact area.

COURSE OUTCOMES:

At the end of the course, student will be able to:

1. Calculate the deflection and slope curves for beams.
2. Explain the principles of failure criteria.
3. Determine the stresses and deflection in unsymmetrical bending of beams.
4. Interpret the concept of torsion.
5. Analyze the contact stresses.

TEXT BOOKS:

1) Richard J. Schmidt Arthur P. Boresi, Advanced Mechanics of materials, Wiley International, 2009.
2) Timoshenko S.P. and Goodlier J.N., Theory of elasticity, McGraw-Hill Publishers 3rd Edition, 2017.
3) L.S Srinath, Advanced Mechanics of Solids, McGraw Hill Education, 2017.

REFERENCE BOOKS:

1. Timoshenko, Theory of plates & Shells, McGraw Hill Education, 2017.
2. Strength of materials & Theory of structures (Vol I & II) by B.C Punmia, Lakshmi publications Pvt. Ltd, New Delhi.
3. Sadhu Singh, Strength of materials, Khanna Book Publishing Company, 2016.

II B.Tech. II - Semester

ADVANCED THERMODYNAMICS (Honors)

L	T	P	C
4	0	0	4

PRE-REQUISITES: Thermodynamics

COURSE OBJECTIVE: To provide the insights on the laws of thermodynamics and its relations, Kinetic theory of ideal gases, non-reactive gas and liquid reactive mixtures, exergy and irreversibility of thermal systems and advanced power cycles.

UNIT I

BASIC CONCEPTS: Thermodynamics - Temperature and Zeroth law of thermodynamics - First law of thermodynamics-Applications - Limitations of first law - Concept of internal energy - Second law of thermodynamics-Applications - concept of entropy-Third law of Thermodynamics.

THERMODYNAMIC RELATIONS: Introduction – Reciprocity and cyclic relations – The Maxwell's relations – The Gibbs and Helmholtz relations - The Clapeyron Equation –Applications, General relations for du, dh, ds - Fugacity Coefficient and Residual Gibbs Function, Thomson Coefficient and Inversion Curve, Thermodynamic similarity.

UNIT II

KINETIC THEORY OF AN IDEAL GAS: Kinetic theory of gases-introduction, basic assumption, molecular flux, equation of state for an ideal gas, collisions with a moving wall, principle of equipartition of energy, classical theory of specific heat capacity. Transport phenomena-intermolecular forces, The Van der Waals equation of state, collision cross section, mean free path.

UNIT III

NON-REACTIVE GAS AND LIQUID MIXTURES: Introduction - Basic definitions for gas mixtures - PVT relationship for mixtures of ideal gases - Properties of mixtures of ideal gases - Gas-Vapor Mixtures, Application of First Law to Psychometric Processes, Real Gas Mixtures.

LIQUID MIXTURES/SOLUTIONS: Ideal Solutions, Real Solutions.

THERMODYNAMIC RELATIONS FOR REAL MIXTURES: Partial Properties, Relations for Activity and Activity Coefficient in Real Liquid Mixtures/Solutions.

UNIT IV

EXERGY: Introduction - Quality of Energy - Available and Unavailable energy - Availability, Surroundings work- Reversible work -Availability function of the closed & open system - availability in a SSSF process in an open system - Applications.

IRREVERSIBILITY: Introduction - Irreversibility for closed and open system - Steady flow process – Effectiveness-Applications.

UNIT V

ADVANCED POWER CYCLES:

VAPOR POWER CYCLES: - Second law analysis of vapor power cycles, Cogeneration, Binary vapor cycles, combined gas vapor power cycles-Applications.

GAS POWER CYCLES: - Second law analysis of gas power cycles-Applications, Atkinson cycle, Lenoir cycle.

COURSE OUTCOMES:

After the completion of the course, students should be able to:

1. Apply the laws of thermodynamics and thermodynamic relations of gas mixtures.
2. Describe the concepts of kinetic theory applicable for ideal gases.
3. Analyse non-reactive gas and liquid mixtures using thermodynamic relations.
4. Apply energy balances to reacting systems for both closed and open system.
5. Analyse vapour and gas power cycles.

TEXT BOOKS:

1. PK Nag, Engineering Thermodynamics, Tata Mcgraw Hill, 6th Edition, 2017.
2. Rolf Haase, Thermodynamics of Irreversible Processes, Dover Publications, Rev. Edition, 2010.

REFERENCE BOOKS:

1. Moran, Shapiro, Boettner, Bailey, Principles of Engineering Thermodynamics, Wiley and sons, 8th Edition, 2015.
2. J. P .Holman, Thermodynamics, McGraw-Hill, 4th Edition, 1987.

III B.Tech. I - Semester

TRIBOLOGY
(Honors)

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To explain the contact of solid surfaces and types of lubrication.
- To understand the genesis of friction, the theories/laws of sliding and rolling friction.
- To apply the principles and design procedures for hydrostatic bearings.
- To understand and analyze the principles of hydrodynamic and mixed/ boundary lubrication.
- To gain knowledge about the types of seals and failure of tribological components.

UNIT I

Introduction: Nature of surfaces and contact-Surface topography-friction and wear mechanisms, wear maps, effect of lubricants- methods of fluid film formation.

Lubrication: Choice of lubricants, types of oil, Grease and solid lubricants- additives- lubrication systems and their selection.

UNIT II

Selection of rolling element bearings: Nominal life, static and dynamic capacity-Equivalent load, probabilities of survival- cubic mean load- bearing mounting details, pre loading of bearings, conditioning monitoring using shock pulse method.

UNIT III

Hydrostatic Bearings: Thrust bearings – pad coefficients- restriction- optimum film thickness - journal bearings – design procedure –Aerostatic bearings; Thrust bearings and Journal bearings –design procedure.

UNIT IV

Hydrodynamic bearings: Fundamentals of fluid formation – Reynold's equation; Hydrodynamic journal bearings – Sommerfield number- performance parameters – optimum bearing with maximum load capacity – Friction – Heat generated and Heat dissipated. Hydrodynamic thrust bearings; Raimondi and Boyd solution for hydrodynamic thrust bearings- fixed tilting pads, single and multiple pad bearings-optimum condition with largest minimum film thickness.

UNIT V

Seals: Different type-mechanical seals, lip seals, packed glands, soft piston seals, Mechanical piston rod packing, labyrinth seals and throttling bushes, oil flinger rings and drain grooves – selection of mechanical seals.

Failure of Tribological components: Failure analysis of plain bearings, rolling bearings, gears and seals, wear analysis using soap and Ferrography.

Dry rubbing Bearings: porous metal bearings and oscillatory journal bearings – qualitative approach only.

COURSE OUTCOMES:
Students will be able to:

1. Learn the concepts of surface topography and types of lubrication.
2. Learn the genesis of friction, the theories/laws of sliding and rolling friction.
3. Apply the principles and design procedures for hydrostatic bearings.
4. Analyze the principles of hydrodynamic and mixed/ boundary lubrication.
5. Gain knowledge about the types of seals and failure of tribological components.

TEXT BOOKS:

1. Rowe WW& O' Dionoghue, Hydrostatic and Hybrid bearing design, Butterworths & Co.Publishers Ltd, 1983.
2. Collacott R. A, Mechanical Fault diagnosis and condition monitoring, Chapman and Hall, 1977.
3. Bernard J. Hamrock, Fundamentals of fluid film lubricant, McGraw-Hill Co., 1994.

REFERENCE BOOKS:

1. Neale MJ, Tribology hand Book, Neumann Butterworths, 1975.
2. Connor and Boyd JJO, Standard hand book of lubrication engineers, ASLE, McGraw Hill Book & Co.,1968.
3. Shigley J, E Charles, Mechanical Engineering Design, McGraw Hill Co., 1989.

III B.Tech. I - Semester

MICRO ELECTRO MECHANICAL SYSTEMS
(Honors)

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To understand basics of Micro Electro Mechanical Systems (MEMS), mechanical sensors and actuators.
- To illustrate thermal sensors and actuators used in MEMS.
- To apply the principle and various devices of Micro-Opto-Electro Mechanical Systems (MOEMS), magnetic sensors and actuators.
- To analyze applications and considerations on micro fluidic systems.
- To illustrate the principles of chemical and bio medical micro systems.

UNIT I

INTRODUCTION: Definition of MEMS, MEMS history and development, micro machining, lithography principles & methods, structural and sacrificial materials, thin film deposition, impurity doping, etching, surface micro machining, wafer bonding, LIGA.

MECHANICAL SENSORS AND ACTUATORS: Principles of sensing and actuation: beam and cantilever, capacitive, piezo-electric, strain, pressure, flow, pressure measurement by micro phone, MEMS gyroscopes, shear mode piezo actuator, gripping piezo actuator, Inchworm technology.

UNIT II

THERMAL SENSORS AND ACTUATORS: Thermal energy basics and heat transfer processes, thermistors, thermo devices, thermo couple, micro machined thermo couple probe, Peltier effect heat pumps, thermal flow sensors, micro hot plate gas sensors, MEMS thermo vessels, pyro electricity, shape memory alloys (SMA), U-shaped horizontal and vertical electro thermal actuator, thermally activated MEMS relay, micro spring thermal actuator, data storage cantilever.

UNIT III

MICRO-OPTO-ELECTRO MECHANICAL SYSTEMS: Principle of MOEMS technology, properties of light, light modulators, beam splitter, micro lens, micro mirrors, digital micro mirror device (DMD), light detectors, grating light valve (GLV), optical switch, wave guide and tuning, shear stress measurement.

MAGNETIC SENSORS AND ACTUATORS: Magnetic materials for MEMS and properties, magnetic sensing and detection, magneto resistive sensor, more on hall effect, magneto diodes, magneto transistor, MEMS magnetic sensor, pressure sensor utilizing MOKE, mag MEMS actuators, by directional micro actuator, feedback circuit integrated magnetic actuator, large force reluctance actuator, magnetic probe based storage device.

UNIT IV

MICRO FLUIDIC SYSTEMS: Applications, considerations on micro scale fluid, fluid actuation methods, dielectro-phoresis (DEP), electro wetting, electro thermal flow, thermo capillary effect, electro osmosis flow, opto electro wetting (OEW), tuning using micro fluidics, typical micro fluidic channel, micro fluid dispenser, micro needle, molecular gate, micro pumps.

RADIO FREQUENCY (RF) MEMS: RF — based communication systems, RF MEMS, MEMS inductors, tuner/filter, resonator, clarification of tuner, filter, resonator, MEMS switches, phase shifter.

UNIT V

CHEMICAL AND BIO MEDICAL MICRO SYSTEMS: Sensing mechanism & principle, membrane-transducer materials, chem.-lab-on-a-chip (CLOC) chemo-resistors, chemo-capacitors, chemo-transistors, electronic nose (E-nose), mass sensitive chemo-sensors, fluorescence detection, calorimetric spectroscopy.

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to:

1. To understand basics of Micro Electro Mechanical Systems (MEMS), mechanical sensors and actuators.
2. Illustrate thermal sensors and actuators used in MEMS.
3. To apply the principle and various devices of Micro-Opto-Electro Mechanical Systems (MOEMS), magnetic sensors and actuators.
4. Analyze applications and considerations on micro fluidic systems.
5. Illustrate the principles of chemical and bio medical micro systems.

TEXT BOOKS:

1. Nitaigour Premchand Mahalik, MEMS, TMH, 1st Edition, 2009.
2. Chang Liu, Foundation of MEMS, Prentice Hall Ltd., 2nd Edition, 2011.

REFERENCE BOOKS:

1. Tai-Ran Hsu, MEMS and Micro Systems: Design and Manufacture, TMH Publishers, 1st Edition, 2017.
2. Thomas M Adams, Richard A Layton, Introductory MEMS, Springer International Publishers, Rev. Edition, 2010.

III B. Tech. I - Semester

MECHANICS OF COMPOSITES
(Honor)

L	T	P	C
4	0	0	4

PREREQUISITES: Mechanics of Solids

COURSE OBJECTIVES:

- To understand about the composite materials and their classification.
- To illustrate micro mechanical analysis of a lamina.
- To gain knowledge about the two-dimensional angle lamina.
- To illustrate macro mechanical analysis of a lamina.
- To gain knowledge in designing the laminates.

UNIT I

INTRODUCTION TO COMPOSITES: Composites, materials- matrix and reinforcement, Particulate composites, rule of mixtures, classification of composites, Applications.

UNIT II

MICRO MECHANICAL ANALYSIS OF A LAMINA: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi-Empirical Models Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion.

UNIT III

HOOKE'S LAW FOR A TWO-DIMENSIONAL ANGLE LAMINA: Engineering Constants of an Angle Lamina, Invariant form of Stiffness and Compliance Matrices for an Angle Lamina Strength Hygro-thermal Stresses and Strains in a Lamina: Hygro-thermal Stress-Strain relationships for a Unidirectional Lamina, Hygro-thermal Stress-Strain Relationships for an Angle Lamina.

UNIT IV

MACRO MECHANICAL ANALYSIS OF A LAMINA: Introduction, Definitions: Stress, Strain, Elastic Moduli, Strain Energy. Hooke's Law for Different Types of Materials, Hooke's Law for a Two-Dimensional Unidirectional Lamina, Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina, Laminate Code, Stress-Strain Relations for a Laminate.

UNIT V

DESIGN OF LAMINATES: Introduction, thin plate theory, especially orthotropic plate, cross and angle ply laminated plates, problems using thin plate theory, Failure theories, Design of Laminated Composites.

COURSE OUTCOMES:

At the end of the course, student will be able to

1) Discuss the composite materials and their classification.
2) Apply the micro mechanical analysis of a lamina.
3) Learn about two-dimensional angle lamina.
4) Apply the macro mechanical analysis of a lamina.
5) Utilize knowledge in designing the laminates.

TEXT BOOKS:

1) Isaac and M Daniel, Engineering Mechanics of Composite Materials, Oxford University Press, 2nd Edition, 2005.
2) Madhujit Mukhop, Mechanics of Composite Materials & Structures, Universities Press, 2004.
3) Autar K. Kaw, Mechanics of Composite Materials, Second Edition, CRC press, 2005.

REFERENCES:

1) R. M. Jones, Mechanics of Composite Materials, Mc Graw Hill Company, New York, 1998.
2) L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Rainfold, New York, 1970.
3) B. D. Agarwal and L. J. Broutman, Analysis and performance of fiber Composites, Wiley Inter science, New York, 3rd Edition, 2006.

III B.Tech. I - Semester

FUEL CELL TECHNOLOGY
(Honors)

L	T	P	C
4	0	0	4

PRE-REQUISITES: Thermodynamics and Chemistry

COURSE OBJECTIVE:

To know details of fuel cell technology, in particular the opportunities for using hydrogen.

UNIT I

HYDROGEN ENERGY ECONOMY: Hydrogen Energy Economy – Conception, Present status and a vision – Applications of Hydrogen - Transport application-cars, light trucks, buses - Stationary and Portable Electronic gadgets.

UNIT II

HYDROGEN PRODUCTION TECHNIQUES: Hydrogen – Physical and chemical properties, salient characteristics - Production of hydrogen – Steam reforming – Water electrolysis –Gasification and woody biomass conversion – Biological hydrogen production – Photo dissociation – Direct thermal or catalytic splitting of water.

UNIT III

HYDROGEN STORAGE: Hydrogen storage options – Compressed gas – Liquid hydrogen method– Hydride storage method– Chemical Storage – Comparisons.

HYDROGEN TRANSPORT: Introduction basic Components, Types of transport system, Applications, Transport of Hydrogen - Pipelines, gaseous, liquid and compound materials.

UNIT IV

FUEL CELLS: History – Principle - Working - Thermodynamics and kinetics of fuel cell process – Types of fuel cells – AFC, PAFC, SOFC, MCFC, DMFC, PEMFC – Relative merits and demerits - Performance evaluation of fuel cell – Comparison of battery Vs fuel cell – Flow Battery.

UNIT V

APPLICATION OF FUEL CELL: Fuel cell usage for domestic power systems - Large scale power generation – Automobile - Space - Environmental analysis of usage of Hydrogen in Fuel cell - Future trends in fuel cells.

COURSE OUTCOMES: After the completion of the course students are able to:

1. Describe the hydrogen energy storage system and its applications.
2. Understand the production techniques of hydrogen.
3. Comprehend the hydrogen storage and transport systems.
4. Compare the performance characteristics of different fuel cells.
5. Compute the power generation capacity of a fuel cell.

TEXT BOOKS:

1. Rebecca L. and Busby, Hydrogen and Fuel Cells: A Comprehensive Guide, Penn Well Corporation, Oklahoma, 2005.
2. Viswanathan, B and M Aulice Scibioh, Fuel Cells – Principles and Applications, Universities Press, 2006.

REFERENCE BOOKS:

1. Bent Sorensen, Hydrogen and Fuel Cells: Emerging Technologies and Applications, Elsevier, 2005.

III B.Tech. II - Semester

CNC MACHINES
(Honors)

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

The main objective of the course is

- Understand the construction and working of the modern CNC machine tools.
- Know the various drives and positional transducers used in CNC machines.
- should be able to develop the complex programs using either manual or computer aided part programming methods.
- Gain the knowledge on different tool & work holding devices used in CNC machines.

UNIT I

INTRODUCTION TO CNC MACHINE TOOLS:

Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines - turning centre, machining centre, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators- Computer Aided Inspection.

UNIT II

STRUCTURE OF CNC MACHINE TOOL:

CNC Machine building, structural details, configuration and design, guide ways-Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion - Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion, spindle assembly, torque transmission elements - gears, timing belts, flexible couplings, Bearings.

UNIT III

DRIVES AND CONTROLS:

Spindle drives - DC shunt motor, 3 phase AC induction motor, feed drives - stepper motor, servo principle, DC and AC servomotors. Open loop and closed loop control, Axis measuring system - synchrony, synchrony-resolver, gratings, moiré fringe gratings. encoders, inductosysn. laser interferometer.

UNIT IV

CNC PROGRAMMING:

Coordinate system, structure of a part program, G & M Codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming, machining cycles, programming for machining centre and turning centre for well-known controllers such as Fanuc, Heidenhain, Sinumerik etc.. generation of CNC codes from CAM packages.

UNIT V

TOOLING AND WORK HOLDING DEVICES:

Introduction to cutting tool materials Carbides, Ceramics, CBN, PCD-inserts classification PMK, NSH, qualified, semi qualified and preset tooling, tooling system for Machining centre and Turning centre, work holding devices for rotating and fixed work parts, economics of CNC. maintenance of CNC machines.

COURSE OUTCOMES:

After completion of this course the students are expected to be able to:

1. Understand evolution and principle of CNC machine tools.
2. Describe constructional features of CNC machine tools.
3. Explain drives and positional transducers used in CNC machine.
4. Write simple programs for CNC turning and machining centers tools.
5. Describe tooling and work holding devices for CNC machine tools.

TEXT BOOKS:

1. Radhakrishnan P, Computer Numerical Control Machines, New Central Book Agency, 2nd Edition, 2014.
2. Rao P. N, CAD/CAM, Tata McGraw-Hill Publishing Company Limited, 1st Edition, 2002.
3. Warren Seamers, Computer Numeric Control, Thomson Delmar, 4th Edition, 2002.

REFERENCE BOOKS:

1. Ken Evans, John Polywka & Stanley Gabrel, Programming of CNC Machines, Industrial Press Inc, 2nd Edition, 2002.
2. Berry Leathan-Jones, "Introduction to Computer Numerical Control, Pitman, London, 1987.
3. HMT, Mechatronics, Tata McGraw-Hill Publishing Company Limited, New Delhi.

III B.Tech. II - Semester

MATERIALS CHARACTERIZATION TECHNIQUES (Honors)

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To understand the various structure analysis tools like X-ray diffraction.
- To apply the microscopy techniques for materials characterization.
- To understand the concepts of thermal analysis techniques.
- To learn about the magnetic characterization techniques.
- To illustrate optical and electronic characterization techniques.

UNIT I

INTRODUCTION TO MATERIALS AND TECHNIQUES: Structure analysis tools: X-ray diffraction: phase identification, indexing and lattice parameter determination, Analytical line profile fitting using various models, Neutron diffraction, Reflection High Energy Electron Diffraction, and Low Energy Electron Diffraction.

UNIT II

MICROSCOPY TECHNIQUES: Optical microscopy, analysis transmission electron microscopy (TEM), energy dispersive X-ray microanalysis (EDS), scanning electron microscopy (SEM), atomic force microscopy (AFM) and scanning probe microscopy (SPM), quantitative metallography.

UNIT III

THERMAL ANALYSIS TECHNIQUES: Differential thermal analysis (DTA), Differential Scanning Calorimeter (DSC), Thermo gravimetric analysis (TGA); Electrical characterization techniques: Electrical resistivity, Hall effect, Magneto resistance.

UNIT IV

MAGNETIC CHARACTERIZATION TECHNIQUES: Introduction to Magnetism, Measurement Methods, Measuring Magnetization by Force, Measuring Magnetization by Induction method, Types of measurements using magnetometers: M-H loop, temperature dependent magnetization, time dependent magnetization, Measurements using AC susceptibility, Magneto-optical Kerr effect, Nuclear Magnetic Resonance, Electron Spin Resonance.

UNIT V

OPTICAL AND ELECTRONIC CHARACTERIZATION TECHNIQUES: UV-VIS spectroscopy, Fourier transform infrared spectroscopy, Raman spectroscopy, X-ray photoelectron spectroscopy.

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to:

1. Understand the various structure analysis tools.
2. Apply microscopic techniques for material characterization.
3. Learn about thermal analysis techniques.
4. Understand magnetic characterization techniques.
5. Learn about optical and electronic characterization techniques.

TEXT BOOKS:

1. R.W. Cahn, P. Haasen and E.J. Kramer, Characterization of Materials (Materials Science and Technology: A Comprehensive Treatment, Vol 2A & 2B, Wiley – VCH, 1994.
2. D. K. Schroder, Semiconductor Material and Device Characterization, Wiley, 3rd Edition, 2006.
3. S Zhang, L. Li and Ashok Kumar, Materials Characterization Techniques, CRC Press, 1st Edition, 2008.

REFERENCE BOOKS:

1. P. E. J.Flewitt and R K Wild, Physical methods for Materials Characterization, IOP publishing, 3rd Edition, 2003.
2. Ed. Z L Wang, Characterization of nano-phase materials, Willet-VCH, 1st Edition, 2000.

III B.Tech. II - Semester

EXPERIMENTAL STRESS ANALYSIS
(Honors)

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

To expose the students to the following:

- Demonstrates principles of experimental approach.
- Measure displacement and perform stress strain analysis of mechanical systems using electrical resistance strain gauges.
- Describe the photo elastic method to study and characterize the elastic behavior of solid bodies.
- Determine stress strain behavior of solid bodies using methods of coating.

UNIT I

PRINCIPLES OF EXPERIMENTAL APPROACH: Merits of Experimental Analysis Introduction, uses of experimental stress analysis advantages of experimental stress analysis, Different methods –Simplification of problems.

UNIT II

STRAIN MEASUREMENT USING STRAIN GAUGES: Definition of strain and its relation of experimental Determinations Properties of Strain Gauge Systems-Types of Strain Gauges –Mechanical, Acoustic and Optical Strain Gauges. Introduction to Electrical strain gauges -Inductance strain gauges –LVDT –Resistance strain gauges –various types –Gauge factor –Materials of adhesion base.

UNIT III

THEORY OF PHOTOELASTICITY: Introduction –Temporary Double refraction –The stress Optic Law –Effects of stressed model in a polariscope for various arrangements –Fringe Sharpening. Brewster‟s Stress Optic law.

UNIT IV

TWO-DIMENSIONAL PHOTOELASTICITY: Introduction –Iso-chromatic Fringe Patterns-Isoclinic Fringe patterns passage of light through plane Polariscope and Circular polariscope Isoclinic Fringe patterns –Compensation techniques –Calibration methods –Separation methods –Scaling Model to prototype Stresses –Materials for photo –Elasticity Properties of Photo elastic Materials.

UNIT V

BRITTLE COATINGS: Introduction, coating stresses, failure theories, brittle coating crack patterns, crack detection, ceramic based brittle coatings, resin based brittle coatings, test procedures for brittle coatings analysis, calibration procedures, analysis of brittle coating data. Moire Methods: Introduction, mechanism of formation of Moire fringes, the geometrical approach to Moire-Fringe analysis, the displacement field approach to Moire-Fringe analysis, out of plane displacement measurements, out of plane slope measurements, sharpening and multiplication of Moire-Fringes, experimental procedure and techniques.

COURSE OUTCOMES:

After successful completion of course the student should be able to

1. Understand different methods of experimental stress analysis.
2. Understand the use of strain gauges for measurement of strain.
3. Understand the theory of photo elasticity and its applications in analysis of structures.
4. Describe various coating techniques.

TEXT BOOK:

1. JW Dally and WF Riley, Experimental Stress Analysis, McGrawHill Publications, 3rd Edition, 1991.
2. CC Perry and HR Lissner, The Strain Gage Primer, McGrawHill, 2000.

REFERENCES:

1. Abdul Mubeen, Experimental Stress Analysis, DhanpatRai and Sons, 2001.
2. PS Theocaris, Moire Fringes in Strain Analysis, Pergammon Press, 2002.

III B.Tech. II - Semester

ELECTRIC & HYBRID VEHICLES

(Honors)

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- Understand electric vehicle & HEV for various applications.
- Have knowledge about the electric vehicle system and its parameters.
- Learn about EV motor drives.
- Understand the concepts of HEV.
- Learn about the energy sources, battery chargers and charging infrastructure.

UNIT I

Introduction to EV & HEV: Past, Present & Feature of EV, Current Major Issues, Recent

Development Trends, EV Concept, Key EV Technology, State-of-the Art EVs & HEVs,

Comparison of EV Vs IC Engine.

UNIT II

EV System: EV Configuration: Fixed & variable gearing, single & multiple motor drives, In-wheel drives.

EV Parameters: Weight, size, force, energy & performance parameters.

UNIT III

EV Motor Drive:

DC Motor: Type of wound-field DC Motor, Torque speed characteristics, DC-DC Converter, Two quadrant DC Chopper, two quadrant zero voltage transition converter-fed dc motor drive, speed control of DC Motor.

Induction Motor Drive: Three Phase Inverter Based Induction Motor Drive, Equal Area PWM, Three Phase Auxiliary resonant snubber (ARS) Inverter Type (ZVC & ZCS), Single Phase ARS Inverter Topology, Speed Control of Induction Motor, FOC, Adaptive Control, Model Reference Adaptive Control (MARS), Sliding mode Control.

UNIT IV

HEV: HEV, Energy Sources & Charging HEV: Configuration of HEV (Series, Parallel, Seriesparallel &Complex), Power Flow control, Examples. Power flow control in all HEV configurations, Examples of HEV system performance.

UNIT V

Energy Sources: Different Batteries, Battery characteristics (Discharging & Charging).

Battery Chargers: Conductive (Basic charger circuits, Microprocessor based charger circuit. Arrangement of an off-board conductive charger, Standard power levels of conductive chargers, Inductive (Principle of inductive charging, Soft-switching power converter for inductive charging), Battery indication methods.

Charging Infrastructure: Domestic Charging Infrastructure, Public Charging Infrastructure, Normal Charging Station, Occasional Charging Station, Fast Charging Station, Battery Swapping Station, Move-and-charge zone.

COURSE OUTCOMES:

1. Understand electric vehicle & HEV for various applications.
2. Have knowledge about the electric vehicle system and its parameters.
3. Learn about EV motor drives.
4. Understand the concepts of HEV.
5. Learn about the energy sources, battery chargers and charging infrastructure.

TEXT BOOKS:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2nd Edition, 2003.
2. James Larminie, John Lowry, Electric Vehicle Technology, Wiley publications, 1st Edition, 2003.

REFERENCE BOOKS:

1. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
2. Seth Leitman, Build Your Own Electric Vehicle, MC Graw Hill, 1st Edition, 2013.

IV B.Tech. I - Semester

MICRO MANUFACTURING
(Honor)

L	T	P	C
4	0	0	4

COURSE OBJECTIVE:

Principle of mechanics of manufacturing in macro and micro are entirely different. Materials change behaviour if processed at micro level. The present course based on the mechanical/chemical behaviour changes during micromachining/manufacturing. Therefore, tool based micro machining and unconventional micromachining processes have been explored.

UNIT I

Introduction and classification of micromachining; Mechanical type micro machining processes: Abrasive jet micromachining (AJMM), Ultrasonic micromachining, abrasive water jet micro machining (AWJMM).

UNIT II

Chemical and electrochemical type advanced machining processes: Electrochemical micromachining (EDMM), electrochemical micro deburring, Chemical and photochemical micromachining.

UNIT III

Thermo electric type micro-machining process: Electric discharge micromachining (EDMM), wire EDM, EDDG, ELID, Laser beam micro machining (LBMM), Electron beam micromachining (EBMM).

UNIT IV

Micro Forming; Micro and Nano structured surface development by Nano plastic forming and Roller Imprinting, Micro Extrusion. Micro bending with LASER. LASER micro welding, Electron beam for micro welding.

UNIT V

Magnetorheological finishing (MRF), Magnetorheological abrasive flow finishing (MRAFF), Magnetic float polishing (MFP), Chemo-mechanical polishing (CMP), Applications of micromachining in industry.

COURSE OUTCOMES:

Upon successful completion of this course, students will:

1. Acquired knowledge about different micro-machining processes.
2. Select and apply various advanced micro-manufacturing processes as per the desired quality of the product.
3. Understand the process of Micro-fabrication, forming and micro welding.
4. Acquired knowledge about super finishing processes and Applications of Micromachining.

TEXT BOOKS:

1. VK Jain, Introduction to micromachining, Narosa Publisher, 2nd Edition, 2019.
2. J. Paulo Davim and Mark J. Jackson, Nano and Micromachining, Wiley Publication, 1st Edition, 2008.

REFERENCE BOOKS:

1. JA Mc Geough, Micromachining of Engineering Materials, CRC Pres, 1st Edition, 2002.
2. VK Jain, Micro manufacturing processes, CRC Press, 1st Edition, 2017.
3. VK Jain, Advanced machining processes, Allied Publisher, 2nd Edition, 2009.

IV B.Tech. I - Semester

ADVANCE METROLOGY AND SENSING SYSTEMS (Honors)

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- Understanding Basic Measurement Systems in real time engineering applications.
- Enables students to work in Quality Control and assurance industries.
- To make the students capable of learning to operate and use advanced metrological devices with ease in industrial environments.

UNIT I

Computer Aided Metrology

High precision measurements – interfacing – software metrology – Automated visual inspection in manufacturing, contact and non – contact type inspection methods, Electrical field techniques, radiation techniques, ultrasonic – Atomic Force Microscopes (AFM), Talysurf instruments.

Measurement Of Surface Roughness

Definitions – Types of Surface Texture: Surface Roughness Measurement Methods Comparison, Contact and Non Contact type roughness measuring devices, 3D Surface Roughness Measurement, Nano Level Surface Roughness Measurement – Instruments.

UNIT II

Image Processing For Metrology

Overview, Computer imaging systems, Image Analysis, Preprocessing, Human vision system, Image model, Image enhancement, gray scale models, histogram models, Image Transforms - Examples.

UNIT III

MEASURING MACHINES AND LASER METROLOGY

Tool Makers Microscope – Coordinate Measuring Machines – Applications – Laser Metrology: Laser Interferometer, Alignment Telescope, laser scanners. On-line and in – process measurements – diameter, surface roughness, Micro holes, surface topography measurements, straightness and flatness measurement, speckle measurements.

UNIT IV

Sensing Systems

Edge detection techniques, Normalization, Grey scale correlation – Reflectance map concepts; surface roughness and texture characterization – photogrammetric. Application of Machine Vision in inspection – Measurement of length, diameters, and Surface roughness – automated visual inspection – 3D and dynamic feature extraction.

UNIT V

Machine Vision: Image Acquisition and Processing – Binary and gray level images, image segmentation and labeling, representation and interpretation of colours.

On-line Quality control: On-line feedback quality control, variable characteristics – control with measurement interval, one unit, and multiple units control systems for lot and batch production.

COURSE OUTCOMES:

Students will be able to:

1. Illustrate the fundamentals of computer aided metrology.
2. Understand the fundamentals of various methods for the image processing for metrology.
3. Learn the methods of measuring machines and laser metrology.
4. Understand the fundamentals of various sensing systems and measurements.
5. Analyze the process machine vision systems and quality control techniques for manufacturing field.

TEXT BOOKS:

1. Nello Zuech, Understanding and Applying Machine Vision, Marcel Dekker Inc., 2nd Edition, 2000.
2. Marshall A. D. and Martin R. R, Computer Vision, Models and Inspection, World Scientific, 1998.
3. John A. Bosch, Giddings, and Lewis Dayton, Coordinate Measuring Machines and Systems, Marcel Dekker Inc., 1st Edition, 1995.

REFERENCE BOOKS:

1. Gupta, I C, A Text Book of Engineering Metrology, Dhanpat Rai Publication, 8th Edition, 2016.
2. Narayana, K L, Engineering Metrology, Scitech Publication(India) Privet Limited, 3rd Edition, 2014.

IV B.Tech. I - Semester

PRODUCT DESIGN
(Honors)

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

Course Objectives:

- To understand the basic concepts of product design process.
- To interpret the operations of product management and impact of manufacturing processes.
- on product decisions.
- To understand concepts of risks and reliability.
- To interpret the various testing procedure of the product design.
- To understand the concepts of maintainability.

UNIT I

Product Design Process: Design Process Steps, Morphology of Design. Problem Solving and Decision Making: Problem-Solving Process, Creative Problem Solving, Invention, Brainstorming, Morphological Analysis, Behavioral Aspects of Decision Making, Decision Theory, Decision Matrix, Decision Trees. Modelling and Simulation: Triz, Role of Models in Engineering Design, Mathematical Modelling, Similitude and Scale Models, Computer Simulation, Geometric Modelling on Computer, Finite-Element Analysis.

UNIT II

Product management: The operation of product management: Customer focus of product management, product planning process, Levels of strategic planning, Wedge analysis, Opportunity search, Product life cycle Life cycle theory and practice.

Product development: Managing new products, Generating ideas, Sources of product innovation, selecting the best ideas, the political dimension of product design, Managing the product launch and customer feedback.

Product managers and manufacturing: The need for effective relationships, The impact of manufacturing processes on product decisions, Prototype planning,, Productivity potentials, Management of product quality, Customer service levels.

UNIT III

Risk and Reliability: Risk and Society, Hazard Analysis, Fault Tree Analysis. Failure Analysis and Quality: Causes of Failures, Failure Modes, Failure Mode and Effect Analysis, FMEA Procedure, Classification of Severity, Computation of Criticality Index, Determination of Corrective Action, Sources of Information, Copyright and Copying. Patent Literature.

UNIT IV

Product Testing; Thermal, vibration, electrical, and combined environments, temperature testing, vibration testing, test effectiveness. Accelerated testing and data analysis, accelerated factors. Weibull probability plotting, testing with censored data.

UNIT V

Design For Maintainability: Maintenance Concepts and Procedures, Component Reliability, Maintainability and Availability, Fault Isolation in design and Self-Diagnostics. Product Design for Safety, Product Safety and User Safety Concepts, Examples of Safe Designs. Design Standardization and Cost Reduction: Standardization Methodology, Benefits of Product Standardization; International, National, Association and Company Level Standards; Parts Modularization.

COURSE OUTCOMES: At the end of the course, student will be able to

1. Understand the basic concepts of product design process.
2. Identify the operations of product management and impact of manufacturing processes on product decisions.
3. Understand concepts of risks and reliability of the products design.
4. Interpret the various testing procedure of the product design.
5. Illustrate the concepts of maintainability.

TEXT BOOKS:

1. George E. Dieter, Linda C. Schmidt, Engineering Design, McGraw-Hill, 5th Edition, 2012.
2. John W. Evans and Jillian Y. Evans, Product Integrity and Reliability in Design, Springer, 2001.

REFERENCE BOOKS:

1. Richard S. Handscombe, The Product Management Handbook, McGraw-Hill, 1988.
2. Kevin Otto, Product Design: Techniques in Reverse Engineering and New Product Development, Pearson, 1st Edition, 2001.

IV B.Tech. I - Semester

VEHICLE DYNAMICS
(Honors)

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- Understand the dynamics of the automotive systems and its performance parameters.
- Identify the driving/ braking resistances and their influences on vehicle dynamics.
- To analyze dynamics systems such as suspension systems, body vibrations, steering
mechanisms.
- To Understand the vehicle aerodynamics and its effects on vehicle performance.
- To identify, formulate, and solve engineering problems related to vehicle dynamics.

UNIT I

INTRODUCTION: History of road and off road vehicle system dynamics - dynamics of the motor vehicle, coordinate systems- vehicle fixed coordinates system, details of vehicle systems, wheel angles, typical data of vehicles. Fundamental approaches to vehicle dynamics modeling lumped mass, vehicle fixed coordinate system, motion variables, earth fixed coordinate system, SAE coordinate system, Euler angles, forces, Newton's second law. Definitions- modeling and simulation of dynamic behaviour of vehicle., motion analysis, force analysis, and energy analysis.

UNIT II

LONGITUDINAL DYNAMICS: Introduction to longitudinal dynamics - Performance of road vehicles: forces and moments on vehicle, equation of motion, tire forces, rolling resistance, weight distribution, tractive effort/tractive resistance and power available from the engine/ power required for propulsion, road performance curves- acceleration, grade ability, drawbar pull and the problems related to these terms. Calculation of maximum acceleration braking torque, braking force, brake proportioning, braking efficiency, stopping distance, load distribution (three wheeled and four wheeled vehicles), calculation of acceleration, tractive effort and reactions for different drives, Stability of a vehicle on slope, (Problems related to these).

UNIT III

LATERAL DYNAMICS: Introduction to lateral dynamics - Steering geometry, types of steering systems, fundamental condition for true rolling, development of lateral forces. slip angle, cornering force, cornering stiffness, pneumatic trail, self aligning torque, power consumed by tire, tire stiffness, hysteresis effect in tires, steady state handling characteristics. yaw velocity, lateral acceleration, curvature response & directional stability.

Stability of a vehicle on a curved track and a banked road. gyroscopic effects, weight transfer during acceleration, cornering and braking, stability of a rigid vehicle and equations of motion of a rigid vehicle, cross wind handling, the problems related to these terms.

UNIT IV

VERTICAL DYNAMICS: Introduction to vertical dynamics - Human response to vibrations, classification of vibration, specification and vibration, sources of vibration, suspension systems, Modal Analysis, One DOF, two DOF, free and forced vibration, damped vibration, magnification and transmissibility, vibration absorber, functions of suspension system. body vibrations: bouncing and pitching. doubly conjugate points (only basic idea). body rolling. roll center and roll axis, roll axis and the vehicle under the action of side forces, stability against body rolling.

Vehicle dynamics and suspension design for stability, choice of suspension spring rate, chassis springs and theory of chassis springs, gas & hydraulic dampers and choice of damper, damper characteristics, mechanics of an independent suspension system. Design and analysis of passive, semi-active and active suspension using quarter car, half car and full car model.

UNIT V

VEHICLE AERODYNAMIC AND DYNAMIC CONTROL SYSTEM: Road Loads: Air resistance-Mechanics of air flow around a vehicle, pressure distribution on a vehicle, factors affecting rolling resistance, aerodynamic forces – aerodynamic drag, drag components, drag coefficient, aerodynamic aids, aerodynamic side force, lift force, pitching moment, yawing moment, rolling moment, cross wind sensitivity.

Vehicle dynamic Control, modelling of actuators, sensors for automobile control, sensors for detecting vehicle environment, central tyre inflation system. Prediction of vehicle performance. ABS, stability control, traction control.

COURSE OUTCOMES:

Student able to

1. Understand the vehicle system dynamics.
2. Evaluate the driving/ braking resistances and their influences on vehicle dynamics.
3. Identify and analyse the dynamics systems such as suspension systems, body vibrations, steering mechanisms.
4. Analyse and solve engineering problems related to vehicle dynamics.
5. Comparing and identifying the different types of control systems in automobiles.

TEXT BOOKS:

1. Rajesh Rajamani, Vehicle Dynamics and Control, Springer, 1st Edition, 2005.
2. Singiresu S. Rao, Mechanical Vibrations, Prentice Hall, 5th Edition, 2010.

REFERENCE BOOKS:

1. J. Y. Woung, Theory of Ground Vehicles, John Willey & Sons, 4th Edition, 2008.
2. Rajesh Rajamani, Vehicle dynamics and control, Springer, 2nd Edition, 2012.

B.Tech MINOR

in

Mechanical Engineering

Syllabus

(Offered to Other Branches)

APPLIED MECHANICS
(Minors)

L	T	P	C
4	0	0	4

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- Understand particle, body, rigid body, concept of force, analysis of forces acting on a rigid body.
- Understand moment and the principle of moments.
- Understand the laws of friction and its applications.
- Analyzing trusses for its member forces.
- Understand the concept of centre of gravity and area moment of inertia.
- Understanding principles of kinematics and kinetics applied to rigid bodies.

UNIT I

Force: Different force systems, principle of transmissibility of forces, law of superposition. Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, triangle law of forces, polygon law of forces, resolution of forces, resolving a force into two rectangular components, Free body diagram, Lami's theorem, Type of Load, supports, Beams, analysis for simply supported, cantilever beams.

UNIT II

Moment: Moment of a force, Varignon's theorem, Principle of moment and its applications (Levers, simple and compound), Parallel forces (like and unlike parallel forces), calculating their resultant, Concept of couple, its properties and effects, General conditions of equilibrium of bodies under coplanar forces, Position of resultant force by moment.

UNIT III

Friction: force of friction, limiting frictional force, coefficient of friction, angle of friction, angle of repose, relation between angle of friction, angle of repose and coefficient of friction. Cone of friction, types of friction, laws of friction, advantages and disadvantages of friction. Equilibrium of bodies on level plane, external force applied horizontal and inclined up and down. Equilibrium of bodies on inclined plane, external forces is applied parallel to the plane, horizontal and incline to inclined plane.

UNIT IV

Centre of Gravity: Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies, Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion, Determination of center of gravity of solid bodies, cone, cylinder and sphere; composite bodies.

UNIT V

Simple Machines: Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines, Simple and compound machine, Definition of ideal machine, reversible and self, locking machine, Effort lost in friction, Load lost in friction, System of pulleys, simple screw jack, worm and worm wheel, single and double winch crab.

COURSE OUTCOMES:

After undergoing this course, the students will be able to

1. Understand and analyse the various types of forces acting on a body, their unit's conversion from one to another and draw free body diagrams.
2. Calculate resultant force and moment to maintain equilibrium.
3. Calculate the co-efficient of friction for different types of surfaces.
4. Determine the centroid/centre of gravity of plain and composite laminar and solid bodies.
5. Determine velocity ratio, mechanical advantage and efficiency of simple machines.

TEXT BOOKS:

1. S Ramamurtham, Engineering Mechanics, DhanpatRai Publishing Co. Ltd., Rev. Edition, 2016.
2. RK Rajput, Applied Mechanics, Laxmi Publications, 3rd Edition, 2016.

REFERENCE BOOKS:

1. RS Khurmi, A Text Book of Engineering Mechanics, S Chand and Co. Ltd., Rev. Edition, 2010.
2. AK Upadhya, Applied Mechanics, SK Kataria & Sons, 5th Edition, 2013.

ENGINEERING MATERIALS
(Minors)

L	T	P	C
4	0	0	4

Pre-requisites: NIL

COURSE OBJECTIVES:

- To acquire the knowledge of different crystal structures and constitution of alloys.
- To understand rules to form solid solution and different reactions in a phase diagram.
- To understand the microstructure and properties of cast irons and non-ferrous alloys.
- To be able to correlate the concepts of phase structures and properties of different types of steels and their heat treatment methods.
- To exemplify different types of destructive and non-destructive testing of materials.

UNIT I

Crystal Structure: Space Lattice and Unit Cells, Crystallography, Crystal Structure of Common Metallic Materials – BCC, FCC and HCP. Miller Indices for Directions and Planes, Atomic Packing Efficiency for Cubic and HCP Structures, Necessity of Alloying, Types of Solid Solutions.

UNIT II

Phase Diagrams: Construction and Interpretation of Phase Diagrams, Phase Rule, Lever Rule, Binary Phase Diagrams, Isomorphous, Eutectic and Eutectoid Transformations with examples, Study of Fe-Fe_3C Phase Diagram.

UNIT III

Engineering Materials–I (Steels): Classification of Steels, Structure, Properties & Applications of - Plain Carbon Steels, Low Alloy Steels, Hadfield Manganese Steels, Tool and Die Steels.

Engineering Materials–II (**Cast Irons):** Classification of Cast Irons, Structure, Properties & Applications of White Cast Iron, Malleable Cast Iron, Grey Cast Iron and Nodular Cast Iron.

UNIT IV

Engineering Materials-III (Non-Ferrous Metals and Alloys): Structure, Properties and Applications of - Copper and its Alloys, Aluminum and its Alloys, Titanium and its Alloys. Al-Cu Phase Diagram.

Heat Treatment: Annealing, Normalizing, Hardening and Tempering of Steels, Construction of TTT Diagrams, Hardenability, Surface-Hardening Methods.

UNIT V

Testing of Engineering Materials: Tensile and Compressive Testing, Hardness – Brinell, Rockwell and Vickers Tests, Impact Testing, Ductile Fracture and Brittle Fracture.

Non-Destructive Testing: Fluorescent Inspection, Radiography, Magnetic Particle Inspection and Ultrasonic Inspection.

COURSE OUTCOMES:

Students will be able to:

1. Know different crystal structures and the importance of alloying.
2. Construct different phase diagrams, understand microstructures and reactions with examples.
3. Acquire the knowledge of engineering materials – steels, cast irons.
4. Analyze various heat treatment processes, non-ferrous metals & alloys and their properties.
5. Characterize different destructive and non-destructive testing of engineering materials.

TEXT BOOKS:

1. V. D. Kodgire, Material Science and Metallurgy for Engineers, Everest Publishing House, 39th Edition, 2017.
2. Sidney H. Avner, Introduction to Physical Metallurgy, McGraw Hill, 2nd Edition, 2017.

REFERENCE BOOKS:

1. William D Callister & R. Balasubramaniam, Materials Science & Engineering, Wiley Publishing, 2nd Edition, 2014.
2. Donald R. Askeland and Pradeep P Fulay, Essentials of Materials Science and Engineering, Cengage Learning, 2nd Edition, 2013.
3. V. Raghavan, Materials Science & Engineering, Eastern Economy Edition, 6th Edition, 2015.

BASIC THERMAL ENGINEERING
(Minors)

L	T	P	C
4	0	0	4

Pre-requisites: NIL

COURSE OBJECTIVES:

- To understand the basic concepts of thermodynamics, heat and work interactions between system and its surroundings.
- To learn the applications of first and second law of thermodynamics to thermal engineering devices.
- To learn about the working of thermal power plants.
- To study the working of IC engines and refrigerators.
- To understand different modes of heat transfer.

UNIT I

Basic Concepts: System, boundary, Surrounding, Universe, Types of Systems, Properties, Thermodynamic Equilibrium, State, Process - Reversible, Quasi static & Irreversible Processes, cycle, Causes of Irreversibility. Energy in State and in Transition - Types, Work and Heat, Point and Path function, Zeroth Law of Thermodynamics.

Joule‘s Experiment, Statement of first law of thermodynamics, First law applied to a flow system: general energy equation, steady flow energy equation and important applications (boiler, turbine and heat exchangers).

UNIT II

Limitations of the First Law of Thermodynamics, PMM 1.Statement of the second law of thermodynamics (Kelvin plancks & Clausius), Thermal reservoir, Heat Engine, Heat pump, refrigerator, Parameters of performance (thermal efficiency and the coefficient of performance), equivalence of two statements. PMM2.

UNIT III

Properties of steam: Properties of steam, Use of property diagram, Steam tables.

Thermal Power plant Cycles: Simple Ranking cycle, Steam power plant layout. Brayton cycle, Open and closed Gas turbine power plant principle, Methods to improve cycle performance: Regeneration Cycle, Reheat Cycle, Inter cooling Cycle.

UNIT IV

Introduction to I.C. Engines: Working principles of 4-Stroke and 2-Stroke Spark Ignition and Compression Ignition Engines, Differences between 2-s and 4-s cycle engines, Differences between SI and CI engines.

Refrigeration: Need of refrigeration**,** working principle of Simple vapour compression refrigeration cycle (Dry saturated vapour refrigerant at compressor inlet), COP.

UNIT V

Heat Transfer: Introduction, modes of heat transfer, Conduction Heat Transfer: General heat conduction equation in Cartesian co-ordinates, Boundary conditions, 1-D Heat transfer with internal heat generation.

Convective Heat Transfer: Classification of Convective Heat Transfer, Buckingham Pi Theorem for forced and Natural convection.

Radiation Heat Transfer: Basic concepts, concept of black body, laws of black-body radiation - Planck's law, Wien's displacement law, Stefan Boltzmann law.

COURSE OUTCOMES:

Students will be able to

1. Apply first law of thermodynamics to energy conversion devices.
2. Apply second law of thermodynamics to energy conversion devices.
3. Analyze the performance of thermal power plant.
4. Understand the working of IC engines and refrigerators.
5. Understand the modes of heat transfer and apply these basics in the design of thermal systems.

TEXT BOOK:

1. R.K. Rajput, Thermal Engineering, Lakshmi Publications, 10th Edition, 2020.
2. PK Nag, Engineering Thermodynamics, McGraw Hill, 6th Edition, 2017.

REFERENCE BOOKS:

1. Mahesh M. Rathore, Thermal Engineering, McGraw Hill, 1st Edition, 2010.
2. V Ganesan, Internal Combustion Engines, McGraw Hill, 4th Edition, 2017.

MANUFACTURING PROCESSES
(Minors)

L	T	P	C
4	0	0	4

PRE-REQUISITES: Engineering Materials

COURSE OBJECTIVES:

- To understand casting principles and different tools used for creating a sound casting.
- To specify various casting processes and gating systems.
- To demonstrate different types welding principles, welding defects - causes and remedies, testing of welds.
- To state various metal working and rolling processes.
- To study various metal forming processes such as forging, extrusion and drawing.
- To get familiarize with the sheet metal working, processing of plastics by injection molding and blow moulding.

UNIT I

Casting: Steps involved in making a casting, Types of Patterns**,** Materials used for Patterns, Pattern Allowances and their Construction, Cores: Types of Cores, Merits, Demerits & Applications of Casting, Casting Defects.

Gating System: Elements of Gating System, Principles of Gating, Gating Ratio, Design of Gating Systems, Risers, Function, Types and Design, Special Casting Processes, Die Casting, Centrifugal Casting and Investment Casting.

UNIT II

Welding: Classification of Welding Processes, Types of Welds and Welded Joints, Their Characteristics, Edge Preparation, Gas Welding, Arc Welding, Submerged Arc Welding, Inert Gas Welding, TIG & MIG Welding, Thermit Welding, Resistance Welding, Friction Welding, Friction Stir Welding, Explosive Welding, Laser Welding, Welding Defects, Causes and Remedies, Oxy – Acetylene Gas Cutting, Soldering & Brazing.

UNIT III

Bulk Deformation Processes - I:Fundamentals on Metal Forming Processes, Hot Working, Warm Working and Cold Working, Strain Hardening, Recovery, Recrystallization and Grain Growth, Comparison of Properties of Cold and Hot

Worked Parts. Rolling: Fundamentals, Theory of Rolling, Types of Rolling Mills and Products, Rolling Defects.

UNIT IV

Bulk Deformation Processes -II: **Forging Processes:** Principles of Forging, Tools and Dies**,** Types of Forging: Smith Forging, Drop Forging, Roll Forging, Rotary Forging, Forging Defects.

Bulk Deformation Processes - III: **Extrusion of Metals**: Basic Extrusion Process and its Characteristics, Hot Extrusion and Cold Extrusion, Forward Extrusion and Backward Extrusion, Impact Extrusion, Hydrostatic Extrusion, Extrusion Defects, Wire Drawing and Tube Drawing.

UNIT V

Sheet Metal Working &Plastics: Blanking and Piercing, Estimation of Blank Size, Deep Drawing, Stretch Forming, Bending, Coining, Spinning, Types of Presses and Press Tools.

Processing of Plastics: Injection Moulding and Blow Moulding.

COURSE OUTCOMES:

At the end of course, the students will be able to:

1. Illustrate the importance of casting and various pattern and cores used for making a sound casting, design a gating system and study various special casting processes.
2. Evaluate the role of metal joining processes, welding principles, welding defects, causes and remedies.
3. Illustrate the necessity of metal working and forming processes, rolling mills.
4. Relate the bulk deformation processes such as forging, extrusion and drawing processes on metals.
5. Infer sheet metal operations and plastic processing to develop engineering components.

TEXT BOOKS:

1. Kalpakjian Sand Steven R Schmid, Manufacturing Engineering and Technology, Pearson Publishing, 7th edition, 2018.
2. P.N. Rao, Manufacturing Technology –Vol. I, Tata McGraw Hill Publishers, 4th Edition, 2017.

REFERENCE BOOKS:

1. Philip C Rosenthal, Principles of Metal Casting, McGraw-Hill Education, 2nd Edition, 2017.
2. P. L. Jain, Principles of Foundry Technology, Tata McGraw Hill Publishers, 5th Edition, 2017.
3. Amitabha Ghosh & Asok Kumar Mallik, Manufacturing Science, East West Press Pvt. Ltd, 2nd Edition, 2010.

BASICS OF ENGINEERING DESIGN
(Minors)

L	T	P	C
4	0	0	4

PRE-REQUISITES: Applied Mechanics

- Engineering mechanics, manufacturing processes and material science.

COURSE OBJECTIVES:

- To introduce behavior of structural components under various loading conditions.
- To impart the knowledge of Shear force and Bending moment diagrams.
- To understand the general design procedures and principles in the design of machine elements.
- To study different materials of construction and their properties and factors determining the selection of material for various applications.
- To determine stresses under different loading conditions.

UNIT I

Simple Stresses & Strains: Elasticity and plasticity, Types of stresses & strains, Hooke’s law, stress, strain diagram for mild steel, Working stress, Factor of safety, Lateral strain, Poisson’s ratio & volumetric strain, Bars of varying section, composite bars, Complex Stresses, Stresses on an inclined plane under different uniaxial and biaxial stress conditions, Principal planes and principal stresses, Mohr’s circle, Relation between elastic constants, Strain energy, Resilience, Gradual, sudden, impact and shock loadings.

UNIT II

Shear Force And Bending Moment: Definition of beam,Types of beams, Concept of shear force and bending moment, S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, UDL, uniformly varying loads and combination of these loads, Point of contra flexure, Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT III

Flexural Stresses: Theory of simple bending, Assumptions, Derivation of bending equation: $M/I = f/y = E/R$ Neutral axis, Determination bending stresses, section modulus of rectangular and circular sections (Solid and Hollow), I, T and Channel sections, Design of simple beam sections.

Torsion: Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

UNIT IV

General Considerations: In the design of Engineering Materials and their properties, selection, manufacturing consideration in design, BIS codes of steels.

Stresses In Machine Members: Combined stresses, torsional and bending stresses, various theories of failure, factor of safety, design for strength and rigidity, preferred numbers.

UNIT V

Strength Of Machine Elements: Stress concentration, theoretical stress concentration factor, fatigue stress concentration factor notch sensitivity, design for fluctuating stresses, endurance limit, estimation of endurance strength, Goodman's line, Soderberg's line, modified Goodman's line.

COURSE OUTCOMES:

After undergoing this course, the students will be able to:

1. Understanding of the concepts of stress and strain in mechanics of solids and apply the fundamental concepts of force-deformation, and stress-strain relationships to the solid mechanics problems.
2. Knowledge of beams and analysis of Shear Force and Bending moments.
3. Apply the basic concepts to find the bending stress distribution and torsional stresses in shafts.
4. Acquires the knowledge about the principles of design, material selection, component behaviour subjected to loads, and criteria of failure.
5. Understands the concepts of stress concentration in machine members and fatigue loading.

TEXT BOOKS:

1. RK Bansal, Strength of Materials, Lakshmi Publication, 6th Edition, 2018.
2. V. B. Bandari, Machine Design, TMH Publishers, 5th Edition, 2020.

REFERENCE BOOKS:

2. Gere and Timoshenko, Mechanics of Materials, CBS Publishers, 2nd Edition, 2004.
3. Joseph E. Shigley, Mechanical Engineering Design, McGraw Hill, 9th Edition, 2010.

PRODUCT DESIGN
(Minors)

L	T	P	C
4	0	0	4

PRE-REQUISITES: Basics of Engineering Design

COURSE OBJECTIVES:

The course should enable the students to:

- Widen student knowledge on design process.
- Enable Students to attain knowledge on tools used in Design Methods.
- Create an understanding on the process of material selection and design.
- Develop in depth knowledge on Engineering statistics and reliability.
- Create awareness on legal and ethical issues in Design and Quality Engineering.

UNIT I

Design Process: The design process, Morphology of Design, Design Drawings, Computer Aided Engineering, Designing of standards, Concurrent Engineering, Product life cycle, Technological Forecasting, Market Identification, Competition Bench marking, Systems Engineering, Life Cycle Engineering, Human Factors in Design, Industrial Design.

UNIT II

Design Methods: Creativity and Problem Solving, Product Design Specifications, Conceptual design, Decision Theory, Decision Tree, Embodiment Design, Detail Design, Mathematical Modelling, Simulation, Geometric Modelling, Finite Element Modelling, Optimization, Search Methods, Geometric Programming, Structural and Shape Optimization.

UNIT III

Material Selection Processing And Design: Material Selection Process, Economics, Cost Vs Performance, Weighted property Index, Value Analysis , Role of Processing in Design, Classification of Manufacturing Process, Design for Manufacture, Design for Assembly, Designing for castings, Forging, Metal Forming, Machining and Welding, Residual Stresses, Fatigue, Fracture and Failure.

UNIT IV

Engineering Statistics And Reliability: Probability, Distributions, Test of Hypothesis, Design of Experiments, Reliability Theory, Design for Reliability, Reliability centered Maintenance.

UNIT V

Legal And Ethical Issues In Design And Quality Engineering: Introduction, The origin of laws, Contracts, Liability, Tort law, Product liability, Protecting intellectual property, Legal and ethical domains, Codes of ethics, Solving ethical conflicts, case studies Total Quality Concept, Quality Assurance, Statistics Process Control, Taguchi Methods, Robust Design, Failure Model Effect Analysis.

COURSE OUTCOMES:

On completion of the course, student will be able to

1. Get clear understanding on CAE / concurrent engineering and systems engineering.
2. Attain problem solving skills through modelling/simulation and optimize design.
3. Ability to do material selection based on economy and value analysis. Develop understanding on DFM/DFA.
4. Have good understanding on DOE, Reliability theory and reliability cantered maintenance.
5. Exposed to laws, codes of ethics, Quality concepts and FMEA.

TEXT BOOKS:

1. Dieter, George E., Engineering Design, A Materials and Processing Approach, McGraw Hill International Editions, 3rd Edition, 2000.
2. Karl T. Ulrich and Steven D. Eppinger, Product Design and Development, McGraw Hill Edition 4th Edition, 2009.

REFERENCES:

1. Pahl, G., Beitz W., Feldhusen J., Grote K.H., Engineering Design, Spinger, 3rd Edition, 2007.
2. Ray M.S., Elements of Engineering Design: An integrated approach, Prentice Hall Inc. 1st Edition, 1985.

B.Tech

MINOR: Advancement in Automobile Engineering

in

Mechanical Engineering

Syllabus

ADVANCED MANUFACTURING TECHNIQUES FOR AUTOMOBILE COMPONENTS

(Minors: Advancement in Automobile Engineering)

L	T	P	C
4	0	0	4

PRE-REQUISITES: Manufacturing processes

COURSE OBJECTIVES:

- To introduce basic engine components and its manufacturing process.
- To introduce manufacturing of air filters and catalytic converter of spark plugs.
- To study various metal forming processes.
- Plastic deformation during forming processes.
- Different laws and equations developed for solving metal forming problems.

UNIT I

Introduction to Automotive Engine Components- Introduction to automotive Engines-overview of parts, their function requirement, Materials used in the automotive sector. Manufacturing of an engine block of cylinder head- Functional requirement of an engine block & cylinder head-Materials used in engine block casting. Manufacturing process – Low pressure die casting, High pressures die casting, expendable pattern casting. Manufacturing of crankshaft-Materials used in crankshaft manufacturing, Production requirement-Process requirement – Forging, Precision machining - Heat treatment.

UNIT II

Manufacturing of Automotive Engine Components : Manufacturing of main bearing – Description, Purpose, Consistent wall thickness, Precise crush height, process requirement – Centrifugal casting, Mold material, Surface finishing for main bearing. Manufacturing of main bearing cap-Special treatment materials for cap-Hot & Cold chamber die casting-Precision drilling operation. Vibration damper-Functional requirement-Production requirement, Process description.

Manufacturing process–Hot rolling, oil tempering, cold oiling, stress relieving, nitriding, Strain aging. Inlet Manifold-Description, Injection molding. Exhaust manifold Description, Process – Welded tubular, Investment casting.

UNIT III

Introduction Metal forming as a manufacturing process and its relation with other processes – Classification based on type of stresses – Examples.

Theoretical analysis (theory of plasticity), Stress-strain relationship, Strain hardening, Material incompressibility, Work of plastic deformation, Work hardening, Yield criteria, Flow rule, Yield criterion and flow rule for Anisotropic material, Initiation and extent of plastic flow- Problems.

UNIT IV

Overview of various metal forming operations: Mechanics of Various Plastic Flow Problems Introduction to; Theory of slip lines, Upper bound theorem, Lower bound theorem.

Forging processes: Metal flow in forging, Analysis of plane strain compression, Analysis of compression of circular disc with slab method. Extrusion Processes: Calculation of extrusion load using slab method, slip line method and upper bound method.

UNIT V

Wire Drawing Processes: Introduction, wire drawing load calculation using slab method.

Rolling Processes: Analysis of longitudinal strip or sheet rolling process (calculation of roll separating force, torque & power, angle of bite, maximum reduction in rolling), rolling defects.

Sheet forming: Mechanics – Flow Rules – Anisotropy - Formability of sheet, Formability tests, forming limit diagrams.

COURSE OUTCOMES:

On completion of the course, student will be able to:

1. Understand the functional requirement of automotive component for the required manufacturing process.
2. Design considerations for the manufacturing process for various automotive components.
3. Apply the theory of plasticity and its application for analyzing various metal forming Processes.
4. Analyze effect of parameters influencing metal forming and compare hot working and cold working with applications.
5. Estimate formability limits for sheets and bulk metals.

TEXT BOOKS:

1. Surender Kumar, Technology of Metal Forming Processes, Prentice - Hall, 1st Edition, 2008.
2. Mohammed A. Omar, The Automotive Body Manufacturing System and Processes, John Wiley & Sons, 1st Edition 2011.

REFERENCES BOOKS:

1. Henry S. Valberg, Applied Metal Forming, Including FEM Analysis, Cambridge University Press, Rev. Edition, 2010.
2. William F. Hosford and Robert M. Caddell, Metal Forming, Mechanics and Metallurgy, Prentice - Hall, 4th Edition, 2012.
3. Mikell P. Groover, Fundamentals of Modern Manufacturing, John Wiley & Sons Inc, 4th Edition 2010.

VEHICLE ERGONOMICS AND STYLING
(Minors: Advancement in Automobile Engineering)

L	T	P	C
4	0	0	4

PRE-REQUISITES: NIL

COURSE OBJECTIVES:

- To impart knowledge on Ergonomics in design of Automotive Vehicles.
- To provide the knowledge of safety and styling in Automotive Vehicles.

UNIT I

Introduction to Automotive Ergonomics and Biomechanics

Ergonomics in Vehicle Design and its Approach its Origin of Ergonomics and Human Factors Engineering, Human Characteristics and Capabilities, Implementing Ergonomics, Anthropometry and Biomechanics: Anthropometry, Applications of Biomechanics. Driving Posture and Healthy Design, Driving Simulators.

UNIT II

Occupant Packaging

Vehicle Packaging, Sequence in Development of Vehicle Package, Definition of Key Vehicle Dimensions and Reference Points, Driver Package Development Procedures. Digital Human Modelling (DHM).

UNIT III

Driver Information Acquisition and Processing

Importance of Time, Understanding Driver Vision Considerations, Information Processing, Human Errors, Psychophysics, Visual Capabilities, Information Acquired through Other Sensory Modalities, Applications of Information Processing for Vehicle Design.

UNIT IV

Design and Styling of Automobile Interiors

Design considerations of Controls, Displays, and Interior Layouts, methods to evaluate controls and displays, Field of view, Forward-Field-of-View Evaluations, Mirror Design Issues, Methods to measure.

Fields of View. Automotive Lighting, Design considerations of Lighting equipment like Headlight, Signal Light, Photometric measurements of Lamp outputs, headlamp evaluation. Entry and Exit of vehicles, Features and Dimensions related to Entry and Exit and methods to evaluate.

UNIT V

Design and Styling of Automobile exteriors

Study of Exterior Interfaces, design and their issues. Automotive Craftmanship, its importance, attributes, measurement methods. Human response to Vibration, thermal environments.

Design Exercises: Implementation of the ergonomics and styling to help build a package of a vehicle.

COURSE OUTCOMES:

On completion of the course, student will be able to:

1. Develop fundamental concepts related to Ergonomics in Automotive Design.
2. Demonstrate the fundamentals of Biomechanics in Automotive Design.
3. Design for Occupant packaging and safety.
4. Estimate design constraints while styling Automobile Interiors.
5. Estimate design constraints while styling Automobile Exteriors.

TEXTBOOKS:

1. Bhise, V.D. Ergonomics in the automotive design process. CRC Press, 1st Edition, 2016.
2. Stuart, M. and H-Point, The fundamentals of car design and packaging. Art Center College of Design, 1st Edition, 2009.

REFERENCE BOOKS:

1. Automotive Ergonomics: Driver-Vehicle Interaction. United States: CRC Press. 1st Edition, 2016.
2. Harvey, C. and Stanton, N.A., Usability evaluation for in-vehicle systems. CRC Press, 1st Edition, 2016.

AUTOMATED, CONNECTED, AND INTELLIGENT VEHICLES

(Minors: Advancement in Automobile Engineering)

L	T	P	C
4	0	0	4

PRE-REQUISITES: Elements of Electrical & Electronics Engineering, Automobile Engineering

COURSE OBJECTIVES:

- To understand working of Connected, automated and Intelligent cars.
- To provide knowledge related to Sensor Technology for Advanced Driver Assistance Systems.
- To study fundamentals of Wireless Technology.
- To know about recent driver assistance system technology and recent development in automated technology.

UNIT I

INTRODUCTION

Introduction to Connected, automated and Intelligent cars: Automotive Electronics Overview, Advanced Driver Assistance Electronic Systems, Connected Car Technology: Connectivity Fundamentals, Navigation and Other Applications, Connected Car Display Technology, Connected and Autonomous Vehicle Technology: Basic Control System Theory applied to Automobiles, Overview of the Operation of ECUs, Basic Cyber-Physical System Theory and Autonomous Vehicles.

UNIT II

Sensor Technology

Sensor Technology for Advanced Driver Assistance Systems: Basics of Radar Technology and Systems, Ultrasonic Sonar Systems, Lidar Sensor Technology and Systems, Camera Technology, Night Vision Technology, Impaired Driver Technology: Driver Impairment Sensor Technology, Sensor Technology for Driver Impairment Detection, Transfer of Control Technology.

UNIT III

Communication

Classification, Applications in the Vehicle, Coupling of Networks, Examples of Networked Vehicles. Buses - CAN Bus, LIN Bus, MOST Bus, Bluetooth, Flex ray, Diagnostic Interfaces.

Vehicle Motion Control

Antilock Brake System (ABS), Electronic Stability Program (ESP), Traction Control System (TCS), Active Steering, and Electronic Transmission Control.

UNIT IV

Wireless Technology

Wireless System Block Diagram and Overview of Components, Transmission Systems – Modulation/Encoding, Receiver System Concepts – Demodulation/Decoding, Signal Propagation Physics, Basic Transmission Line and Antenna Theory, Wireless System Standards and Standard Organizations. Internet of Things, Wireless Networking Fundamentals, Integration of Wireless Networking and On-Board Vehicle Networks.

UNIT V

Recent Driver Assistance System and Vehicles

Basics of Theory of Operation, Applications – Legacy, Applications – New, Applications – Future, Integration of ADAS Technology into Vehicle Electronics, System Examples, Role of Sensor Data Fusion, Recent Driver Assistance System Technology applied in various automobile companies dealing with Non-Passenger Car, mini project to apply knowledge of various technologies related to connected vehicles.

COURSE OUTCOMES

On completion of the course, student will be able to

1. Explain basics and advancement in Automated and intelligent Cars.
2. Explore basics related to sensor technology in automated vehicles.
3. Understand the communication protocols and diagnostics of the sub systems.
4. Learn fundaments related to wireless technology in connected vehicles.
5. Understand recent driver assistance system technology associated with automated vehicles.

TEXT BOOKS:

1. Dimitrakopoulos, G, Tsakanikas A, Panagiotopoulos E, Autonomous Vehicles: Technologies, Regulations, and Societal Impacts, Elsevier Science, 2021.
2. G. Mullett, Wireless Telecommunications Systems and Networks, Thomson – Delmar Learning, ISNB#1-4018-8659-0, 2006.

REFERENCE BOOKS:

1. Dietmar P.F. Möller, Roland E. Haas, Guide to Automotive Connectivity and Cybersecurity: Trends, Technologies.
2. G. Mullett, Basic Telecommunications: The Physical Layer, Thomson – Delmar Learning, ISBN#1-4018-4339-5, 2003.
3. Ponnaluri, R., Alluri, P, Connected and Automated Vehicles: Developing Policies, Designing Programs, and Deploying Projects: From Policy to Practice, Elsevier Science, 2021.

AUTOMOTIVE AERODYNAMICS
(Minors: Advancement in Automobile Engineering)

L	T	P	C
4	0	0	4

PRE-REQUISITES: Computational Fluid Dynamics

COURSE OBJECTIVES:

Students undergoing this course are expected to:

- Provide guidance to industry on reducing the aerodynamic drag in heavy truck vehicles.
- Develop innovative drag reducing concepts that are operationally and economically sound.
- Establish a database of experimental, computational, and conceptual design information.
- Demonstrate the potential of new drag-reduction concepts.

UNIT I

Introduction: Scope and Historical Development Trends - Fundamental of Fluid Mechanics - Flow Phenomenon Related To Vehicles - External & Internal Flow Problem - Resistance To Vehicle Motion - Performance - Fuel Consumption And Performance - Potential of Vehicle Aerodynamics.

UNIT II

Aerodynamic Drag Of Cars: Cars as a Bluff Body - Flow Field Around Car - Drag Force - Types of Drag Force - Analysis of Aerodynamic Drag -Drag Coefficient of Cars - Strategies for Aerodynamic Development – Low Drag Profiles, Lift, Body Styling.

UNIT III

Shape Optimization Of Cars: Front End Modification - Front And Rear Wind Shield Angle - Boat Tailing - Hatch Back, Fast Back And Square Back - Dust Flow Patterns at the Rear - Effects of Gap Configuration - Effect of Fasteners.

The Origin of Forces and Moments on Vehicle - Side Wind Problems - Methods to Calculate Forces and Moments - Vehicle Dynamics Under Side Winds - The Effects of Forces and Moments.

UNIT IV

Vehicle Handling: Characteristics of Forces and Moments - Dirt Accumulation on the Vehicle - Wind Noise – Drag Reduction in Commercial Vehicles.

UNIT V

Wind Tunnels For Automotive Aerodynamic: Introduction – Principle of Wind Tunnel Technology – Limitation of Simulation – Stress with Scale Models – Full Scale Wind Tunnels – Measurement Techniques – Equipment and Transducers – Road Testing Methods – Numerical Methods.

COURSE OUTCOMES:

Upon the successful completion of the course, learners will be able to:

1. Evaluate basic fluid theory.
2. Apply CFD to a range of problems.
3. Understand lift, drag and down force definitions and calculations.
4. Demonstrate a knowledge and understanding of aerodynamics in automotive field.
5. Explain the principles and functions of wind tunnel.

TEXT BOOK:

1. Wolf – Heinrich Hucho, Aerodynamics of Road Vehicles: From Fluid Mechanics to Vehicle Engineering, Elsevier Ltd., 4th Edition, 1998.
2. Heinz Heisler, Advanced Vehicle Technology, Butterworth –Heinemann 2nd Edition, 2002.

REFERENCE BOOKS:

1. Pope. A., Wind Tunnel Testing, John Wiley & Sons, 2nd Edition, 1974.
2. Sumantran. V, Gino Sovran, Vehicle Aerodynamics, Society of Automotive Engineers, U.S., 1st Edition, 1994.

VEHICLE TESTING AND AUTOMOTIVE STANDARDS
(Minors: Advancement in Automobile Engineering)

L	T	P	C
4	0	0	4

PRE-REQUISITES: Automobile Engineering

COURSE OBJECTIVES:

- To understand the various facets of vehicle performance.
- To diagnose the factors affecting engine performance.
- To diagnose the factors affecting operations of a vehicle.
- To understand the various processes of Vehicle Testing.

UNIT I

Engine Performance Diagnosis: Engine leak and noise Diagnosis, Exhaust, Oil consumption and Temperature tests, Cooling System Diagnosis, Power balance tests and Compression tests, Valve timing and clearance tests.

UNIT II

Operational Performance: Engine Performance & Operating Characteristics, Operation at Full Load and Part Load Conditions, Effect of Vehicle Condition, Tire and Road Condition, Traffic Condition.

UNIT III

Vehicle Testing: NVH, Power and Fuel Consumption, Testing on Chassis Dynamometer, Road and Track Testing, Initial Inspection, Run-in, Durability and Extensive Driving, Maximum Speed and Acceleration, Brake Testing.

UNIT IV

Automotive Standards: Vehicle Pollution Norms, Bharat Stage Standards, NCAP Standards for Vehicle Crash testing. Vehicle Standardization.

UNIT V

Motor Vehicle Act: Schedules and sections, Registration of motor vehicles, Licensing of drivers, Control of permit, Limits of speed, traffic signs. Constructional regulations. Description of goods carrier, delivery van, tanker, tipper, Municipal, firefighting and break down service vehicle.

COURSE OUTCOMES:

On completion of the course, student will be able to:

1. Outline the factors affecting Engine performance.
2. Examine the function of various Engine components by appropriate testing.
3. Analyse the engine performance and operating characteristics.
4. Determine the effect of various operating factors on the performance of the vehicle.
5. Design tests for testing vehicles for various operating conditions.

TEXTBOOKS:

1. Martyr A. J, Plint M. A, Engine Testing Theory and Practice, 3rd edition, Butterworth-Heinemann, 2007.
2. Crouse. W. H, Anglin. D. L, Motor Vehicle Inspection, McGraw Hill, 1978.

REFERENCE BOOKS:

1. Giles J. G, Vehicle Operation & Performance, Illife Books Ltd., 1st Edition, 1989.
2. Advanced Vehicle Testing and Evaluation, United States: United States. Department of Energy, 2013.

NOISE, VIBRATION AND HARSHNESS
(Minors: Advancement in Automobile Engineering)

L	T	P	C
4	0	0	4

PRE-REQUISITES: Kinematics of Machines, Dynamics of Machines

COURSE OBJECTIVES:

- To help the students to acquire in-depth knowledge of vibration and its control of an automobile.
- To make students to understand the different sources of engine and mechanical noises.
- To enable the students with the knowledge of noise, harshness and vibration control.

UNIT I

Vibration

Free and forced vibration, un-damped and damped vibration, linear and nonlinear vibration, response of damped and un-damped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

UNIT II

Vibration Control

Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT III

Engine Noise

Introduction noise dose level, legislation, measurement and analysis of noise in engines, Noise characteristics, overall noise levels, assessment of combustion noise, engine radiated noise.

Mechanical Noise

Assessment of mechanical noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

UNIT IV

Noise Control:

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers.

Harshness:

Harshness, sources. its effects, measurement and control.

UNIT V

Measuring Instruments

Vibration Instruments- Vibration Exciters, Analysers, Principle, Free and Forced Vibration test, Frequency and Domain Analysis, Sound Intensity and mapping and introduction to array technique. Digital Signalling Process. Recent Trends.

COURSE OUTCOMES:

Upon Successful Completion of this course, Students will be able to

1. Evaluate the single and two degree of freedom systems all types of vibrations and determining the natural frequencies.
2. Possess the knowledge of vibration control through dampers, isolators in IC Engines and calculating the modal analysis of the shock absorbers.
3. Prediction and measurement of engine and mechanical noise of an automobile.
4. Gain the knowledge of controlling the various sources of noise by different methods.
5. Ability to measure and control harshness, vibration using various methods.

TEXT BOOKS:

1. Malcom J. croker, Noise and Vibration Control, Wiley, 2007.
2. Norton MP, Fundamental of Noise and Vibration, Cambridge University Press, 2003.

REFERENCE BOOK:

1. Boris and Korney, Dynamic Vibration Absorbers, John Wiley, 1993.
2. Lewis L, Industrial Noise Control, McGraw Hill Inc, 1991.

OPEN ELECTIVES

III B.Tech. I - Semester

BASICS OF ELECTRONIC AND DIGITAL CIRCUITS

(OPEN ELECTIVE I)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- Study the physical phenomena and electrical characteristics of diodes and the application of diodes as rectifiers with and without filters.
- The principle of working and operation of Bipolar Junction Transistor and Field Effect Transistor with characteristics and transistor biasing methods.
- Small signal analysis of BJT and FET transistor amplifiers in different configuration and basic principle of different oscillator circuits with their analysis.
- The concept of linear wave shaping circuits such as RC low pass and high pass with sinusoidal, step, pulse, square inputs and the non-linear wave shaping circuits such as clippers and clampers with their transfer characteristics.
- The principle of working, operation and waveforms of various multi vibrators and its applications.

UNIT I

DIODE, RECTIFIERS AND FILTERS

Diode: Open circuited p-n junction, biased p-n junction-forward bias and reverse bias, PN junction Diode and V-I Characteristics, Zener Diode and V-I Characteristics.

Rectifier - half wave rectifier, full wave rectifier and bridge rectifier-operation, input and output waveforms.

Filters–Inductor filter, capacitor filter and L-section filter-operation, input and output waveforms.

UNIT II

TRANSISTOR AND BIASING

BJT: Junction transistor, transistor current components, transistor configurations, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations.

FET: FET types, construction, operation, characteristics, MOSFET-types, construction, operation, characteristics.

Transistor Biasing: Need for biasing, operating point, load line analysis, BJT biasing methods-basic stability, fixed bias, collector to base bias, self-bias.

UNIT III

AMPLIFIERS AND OSCILLATORS

BJT Amplifier: Transistor hybrid model, determination of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB and CE amplifiers using exact analysis, Comparison of transistor amplifiers.

FET Amplifier: FET small signal model, analysis of CS and CD amplifiers, comparison of FET amplifiers.

Oscillators: Oscillator principle, condition for oscillations, types of oscillators, RC-phase shift, LC Oscillators-Hartley and Colpitt's oscillators with BJT.

UNIT IV

WAVE SHAPING

Linear Waveshaping: Low pass, High pass RC circuits, their response for sinusoidal, step, pulse, square inputs, RC network as differentiator and integrator.

Non-Linear Wave Shaping: Clippers: Diode clippers, clipping at two independent levels, Transfer characteristics of clippers, Transistor clippers, Emitter coupled clipper.

Clampers: Positive clamper and negative clamper, clamping circuit theorem.

UNIT V

MULTIVIBRATOR (Qualitative treatment only):

Bistable Multivibrator: Collector coupled bistable multivibrator - fixed bias and self-bias bistable multivibrators, Triggering of binary circuits.

Monostable Multivibrator: Collector coupled monostable multivibrator-circuit, operation and waveforms, Triggering of monostable multivibrator, Applications of monostable multivibrator.

Astable Multivibrator: Collector coupled a stable multivibrator-circuit, operation and waveforms, Application of a stable multivibrator.

COURSE OUTCOMES:

At the end of this course the student can able to:

1. Understand the formation of p-n junction and how it can be used in different modes of operation and know the construction, working principle of rectifiers with and without filters.

2. Understand the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations and bias the transistor for various applications such as amplifier, switch etc.
3. Perform the analysis of small signal low frequency transistor amplifier circuits using BJT and FET in different configurations and different oscillators.
4. Design linear and non-linear wave shaping circuits and apply the fundamental concepts of wave shaping for various switching and signal generating circuits.
5. Understand the concept of different multivibrators and apply to various pulse and digital circuits.

TEXT BOOKS:

1. Jacob Millman, C. Halkies, C. D. Parikh, Integrated Electronics, Tata Mc-Graw Hill, 2009.
2. A. Anand Kumar, Pulse and Digital Circuits, PHI, 2005.

REFERENCES BOOKS:

1. J. Millman, C. Halkias, Electronic Devices and Circuits, Tata Mc-Graw Hill, 2nd Edition, 2010.
2. J. Millman and H. Taub, Pulse, Digital and Switching Waveforms, McGraw-Hill, 3rd Edition, 2017.

III B.Tech. I - Semester

PRINCIPLES OF COMMUNICATION SYSTEMS (OPEN ELECTIVE I)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

This course will enable students to

- Familiarize with the fundamentals of analog and digital communication systems.
- Understand and analyze concepts of Analog Modulation schemes: AM, FM.
- Understand and analyze concepts digitization of signals: sampling, quantizing and encoding.
- Evolve the concept of quantization noise for sampled and encoded signals and study the concepts of reconstruction from these samples at a receiver.

UNIT I

AMPLITUDE MODULATION:

Introduction to communication system, Need for modulation, Amplitude Modulation: Introduction, Amplitude Modulation: Time & Frequency – Domain description, power relations in AM waves, Generation of AM waves, square law Modulator, Switching modulator, Envelop detector, Noise in AM.

UNIT II

DSBSC Modulation: Time and Frequency – Domain description, Balanced modulator, Coherent detection, Costas Receiver.

SSB and VSB Methods of Modulation: SSB Modulation, VSB Modulation, Time and Frequency – Domain description, Frequency- Division Multiplexing.

UNIT III

ANGLE MODULATION:

Angle Modulation: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, Noise in FM.

UNIT IV

PULSE ANALOG MODULATION:

Introduction, The Low pass Sampling process, Pulse Amplitude Modulation, PWM, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, Comparison of FDM and TDM.

UNIT V

SAMPLING AND QUANTIZATION:

Why Digitize Analog Sources?

Pulse– Code Modulation: Sampling, Quantization, Encoding, Quantization Noise, Differential pulse code modulation Delta Modulation, Adaptive delta modulation, Comparison between PCM, DM, ADM and DPCM.

COURSE OUTCOMES:

After studying this course, students will be able to:

1. Describe the basic principle of communication system.
2. Differentiate various Analog modulation and demodulation schemes and their spectral characteristics.
3. Analyze noise characteristics of various analog modulation methods.
4. Demonstrate and solve communication system parameters for various types of modulation and demodulation techniques.
5. Differentiate between various types of pulse modulation.

TEXT BOOKS:

1. H Taub & amp; D. Schilling, Gautam Sahe, Principles of Communication Systems, TMH, 3rd Edition, 2007.
2. Simon Haykins & Moher, Communication Systems, John Willey, 5th Edition, 2010.

REFERENCE BOOKS:

1. George Kennedy and Bernard Davis, Electronics & amp; Communication System, TMH, 2004.
2. B. P. Lathi, Modern Digital and Analog Communication Systems, Oxford University Press., 4th Edition, 2011.

III B.Tech. I - Semester

DATA STRUCTURES

(OPEN ELECTIVE I)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Understand and apply algorithm analysis for various searching and sorting techniques.
- Understand the concept of linked lists and be use it in various applications.
- Be able to use Stacks and Queues in various applications.
- Understand the concept of Trees & Graphs and perform various operations on it.
- Understand the concept of Hashing & different types of Hashing Techniques.

UNIT I

Algorithms, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big Oh, Omega and Theta notations, Complexity Analysis Examples. Searching and Sorting: Linear and binary search methods. Bubble sort, Insertion sort, Selection Sort, Radix Sort, Comparison of sorting methods.

UNIT II

Data structures-Linear and nonlinear data structures, Linear List, Array representation, Linked representation, singly linked lists -insertion, deletion, search operations, doubly linked lists-insertion, deletion operations, circular Linked lists-insertion, deletion operations, Applications of Linked Lists – Polynomial Representation, Sparse Matrix Representation.

UNIT III

Stacks - Representation of Stacks using arrays and linked lists, Applications of stacks Expression evaluation - Infix to Postfix Conversion, Evaluating Postfix Expressions, Reversing the list.

Queues – Representation of Queues using arrays and linked lists, Applications of Queues, Circular queue, Double Ended Queue -insertion, and deletion.

UNIT IV

Trees- Terminology, Properties of Binary trees, Binary tree representations, recursive and non-recursive binary tree traversals, Priority Queues, Heaps-Max Heap, Min Heap.

Search trees- Binary search tree, Operations of Binary Search Trees - insertion, deletion and search, balanced search trees, AVL trees - Definition, operations.

UNIT V

Graphs- Introduction, Definition, Graph Representation, Elementary Graph Operations – Vertex Insertion, Vertex Deletion, Edge Insertion, Edge Deletion etc, Graph Traversals.

Hashing: Definition, Hash table, Hash function, Collision, Collision Resolution Techniques-Chaining, and Open Addressing.

COURSE OUTCOMES:

By the end of the course, the students should be able to:

1. Use various searching and sorting techniques, and analyze the complexity of various algorithms.
2. Perform various operations on Linked Lists, and use them in various applications.
3. Perform various operations on Stacks and Queues, and use them in various applications.
4. Perform various operations on Trees and Graphs, and use them in various applications.
5. Understand different types of Hashing Techniques.

TEXT BOOKS:

1. R. Lafore, Data structures and Algorithms in Java, Pearson education, 2nd Edition, 2002.
2. Reema Thareja, Data Structures, Using C, OXFORD Higher Education, 2nd Edition, 2014.
3. Mark Allen Weiss, Data structures and Algorithm Analysis in C++, Pearson Education. Ltd., 3rd Edition, 2007.

REFERENCE BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stien, Introduction to Algorithms, PHI Learning Privet Limited, 3rd Edition, 2019.
2. Langsam, Augenstein and Tanenbaum, Data structures using C and C++, PHI, 2nd Edition, 2015.

III B.Tech. I - Semester

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

(OPEN ELECTIVE I)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To identify Java language components and how they work together in applications.
- To learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- To learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications.
- To understand how to design applications with threads in Java and connect to databases.

UNIT I

Introduction to OOPS: Introduction, Need of OOP, Principles of Object Oriented Languages, Procedural languages vs OOP, Applications of OOP, History of Java, JVM, Java Features, Programming Style, Escape Sequence Comments.

Data Types, Variables, Operators and Flow of Control: Variables, Primitive Data types, Constants, Identifiers- Naming Conventions, Keywords, Literals, Operators- Binary, Unary, Ternary, Expressions, Precedence rules and Associativity, Primitive Type Conversion and casting, Flow of Control-Branching, Conditional Loops.

UNIT II

Classes and Objects: Class declaration and Modifiers, Class Members, Declaration of Class Object, Object Creation, Access control for Class Members, Defining methods, Method Overloading, Recursive methods, Constructor, Constructor overloading, static keyword, this keyword. Class String, Methods for Extracting characters from strings, Command Line Arguments, String Methods.

Inheritance: Types of Inheritance, Deriving classes using Extends keyword, Super keyword, Final keyword, Polymorphism- Abstract classes and methods, Overriding, final methods and classes.

UNIT III

Interface: Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Static methods in interface, functional interfaces.

Packages and Java Library: Defining package, Importing packages and classes into programs, Path and class path, Access control, Java.lang package and its classes, wrapper classes, auto –boxing and auto-unboxing, Java.util package.

UNIT IV

Exception Handling: Introduction, Exception handling techniques- try, catch, throw, throws, finally block, nested try and catch blocks, User defined Exception, checked exception, unchecked exception.

Input/Output and String Handling: Files and streams- Byte stream, I/O stream, Character Stream, File Reader and Writer, charArrayReader and Writer, String Buffer, String Builder.

UNIT V

Muti- threading: Introduction, Need for Multiple threads, Mulithreaded Programming, Thread Class, Runnable interface, Creation of new thread, thread states, thread priority.

Java Database Connectivity: Introduction, JDBC Architecture, Environment Setup, JDBC Database Connections, Resultset Interface, Creating JDBC Applications.

COURSE OUTCOMES:

1. Able to understand the features of Java and basic programming concepts.
2. Able to create and use Classes, objects, Methods, Constructor, Strings and Inheritance.
3. Able to use Interfaces and learn to build own packages in java.
4. Apply the concept of exception handling, Input/ Output operations and advance string operations.
5. Develop applications or programs using multithreading and connect to database.

TEXT BOOKS:

1. Anitha Seth, B. L. Juneja, JAVA one step ahead, Oxford University Press, 1st Edition, 2017.
2. Herbert Schildt, The complete Reference Java, TMH, 11th Edition, 2020.
3. Cay S. Horstmann, Gary cornell, Core Java Volume – I Fundamentals, Prentice Hall, 9th Edition, 2013.

REFERENCE BOOKS:

1. Y Daniel Liang, Introduction to java programming, Pearson, 7th Edition, 2009.
2. Joel Murach, Murach's Java Programming, Mike Murach & Associates Inc., 4th Edition, 2011.

E-Resources:

1) https://nptel.ac.in/courses/106/105/106105191/
2) https://www.w3schools.com/java/java_data_types.asp

III B.Tech. I - Semester

FUNDAMENTALS OF POWER GENERATION AND TRANSMISSION (OPEN ELECTIVE I)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the purpose and principle of operation of different components of thermal power station and nuclear power station.
- To study the constructional details and operation of different components of an air and gas insulated substations.
- To study the computational procedure of inductance, capacitance of transmission lines and concepts of GMD/GMR.
- To study the performance and modeling of different transmission lines.
- To study the various electrical and mechanical factors governing the performance of transmission lines as well as to study the performance of overhead insulators.

UNIT I

Thermal and Nuclear Power Stations

Thermal power station – Selection of site, general layout of a thermal power plant showing paths of coal, steam, water, air, ash and flue gasses, ash handling system, brief description of major components.

Nuclear power stations – Selection of site, nuclear fission, nuclear fuels, nuclear chain reaction, general layout of a of nuclear power plant, brief description of major components, radiation hazards and shielding, nuclear waste disposal.

UNIT II

Substations

Air Insulated Substations –Indoor and outdoor substations, substation layout of 33/11 kV showing the location of all the substation equipment, single bus bar, sectionalized single bus bar with relevant diagrams.

Gas Insulated Substations (GIS) – Advantages of gas insulated substations, constructional aspects of GIS, installation and maintenance of GIS, comparison of air insulated substations and gas insulated substations.

UNIT III

Transmission Line Parameters-I

Transmission line parameters, calculation of inductance for single phase and three phase single circuit lines - symmetrical and asymmetrical conductor configuration with and without transposition, concept of GMR and GMD.

Transmission Line Parameters-II

Calculation of capacitance for single phase and three phase single circuit lines -symmetrical and asymmetrical conductor configuration with and without transposition– Numerical Problems.

UNIT IV

Performance of Short, Medium and Long Transmission Lines

Classification of Transmission Lines-Short transmission line model representation by using end condenser method, medium transmission line model representation by Nominal "T" and Nominal "π" methods, representation of long transmission line, rigorous mathematical solution, numerical problems.

UNIT V

Various Factors governing the Performance of Transmission Line-Skin effect, proximity effect and Ferranti effect. Corona, description of the phenomenon, factors affecting corona.

Sag and Tension Calculations and Overhead Line Insulators- Sag and Tension calculations with equal and unequal heights of towers, effect of wind and ice on weight of conductor, types of insulators, voltage distribution, calculation of string efficiency.

COURSE OUTCOMES:

Students are able to:

1. Understand the function of different components of thermal and nuclear power plants.
2. Identify the different components of air and gas insulated substations.
3. Evaluate the different parameters of transmission lines.
4. Model and analyze the performance of different transmission lines.
5. Analyze the various electrical factors governing the performance of transmission lines and understand the concepts of sag and string efficiency.

TEXT BOOKS:

1. M. L. Soni, P. V. Gupta, U. S. Bhatnagar and A. Chakrabarti, A Text Book on Power System Engineering, Dhanpat Rai & Co. Pvt. Ltd, 2016.
2. C. L. Wadhwa, Electrical power systems, New Age International (P) Limited, Publishers, 7th Edition, 2017.

3. C. L. Wadhawa, Generation, Distribution and Utilization of Electric Energy, New age International (P) Limited, Publishers, 3rd Edition, 2015.

REFERENCE BOOKS:

1. J. B Gupta, A course in Power Systems, SK Publications, 11th Edition, 2013.
2. P. S. R. Murthy, Electrical Power Systems, B. S. Publications, 1st Edition, 2017.
3. M V Deshpande, Elements of Electrical Power Station Design, PHI, New Delhi, 1st Edition, 2010.

III B.Tech. I - Semester

NON-CONVENTIONAL ENERGY SOURCES

(OPEN ELECTIVE I)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objectives of this course is to acquire knowledge on:

- solar radiation data, extra-terrestrial radiation, radiation on earth's surface.
- maximum power point techniques in solar pv and wind.
- wind energy conversion systems, Betz coefficient, tip speed ratio.
- basic principle and working of hydro, tidal systems.
- basic principle and working biomass, fuel cell and geothermal systems.

UNIT I

Fundamentals of Energy Systems

Energy conservation principle, Energy scenario (world and India), Solar radiation**:** Outside earth's atmosphere, Earth surface – Analysis of solar radiation data – Geometry – Radiation on tilted surface, Numerical problems.

UNIT II

Solar Thermal Systems

Liquid flat plate collections**:** Performance analysis, Transmissivity, Absorptivity, Product collector efficiency factor, Collector heat removal factor, Numerical problems, Introduction to solar air heaters, Concentrating collectors and solar pond.

UNIT III

Solar Photovoltaic Systems

Balance of systems, I-V & P-V characteristics, System design**,** Storage sizing, PV system sizing, Maximum power point techniques**,** Perturb and observe (P&O) technique.

Wind Energy

Wind patterns, Types of turbines, Kinetic energy of wind, Betz coefficient, Tip–speed ratio, efficiency, Power output of wind turbine, Maximum power point tracking.

UNIT IV

Hydro and Tidal power systems

Basic working principle, Classification of hydro systems**:** large, small, micro, Measurement of head and flow, Energy equation, Types of turbines, Numerical

problems.
Tidal power-Basics, Kinetic energy equation, Numerical problems, Wave power-basics, Kinetic energy equation.

UNIT V

Biomass, fuel cells and geothermal systems

Biomass Energy**:** Fuel classification – Pyrolysis – Direct combustion of heat– Different digesters and sizing.
Fuel cell**:** classification – Efficiency – V-I characteristics–Geothermal**:** classification – Dry rock and acquifer –Energy analysis.

COURSE OUTCOMES:

The students should be able to:

1. analyze solar radiation data, extraterrestrial radiation, radiation on earth's surface.
2. develop maximum power point techniques in solar PV and wind.
3. explain wind energy conversion systems, Betz coefficient , tip speed ratio.
4. explain basic principle and working of hydro, tidal systems.
5. explain the basic principle of biomass ,fuel cell and geothermal systems.

TEXT BOOKS:

1. S. P. Sukhatme and J. K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, TMH, New Delhi, 3rd Edition, 2009.
2. John Twidell and Tony Weir, Renewable Energy Resources, Routledge, 3rd Edition, 2015.
3. John Andrews and Nick Jelly, Energy Science: Principles, Technologies and Impacts, Oxford, 2nd Edition, 2013.

REFERENCE BOOKS:

1. Ramesh & Kumar, Renewable Energy Technologies, Narosa, 1997.
2. Chetong Singh Solanki, Renewable energy technologies, A practical guide for beginners, PHI, 2008.

III B.Tech. I - Semester

ELEMENTS OF CIVIL ENGINEERING

(OPEN ELECTIVE I)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To know the different fields of Civil Engineering, Building Materials and structural Elements.
2. To expose a wide range of concepts in steel connections and pre-stressed members.
3. To provide basic fundamental knowledge on Transportation Engineering, Environmental engineering.

UNIT I

Civil Engineering Materials:

Traditional materials: Stones-Bricks-Lime-Cement-Timber.

Mortars: Sand -Cement Mortar-Lime Mortar-Mud Mortar-Special Mortar-Tests on Mortar. **Concrete:** Plain Concrete-Reinforced Cement Concrete (R.C.C.)-Reinforced Brick Concrete (RBC) - Pre-stressed Concrete (PSC) - Fibre-Reinforced Concrete (FRC) Cellular Concrete- Ferro-Cement.

Metals as building materials: Ferrous Metals-Aluminium-Copper.

Miscellaneous building materials: Glass-Plastics – Bitumen – Asbestos – Paints – Distempers – Varnishes - Solid and Hollow Concrete Blocks - Roofing and Flooring Tiles.

UNIT II

Building Construction:

Building planning: Elements of a Building-Basic Requirements of a Building-Planning-Planning Suitable Orientation-Planning for Energy Efficiency-Planning for Suitable Utility-Planning for Meeting Other Requirements.

Foundations: Dimensions of Foundation - Conventional Spread Footings - R.C.C. Footings - Grillage Footing Arch Foundation - Pile Foundations - Foundations in Black Cotton Soil.

Super structures: Types of Super Structures Based on the Method of Load Transfers – Walls - Stone Masonry - Brick Masonry – Plastering – Pointing – Flooring – Roof - Doors and Windows – Lintels – Stairs.

UNIT III

Concrete Structures: Introduction to RCC structures, Materials, permissible stresses and IS Specifications; Working stress methods; Limit State Method - Stress Blocks parameters.

UNIT IV

Steel Structures: Introduction to steel structures, Properties of steel sections, permissible stresses, IS Specifications; Riveted and welded joints and bolted connections.

Pre-Stressed Concrete: Introduction to Pre-Stressed structures, Basic concepts, material for pre-stressing, losses in Pre stress, classification of pre-stressing system.

UNIT V

Roads: Benefits- Classifications - Traffic signs, Bridges-components of Bridges – Dams and its Types, Purpose of reservoir.

Environmental Engineering: Protected water supply, water treatment methods-sewage treatment- Pollution-Types-causes-remedial measures.

COURSE OUTCOMES:

1. To impart basic knowledge on civil engineering materials.
2. To explore basic knowledge on building construction materials.
3. The students will be able to analyze the material on the basis of their properties and thus assigning different weight age to their use for technical purposes and to provide exposure on the fundamental elements of civil engineering structures.
4. To explore the knowledge on steel connections and pre-stressed members.
5. The student will be able to know about pavements and water treatment methods.

TEXT BOOKS:

1. Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kr. Jain, Basic Civil Engineering, Laxmi Publications, 2003.
2. S Shanmugam, Ms Palanichamy, Basic civil and Mechanical Engineering, Mc Graw Hill, 1st Edition, 2018.

REFERENCE BOOKS:

1. SS Bhavikatti, Basic civil Engineering, New Age International publishers, 1st Edition, 2018.
2. Nevile, Properties of concrete, Longman publishers, 5th Edition, 2012.

III B.Tech. I - Semester

ADVANCED CONCRETE TECHNOLOGY

(OPEN ELECTIVE I)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To understand the properties of ingredients of concrete.
2. To study the behavior of concrete at its fresh and hardened state.
3. To study about the concrete design mix and to know about the procedures in concrete at different stage.

UNIT I

Concrete Making Materials: Cement – Bogus Compounds – Hydration Process – Types of Cement – Aggregates – Gradation Charts – Combined Aggregate – Alkali Silica Reaction – Admixtures – Chemical and Mineral Admixtures.

UNIT II

Mix Design: Factors influencing mix proportion, Mix design by ACI method and I.S. code method, Design of high strength concrete.

UNIT III

Durability of concrete : Shrinkage and creep of concrete, permeability of concrete, Acid Attack, Thermal properties of concrete, Micro cracking of concrete, Corrosion Causes effects and remedial measures.

Properties of Concrete:

Fresh concrete: Workability, Compaction Factor, Vee Bee time.

Hardened concretes: Cube Strength, Cylindrical Strength, Flexural Strength and Non-Destructive Testing.

UNIT IV

High Strength Concrete: Microstructure – Manufacturing and Properties – Design of HSC Using Erintroy Shaklok method – Ultra High Strength Concrete. High Performance Concrete – Requirements and Properties of High Performance Concrete – Design Considerations.

UNIT V

Special Concretes: Self Compacting concrete, Polymer Concrete, Fibre Reinforced Concrete -Reactive Powder Concrete – Requirements and Guidelines – Advantages and Applications. Concrete Mix Design: Quality Control – Quality

Assurance – Quality Audit – Mix Design Method – BIS Method – DOE Method – Light Weight Concrete, Self Compacting Concrete.

COURSE OUTCOMES:

On completion of this course, the students will be able to

1. Identify quality control tests on concrete making materials.
2. Design concrete mixes as per IS and ACI codes.
3. Understand the behaviour of fresh and hardened concrete.
4. Design high strength concrete and their specific applications and use of admixtures.
5. Understand the need for special concretes.

TEXT BOOKS:

1. Shetty, M. S., Concrete Technology, Theory & Practice, S.Chand and Co., 2006.
2. Gambhir, M. L., Concrete Technology, Tata McGraw Hill, 5th Edition, 2013.
3. Santakumar A. R., Concrete Technology, Oxford University Press, New Delhi, 2nd Edition, 2018.

REFERENCE BOOKS:

1. Nevile, Properties of concrete, Longman publishers, 5th Edition, 2012.
2. Indian Standard: 10262-2009 Code of Practice for concrete Mix Design.

III B.Tech. II - Semester

DATA COMMUNICATIONS

(OPEN ELECTIVE II)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

This course will enable students to

- To focus on information sharing and networks.
- To introduce flow of data, categories of network, different topologies.
- To focus on different coding schemes.
- To give clear idea of signals, transmission media, errors in data communications and their correction, networks classes and devices, etc.

UNIT I

Introduction to Data Communications:

Components, Data Representation, Data Flow, Networks- Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks Interconnection of Networks, The Internet - A Brief History, The Internet Today, Protocol and Standards - Protocols, Standards, Standards Organizations, Internet Standards. Network Models, Layered Tasks, OSI model, Layers in OSI model, TCP/IP Protocol Suite.

UNIT II

Data Link Layer:

Links, Access Networks, and LANs- Introduction to the Link Layer, The Services Provided by the Link Layer, Types of errors, Redundancy, Detection vs Correction, Forward error correction Versus Retransmission Error-Detection and Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) , Framing, Flow Control and Error Control protocols , Noisy less Channels and Noisy Channels, HDLC, Multiple Access Protocols, Random Access ,ALOHA, Controlled access, Channelization Protocols. 802.11 MAC Protocol, IEEE 802.11 Frame.

UNIT III

The Network Layer:

Introduction, Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks, Inside a Router-Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane, The Internet Protocol(IP):Forwarding and Addressing in the Internet- Datagram format, Ipv4 Addressing, Internet Control Message Protocol(ICMP), IPv6.

UNIT IV

Transport Layer:

Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing, Connectionless Transport: UDP -UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer-Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go- Back-N(GBN), Selective Repeat(SR), Connection Oriented Transport: TCP - The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control - The Cause and the Costs of Congestion, Approaches to Congestion Control.

UNIT V

Application Layer:

Principles of Networking Applications – Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the File Transfer: FTP,- FTP Commands and Replies, Electronic Mail in the Internet- STMP, Comparison with HTTP, DNS-The Internet's Directory Service – Service Provided by DNS, Overview of How DNS Works, DNS Records and messages.

COURSE OUTCOMES:

After studying this course, students will be able to:

1. Explain the various components of data communication.
2. Explain the fundamentals of digital communication and switching.
3. Compare and contrast data link layer protocols.
4. Summarize IEEE 802.xx standards.
5. Analyze the principles of Networking and applications.

TEXT BOOKS:

1. Behrouz A. Forouzan, Data Communications and Networking, Tata McGraw-Hill, 5^{th} Edition, 2013.
2. Kurose James F, Keith W, Computer Networking A Top-Down Approach, Pearson Education, 6^{th} Edition, 2017.

REFERENCE BOOKS:

1. Alberto Leon-Garcia and Indra Widjaja, Communication Networks - Fundamental Concepts and Key architectures, Tata McGraw-Hill, 2^{nd} Edition, 2004.
2. William Stallings, Data and Computer Communication, Pearson Education, 8^{th} Edition, 2007.

III B.Tech. II - Semester

FUNDAMENTALS OF MICROPROCESSORS & MICROCONTROLLERS

(OPEN ELECTIVE II)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the organization and architecture of Micro Processor.
- To understand addressing modes to access memory.
- To understand the programming principles for 8086 and 8051.
- To understand the interfacing of MP with IO as well as other devices.
- Study the features of 8051 Microcontroller, its instruction set and also other controllers like PIC controllers.

UNIT I

Introduction to Microprocessor Architecture

Introduction and evolution of Microprocessors– Architecture of 8086– Register Organization of 8086–Memory organization of 8086– General bus operation of 8086– Introduction to 80286–80386 and 80486 and Pentium.

UNIT II

Minimum and Maximum Mode Operations

Instruction set, Addressing modes–Minimum and Maximum mode operations of 8086.

8086 PROGRAMMING: Instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT III

I/O Interface

8255 PPI– Architecture of 8255–Modes of operation– Interfacing I/O devicesto8086using8255–Interfacing A to D converters– Interfacing D to A converters– Stepper motor interfacing– Static memory interfacing with 8086– DMA controller (8257)– Architecture–Interfacing 8257 DMA controller, Interfacing of 8259–Keyboard/display controller (8279)–Architecture–Modes of operation–Command words of 8279– Interfacing of 8279.

UNIT IV

Introduction to 8051 Micro Controller

Overview of 8051 Micro Controller– Architecture– Register set– I/O ports and Memory Organization–Interrupts–Timers and Counters– Serial Communication.

UNIT V

Pic Microcontroller

Introduction, characteristics of PIC microcontroller, PIC microcontroller families, memory organization, parallel and serial input and output, timers, Interrupts.

COURSE OUTCOMES:

1. To be able to understand the microprocessor capability in general and explore the evaluation of microprocessors.
2. To be able to understand the addressing modes of microprocessors.
3. To be able to program mp and mc.
4. To be able to interface mp and mc with other electronic devices.
5. To be able to understand the micro controller capability.
6. To be able to understand the design Microcontroller for simple Applications.

TEXT BOOKS:

1. Douglas V Hall, Microprocessors and Interfacing, Mc–Graw Hill, 3rd Edition, 2017.
2. Kenneth J. Ayala, Dhananjay V. Gadre, Cengage Learninbg, The 8051 Microcontroller & Embedded Systems Using Assembly and C, 2nd Edition, 2007.

REFERENCE BOOKS:

1. R. S. Kaler, A Textbook of Microprocessors and Micro Controllers, I.K. International Publishing House Pvt. Ltd., 1st Edition, 2013.
2. Ajay V. Deshmukh, Microcontrollers– Theory and Applications, Tata McGraw–Hill, 2005.
3. Krishna Kant, Microprocessors and Microcontrollers- Architecture, Programming and System Design, PHI Learning Private Limited, 2nd Edition, 2014.

III B.Tech. II - Semester

DATABASE MANAGEMENT SYSTEMS

(OPEN ELECTIVE II)

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

To learn the principles of systematically designing and using large scale Database Management Systems for various applications.

UNIT I

Introduction to Database Management System, Data Independence- Relation Systems and Others, Database system architecture, Introduction- The Three Levels of Architecture-The External Level- the Conceptual Level- the Internal Level- Mapping- the Database Administrator, Various Data Models.

The ER Model - The Relational Model, Relational Calculus, Introduction to Database Design, Database Design and ER Diagrams-Entities Attributes, and Entity Sets-Relationship and Relationship Sets - Conceptual Design with ER Model.

UNIT II

The Relational Model – Basic Concepts, Integrity Constraints Over Relations-Key Constraints – Foreign Key Constraints - Relational Algebra Operations - Selection and Projection- Set Operations, Renaming – Joins- Division.

SQL – Various parts of SQL, Basic form of SQL Query, Union, Intersect, and Except, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers.

UNIT III

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), concept of surrogate key, Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF).

UNIT IV

Transaction Management and Concurrency Control

Transaction, properties of transactions, Various concurrency control techniques – lock based, timestamp based, lock granularity, lock types, 2PL for ensuring serializability, deadlocks – dealing with deadlocks, Database Recovery management : Log based recovery.

UNIT V

Overview of Storages and Indexing, Data on External Storage- File Organization and Indexing – Clustered Indexing – Primary and Secondary Indexes, Index Data Structures, Tree-Based Indexing – B Trees, B+ Trees, Hash-Based Indexing – Basic idea, Comparison of File Organization.

COURSE OUTCOMES:

1. Understand database concepts and the use of data models in describing database.
2. Create, maintain and manipulate a relational database using SQL.
3. Understand the importance of schema refinement & be able to refine the schema.
4. Understand how the DBMS manages the execution of transactions.
5. Understand and differentiate various file organizations for the representation of data.

TEXT BOOKS:

1. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, TATA McGraw Hill, 3rd Edition, 2014.
2. Abraham Silberschatz, Henry F. Korth, Database System Concepts, McGraw Hill Education, 6th Edition, 2013.

REFERENCE BOOKS:

1. Elmasri Ramez, Navathe Shamkant, Fundamentals of Database Systems, Pearson Education, 7th Edition, 2017.
2. C. J. Date, Introduction to Database Systems, Pearson Education, 1905.
3. Peter Rob & Carlos Coronel, Database Systems design, Implementation and Management, Course Technology Inc, 6th Edition, 2004.

III B.Tech. II - Semester

DESIGN AND ANALYSIS OF ALGORITHMS

(OPEN ELECTIVE II)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Upon completion of this course, students will be able to do the following:
- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

UNIT I

Introduction: What is an Algorithm, Algorithm Specification, Pseudocode Conventions Recursive Algorithm, Performance Analysis, Space Complexity, Time Complexity, Amortized Complexity, Asymptotic Notation, Practical Complexities, Performance Measurement.

UNIT II

Divide and Conquer: General Method, Defective Chessboard, Binary Search, Finding the Maximum and Minimum, Merge Sort, Quick Sort, Performance Measurement, Randomized Sorting Algorithms (Quick Sort).

UNIT III

The Greedy Method: The General Method, Knapsack Problem, Job Sequencing with Deadlines, Minimum-cost Spanning Trees, Prim’s Algorithm, Kruskal’s Algorithms, An Optimal Randomized Algorithm, Optimal Merge Patterns, Single Source Shortest Paths.

UNIT IV

Dynamic Programming: All - Pairs Shortest Paths, Single – Source Shortest paths General Weights, String Editing, 0/1 Knapsack, Reliability Design.

UNIT V

Backtracking: The General Method, The 8-Queens Problem, Sum of Subsets, Graph Coloring, Hamiltonian Cycles. Branch and Bound: The Method, Least cost (LC) Search, Control Abstraction for LC-Search, Bounding, FIFO Branch-and-Bound, LC Branch and Bound, 0/1 Knapsack Problem, LC Branch-and Bound Solution, FIFO Branch-and-Bound Solution, Traveling Salesperson.

COURSE OUTCOMES:

Students who complete the course will have demonstrated the ability to do the following:

1. Argue the correctness of algorithms using inductive proofs and invariants.
2. Analyze worst-case running times of algorithms using asymptotic analysis.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
5. Describe the greedy paradigm and explain when an algorithmic design situation calls for it.

TEXT BOOKS:

1. E. Horowitz S. Sahni, Fundamentals of computer algorithms, University Press, 2nd Edition, 2008.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, PHI Learning, 3rd Edition, 2010.

REFERENCE BOOKS:

1. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, The Design and Analysis of Computer Algorithms, Addison-Wesley; 1st Edition, 1974.
2. Jon Kleinberg, Algorithm Design, Pearson, 1st Edition, 2013.

III B.Tech. II - Semester

PROGRAMMABLE LOGIC CONTROLLERS

(OPEN ELECTIVE II)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objectives of this course is to acquire knowledge to:

- have knowledge on PLC.
- acquire the knowledge on programming of PLC.
- understand different PLC registers and their description.
- have knowledge on data handling functions of PLC.
- know how to handle analog signal and converting of A/D in PLC.

UNIT I

Introduction

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.

UNIT II

PLC Programming

PLC Programming: Input instructions, outputs, operational procedures, programming examples using contacts and coils. Digital logic gates, programming in the Boolean algebra system, conversion examples. Ladder diagrams and sequence listings, ladder diagram construction.

UNIT III

Programmable Timers and Counters

Timer instructions – On delay time instruction – Off delay timer instruction – Retentive timer – Counter instructions – Up counter – Down counter – Cascading counters – Incremental encoder – Counter applications – Combining counter and timer functions.

UNIT IV

Program Control Instructions

Master control reset instruction – Jump instructions and sub routines – Immediate input and output instructions.- Data manipulation – Data transfer operation – Data compare instruction – Data manipulation programs – Numerical data I/O interfaces – Math instructions – Addition, subtraction, multiplication & division instruction – Sequential instructions – Sequence programs – Shift registers – Word shift registers.

UNIT V
Applications

Control of water level indicator – Alarm monitor - Conveyor motor control – Parking garage – Ladder diagram for process control – PID controller.

COURSE OUTCOMES:

The students are able to:

1. know the PLCs and their I/O modules.
2. develop control algorithms to PLC using ladder logic.
3. manage PLC registers for effective utilization in different applications.
4. design PID controller with PLC.
5. handle analog signal and converting of A/D in PLC.

TEXT BOOKS:

1. Frank D. Petruzella, Programmable logic controllers, McGraw Hill, 3rd Edition, 2004.
2. John W. Webb and Ronald A. Reiss, Programmable Logic Controllers – Principle and Applications, PHI, 5th Edition, 2009.

REFERENCE BOOKS:

1. JR. Hackworth and F.D Hackworth Jr., Programmable Logic Controllers – Programming Method and Applications, Pearson, 2004.
2. Gary Dunning, Introduction to Programmable Logic Controllers, Delmar Cengage Learning, 6th Edition, 2005.
3. W. Bolton, Programmable Logic Controllers, Elsevier publisher, 5th Edition, 2009.

III B.Tech. II - Semester

POWER ELECTRONIC CONVERTORS

(OPEN ELECTIVE II)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the characteristics of various power semiconductor devices and to design firing circuits for SCR.
- To understand the operation of single phase and three phase converters and dual converters.
- To understand the operation of different types of DC-DC converters.
- To understand the operation of inverters and application of PWM techniques for voltage control.
- To analyze the operation of AC-AC regulators.

UNIT I

Power Semiconductor Devices:

Basic theory of operation of Thyristors – Silicon Controlled Rectifiers (SCR's) – Static & Dynamic Characteristics – Turn-on and Turn off Methods of SCR – Snubber circuit – Basic structure, working and Characteristics of Power MOSFET and IGBT – Applications.

UNIT II

AC-DC Converters:

Single phase half wave-controlled rectifiers R, RL loads – effect of freewheeling diode – Single Phase fully bridge converter with R, RL and RLE load – Derivation of output voltage and currents – Continuous and Discontinuous conduction - Effect of source inductance – Expression for output voltages – Numerical Problems – Dual converter operation with circulating and non-circulating currents.

Three Phase half wave and fully controlled rectifiers with R and RL load – Expression for Output Voltage.

UNIT III

DC–DC Converters:

Operation of Basic Chopper - Classification - Control Techniques – Analysis of Buck, Boost and Buck-Boost converters – Output voltage equations using volt-sec balance in CCM & DCM – Expressions for output voltage ripple and inductor current ripple (for RL load only) – Numerical Problems.

UNIT IV

DC–AC Converters:

Introduction - Classification – Single Phase half bridge and full bridge inverters with R and RL loads – Three Phase square wave inverters – 120^0 conduction and 180^0 conduction modes of operation – PWM techniques – Single pulse, Multiple pulse and Sinusoidal PWM, amplitude and frequency modulation indices.

UNIT V

AC – AC Converters:

Introduction – Single Phase AC voltage controllers – Phase control with R and RL loads – Integral cycle control – Sequential AC Voltage Controllers - Three phase AC voltage regulator with R load – Single phase step down Cycloconverter (Center-tap configuration) – Numerical Problems.

COURSE OUTCOMES:

At the end of this course the student will able to:

1. Explain the characteristics of various power semiconductor devices and analyze the static and dynamic characteristics of SCR's. And design of firing circuits of SCR.
2. Explain the operation of single phase full–wave converters and three phase full–wave converters.
3. Analyze the operation of different types of DC-DC converters.
4. Explain the operation of inverters and application of PWM techniques for voltage control.
5. Explain the operation of AC-AC regulators.

TEXT BOOKS:

1. Ned Mohan, Tore M. Undeland, William P Robbins, Power Electronics: Converters, Applications and Design, John Wiley & Sons, 3rd Edition, 2009.
2. M. H. Rashid, Power Electronics: Circuits, Devices and Applications, Prentice Hall of India, 4th Edition, 2018.

REFERENCE BOOKS:

1. Philip T. Krein, Elements of Power Electronics, Oxford, 2nd Edition, 2014.
2. L. Umanand, Power Electronics: Essentials & Applications, Wiley, Pvt. Limited, India, 3rd Edition, 2013.
3. G. K. Dubey, S. R. Doradla, A. Joshi and R. M. K. Sinha, Thyristorised Power Controllers, New Age International (P) Limited Publishers, 2nd Edition, 2010.

III B.Tech. II - Semester

BASICS OF ENVIRONMENTAL ENGINEERING

(OPEN ELECTIVE II)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the basic of water borne diseases, drinking water standards and treatment of wastewater and disposal.
- To expose the students to understand to treatment of wastewater and disposal.
- To learn the basics of air pollution and effects, noise pollution and solid waste disposal.

UNIT I

Water: Introduction; Sources of water; Availability of fresh water; Water borne diseases; Brief explanation on ground and surface water treatment; Potable water standards as per IS and WHO standards; Water conservation; Role of public health engineering department in the prevention of the water borne diseases.

UNIT II

Wastewater: Wastewater sources; Sewage characteristics; Brief explanation on treatment of sewage; Disposal of treated wastewater; Practise on reuse of treated wastewater; Effects of wastewater without treatment disposal in streams, on land.

UNIT III

Air pollution sources and effects: Layers of atmosphere; Sources and classification of air pollutants – Man made, Natural sources; Type of air pollutants; Pollution due to automobiles; Effect of air pollution on health, vegetation and materials; Global warming; Worst environmental disasters caused by humans.

UNIT IV

Noise Pollution: Sources of noise pollution - plane, point and line sources, multiple sources; Effect of noise pollution on humans; Control of noise pollution; Outdoor and indoor noise propagation; Intensity of noise pollution; Noise pollution permissible limits as per CPCB and WHO.

UNIT V

Solid Waste: Sources of solid waste – classification solid waste - Basic principles of Solid Waste storage, collection, transportation, processing and Disposal.

COURSE OUTCOMES:

Upon successful completion of the course, the students will be able to:

1. Demonstrate water sources, water borne diseases, water treatment and potable water standards.
2. Understand basics of wastewater treatment and disposal methods.
3. Identity air pollution sources and understand air pollution effects.
4. Identity noise pollution sources and understand noise pollution effects.
5. Understand sources and basic principles of solid waste.

TEXT BOOKS:

1. S. K. Garg, Water supply Engineering – Environmental Engineering (Vol.I), Khanna Publishers, 35th Edition, 2019.
2. S. K. Garg, Sewage Disposal and Air Pollution Engineering – Environmental Engineering (Vol. II), Khanna Publishers, 2019.
3. Punmia B.C., Ashok Jain & Arun Jain, Water Supply Engineering, Laxmi Publication Pvt., Ltd., 2nd Edition, 2016.

REFERENCES BOOKS:

1. Peavy, H. S, Rowe, D. R., and G. Tchobanoglous, Environmental Engineering, McGraw Hill Inc., 2017.
2. Punmia B. C., Ashok Jain & Arun Jain, Wastewater Engineering, Laxmi Publication Pvt., Ltd., 2016.

III B.Tech. II - Semester

INNOVATIVE CONSTRUCTION MATERIALS

(OPEN ELECTIVE II)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the applications and properties of various building materials.
- To know the various types of metals, Polymers, Bitumen in construction and to know the properties, usage of gypsum, adhesives, water proofing materials in construction industry.
- To understand the potential applications of architectural materials and to obtain the knowledge about smart materials.

UNIT I

Modern Building Materials: Ceramics, Sealants for joints, fibre glass reinforced plastic, refractories- composite materials, Geosynthetics, Concrete Canvas, Geotextile and its types. Paints, Enamels And Varnishes: Introduction, rubber paints, plastic emulsion paints, plastic paints, enamel paints, texture paints, varnish, wax polish.

UNIT II

Metals, Plastics, Bitumen: Metals and Special Alloys of Steel - Water Jet Cut Stainless Steel, Mill Slab Steel, Tension Rods Assemblies and Cast Iron - Heat Treatment – Tendons - GI sheets, tubes and lightweight roofing materials - Aluminum and its products. Plastics, Bitumen: Composition, polymerization, Classification of plastics, biodegradable plastic, Grades of Bitumen, Unplasticized Polyvinyl Chloride (UPVC) and its materials.

UNIT III

Architectural Materials:

Glass: Composition, classification, properties and types of glass, architectural glass. Wood and Wood Product, Floor Finishes, laminates.

Sound Absorbent Materials: Porous materials, porous-cum-elastic materials, perforated materials, Baffle materials – ceiling and walls panels.

UNIT IV

Smart Materials: Neoprene, Bridge pads, thermocol, Smart and Intelligent Materials – Special features –Case studies showing the applications of smart and Intelligent Materials. Case studies showing the applications of smart and Intelligent Materials.

UNIT V

Gypsum: Introduction, plaster of Paris, gypsum wall plasters, gypsum plaster boards, Non-load bearing Gypsum partition blocks.

Miscellaneous materials: Adhesives- advantages and disadvantages, properties, types of Adhesives; Different types of Building faced cladding materials; heat insulating materials; water proofing materials.

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

1. Identify different types of modern materials, Paints, Enamels and Varnishes that are used in construction.
2. Explain the role of metals, Polymers, Bitumen in construction industry.
3. Identify the required architectural materials for various buildings.
4. Outline various smart materials suitable for structures.
5. Explain the usage of materials like gypsum, adhesives, water proofing materials in construction industry.

TEXT BOOKS:

1. S. C. Rangwala, Engineering Materials, Charotar Publishing House, 33th Edition, 2017.
2. S. K Duggal, Building materials, New Age International publishers, 3rd Edition, 2009.

REFERENCE BOOKS:

1. P. C Varghese, Building materials, PHI Learning, 2nd Edition, 2005.
2. Kumar Mehta P. and Paulo J. M. Monteiro, Concrete: Microstructure, Properties and Materials, McGraw-Hill, New Delhi, 4th Edition, 2014.

IV B.Tech. I - Semester

PRINCIPLES OF SIGNALS AND SYSTEMS

(OPEN ELECTIVE III)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are given below:

- To introduce the terminology of signals and systems.
- To introduce Fourier series and Fourier Transform through signal analysis.
- To analyze the linear systems in time and frequency domains.
- To introduce Laplace transform as mathematical tool to analyze continuous-time signals and systems.
- To introduce Sampling theorem and to study z-transform to analyze discrete-time signals and systems.

UNIT I

INTRODUCTION: Definitions of Signals and Systems, Classification of Signals, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling, Complex exponential and sinusoidal signals, Singularity functions: unit impulse and properties, step function, signum function and ramp function. Classification of Systems.

UNIT II

FOURIER SERIES AND FOURIER TRANSFORM: Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum.

Fourier transform (F.T) of standard signals, Fourier transform of periodic signals, properties of Fourier transform.

UNIT III

SAMPLING: Graphical and analytical proof for Band Limited Signals, Reconstruction of signal from its samples, effect of under sampling – Aliasing, impulse sampling, Natural and Flat top Sampling Related Problems.

ANALYSIS OF LINEAR SYSTEMS: Linear time invariant (LTI) system, impulse response, Concept of convolution in time domain and frequency domain, Causality and Stability Conditions, Transfer function of a LTI system, Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF,BPF and BSF characteristics.

UNIT IV

LAPLACE TRANSFORM: Review of Laplace transform (L.T), Relation between L.T and F.T. of a signal, Concept of region of convergence (ROC) for Laplace transforms, Properties of Laplace transform, Laplace transform of certain signals using waveform synthesis, Inverse Laplace transform, Solution of differential equations using L.T.

UNIT V

Z–TRANSFORM: Concept of Z- Transform (Z.T) of a discrete sequence. Distinction between Laplace, Fourier and Z-transforms. Region of convergence in Z-Transform, Properties of Z-transforms, Inverse Z-transform.

COURSE OUTCOMES:

At the end of this course the student will able to:

1. Understand and differentiate among various classes of signals and Systems.
2. Analyze the continuous-time signals and continuous-time systems using Fourier series, Fourier transform.
3. Apply sampling theorem to convert continuous-time signals to discrete-time signal and various representations of LTI systems.
4. Apply Laplace transform to analyze discrete-time signals and systems.
5. Apply Z-transform to analyze discrete-time signals and systems.

TEXT BOOKS:

1. B.P. Lathi, Signals, Systems & Communications, BS Publications, 2003.
2. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, Signals and Systems, PHI, 2nd Edition, 2015.
3. I. Ravi Kumar, Signals and Systems, PHI, 2009.

REFERENCE BOOKS:

1. Simon Haykin and Van Veen, Signals & Systems, Wiley, 2nd Edition, 2007.
2. BP Lathi, Principles of Linear Systems and Signals, Oxford University Press, 2nd Edition, 2009.
3. K Raja Rajeswari, B VisweswaraRao, Signals and Systems, PHI, 2009.
4. Michel J. Robert, Fundamentals of Signals and Systems, MGH, International Edition, 2008.

IV B.Tech. I - Semester

INTERNET OF THINGS AND APLICATIONS

(OPEN ELECTIVE III)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

Students undergoing this course are expected to:

- To introduce the terminology, technology and its applications.
- To introduce the concept of M2M (machine to machine) with necessary protocols.
- To introduce the Python Scripting Language which is used in many IoT devices.
- To introduce the Raspberry PI platform, that is widely used in IoT applications.
- To introduce the implementation of web-based services on IoT devices.

UNIT I

Introduction to Internet of Things

Definition and Characteristics of IoT, Physical Design of IoT, IoT Protocols, IoT communication models, IoT Communication APIs, Networking basics, Machine-to-Machine Communications. IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols. Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

UNIT II

IoT system management

Software defined networks (SDN), network function virtualization, difference between SDN and NFV for IoT. Basics of IoT System Management with NETCONF, YANG- NETCONF, YANG, SNMP NETOPEER, M2M to IoT, Definition and differing characteristics, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT.

UNIT III

IoT Architectural and Wireless Technologies for IoT

Building architecture, design principles and needed capabilities, IoT architecture outline, standards considerations. Reference Architecture and Reference Model.

Wireless Technologies for IoT: Protocol Standardization for IoT, M2M, RFID & NFC protocol.

UNIT IV

IoT Physical Devices

Introduction to different IoT tools, IoT Physical Devices and Endpoints, Introduction to Raspberry PI, Interfaces (serial, SPI, I2C).

Programming – Python program to Interface Raspberry PI with external gadgets, reading inputs from pins, and controlling output.

UNIT V

Cloud Analytics

Introduction to cloud computing, Role of Cloud Computing in IoT, Cloud-to-Device Connectivity. IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs. Webserver – Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API.

COURSE OUTCOMES:

After undergoing the course students will be able to:

1. Ability to understand the broad scope and applications of IoT.
2. Ability to understand and differentiate between M2M and IoT, IoT network characteristics and device management.
3. Ability to understand IoT Architecture and reference models and also different protocols such as NFC, RFID, and M2M.
4. Ability to understand Raspberry Pi and Python Programming concepts.
5. Ability to understand the role of cloud concepts in IoT, its advantages and applications.

TEXT BOOKS:

1. Arshdeep Bahga and Vijay Madisetti, Internet of Things - A Hands-on Approach, Universities Press, 2015, ISBN: 9788173719547.
2. Matt Richardson & Shawn Wallace, Getting Started with Raspberry Pi, O'Reilly (SPD), 2014, ISBN: 9789350239759.

REFERENCE BOOKS:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.
2. Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, A press Publications, 2013.

IV B.Tech. I - Semester

CRYPTOGRAPHY AND NETWORK SECURITY

(OPEN ELECTIVE III)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The main objectives of this course are:

- To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, public key.
- Algorithms, design issues and working principles of various authentication protocols and various secure communication standards including Kerberos, IPsec, and SSL/TLS.

UNIT I

Basic Principles: Security Goals, Security Attacks, Services and Mechanisms.

Mathematics of Cryptography: Binary operation, Integer division, Euclidean and Extended Euclidean algorithm, Modular Arithmetic Additive inverse, Multiplicative inverse, Addition table, Multiplication table, Euler's phi function.

UNIT II

Symmetric Encryption: Introduction, Mono Alphabetic and Poly Alphabetic Ciphers, Feistel Cipher, **Data Encryption Standard:** DES Structure, DES Analysis.

Advanced Encryption Standard: AES Structure, AES Analysis.

UNIT III

Asymmetric Encryption: Introduction, **RSA Algorithm:** Procedure, Key generation, Attacks, Examples, ElGAMAL Cryptosystem.

UNIT IV

Data Integrity, Digital Signature Schemes & Key Management: Message Integrity, Message Authentication, SHA-512, Digital Signatures, Services, Attacks on Digital Signature, Schemes, Symmetric Key Distribution, Kerberos, Public key Distribution.

UNIT V

Network Security-I: Security at application layer: PGP and S/MIME.

Network Security-II: Security at the Network Layer: IP Security, AH, ESP, Security Association, Security Policy, Internet Key Exchange **Intrusion**

Detection System: Host Based, Network Based, Audit Records, Virus and its types, Firewalls.

COURSE OUTCOMES:

At the end of the course, student will be able to:

- Understand different security threats and countermeasures.
- Classify the basic principles of symmetric key algorithms and its operations.
- Understand the basic principles of Public key algorithms and Working operations of Asymmetric key algorithms.
- Design applications of hash algorithms, digital signatures and key management techniques.
- Determine the knowledge of Application and Network layer security Protocols.

TEXT BOOKS:

1. Behrouz A Forouzan, Deb deep Mukhopadhyay, Cryptography and Network Security, McGraw Hill, 3rd Edition, 2015.
2. William Stallings, Cryptography and Network Security - Principles and Practice, Pearson, 7th Edition, 2006.
3. Keith M.Martin, Everyday Cryptography, Oxford, 1st Edition, 2016.

REFERENCE BOOKS:

1. Bernard Meneges, Network Security and Cryptography, Cengage Learning, 1st Edition, 2018.

IV B.Tech. I - Semester

OPERATING SYSTEMS

(OPEN ELECTIVE III)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Study the basic concepts and functions of operating systems.
- Understand the structure and functions of the OS.
- Learn about Processes, Threads and Scheduling algorithms.
- Understand the principles of concurrency and Deadlocks.
- Learn various memory management schemes.
- Study I/O management and File systems.

UNIT I

Introduction to Operating System Concept: Types of operating systems, operating systems concepts, Structure of operating System, operating systems services,

UNIT II

Process Management: Process concept, The process, Process State Diagram, Process control block, Process Scheduling- Scheduling Queues, Schedulers, Operations on Processes, Scheduling-Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

UNIT III

Concurrency: Process Synchronization, The Critical- Section Problem, Synchronization Hardware, Semaphores, Classic Problems of Synchronization.

Principles of deadlock – System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery form Deadlock.

UNIT IV

Memory Management: Swapping, Contiguous Memory Allocation, Paging, structure of the Page Table, Segmentation.

Virtual Memory Management: Virtual Memory, Demand Paging, Page-Replacement Algorithms, Thrashing.

UNIT V

File system Interface: The concept of a file, Access Methods, Directory structure, File system mounting.

File System implementation: File system structure, allocation methods, free-space management, Overview of Mass-storage structure, Disk scheduling.

COURSE OUTCOMES:

After learning, the course the students should be able to:

- Describe various generations of Operating System and functions of Operating System.
- Understand process management & various CPU scheduling algorithms.
- Apply the principles of concurrency, Design deadlock prevention and avoidance algorithms.
- Compare and contrast various memory management schemes.
- Design and Implement a prototype file systems and system protection.

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley and Sons Inc., 9th Edition, 2013.
2. William Stallings, Operating Systems – Internals and Design Principles, Prentice Hall, 7th Edition, 2011.
3. S Halder, Alex A Aravind, Operating Systems, Pearson Education, 2nd Edition, 2016.

REFERENCE BOOKS:

1. Andrew S. Tanenbaum and Herbert Bos, Modern Operating Systems, Wesley, 4th Edition, 2014.
2. Charles Crowley, Operating Systems: A Design-Oriented Approach, Tata Mc Graw Hill Education, 1996.
3. D M Dhamdhere, Operating Systems: A Concept-Based Approach, Tata Mc Graw-Hill Education, 2nd Edition, 2007.

IV B.Tech. I - Semester

BATTERY MANAGEMENT SYSTEMS AND CHARGING STATIONS

(OPEN ELECTIVE III)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To elaborate various technical parameters of batteries.
- To distinguish between various types of batteries used for EV applications.
- To develop battery charger for an EV.

UNIT I Battery parameters

Cell and battery voltages, Charge (or Amphour) capacity, Energy stored, Energy density, Specific power, Amphour (or charge) efficiency, Energy efficiency, Self-discharge rates, Battery geometry, Battery temperature, heating and cooling needs, Battery life and number of deep cycles.

UNIT II EV Batteries:

Lead Acid Batteries

Lead acid battery basics, Special characteristics of lead acid batteries, Battery life and maintenance, Battery charging, Summary.

Nickel-based Batteries

Introduction, Nickel cadmium, Nickel metal hydride batteries.

UNIT III Sodium, Lithium and Metal air batteries:

Sodium-based Batteries

Introduction, Sodium sulphur batteries, Sodium metal chloride (Zebra) batteries.

Lithium Batteries

Introduction, The lithium polymer battery, The lithium ion battery.

Metal Air Batteries

Introduction, The aluminium air battery, The zinc air battery.

UNIT IV Charging Infrastructure

Domestic Charging Infrastructure, Public Charging Infrastructure, Normal Charging Station, Occasional Charging Station, Fast Charging Station, Battery Swapping Station, Move-and-charge zone.

UNIT V EV Charging

Battery Chargers: Charge equalisation, Conductive (Basic charger circuits, Microprocessor based charger circuit. Arrangement of an off-board conductive charger, Standard power levels of conductive chargers, Inductive (Principle of inductive charging, Soft-switching power converter for inductive charging), Battery indication methods.

COURSE OUTCOMES:

- Elaborate various technical parameters of batteries.
- Distinguish between various types of batteries used for EV applications.
- To develop battery charger for an EV.

TEXT BOOKS:

1 James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2nd Edition, 2012.

2 C.C Chan, K.T Chau, Modern Electric Vehicle Technology, Oxford University Press Inc., 1st Edition, 2001.

REFERENCE BOOKS:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 1st Edition, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 1st Edition, 2004.

IV B.Tech. I - Semester

ELECTRIC & HYBRID VEHICLE

(OPEN ELECTIVE III)

L	T	P	C
3	0	0	3

PREAMBLE

This course introduces the fundamental concepts, principles, analysis and design of electric and hybrid vehicles. This course goes deeper into the various aspects of hybrid and electric drive train such as their configuration, types of electric machines that can be used, energy storage devices, etc. Various energy storage system andits control strategies are analyzed in detail.

UNIT I

INTRODUCTION TO ELECTRIC VEHICLES: Electric Vehicles, Electric Vehicle Components, Types of electric vehicles, Electric vehicle layout, performance of electric vehicles – traction motor characteristics, tractive effort, advantage and challenges of electric vehicles

UNIT II

HYBRID VEHICLES: Introduction to Hybrid Electric Vehicle (HEV), Architectures of HEV: Series HEV, Parallel HEV and Series–Parallel HEV, plug-in hybrid electric vehicles and range extended hybrid electric vehicles.

UNIT III

ELECTRIC PROPULSION SYSTEMS: Induction Motor, permanent magnet Motors, brushless DC Motor characteristics and regenerative braking.

UNIT IV

BATTERY: Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design.

UNIT V

ENERGY STORAGE DEVICES: Electro mechanical batteries – basics of lead acid batteries, nickel based batteries, lithium based batteries, electrochemical reactions, concept of ultra-capacitors.

COURSE OUTCOMES:

At the end of this course, students will demonstrate the ability to

1. Understanding of electrical vehicle drive system
2. Understanding of Hybrid electrical vehicle drive system.
3. Understand in about various motors used in electrical and hybrid vehicle drive system
4. Understand and analyze the properties of batteries storage and Its management strategies
5. Understand about various energy storage devices used in electrical and hybrid vehicle drive system

TEXT BOOKS:

1. Chris Mi,M. Abul Masrur, David Wenzhong Gao , Hybrid Electric Vehicles Principles And Applications With Practical Perspectives, A John Wiley & Sons, Ltd., Publication, 2011
2. Tom Denton, Automobile Electrical and Electronics Systems, Elsevier Publications, 3rd Edition, 2004.
3. Mehrdad Ehsani, YiminGao, AliEmadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, CRC Press, 3rd Edition, 2018.

REFERENCE BOOKS:

1. Simona Onori ,Lorenzo Serrao, iorgio Rizzoni, Hybrid Electric Vehicles Energy Management Strategies, Springer publications, 2016.
2. Krishnan R, Permanent Magnet synchronous and Brushless DC Motor Drives, CRC Publishers, 1st Edition, 2010.
3. Krishnan R, Switched Reluctance Motor Drives: Modeling, Simulation, Analysis, Design and Applications, CRC Publishers, 1st Edition, 2001.

IV B.Tech. I - Semester

REPAIR & REHABILITATION OF STRUCTURES

(OPEN ELECTIVE III)

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

1. Study the assessment, maintenance and repair techniques of concrete structures.
2. Different case studies are analyzed to define the best strategy to maintain and repair the structure.
3. Identify scope of rehabilitation work for dilapidated / obsolete buildings.

UNIT I

Materials for repair and rehabilitation: Admixtures- types of admixtures- purposes of using admixtures- chemical composition- Natural admixtures- Fibres- wraps- Glass and Carbon fibre wraps- Steel Plates - Non destructive evaluation: Importance- Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects – Visual investigation- Acoustical emission methods- Corrosion activity measurement- chloride content – Depth of carbonation- Impact echo methods- Ultrasound pulse velocity methods- Pull out tests.

UNIT II

Strengthening and stabilization: Techniques- design considerations- Beam shear capacity strengthening- Shear Transfer strengthening- stress reduction techniques- Column strengthening-flexural strengthening- Connection stabilization and strengthening, Crack stabilization.

UNIT III

Bonded installation techniques: Externally bonded FRP- Wet layup sheet, bolted plate, near surface mounted FRP, fundamental debonding mechanisms- intermediate crack debonding- CDC debonding- plate end debonding- strengthening of floor of structures.

UNIT IV

Techniques for Repair: Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning. Repairs to Masonry Structures & Temples: Damages to masonry structures – Repairing techniques, Damages to temples – Repairing techniques. Foundation Problems: Settlement of soils – Repairs, Sinking of piles – Repairs.

UNIT V

Corrosion of Reinforcement: Preventive measures – Coatings – Use of SBR modified cementitious mortar, Epoxy resin mortar, Acrylic modified cementitious mortar, Flowing concrete.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to:

1. Recognize the mechanisms of degradation of concrete structures and to design durable concrete structures.
2. Conduct field monitoring and non-destructive evaluation of concrete structures.
3. Design and suggest repair strategies for deteriorated concrete structures including repairing with composites.
4. Understand the methods of strengthening methods for concrete structures.
5. Assessment of the serviceability and residual life span of concrete structures by Visual inspection and in situ tests.

TEXT BOOKS:

1. Neville & Brooks, Concrete technology, Pearson Education Limited, 2nd Edition, 2010.
2. Rafat Siddique, Special Structural concrete, Galgotia Publications, 2000.

REFERENCES BOOKS:

1. Peter H Emmons, Concrete repair and maintenance illustrated, RSMeans, 1st Edition, 2002.
2. M S Shetty, Concrete Technology, S Chand, 2006.

IV B.Tech. I - Semester

DISASTER MANAGEMENT & MITIGATION

(OPEN ELECTIVE III)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To impart knowledge of causes of various disaster and its impact.
2. To understand the concept of Disaster Management Cycle and Framework.
3. To explain the Applications of Science and Technology for Disaster Management & Mitigation.

UNIT I

Introduction: Understanding the Concepts and definitions of Disaster and its types, Hazard, Vulnerability, Risk, Capacity, Disaster and Development, and disaster management.

UNIT II

Consequences and Control of Disasters: Geological, Hydro-Meteorological, Biological, Technological and Man- made Disasters, Global Disaster Trends, Emerging Risks of Disasters, Climate Change and Urban Disasters.

UNIT III

Disaster Management Cycle and Framework: Disaster Management Cycle, Paradigm Shift in Disaster Management Pre-Disaster Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development, Awareness During Disaster Evacuation, Disaster Communication, Search and Rescue, Emergency Operation Centre, Incident Command System, Relief and Rehabilitation, Damage and Needs Assessment, Restoration of Critical Infrastructure, Early Recovery, Reconstruction and Redevelopment, IDNDR, Yokohama Strategy, Hyogo Framework of Action.

UNIT IV

Disaster Management in India: Disaster Profile of India, Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005, Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management, Role of Government, Non-Government and Inter-Governmental Agencies.

UNIT V

Applications of Science and Technology for Disaster Management & Mitigation: Geo-informatics in Disaster Management, Disaster Communication System, Land Use Planning and Development Regulations, Structural and Non Structural Mitigation of Disasters, S&T Institutions for Disaster Management in India.

COURSE OUTCOMES:

After learning the course the students should be able to:

1. Understand disasters, disaster preparedness and apply the mitigation measures.
2. Understand role of IT, remote sensing, GIS and GPS in risk reduction.
3. Apply knowledge of disaster management acts and guidelines.
4. Get to know natural as well as manmade disaster and their extent and possible effects on the economy.
5. Plan of national importance structures based upon the previous history.

TEXT BOOKS:

1. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012).
2. Damon, P. Copola, Introduction to International Disaster Management, Butterworth Heineman, 1st Edition, 2006.
3. Gupta A.K., Niar S.S and Chatterjee S, Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, 2013.

REFERENCE BOOKS:

1. Murthy D.B.N, Disaster Management, Deep and Deep Publication PVT. Ltd., 2012.
2. Modh S, Managing Natural Disasters, Mac Millan, 2010.

IV B.Tech. I - Semester

VLSI DESIGN

(OPEN ELECTIVE IV)

L	T	P	C
3	0	0	3

Pre requisites: EDC and STLD Courses.

UNIT I

INTRODUCTION TO MOS TRANSISTORS AND ITS FABICATION:

IC Technology and its Era. Types of MOSFET - Enhancement and Depletion modes Construction and operation of MOSFET, Fabrication of NMOS, PMOS, CMOS-N well-P well and Bi-CMOS fabrication processes, Introduction to Gallium Arsenide (GaAs) Devices and FinFET.

UNIT II

BASIC ELECTRICAL PROPERTIES OF MOS CIRCUITS AND SCALING:

Ids-Vds relationships-non saturated region-saturated region, Aspects of MOS transistor Threshold Voltage, Trans-conductance, Output Conductance and Figure of Merit, The pass transistor and NMOS Inverter. Determination of pull-up to pull-down Ratio of NMOS Inverter driven by another NMOS inverter and driven through one or more pass transistors, Latch-up in CMOS circuits.

UNIT III

MOS CIRCUIT DESIGN PROCESSES:

CMOS circuit diagram- Stick Diagram and Layout diagram, Design Rules for layout diagram-Lambda based design rules and micron based design rules, Layout Diagrams of NAND and NOR gates and CMOS inverter, Symbolic Diagrams.

UNIT IV

BASIC CIRCUIT CONCEPTS:

Sheet Resistance, and its concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, and some examples of its calculations. The Delay Unit, Inverter Delays, Driving large capacitive loads, Propagation Delays, Wiring Capacitances, Choice of layers.

UNIT V

IMPLEMENTATION STRATEGIES AND TESTING:

ASIC Design using Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures, CPLD. Design for Testability (DFT)-Boundary Scan Test (BST)-Built In Self Test (BIST).

Introduction to Low Power VLSI Design: Low Power CMOS Logic Circuits: Over view of power consumption, Low –power design through voltage scaling.

COURSE OUTCOMES:

At the end of this course the student can able to:

1. Explain the operation of MOSFET and the fabrication of various MOSFETS.
2. Understand the basic electrical properties of MOS circuits.
3. Analyze the CMOS circuit design processes and scaling of MOS circuits.
4. Design the logic circuits using VHDL, test and understand the Implementation strategies.
5. Design the logic circuits using VHDL, test and Low Power CMOS Logic Circuits.

TEXT BOOKS:

1. Kamran Eshraghian, Eshraghian Dougles, A.Pucknell, and Sholeh Eshraghian, Essentials of VLSI Circuits and Systems, Prentice Hall Of India Publications, 1st Edition, 2005.
2. J.Bhaskar, VHDL Primer, Prentice Hall Of India Publications, 3rd Edition, 2015.

REFERENCES BOOKS:

1. A.Albert Raj & T.Latha, VLSI Design, PHI Learing Private Limited, 2015.
2. K.Lal Kishore and V.S.V.Prabhakar, VLSI Designing, I.K.International Publishing House Private Limited, 1st Edition, 2017.
3. Dr. K.V.K.K.Prasad, Kattula Shyamala, VLSI Design – Black Book, Kogent Learning Solutions Inc., 2017.

E-REFERENCES

1. VLSI Design Tutorial, https://www.tutorialspoint.com/vlsi_design/index.html.
2. NPTEL,VLSI Design, https://nptel.ac.in/courses/117/101/117101058/#

IV B.Tech. I - Semester

INFORMATION THEORY AND CODING

(OPEN ELECTIVE IV)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To define and apply the basic concepts of information theory (entropy, channel capacity etc.).
- To learn the principles and applications of information theory in communication systems.
- To study various data compression methods and describe the most common such methods.
- To understand the theoretical framework upon which error-control codes are built.

UNIT I

Information Theory: Discrete messages, Information and its properties. Average information, Entropy and its properties. Information rate, Mutual information and its properties.

UNIT II

Source Coding: Introduction, Shannon's theorem, Shannon-Fano coding, Huffman coding, efficiency calculations,channel capacity of discrete and analog Channels, Gaussian channel capacity, bandwidth –S/N trade off. Source Coding For Text: Adaptive Huffman Coding, Arithmetic Coding, LZW algorithm.

UNIT III

Linear Block Codes: Introduction, Matrix description of Linear Block codes, Error detection and error correctioncapabilities of Linear block codes, Hamming codes.

UNIT IV

Binary Cyclic Codes: Polynomial Representation of Code words, Generator Polynomial, Systematic Codes, Generator Matrix, Syndrome Calculation and Error Detection, Decoding of Cyclic Codes.

UNIT V

Convolution Codes: Introduction, encoding of convolution codes, time domain approach, transform domain approach.Graphical approach: state, tree and trellis diagram decoding using Viterbi algorithm.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

1. Calculate entropy, joint entropy, relative entropy, conditional entropy, and channel

   capacityof a system.
2. Analyze different source coding techniques and Differentiate between lossy and lossless compression techniques.
3. Compute and analyze different error control coding schemes for the reliable transmission of digital information over the channel.
4. Compute and analyze binary cyclic codes.
5. Compute and analyze convolution codes.

TEXT BOOKS:

1. T. M. Cover, J. A. Thomas, Elements of Information Theory, Wiley, 2nd Edition, 2006.
2. R. Togneri, C.J.S deSilva, Fundamentals of Information Theory and Coding Design, Chapman and Hall/CRC, 1st Edition, 2003.

REFERENCE BOOKS:

1. R. J. McEliece, The Theory of Information and Coding, Cambridge Uinversity Press, 2004.
2. R. Bose, Information Theory Coding and Cryptography, Tata McGraw Education, 2002.

IV B.Tech. I - Semester

SOFTWARE ENGINEERING

(OPEN ELECTIVE IV)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

This course is designed to:

- To help students to develop skills that will enable them to construct software of high

  Quality – software that is reliable, and that is reasonably easy to understand, modify

  and maintain.
- This course introduces the concepts and methods required for the construction of large

  software intensive systems. It aims to develop a broad understanding of the discipline of software engineering.
- Represent classes, responsibilities and states using UML notation.
- Capable of team and organizational leadership in computing project settings, and have a broad understanding of ethical application of computing-based solutions to societal and organizational problems.
- Apply their foundations in software engineering to adapt to readily changing environments using the appropriate theory, principles and processes.

UNIT I

Software and Software Engineering: The Nature of Software, The Unique Nature of WebApps, Software Engineering, Software Process, Software Engineering Practice, Software Myths.

Process Models: A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models.

UNIT II

Requirements Analysis and Specification: Requirements Gathering and Analysis, Software Requirement Specification (SRS), Formal System Specification.

Software Design: Overview of the Design Process, How to Characterize of a Design? Cohesion and Coupling, Layered Arrangement of Modules, Approaches to Software Design, Developing the DFD Model of a System.

UNIT III

Unified Modeling Language (UML): Introduction to UML, why we model, Standard Diagrams: Structural Diagrams- Class diagram, Object diagram, Component diagram, Deployment diagram, Behavioural Diagrams- Use case diagram, Sequence diagram, Collaboration diagram, State chart diagram, Activity diagram.

UNIT IV

Coding And Testing: Coding, Code Review, Software Documentation, Testing, Unit Testing, Black-Box Testing, White-Box Testing, Debugging, Program Analysis Tool, Integration Testing, Testing Object-Oriented Programs, System Testing, Some General Issues Associated with Testing.

UNIT V

Software Reliability and Quality Management: Software Reliability, Statistical Testing, Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity

Model.

Software Maintenance: Software maintenance, Maintenance Process Models, Maintenance Cost, Software Configuration Management.

COURSE OUTCOMES:

Students taking this subject will gain software engineering skills in the following areas:

1. Define and develop a software project from requirement gathering to implementation.
2. Obtain knowledge about principles and practices of software engineering.
3. Represent classes, responsibilities and states using UML notation.
4. Focus on the fundamentals of modeling a software project.
5. Obtain knowledge about estimation and maintenance of software systems.

TEXT BOOKS:

1. Roger S. Pressman, Software Engineering a Practitioner's Approach, 7^{th} Edition McGrawHill, 2009.

2. Rajib Mall, Fundamentals of Software Engineering, PHI, 3rd Edition, 2009.
3. Ian Sommerville, Software Engineering, Pearson education, 9th Edition, 2017.

REFERENCE BOOKS:

1. Waman S Jawadekar, Software Engineering : A Primer, Tata McGraw-Hill, 2008.
2. PankajJalote, Software Engineering, A Precise Approach, Wiley, 2010.
3. Deepak Jain, Software Engineering, Principles and Practices, Oxford University Press, 2008.

e-Resources:

1) https://nptel.ac.in/courses/106/105/106105182/

IV B.Tech. I - Semester

CLOUD COMPUTING

(OPEN ELECTIVE IV)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To implement Virtualization.
- To implement Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.
- Broadly educate to know the impact of engineering on legal and societal issues involved.

UNIT I

Introduction: Network centric computing, Network centric content, peer-to – peer systems, cloud computing delivery models and services, Ethical issues, Vulnerabilities, Major challenges for cloud computing.

Parallel and Distributed Systems: Introduction, architecture, distributed systems, communication protocols, logical clocks, message delivery rules, concurrency, model concurrency with Petri Nets.

UNIT II

Cloud Infrastructure: At Amazon, The Google Perspective, Microsoft Windows Azure, Open Source Software Platforms, Cloud storage diversity, Inter cloud, energy use and ecological impact, responsibility sharing, user experience, Software licensing.

Cloud Computing: Applications and Paradigms: Challenges for cloud, existing cloud applications and new opportunities, architectural styles, workflows, The Zookeeper, The Map Reduce Program model, HPC on cloud, biological research.

UNIT III

Cloud Resource virtualization: Virtualization, layering and virtualization, virtual machine monitors, virtual machines, virtualization- full and para, performance and security isolation, hardware support for virtualization, Case Study: Xen, vBlades, Cloud Resource Management and Scheduling: Policies and Mechanisms, Applications of control theory to task scheduling, Stability of a two-level resource allocation architecture, feedback control based on dynamic thresholds, coordination, resource bundling, scheduling algorithms, fair queuing, start time fair queuing, cloud scheduling subject to deadlines, Scheduling Map Reduce applications, Resource management and dynamic application scaling.

UNIT IV

Storage Systems: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google filesystem. Apache Hadoop, Big Table, Cloud Security: Cloud security risks, security – a top concern for cloud users, privacy and privacy impact assessment, trust, OS security, Virtual machine security, Security risks.

UNIT V

Cloud Application Development: Amazon Web Services : EC2 – instances, connecting clients, security rules, launching, usage of S3 in Java, Installing Simple Notification Service on Ubuntu 10.04, Installing Hadoop on Eclipse, Cloud based simulation of a Distributed trust algorithm, Cloud service for adaptive data streaming.

COURSE OUTCOMES:

At the end of the course, student will be able to

1. Interpret the key dimensions of the challenge of Cloud Computing.
2. Examine the economics, financial, and technological implications for selecting cloud computing for own organization.
3. Assessing the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications.
4. Evaluate own organizations' needs for capacity building and training in cloud computing- related IT areas.
5. To Illustrate Virtualization for Data-Center Automation.

TEXT BOOKS:

1. Dan C Marinescu, Cloud Computing, Theory and Practice, Morgan Kaufmann, 2013.
2. Anthony T Velte, Toby J Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, TMH, 2017.

REFERENCE BOOKS:

1. Raj Kumar Buyya, Christen vecctiola, S Tammarai selvi, Mastering Cloud Computing, Foundations and Application Programming, Morgan Kaufmann, 2013.

IV B.Tech. I - Semester

CYBER SECURITY
(OPEN ELECTIVE IV)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- The Cyber security Course will provide the students with foundational Cyber Security principles, Security architecture, risk management, attacks, incidents, and emerging IT and IS technologies.
- Students will gain insight into the importance of Cyber Security and the integral role of Cyber Security professionals.

UNIT I

Introduction to Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? , Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens.

UNIT II

Cyber offenses: How Criminals Plan Them –Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Cloud Computing.

UNIT III

Cybercrime Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT IV

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Phishing and Identity Theft: Introduction, Phishing, Identity Theft (IDTheft).

UNIT V

Cybercrimes and Cyber security: Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Information Security Planning and Governance, Information Security Policy Standards, Practices, The information Security Blueprint, Security education, Training and awareness program, Continuing Strategies.

COURSE OUTCOMES:

1. Cyber Security architecture principles.
2. Identifying System and application security threats and vulnerabilities.
3. Identifying different classes of attacks.
4. Cyber Security incidents to apply appropriate response.
5. Describing risk management processes and practices.
6. Evaluation of decision making outcomes of Cyber Security scenarios.

TEXT BOOKS:

1. Nina Godbole, Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley, 2011.
2. Micheal E. Whitman and Herbert J. Mattord, Principles of Information Security, Course Technology Inc, 6th Edition, 2017.

REFERENCES:

1. Mark Rhodes Ousley, Information Security, MGH, 2nd Edition, 2013.

IV B.Tech. I - Semester

FUNDAMENTALS OF UTILIZATION OF ELECTRICAL ENERGY

(OPEN ELECTIVE IV)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the different types of electric heating and welding techniques.
- To study the basic principles of illumination and to design the lighting systems.
- To understand the operating principles and characteristics of various motors with respect to speed, temperature and loading conditions.
- To understand the concept of various energy storage systems and its wide applications.
- To understand the basic principle of electric traction including speed–time curves of different traction services.
- To understand the method of calculation of various traction systems for braking, acceleration and other related parameters.

UNIT I

Electric Heating & Welding:

Electric Heating: Advantages and methods of electric heating, resistance heating, induction heating and dielectric heating.

Electric Welding: Resistance and arc welding, electric welding equipment, comparison between AC and DC welding.

UNIT II

Illumination fundamentals: Illumination fundamentals Introduction, terms used in illumination–Laws of illumination–Polar curves–Integrating sphere–Lux meter–Discharge lamps, MV and SV lamps – Lumen or flux method of calculation - Sources of light.

UNIT III

Various Illumination Methods: Discharge lamps– mercury vapour and sodium vapour lamps - comparison between tungsten filament lamps and fluorescent tubes – Basic principles of light control– Types and design of lighting and flood lighting – LED lighting.

UNIT IV

Electric Traction –I: System of electric traction and track electrification– review of existing electric traction systems in India– special features of traction motor– mechanics of train movement– speed-time curves for different services – trapezoidal and quadrilateral speed time curves.

UNIT V

Electric Traction –II: Calculations of tractive effort–power –specific energy consumption for given run– effect of varying acceleration and braking retardation– adhesive weight and coefficient of adhesion.

COURSE OUTCOMES:

At the end of this course the students are

1. Able to identify the most appropriate electric heating and welding techniques for specific applications.
2. Able to develop a clear idea on various illumination techniques and hence design lighting scheme for specific applications.
3. Able to understand the operation and principle of different types of lamps.
4. Able to determine the speed/time characteristics of different types of traction motors.
5. Able to estimate energy consumption levels at various modes of operation.

TEXT BOOKS:

1. Utilization of Electrical Energy by E. Openshaw Taylor, Orient Longman, 2009.
2. Partab, Art & Science of Utilization of electrical Energy, Dhanpat Rai & Sons, 3rd Edition 2014.

REFERENCE BOOKS:

1. N.V.Suryanarayana, Utilization of Electrical Power including Electric drives and Electric traction, New Age International (P) Limited, Publishers, 2nd Edition, 2017.
2. C.L.Wadhwa, Generation, Distribution and Utilization of Electrical Energy, New Age international (P) Limited, 3rd Edition, 2017.

IV B. Tech. I - Semester

CONCEPTS OF SMART GRID

(OPEN ELECTIVE IV)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand concept of smart grid and developments on smart grid.
- To understand smart grid technologies and application of smart grid concept in hybrid electric vehicles etc.
- To have knowledge on smart substations, feeder automation and application for monitoring and protection.
- To have knowledge on micro grids and distributed energy systems.
- To learn about the power quality aspects and communication technology in smart grid.

UNIT I

Introduction to smart grid: Evolution of electric grid – concept of smart grid – definitions – need of smart grid, functions of smart grid, opportunities & barriers of smart grid –difference between conventional grid & smart grid –concept of resilient &self-healing grid –present development & international policies on smart grid.

UNIT II

Smart grid technologies: Part 1: Introduction to smart meters – real time prizing – smart appliances –automatic meter reading (AMR) –outage management system(OMS) –plug in hybrid electric vehicles(PHEV) – vehicle to grid – smart sensors –home & building automation –phase shifting transformers.

UNIT III

Smart grid technologies: Part 2: Smart substations– substation automation – feeder automation –geographic information system(GIS) –intelligent electronic devices(IED) & their application for monitoring & protection–smart storage like battery, super conducting magnetic energy storage, pumped hydro and compressed air energy storage–wide area measurement system(WAMS) –phase measurement unit(PMU).

Unit IV

Microgrids and distributed energy resources: Concept of micro grid, need & applications of microgrid –formation of microgrid –issues of interconnection– protection & control of microgrid–plastic & organic solar cells, thin film solar cells –variable speed wind generators, fuel cells, micro turbines, captive power plants–integration of renewable energy sources.

UNIT V

Power quality management in smart grid: Power quality &electromagnetic compatibility in smart – grid power quality issues of grid connected renewable energy sources.

Information and communication technology in smart grid: Advanced metering infrastructure (AMI) – neighborhood area networks (NAN) – home area network (HAN) – wide area network (WAN).

COURSE OUTCOMES:

At the end of this course the students are

1. Able to develop more understanding on the concepts of smart grid and its present developments.
2. Able to explain about the different smart meters and advanced metering infrastructure.
3. Able to explain about smart substations, feeder automation, GIS etc.
4. Able to analyze the micro grids and distributed generation systems.
5. Able to develop understanding on power quality management in smart grid, information and communication technology in smart grid infrastructure.

TEXT BOOKS:

1. Ali Keyhani, Mohammad N. Marwali, Min Dai, Integration of Green and Renewable Energy in Electric Power Systems, Wiley Publications, 1st Edition, 2010.
2. Clark W. Gellings, The Smart Grid: Enabling Energy Efficiency and Demand Response, River Publishers, 1st Edition, 2009.
3. Janaka B Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, Smart Grid: Technology and Applications, Wiley Publications, 1st Edition, 2012.

REFERENCE BOOKS:

1. Stuart Borlase, Smart Grid: Infrastructure, Technology and Solutions, CRC Press, 1st Edition 2012.
2. Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang, Smart Grid – The New and Improved Power Grid: A Survey, IEEE Communications Surveys & Tutorials , Vol. 14, No. 4, 2012.

IV B.Tech. I - Semester

SMART CITY PLANNING AND DEVELOPMENT

(OPEN ELECTIVE IV)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

Students will be able to:

- To develop overall city strategy to become contemporary and competitive with smart system and to understand risk and feasibility to ensure the economic health of the city through smart technology implementations.
- To understand smart community, smart transportation and smart buildings and to identify smart system to city water supply and drainage network issues.
- To apply smart technologies across the spectrum of infrastructure, E-Governance and IOT enabled services**.**

UNIT I

Introduction: Understanding – Dimensions – Global experience, Global standards and performance benchmarks, Practice codes. India 100 smart cities policy and mission, Smart city planning and development, financing smart cities development, Governance of smart cities.

UNIT II

Smart Cities Planning and Development: Introduction to smart community – smart community concepts: concept of smart community – smart transportation – smart building and home devices – smart health – smart government – smart energy and water – cyber security, safety and privacy – Internet of Things, Blockchain, Artificial Intelligence, Virtual Reality.

UNIT III

Smart Urban Transport Systems: Elements of Infrastructure (Physical, Social, Utilities and services), Basic definitions, concepts, significance and importance; Data required for provision and planning of urban networks and services; Resource analysis, Provision of infrastructure. Role of transport, types of transport systems, evolution of transport modes, transport problems and mobility issues. Urban form and Transport patterns, land use – transport cycle, concept of accessibility. Hierarchy, capacity and geometric design elements of roads and intersections. Basic principles of Transport infrastructure design. Urban transport planning process –Transport, environment and safety issues. Principles and approaches of Traffic Management, Transport System Management.

UNIT IV

Smart water supply and drainage:

Water Supply: sources of water, treatment and storage, transportation and distribution, quality, networks, distribution losses, water harvesting, recycling and reuse, norms and standards of provision, institutional arrangements, planning provisions and management issues.

Drainage and Wastewater: Wastewater Collection and Conveyance, Design of Waste stabilization Ponds, Lagoons, Root Zone Treatment Systems, Membrane bioreactors, fluidized bed reactors, Hybrid Systems, Anaerobic systems for wastewater treatment, Design of Septic tank, Sludge Treatment and Disposal, Design of Digester Tank, Sludge Dewatering and Ultimate Disposal.

UNIT V

E-Governance and IoT: The concept of management, concept of e-management & e -business, e-Government Principles, Form e-Government to e-governance, e-governance and developing countries, Designing and Implementing e-Government Strategy, E governance: Issues in implementation. IOT fundamentals, protocols, design and development, data analytics and supporting services, case studies.

COURSE OUTCOMES:

Students shall be able to:

1. Explore and understand the fundamental concepts of smart and sustainable cities.
2. Explain the component of smart cities and study current technological advancements.
3. Plan smart solutions for present Urban Transport problems.
4. Develop smart solutions for water supply and drainage problems.
5. Identify and recognize the role of E-governance and IoT solutions.

TEXT BOOKS:

1. Katherine S. Willis, The Routledge Companion to Smart Cities, Allessandro Aurigi, Routledge International Handbooks, 1st Edition, 2020.
2. Hitachi-Tokyo Laboratory, Society 5.0: A People-centric super-smart society, Springer, 1st Edition, 2020.
3. Technologies for Sustainable Urban Development, Springer, 2020.

REFERENCES BOOKS:

1. Allen G.Noble, (Eds), Regional Development and Planning for the 21st Century: New Priorities and New Philosophies, Aldershot, USA, 1988.
2. Andy Pike, Andres Rodriguez-Pose, John Tomaney, Handbook of Local and RegionalDevelopment, Taylor & Francis, 2010.

IV B.Tech. I - Semester

GREEN BUILDING TECHNOLOGIES

(OPEN ELECTIVE IV)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To learn about the environmental Implications of building construction materials.
- To learn about suitable Industrial waste materials including Biomass materials that can be used as construction material for various Infra Projects and to understand Thermal characteristics and heat flow characteristics of building materials.
- To study about non-conventional energy resources like solar energy and different case studies and to learn about management of water, solid waste and sewage.

UNIT I

Introduction: Environmental implications of buildings energy, carbon emissions, water use, waste Disposal. Building materials: sources, methods of production and environmental Implications. Green cover and built environment.

UNIT II

Implications of Resources: Implications of resources for Building Materials and alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.

UNIT III

Comforts in Building: Comforts in Building: Thermal Comfort in Buildings-Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings.

UNIT IV

Energy Conservation: Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.

UNIT V

Green Composites for Buildings and Waste Management: Green Composites for buildings: Concepts of Green Composites. Water Utilization in Buildings Waste Management: Low Energy Approaches to Water Management.

Management of Solid Wastes. Management of Sullage Water and Sewage.

COURSE OUTCOMES:

Upon completion of this course, students should be able to

1. Explain environmental Implications of building construction materials.
2. Understand various concepts of building materials, alternative materials, biomass resources and recycling of Industrial and Building wastes.
3. Understand the impact of continued use of non-renewable energy resources.
4. Investigate renewable energy systems.
5. Understand energy consumption, efficiency and waste management.

TEXT BOOKS:

1. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao, Alternative Building Materials and Technologies, New Age International, 2nd Edition, 2017.
2. Michael Bauer, Peter Mösle and Michael Schwarz, Green Building - Guidebook for Sustainable Architecture, Springer, 2010.

REFERENCES BOOKS:

1. Osman Attmann, Green Architecture Advanced Technologies and Materials, McGraw Hill, 1st Edition, 2010.
2. Michael F. Ash, Materials and the Environment, Elsevier, 2009.
3. Jerry Yudelson, Green building Through Integrated Design, McGraw Hill, 2009.

OPEN ELECTIVES OFFERED BY MECHANICAL ENGINEERING DEPARTMENT

III B.Tech. I-Semester

PRINCIPLES OF MECHANICS
(OPEN ELECTIVE - I)

L	T	P	C
3	0	0	3

COURSE OUTCOMES:

After undergoing this course, the students will be able to:

- Understand and analyse the various types of forces acting on a body, their unit's conversion from one to another and draw free body diagrams.
- Calculate resultant force and moment to maintain equilibrium.
- Calculate the co-efficient of friction for different types of surfaces.
- Determine the centroid/centre of gravity of plain and composite laminar and solid bodies.
- Determine velocity ratio, mechanical advantage and efficiency of simple machines.

UNIT I

Force: Different force systems, principle of transmissibility of forces, law of superposition. Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, triangle law of forces, polygon law of forces, resolution of forces, resolving a force into two rectangular components, Free body diagram, Lami's theorem, Type of Load, supports, Beams, analysis for simply supported, cantilever beams.

UNIT II

Moment: Moment of a force, Varignon's theorem, Principle of moment and its applications (Levers, simple and compound), Parallel forces (like and unlike parallel forces), calculating their resultant, Concept of couple, its properties and effects, General conditions of equilibrium of bodies under coplanar forces, Position of resultant force by moment.

UNIT III

Friction: force of friction, limiting frictional force, coefficient of friction, angle of friction, angle of repose, relation between angle of friction, angle of repose and coefficient of friction. Cone of friction, types of friction, laws of friction, advantages and disadvantages of friction. Equilibrium of bodies on level plane, external force applied horizontal and inclined up and down. Equilibrium of bodies on inclined plane, external forces is applied parallel to the plane, horizontal and incline to inclined plane.

UNIT IV

Centre of Gravity: Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies, Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion, Determination of center of gravity of solid bodies, cone, cylinder and sphere; composite bodies.

UNIT V

Simple Machines: Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines, Simple and compound machine, Definition of ideal machine, reversible and self, locking machine, Effort lost in friction, Load lost in friction, System of pulleys, simple screw jack, worm and worm wheel, single and double winch crab.

COURSE OUTCOMES:

After undergoing this course, the students will be able to:

1. Understand and analyse the various types of forces acting on a body, their unit's conversion from one to another and draw free body diagrams.
2. Calculate resultant force and moment to maintain equilibrium.
3. Calculate the co-efficient of friction for different types of surfaces.
4. Determine the centroid/centre of gravity of plain and composite laminar and solid bodies.
5. Determine velocity ratio, mechanical advantage and efficiency of simple machines.

TEXT BOOKS:

1. S Ramamurtham, Engineering Mechanics, DhanpatRai Publishing Co. Ltd., Rev. Edition, 2016.
2. RK Rajput, Applied Mechanics, Laxmi Publications, 3rd Edition, 2016.

REFERENCE BOOKS:

1. RS Khurmi, A Text Book of Engineering Mechanics, S Chand and Co. Ltd., Rev. Edition, 2010.
2. AK Upadhya, Applied Mechanics, SK Kataria& Sons, 5th Edition, 2013.

III B.Tech. I-Semester

TURBO MACHINES
(OPEN ELECTIVE – 1)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Understand the working principles of turbines and pumps/compressors.
- Be able to perform basic loading and performance analysis for a variety of machines.
- Understand the fluid-thermodynamic mechanisms associated with performance degradation.
- Be able to perform basic design studies.
- Understand the basic operating principles of centrifugal machines, propellers, and turbines.

UNIT I

Introduction: Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Unit and specific quantities.

Thermodynamics of fluid flow: Application of first and second law of thermodynamics to turbo machines, Efficiencies of turbo machines, Static and Stagnation states, overall isentropic efficiency, stage efficiency and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process.

UNIT II

Steam Turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Multi-stage impulse turbine, expression for maximum utilization factor, Numerical Problems.

Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging. Numerical Problems.

UNIT III

Hydraulic Turbines: Classification, various efficiencies.

Pelton Wheel – Principle of working, velocity triangles, design parameters, maximum efficiency, and numerical problems.

Francis turbine – Principle of working, velocity triangles, design parameters, and numerical problems.

Kaplan and Propeller turbines - Principle of working, velocity triangles, design parameters and Numerical Problems. Theory and types of Draft tubes.

UNIT VI

Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Theoretical head – capacity relationship, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems.

UNIT V

Gas Turbines: Simple Gas Turbine Plant- Ideal Cycle, Closed Cycle and Open Cycle for Gas Turbines, Constant Pressure Cycle, Constant Volume Cycle, Efficiency, Work Ratio and Optimum Pressure Ratio for Simple Gas Turbine Cycle. Parameters of Performance, Actual Cycle, Regeneration, Inter-Cooling and Reheating, Closed and Semi-Closed Cycle.

COURSE OUTCOMES:

At the end of course the students will be able to:

1. Model studies and thermodynamics analysis of turbomachines.
2. Classify, analyse and understand various type of steam turbine.
3. Classify, analyse and understand various type of hydraulic turbine.
4. Classify, analyse and understand various type of gas turbine.
5. Understand the concept of radial power absorbing machine and the problems involved during its operation.

TEXT BOOKS:

1. V Kadambi and Manohar Prasad, An Introduction to Energy Conversion Turbo machinery : Volume III, New Age International Publishers, 2nd Edition, 2011.
2. B. U. Pai, Turbo Machines Wiley India Pvt, Ltd 1st Edition, 2013.

REFERENCE BOOKS:

1. S. M. Yahya, Turbines, Compressors & Fan, Tata McGraw Hill Co. Ltd 2nd Edition, 2017.
2. S. L. Dixon, Fluid Mechanics & Thermodynamics of Turbo machines, Elsevier, 5th Edition, 2005

III B.Tech. I-Semester

ELEMENTS OF MECHANICAL ENGINEERING
(OPEN ELECTIVE – 1)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the concepts about stresses and strains.
- To gain knowledge about the components of transmission systems.
- To acquire knowledge about project management techniques.
- To gain knowledge about manufacturing processes and materials.
- To understand the concepts of boilers, steam power plant, petrol and diesel engines.

UNIT I

STRESSES & STRAINS: Types of stresses and strains, elasticity, plasticity, Hooke's law, stress-strain diagrams, modules of elasticity, Poisson's ratio, linear and volumetric strain, compound bars and temperature stresses.

Types of supports – loads – Shear force and bending moment for cantilever and simply supported beams.

UNIT II

TRANSMISSION SYSTEMS: Belts -Ropes and chain: belt and rope drives, velocity ratio, slip, length of belt, open belt and cross belt drives, ratio of friction tensions, power transmitted by belts. Gears- Nomenclature, classification, Gear Trains- velocity ratio, classification.

UNIT III

PROJECT MANAGEMENT: CPM, PERT, llT, MRP, ERP, Work Study, Time study and sampling.

UNIT IV

MANUFACTURING PROCESSES: Introduction to metal casting, forming, welding and machining processes. Working of lathe, shaper, milling machines, CNC machines.

Introduction to materials- metals- ferrous, non-ferrous and non-metals.

UNIT- V

STEAM BOILERS: Introduction to boilers, working Babcock and Willcox and Cochran boilers.

STEAM POWER PLANT: Plant layout, working of different circuits.

Internal combustion Engines: classification of IC engines, basic engine components and nomenclature, working principle of engines, Four strokes and two stroke petrol and diesel engines, comparison of CI and SI engines, comparison of four stroke and two stroke engines.

COURSE OUTCOMES:

At the end of the course, student will be able to

1. Discuss the concepts about stresses and strains.
2. Justify about the components of transmission systems.
3. Analyze Problems related to project management techniques.
4. Utilize knowledge about manufacturing processes and materials.
5. Learn the concepts of boilers, steam power plant, petrol and diesel engines.

TEXTBOOKS:

1. Strength of Materials and Mechanics of Structures, B.C. Punmia, Standard Publications and distributions, 9^{th} Edition, 1991.
2. Thermal Engineering, Ballaney, P.L., Khanna Publishers, 2003.
3. Elements of Mechanical Engineering, A.R.Asrani, S.M.Bhatt and P.K.Shah, B.S. Publications, 2009.

REFERENCE BOOKS:

1. Elements of Mechanical Engineering, M.L.Mathur, F.S.Metha& R.P.Tiwari Jain Brothers Publ., 2009.
2. Theory of Machines, S.S. Rattan, Tata McGraw Hill., 2004 & 2009.

III B.Tech. I-Semester

OPERATIONS MANAGEMENT
(OPEN ELECTIVE – I)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To develop the skills of forecasting, production systems and Aggregate Planning.
- To provide the knowledge of materials management and scheduling policies.
- To understand the principles of inventory control, MRP and contemporary management techniques.
- To guide in learning the key concepts and issues of quality management in both manufacturing and service organizations.
- To develop the knowledge and skill to find out the optimum solutions for a given situation using optimization techniques.

UNIT I:

Forecasting: Introduction, types of forecasting and their uses, General principles of forecasting, forecasting techniques: qualitative and quantitative methods of forecasting.

Production Systems: Types of production systems: job, batch, mass and flow type production.

Aggregate Planning: Introduction, aggregate planning strategies, aggregate planning methods, problems.

UNIT ll:

Scheduling: Introduction, difference with loading, scheduling policies, techniques, standard scheduling methods.

Materials Management: Introduction, functions of materials management, inventory, inventory management, types of inventories, Selective inventory control techniques: ABC analysis, VED analysis.

UNIT llI:

Inventory Control: P and Q Systems, Basic Economic Order Quantity model, Price break model, assumptions and problems.

Material Requirement Planning: Introduction, Inputs, outputs and MRP logic.

Contemporary Management Techniques: Introduction to Lean, llT, ERP and Supply chain Management.

UNIT IV:

Quality Management: Quality engineering, Taguchi Principles, SQC – X bar, p and c charts, problems, Juran's principles Introduction to quality acceptance sampling.

Deming's Philosophy, Introduction to Total quality management, Quality Function Deployment, Introduction to six sigma and ISO 9000 2015 standards.

UNIT V:

Optimization: Linear Programming- Graphical and simplex method- problems, Demonstration of Transportation and Assignment Models, Travelling Salesman problem.

COURSE OUTCOMES:

At the end of the course, student will be able to

1) Apply appropriate forecasting techniques & Aggregate planning methods
2) Learn Materials management analysis and scheduling policies
3) Learn about the inventory control techniques, MRP and contemporary management techniques.
4) Apply quality management principles proposed by Taguachi, Juran & Demigs
5) Apply optimization to LP model & transportation and assignment problems

TEXTBOOKS:

1. Jay Heizer , Barry Render, Chuck Munson , Amit Sachan, Operations Management, Pearson publications, Twelfth Edition, 2017
2. R. Dan Reid and Nada R. Sanders, Operations Management – an Integrated Approach, John Wiley & Sons, 2nd Edition, 2005

REFERENCES:

1. K jell B. Zandin, Maynard's Industrial Engineering Handbook, McGraw- Hill Companies, 5th Edition 2001.
2. S. N. Chary, Production and Operations Management, McGraw-Hill, 6th Edition, 2019

III B. Tech. II-Semester

COMPUTER AIDED DESIGN AND ANALYSIS
(OPEN ELECTIVE II)

L	T	P	C
3	0	0	3

Course Objectives:

The students will acquire the knowledge:

1. To understand the basic fundamentals of computer aided design.
2. To learn 2D & 3D transformations of the basic entities like line, circle, ellipse etc.
3. To understand the concepts behind formulation methods in FEM.

UNIT I Introduction:

Introduction to CAD, Elements of CAD, Essential requirements of CAD, Concepts of integrated CAD, Engineering Applications CAD systems, Computer Graphics Input devices-cursor control Devices, Digitizers, Keyboard terminals, Image scanner, Speech control devices and Touch panels, Flat Panel display, printers and plotters.

UNIT II Computer Graphics

Graphics standards, Graphics Software, Software Configuration, Graphics Functions, Output primitives- Bresenham's line drawing algorithm and Bresenham's circle generating algorithm Geometric Transformations: World/device Coordinate Representation, Windowing and clipping, 2D Geometric Transformations-Translation, Scaling, Shearing, Rotation & Reflection Matrix representation, Composite transformation, 3D transformations, multiple transformation.

UNIT III Curves:

Curves representation, Properties of curve design and representation, Interpolation vs approximation, Parametric representation of analytic curves, Parametric continuity conditions, Parametric representation of synthetic curves-Hermite cubic splines-Blending function formulation and its properties, Bezier Curves-Blending function formulation and its properties, Composite Bezier curves, B-spline curves and its properties.

UNIT IV 3D Graphics:

Fundamentals of Solid modeling, Boundary representation, Constructive solid geometry, Sweep representation, Color models. Basic application commands for 2D drafting software AutoCAD & 3D solid modeling software Solidworks.

UNIT V Basics of Finite Element Analysis:

Basic concept of the finite element method, comparison of FEM with direct analytical solutions; Steps in finite element analysis of physical systems, Finite Element analysis of 1-D problems like spring and bar elements formulation and development of elemental stiffness equations and their assembly, solution and its post processing.

Course Outcomes

1. Understand the fundamental concepts of CAD and applications of computer graphics.
2. Interpret the geometric techniques and requirements including points and lines.
3. Describe the parametric curves, surfaces and solid modelling techniques using transformation matrix.
4. Understand the virtual environment of 3D modelling and able to modelling the 3D objects.
5. Understand basics of FEM and Able to apply suitable boundary conditions to a global equation for 1D elements.

TEXT BOOKS:

1. Hearn & Baker, Computer Graphics, Prentice Hall of India, 2nd Edition, 1994.
2. Groover and Zimmers, CAD/CAM: Computer-Aided Design and Manufacturing, Prentice Hall India Ltd. 1st Edition, 1984.

REFERENCES BOOKS:

1. Ibrahim Zeid, R Sivasubramanian, CAD/CAM: Theory and Practice, McGraw Hill, 2nd Edition, 2009.
2. Rogers and Adams, Mathematical Elements for Computer Graphics, McGraw Hill, 2nd Edition, 2017.

III B. Tech. II-Semester

SMART MATERIALS
(OPEN ELECTIVE II)

L	T	P	C
3	0	0	3

PREREQUISITE: Engineering materials.

COURSE OBJECTIVES

- Impart knowledge on various smart materials and modeling of smart materials for Engineering applications.

UNIT I

Classes of materials and their uses, Evaluation of material science, principles of smart materials, Overview of smart materials, Classification of smart structures, common smart materials and associated stimulus-response, application areas of smart systems.

UNIT II

Piezoelectric materials: Piezoelectricity and piezoelectric materials, Constitutive equations of piezoelectric materials, Piezoelectric actuator and types, Control of piezoelectric actuators, piezo electric polymers, Applications of piezoelectric actuators.

UNIT III

Shape memory alloys (SMA): Properties of shape memory alloys, Shape memory effects, Pseudo-elasticity in SMA, Design of shape memory actuator, selection of materials, Smart actuation and control, Applications of SMA in precision equipment for automobiles, and medical devices.

UNIT VI

Magneto strictive materials: Basics of magnetic properties of materials, principles of magnetostriction, Rare earth magneto strictive materials, Design & control of magneto strictive actuators, Applications of magneto strictive materials for active vibration control. magnetorheological materials.

UNIT V

Energy harvesting materials, self-healing materials, Micro-electro mechanical smart systems, Self organizing nano materials, smart materials in drug delivery, Artificial muscles, smart corrosion protection coatings, Ultrasonic transducers, Hydrogels in microfluidics, Vibration dampers.

COURSE OUTCOMES:

Upon the successful completion of the course the students will be able to

1. Classify smart materials based on the general operational principles.
2. Describe the principles and applications of piezoelectric materials.
3. Understand the concepts of Smart Memory Alloys and their applications.

4. Understand the concept of magneto strictive material, types and their application in active vibration control.
5. Perceive the concepts of smart materials in future applications

TEXT BOOKS:

1. M. V. Gandhi and B. So Thompson, Smart Materials and Structures, Chapman & Hall, 1992.

2. A.V. Srinivasan, Smart Structures; Analysis and Design, Cambridge University Press, Cambridge; 2001.

REFERENCE BOOKS:

1. A.J. Moulson and J.M-Herbert, Electro ceramics: Materials, Properties, Wiley, 2nd Edition, 2003.

2. G. Gautschi, Piezoelectric Sensories: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors. Materials and Amplifiers, Springer, Berlin; New York, 2002.

III B. Tech. II-Semester

MECHATRONICS
(OPEN ELECTIVE II)

L	T	P	C
3	0	0	3

PREREQUISITES: Basics in mechanics, mechanisms, electronics and programming.

COURSE OBJECTIVE

- Understand key elements of Mechatronics system, representation into block diagram.
- Understand principles of sensors, its characteristics, interfacing with microcontroller.
- Understand the concept of PLC and microcontroller.
- Understand concept of ladder programming in PLC and microcontroller.
- Understand concept of Data Acquisition Systems and its role in Mechatronics.

UNIT I

Mechatronics systems – elements & levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based controllers, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement, position, proximity, velocity, motion, force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

UNIT II

Solid state electronic devices - PN junction diode, BJT, FET, DIAC, TRIAC and LEDs. Analog signal conditioning, operational amplifiers, noise reduction, filtering.

UNIT III

Actuating systems - Hydraulic and pneumatic actuating systems - Fluid systems, Hydraulic systems, and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems. Mechanical actuating systems and electrical actuating systems – basic principles and elements.

Control systems - Digital electronics and systems, digital logic control, microprocessors and micro controllers, programming, process controllers, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT IV

System and interfacing and data acquisition – Data Acquisition Systems, Analog to Digital and Digital to Analog conversions; Digital Signal Processing – data flow in DSPs, block diagrams, typical layouts, Interfacing motor drives.

UNIT V

Dynamic models and analogies - System response. Process Controllers – Digital Controllers, Programmable Logic Controllers, Design of mechatronics systems & future trends.

COURSE OUTCOMES:

Students will be able to:

1. Identify key elements of mechatronics system and its representation in terms of block diagram.
2. Understand working of solid-state electronic devices and apply knowledge of the concept of signal processing and signal conditioning.
3. Analyse the requirements for a given industrial process and select the most appropriate Actuators, sensors, design control systems according to applications.
4. Understand the concept of DQA, signal processing and use of interfacing systems such as ADC, DAC, digital I/O.
5. Development of PLC Ladder programming for given applications.

TEXT BOOKS:

1. KP Ramachandran, GK Vijaya Raghavan & MS Balasundaram, MECHATRONICS Integrated Mechanical Electronics Systems, WILEY, 1st Edition, 2008
2. Newton C Braga, Mechatronics Source Book, Thomson Publications, 1st Edition, 2002.

REFERENCES BOOKS:

1. W. Bolton, Mechatronics, Electronic Control Systems in Mechanical and Electrical Engg., Pearson, 4th Edition, 2012
2. Godfrey C. Onwubolu, Mechatronics, Principles and Application, Elsevier, 1st Edition, 2005

III B. Tech. II-Semester

OPERATIONS RESEARCH
(OPEN ELECTIVE II)

L	T	P	C
3	0	0	3

Prerequisite:

1. Knowledge of mathematics at high school level.
2. Knowledge of probability distributions and statistics, and preferably basic calculus, for learning Simulation.

COURSE OBJECTIVES:

1. Understand the theoretical workings of the simplex method for linear programming.
2. Solve specialized linear programming problems like the transportation and assignment problems.
3. Understand the sequencing and replacement applications in engineering.
4. Understand the importance of game theory and waiting lines models.
5. Understand how to model and solve problems using network analysis.
6. Understand the applications of basic methods form and challenges in inventory.

UNIT I

Introduction to Operations Research: Definition of Operations Research, Characteristics and phases of Operations Research, Scope of Operations Research, Operations Research Models, General Methods for Solving Operations Research Models.

Linear Programming: Mathematical Formulation, Graphical solution, Simplex method, artificial variables techniques- Big M method.

UNIT II

Transportation Problems: Mathematical Formulation, Balanced and unbalanced transportation problem, optimal solution - MODI Method, Degeneracy in Transportation problems.

Assignment problem: Mathematical Formulation, Optimal solution, Balanced and unbalanced Assignment problem, Traveling Salesman problem.

UNIT III

Replacement: Introduction, Replacement of items that deteriorate with time, when money value is not counted and counted — Replacement of items that fail completely- Group Replacement.

Job Sequencing — Introduction, Johnson's Algorithm for n jobs through two machines, n jobs through three machines.

UNIT IV

Theory of Games: Introduction, Terminology, Solution of games with saddle points and without saddle points- 2 x 2 games, Dominance principle to reduce size of game, m x 2 & 2 x n games - graphical method.

Queuing Models: Structure of queuing models, characteristics of Queuing process, Kendall's notation, Single channel systems - (M/M/1: ∞/FIFO) model and (M/M/1: N/FIFO) model

UNIT V

Network Analysis: Introduction, Project Scheduling by CPM and PERT, Network diagram representation, rules for drawing network diagram, Labelling by Fulkerson's rule, Network calculations - EST, EFT, LST, LFT, Float/Slack and critical path, PERT calculations.

Inventory Models: Definition of inventory, costs associated with inventory problems, classification of inventory models, Deterministic inventory models - EOQ model without and with shortages, Production inventory model without and with shortages, Inventory models with price - breaks.

COURSE OUTCOMES:
Students will be able to:

1. Identify and formulate LP problems using various methods for maximization and minimization problems.
2. Apply mathematical techniques in different application areas of operations research like transportation, assignment models.
3. Apply process sequencing and machine replacement of engineering problems
4. Apply the principles of Game theory and waiting lines to real world Competitive situations.
5. Apply the techniques of Critical Path Method and PERT in project management and quantitative analysis of Inventory.

TEXT BOOK:

1. S.D. Sharma, Operations Research (Theory Methods & Applications), Kedarnadh & Ramnadh & Co., Meerut, Rev Edition, 2014.
2. Premkumar Gupta and Hira, Operation Research, S Chand Company Ltd., 3rd Edition, 2012.

REFERENCE BOOKS:

1. Handy, A. Taha, Operations Research, Prentice Hall of India, 9th Edition, 2011.
2. Philip and Ravindran, Operational Research‖, John Wiley, 2nd Edition, 2011.

IV B. Tech. I Semester

INTRODUCTION TO AUTOMOBILE ENGINEERING
(OPEN ELECTIVE III)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- Understand the automobile components and their classification.
- Acquire knowledge of automobile engine auxiliary systems.
- Interpret construction, working and functions of transmission and Suspension systems.
- To understand the need of braking systems in an automobile and interpret construction, working and functions of steering system.
- To understand emissions from automobile and alternatives to reduce pollution.

UNIT I

Introduction: Types of Automobile, Automobile Layout, Chassis and Body Components, Rear Wheel Drive, Front Wheel Drive, Four Wheel Drive.

Engine: Construction Details and Materials of Cylinder Head, Piston, Piston Rings, Fly Wheel, Valve & Valve Trains, Firing Order.

Fuel Intake System: Fuel Injection Systems for Diesel and Petrol, MPFI, GDI, CRDI, Fuel Pump, Filters, Turbo Charging and Super Charging.

Cooling System: Purpose, Methods of Cooling, Air Cooling, Water Cooling, Coolants.

UNIT II

Lubrication System: Objective & Requirements of Lubricant and Various Systems of Engine Lubrication.

Ignition System: Functions, Battery Ignition System, Magneto Coil Ignition System, Electronic Ignition Systems.

Electrical System: Starting Systems, Bendix Drive, Solenoid Switch, Various Accessories - Horn, Wiper, Fuel Gauge, Oil Pressure Gauge.

UNIT III

Transmission System: Clutches: Principle, Types, Single Plate Clutch, Multi Plate Clutch, and Centrifugal Clutches.

Gear Boxes: Types, Sliding Mesh, Constant Mesh, Torque Converter and Continuously Variable transmission (CVT).

Suspension System: Rigid Axle Suspension System, Independent Suspension System, Leaf Spring, Coil Spring, Torsion Bar, Dampers, Shock Absorber.

UNIT VI

Braking System: Mechanical Brake System, Hydraulic Brake System, Pneumatic and Vacuum Brakes, Brake System Components: Drum and Disc Brakes, Master Cylinder, Wheel Cylinder, Tandem Master Cylinder, Antilock Brake System (ABS).

Steering System: Steering Geometry**:** Camber, Castor, King Pin Rake, Combined Angle Toe-In, Toe-Out. Steering Gears: Types, Steering Linkages, Rack and Pinion Steering Gear. Types of Steering Mechanism: Ackerman Steering Mechanism, Davis Steering Mechanism. Slip Angle, Cornering Power, Under Steer and Over Steer, Wheel Alignment and Balancing.

UNIT V

Vehicle Pollution Control: Components of Exhaust Gas, National and International Pollution Standards, Pollution Control Techniques: Catalytic Converter, Selective Catalytic Reduction (SCR), Diesel particulate filters (DPF), Exhaust Gas Recirculation (EGR), Crank Case Ventilation.

COURSE OUTCOMES:

At the end of course the students will be able to:

1. Identify the different types of Automobiles and their components.
2. Discuss the working of auxiliary systems of Automobile Engine.
3. Illustrate the concepts of transmission systems and identify the suitable suspension system based on application.
4. Choose suitable steering and braking system based on application.
5. Explain the pollutions norms and technologies available to reduce pollution.

TEXT BOOKS:

1. Kripal Singh, Automobile Engineering (Volume 1 & 2), Standard Publishers, 14th Edition, 2018.
2. William H. Crouse, Automotive Mechanics, Tata McGraw-Hill Education, 10th Edition, 2017.

REFERENCE BOOKS:

1. T. K. Garrett, Kenneth Newton, William Steeds, The Motor Vehicle, SAE International, 13th Edition, 2001.
2. Ehsani, Mehrdad, Modern electric, hybrid electric, and fuel cell vehicles, CRC press, 3rd edition, 2018.
3. G.B.S. Narang, Automotive Mechanics, Khanna Publications, 17th Edition, 2011.

IV B. Tech. I -Semester

NANOTECHNOLOGY
(OPEN ELECTIVE III)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To introduce the concept of nanoscience and nanotechnology.
2. To learn about the different nanostructured materials.
3. To know the physical and chemical methods of synthesis of nanomaterials.
4. To understand the importance and applications of nanotechnology.

UNIT I

Introduction: History, background and interdisciplinary nature of nanoscience and nanotechnology, challenges of Richard Feynman, scientific revolutions, nanosized effects surface to volume ratio, importance of nanoscale materials and their devices.

UNIT II

Classification of nanostructured materials: Zero dimensional, one-dimensional, two-dimensional and three-dimensional nanomaterials, grapheme, fullerene, nanotubes, nanowires, nanosheets, quantum size effect (QSE) in 1D, 2D, 3D nanomaterials, quantum dots.

UNIT III

Synthesis of nanomaterials - Physical Methods: Ball milling synthesis, Arc discharge, Ion sputtering method, Physical vapour Deposition (PVD) – Chemical vapour Deposition (CVD) - Atomic layer Deposition (ALD), Langmuir-Blodgett (LB) technique.

Synthesis of nanomaterials - Chemical Methods: Spray pyrolysis method, flame spray pyrolysis, gas phase synthesis, gas condensation process, chemical vapor condensation. Fundamental aspects of Vapor-Liquid-Solid (VLS) and Solution-Liquid-Solid (SLS) processes.

UNIT IV

Structural Characterization: X-ray diffraction (XRD), Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Scanning probe microscopy (SPM), Scanning tunneling microscopy and field-ion microscopy.

UNIT V

Applications: Nanotechnology in automobile applications - Applications of nanotechnology towards car body shell, car body, car interior, chassis and tyres, engine and drive train.

Nanotechnology in aerospace applications: Potential applications in space craft and space structures, Radiation shielding (Thermal protection), Space elevator, Space elevator (electromagnetic).

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to:

1. Understand the concepts of nanoscience and nanotechnology.
2. Acquire knowledge about the classification of nanostructures.
3. Identify various physical and chemical methods of synthesis of nanomaterials.

4. Understand the tools for characterization of nanomaterials.
5. Explore the applications of nanomaterials in automotive and aerospace sectors.

TEXT BOOKS:

1. Shareefraza J. Ukkund, Prasad Puthiyillam, Foundations of Nanoscale Science and Technology, LAP-Lambert Academic Publishing, 1st Edition, 2018.
2. Naveen Kumar Jagadapura Ramegowda, Shareefraza J. Ukkund, Prasad Puthiyillam, Synthesis and Processing Techniques, LAP-Lambert Academic Publishing, 1st Edition, 2018.

REFERENCE BOOKS

1. Prasad Puthiyillam, Applications of Nanotechnology, LAP-Lambert Academic Publishing, 1st Edition, 2018.

IV B. Tech. I -Semester

INDUSTRIAL ROBOTICS
(OPEN ELECTIVE III)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The general objectives of the course are to enable the students to

1. Understand the components and their working principles of a robotic system.
2. Expand this knowledge into the vast area of robotics.
3. The students will be exposed to the concepts of robot kinematics, Dynamics, Trajectory planning.
4. Mathematical approach to explain how the robotic arm motion can be described.
5. The students will understand the functioning of sensors and actuators.

UNIT I

ROBOT FUNDAMENTALS:

Automation and Robotics, History of robots, Laws of Robotics, Robot Specifications – Precision, accuracy and repeatability, Anatomy of a Robot – Links, Joints, number of degrees of freedom (DOF), Arm and Wrist configurations, classification by coordinate system and control system. Work Volume, An overview of Robotics – present and future prospects.

UNIT II

COMPONENTS OF THE INDUSTRIAL ROBOTS:

Components, Architecture – Requirements and challenges of end effectors, Types of end effectors - Tools & Grippers - Mechanical, Vacuum, Magnetic etc. Considerations in gripper selection and design, Common types of robotic arms – PUMA, SCARA.

MOTION ANALYSIS:

2D and 3D - Homogeneous transformations as applicable to rotation and translation – problems.

UNIT III

MANIPULATOR KINEMATICS:

Kinematic Modeling of Manipulator - Forward kinematics, D-H notation – Kinematic relation between adjacent links– problems, Inverse kinematics.

DIFFERENTIAL MOTION AND DYNAMICS:

Differential transformation, manipulator Jacobian – 2-DOF planar arms, Jacobian singularities.

Dynamics: Lagrange – Euler and Newton – Euler formulations and comparison.

UNIT IV

TRAJECTORY PLANNING AND ROBOT PROGRAMMING:

General considerations in path description and generation: Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion – Robot programming, languages and software packages - VAL programming - description of paths with a robot programming language.

UNIT V

ROBOT ACTUATORS AND FEEDBACK COMPONENTS:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors.

Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

ROBOT APPLICATIONS IN MANUFACTURING:

Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

COURSE OUTCOMES:

Upon successful completion of this course, you should be able to:

1. To learn about knowledge for the design of robotics.
2. Identify various robot configurations and components.
3. Carry out kinematic and dynamic analysis for simple serial kinematic chains.
4. Perform trajectory planning for a manipulator by avoiding obstacles and develop programming principles, languages for a robot control system.
5. Select appropriate actuators and sensors for a robot based on specific application.

TEXT BOOKS:

1. Groover M P, Industrial Robotics, Pearson Edu. 1st Edition, 1987.
2. Mittal R K & Nagrath I J, Robotics and Control, TMH, 2017.

REFERENCES:

1. K. S. Fu, , Ralph Gonzalez, C.S.G. Lee, Robotics, McGraw Hill, Rev Edition, 2017.
2. Richard D. Klafter, Robotic Engineering: An Integrated Approach, Prentice Hall, 1st Edition, 1989.

IV B. Tech. I -Semester

SMART MANUFACTURING
(OPEN ELECTIVE III)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand concepts of smart manufacturing.
- To gain knowledge about smart machines and sensors.
- To understand the principles of IoT connectivity to industry 4.0.
- To acquire knowledge about digital twin and its applications and machine learning and artificial intelligence in manufacturing.
- To understand the basic concepts of metaverse.

UNIT I

Concepts of Smart Manufacturing: Definition and key characteristics of smart manufacturing, Corporate adaptation processes, manufacturing challenges, challenges vs technologies, Stages in smart manufacturing. Minimizing Six big losses in manufacturing with Industry 4.0, and their benefits

UNIT II

Smart Machines and Smart Sensors: Concept and Functions of a Smart, Machine Salient features and Critical Subsystems of a Smart Machine, Smart sensors; smart sensors ecosystem, need, benefits and applications of sensors in industry, Introduction to IoT, IIoT, and Cyber physical systems, Sensing for Manufacturing Process in IIoT, Block Diagram of an IoT Sensing Device, Sensors in IIoT Applications, Smart Machine Interfaces,

UNIT III

IoT connectivity for Industry 4.0: Industrial communication requirement and its infrastructure, an overview of different types of networks, mesh network in industrial IoT, IoT protocols and the internet, TCP/IP (transmission control protocol/internet protocol) model, IoT connectivity standards: common protocols, application layer protocols, internet/network layer protocols, physical layer IoT protocols, choosing the right IoT connectivity protocol.

UNIT IV

Digital Twin: Introduction, applications of digital twins, impact zones of digital twins in manufacturing (factories/plants and OEMs), advantages of digital twins, basic steps of digital twin technology

Machine Learning (ML) and Artificial Intelligence (AI) in Manufacturing: Introduction, benefits and applications of ML in industries, common approaches of ML; supervised and unsupervised, semi-supervised and reinforced ML.

UNIT V

Metaverse – Basic concepts, AR/VR, Social Metaverse, Industrial Metaverse, How Web 3.0 is changing the Internet, Asset Classes Inside the Metaverse, Land, Coins, Characters/ Avatars, Skins, Utility, Industries Disrupted by the Metaverse, Smart wearables.

COURSE OUTCOMES:

At the end of the course, student will be able to:

1. Apply the basic concepts of smart manufacturing.
2. Analyze about smart machines and sensors.
3. Utilize the principles of IoT connectivity to industry 4.0.
4. Perceive about digital twin and its applications and machine learning and artificial intelligence in manufacturing.
5. Learn the basic concepts of metaverse.

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education, 2nd Edition, 2010.
2. Tom M. Mitchell, Machine Learning, McGraw Hill, 2013.
3. Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press, 2004.

REFERENCE BOOKS:

1. Elaine Rich, Kevin Knight and Shivashankar B. Nair, Artificial Intelligence, McGraw Hill Education, 3rd Edition, 2008.
2. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI Learning, 2012.

IV B. Tech. I-Semester

BASICS OF POWER PLANT ENGINEERING
(OPEN ELECTIVE IV)

L	T	P	C
3	0	0	3

Prerequisite: Applied Thermodynamics, Fluid Mechanics & Hydraulic Machines, Internal Combustion Engines and Gas Turbines.

COURSE OBJECTIVES

- To acquire the knowledge of power generation from steam power plant and to list different types of fuels used in power plants.
- To describe basic working principles of gas turbine and diesel engine power plants.
- To learn the basic concepts in supercritical and ultra-supercritical power plants.
- To learn basic concepts of hydroelectric power plants and working of different hydroelectric power plants and list the principal components and types of nuclear reactors.
- Define terms and factors associated with power plant economics and discussing environmental aspects of power plant operation.

UNIT I

Introduction: Concept of Power Plants, Classification of Power Plants, Introduction to the Sources of Energy – Resources and Development of Power in India.

Steam Power Plant: Plant Layout, Working of different circuits, Fuel handling equipment-coal handling-choice of handling equipment, coal storage-Ash handling systems.

Combustion Process: Types of coals-Properties of coal**,** overfeed and under feed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components.

UNIT II

Diesel Power Plant- Introduction –Plant layout with auxiliaries – fuel supply system, air starting equipment – super charging.

Gas Turbine Plant- Overview of gas turbine plant – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison. Design considerations of gas power plant.

UNIT III

Hydro Electric Power Plant- Water power – Hydrological cycle flow measurement – Hydrographs – storage and Pondage – surge tanks. Classification of hydroelectric power plants – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

Nuclear Power plant- Nuclear fuel – fertile materials – Nuclear reactor – reactor operation. Types of reactors: Pressurized water reactor, Boiling water reactor, fast Breeder Reactor, Gas cooled Reactor.

UNIT IV

Power from Non-Conventional Sources: Utilization of Solar- Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy. Direct Energy Conversion. Fuel cells and MHD generation.

UNIT V

Power plant economics and environmental considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor- related exercises. Effluents from power plants and Impact on environment, pollutants and pollution standards, Methods of Pollution control.

COURSE OUTCOMES:

At the end of course:

1. Student able to understand working of different circuits and combustion processes in steam power plants.
2. Student able to Identify elements in a layout and know their functions of steam, diesel, gas, hydro, nuclear and power plants.
3. Student able to get the knowledge in advancements in supercritical and ultra-supercritical power plant systems.
4. Student able to describe the working principle and reactor operations of the nuclear power plant and their impact on environment
5. Student able to determine performance of power plants based on load variations and know the pollutant, impacts & pollution standards.

TEXT BOOKS:

1. S.C. Arora and S. Domkundwar, A Course in Power Plant Engineering, DhanpatRai & Sons, 8th Edition, 2016.
2. P.K.Nag, Power Plant Engineering, Tata McGraw-Hill, 4th Edition, 2017.
3. Swapan Basu and Ajay Kumar Debnath, Power Plant Instrumentation and Control Handbook A Guide to Thermal Power Plants, Academic press, 2nd Edition, 2019.

REFERENCE BOOKS:

1. R.K. Rajput, A Text Book of Power Plant Engineering, Laxmi Publications, 5th Edition, 2016.
2. P.C.Sharma, Power Plant Engineering, S. K. Kataria & Son, 9th Edition, 2013.

IV B. Tech. I-Semester

ADVANCED MANUFACTURING PROCESSES
(OPEN ELECTIVE IV)

L	T	P	C
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COURSE OBJECTIVES:

- To understand the principles of various coating techniques and fabrication methods for MEMS devices
- To make the students understand the properties, processing and design of ceramic and composite materials
- To understand the fabrication methods for MEMS devices.
- To understand the concepts and principles of nano manufacturing methods.
- To learn various Rapid Prototyping (RP) processes and their applications.

UNIT I:

COATING TECHNIQUES: Scope, Cleaners, Methods of cleaning, Surface coating types, ceramic and organic methods of coating, and economics of coating. Electro forming, Chemical vapor deposition, Physical vapor deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

UNIT II:

PROCESSING OF CERAMICS: Applications, characteristics, classification, Processing of particulate ceramics, Powder preparations, consolidation, hot compaction, drying, sintering, and finishing of ceramics, Areas of application. PROCESSING OF COMPOSITES: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

UNIT III:

FABRICATION OF MICROELECTRONIC DEVICES: Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in micro-electronics, surface mount technology, Integrated circuit economics.

UNIT IV:

NANOMANUFACTURING: Nanotubes, Nanoparticles, nanowires, Lithography, Electrospinning, mechanical milling, Inert gas condensation, sputtering, laser ablation, Arc discharge, Solgel methods, working, applications, advantages.

UNIT V:

RAPID PROTOTYPING: Working Principles, Methods, Stereo Lithography, Laser Sintering, Fused Deposition Method, Applications and Limitations, Rapid tooling, Techniques of rapid manufacturing.

COURSE OUTCOMES: At the end of the course, student will be able to

1. Understand the working principles of various surface coating methods.
2. Discuss novel and promising techniques in the processing of ceramics and composites.

3. Select suitable fabrication methods for MEMS components.
4. Learn the concepts and principles of nano manufacturing methods.
5. Illustrate the working principles of RP and select appropriate RP process for the application.

TEXT BOOKS:

1. Kalpakijian, Manufacturing Engineering and Technology I, Adisson Wesley, 1995.
2. R. A. Lindburg, Process and Materials of Manufacturing, 1st Edition, PHI, 1990.

REFERENCES:

1. Rao. R. Thummala and Eugene, J. Rymaszewski, Microelectronic packaging handbook, VanNostrand Renihold,1 990
2. Tai - Run Hsu, MEMS & Micro Systems Design and manufacture, TMGH, 1st Edition, 2017.
3. V.K.Jain, Advanced Machining Processes, Allied Publications, 2009.

IV B. Tech. I Semester

INTRODUCTION TO FINITE ELEMENT ANALYSIS
(OPEN ELECTIVE IV)

L	T	P	C
3	0	0	3

Prerequisites: Mechanics of Solids**,** Design of Machine Members & Heat Transfer.

COURSE OBJECTIVES:

- Apply numerical approximate methods as a tool for structural problem solving.
- Implement the basics of FEM to relate stresses and strains.
- Understanding of mechanical engineering design concepts to use the Finite Element Method software correctly and efficiently.
- Solve 1-D, 2-D and dynamic problems using Finite Element Analysis approach.
- Apply the numerical integration technique to model in FEM.
- Use FEA software to study the steady heat transfer and dynamic analysis.

UNIT I

Overview of approximate methods for the solution of the mathematical models.

Basic equations of stresses-equilibrium, boundary conditions, stress–strain, strain-displacement relations, plane stress and plane strain conditions.

Functional approximate methods: Concept of potential energy, Rayleigh- Ritz method, weighted residual methods.

UNIT II

Introduction to FEM, application of FEM. General Description, basic steps of FEM, comparison of FEM with other methods, interpolation functions, coordinate system, shape functions.

One Dimensional analysis: Stiffness matrix for a axial bar element using Potential Energy approach and virtual work, Linear and Quadratic elements, Finite element analysis of uniform, stepped bars subjected to mechanical and temperature effects - Assembly of Global stiffness matrix and load vector - properties of stiffness matrix, Treatment for various boundary conditions by Elimination and Penalty Approach, convergence requirements.

UNIT III

Analysis of Trusses: Stiffness equations for a truss element, Finite Element Analysis of Trusses - Plane Truss elements.

Analysis of beams: shape function for beam element (Hermite shape functions) - Element stiffness matrix by strain energy concept- Load vector – Beam problems related to various loading and boundary conditions.

UNIT IV

Two-dimensional analysis:

Triangular Element (CST): Shape function, Jacobian matrix, strain displacement matrix, stress-strain relationship matrix, and force vector. Iso-Sub-Super parametric formulation.

Quadrilateral Element (Q4): Shape function, Jacobian matrix, strain displacement matrix, stress-strain relationship matrix, force vector. Numerical integration and Higher order elements.

UNIT V

Heat transfer analysis: mode and laws of heat transfer, 1-D steady state heat transfer, thermal forces due to lateral surface heat convection and internal heat generation, 1-D fin elements.

Dynamic Analysis: Dynamic equation of motion - Lumped and consistent mass matrices – Eigenvalues and Eigen Vectors – dynamic equation of motion of bar element by Lagrange equation and Hamilton's principle. Transverse vibration of beam, free vibration analysis.

Course Outcomes

On completion of these courses, the students will be able to

1. Understand the numerical methods involved in Finite Element Theory.
2. Demonstrate the general procedure to generate a finite element model and understand the role and significance of shape functions in finite element formulations.
3. Formulate and solve one dimensional structural problem involving bar, beam, and trusses.
4. Understand the formulation of two-dimensional elements. (CST and LST elements) and apply the numerical integration technique to solve the quadrilateral and higher order elements in FEM.
5. Illustrate an ability to identify, formulate, and apply FEA software to solve steady heat transfer and dynamic analysis.

TEXT BOOKS:

1. S.S. Rao, The finite element methods in engineering, Elsevier, 5th Edition, 2011.
2. Tirupathi K. Chandrupatla and Ashok D. Belagundu, Introduction to finite elements in engineering, Prentice –Hall, 4th Edition, 2015.

REFERENCE BOOKS:

1. J. N. Reddy, An Introduction to Finite Element Methods, McGraw-Hill 4th Edition, 2018.
2. O.C. Zienkowitz, The Finite element method in engineering science, McGraw-Hill, 7th Edition, 2013.
3. S.Md. Jalaludeen, Introduction of Finite Element Analysis, Anuradha publications, Rev. Edition, 2016.

IV B. Tech. I Semester

INDUSTRIAL ENGINEERING AND MANAGEMENT
(OPEN ELECTIVE IV)

L	T	P	C
3	0	0	3

Course Objectives:

- To understand the scientific principles of management to improve productivity.
- To impart the knowledge of financial management.
- To understand the types of plant layout and principles of statistical quality control.
- To explain the concepts of human resources management.
- To apply project management techniques in solving project related issues.

UNIT-I

Introduction: Definition of Industrial Engineering, development, applications, Role of an industrial engineer, Quantitative tools of IE, and productivity measurement, Concepts of Management, Importance, Functions of management, Scientific management, Taylor's principles, theory X and theory Y, Fayol's principles of management.

UNIT-II

Financial Management: Concept, meaning and functions of financial management, shares, bonds, debentures, time value of money, evaluation of financial alternatives, numerical problems. Capital budgeting – Marketing Management- Functions, strategies, channels of distributions. Operations Management: Importance, types of production, applications, work study, method study and time study, work sampling, PMTS, micro-motion study, rating techniques, MTM, work factor system, principles of Ergonomics, flow process charts, string diagrams and Therbligs.

UNIT-Ill

Plant layout: Definition, types and principles of plant layouts. Statistical Quality Control: Control charts and its applications- X, R and cr charts and their applications, numerical examples.

UNIT-IV

Human Resource management: Concept and functions of Human Resource Management, Industrial relations, Job-evaluation and merit rating, wage and salary administration. Value analysis: Value engineering, implementation procedure.

UNIT-V

Project management: PERT, CPM- differences, applications, critical path, determination of floats, importance, project crashing, smoothing and numerical examples.

COURSE OUTCOMES: At the end of course, students will able to do

1. Learn the scientific principles of management to improve productivity.
2. Gain the knowledge of financial management.
3. Learn the types of plant layout and principles of statistical quality control.

4. Apply the concepts of human resources management.
5. Analyze project related issues and solve through project management techniques.

TEXTBOOKS:

1. Industrial Engineering and Management by O.P Khanna, Khanna Publishers.
2. Industrial Engineering and Production Management, Martand Telsang, S.Chand Company Ltd. New Delhi.

REFERENCES:

1. Operations Management by J.G Monks, McGraw-Hill Publishers.
2. Production and Operations Management, R.Panneerselvam, PHI, 3rd Edition
3. Industrial Engineering by Banga & Sharma.