Kandula Sreenivasa Reddy Memorial College of Engineering(Autonomous)

Kadapa – 516005, A.P.

(Approved by AICTE, Affiliated to JNTUA, Ananthapuram, Accredited by NAAC)

(An ISO 9001-2008, ISO 14001:2015 Certified Institution)

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B. Tech (Regular-Full time)

(Effective for the students admitted into I year from Academic Year : 2023-24 onwards and Lateral Entry students admitted into II year from Academic Year: 2024-25 onwards)

Academic Regulations (R23UG) Course Structure and SYLLABUS (I, II, III and IV Sem.)

KSRM COLLEGE OF ENGINEERING (AUTONOMOUS)

VISION & MISSION

VISION:

To evolve as center of repute for providing quality academic programs amalgamated with creative learning and research excellence to produce graduates with leadership qualities, ethical and human values to serve the nation.

MISSION:

M1: To provide high quality education with enriched curriculum blended with impactful teaching-learning practices.

M2: To promote research, entrepreneurship and innovation through industry collaborations.

M3: To produce highly competent professional leaders for contributing to Socio-economic development of region and the nation.

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

To evolve as a department of high repute in Mechanical Engineering and allied fields through effective teaching, learning process and research activities, operating with a sense of professional and social responsibility.

MISSION

M1: To produce Mechanical Engineers with sound knowledge through quality teaching-learning process and well-designed curriculum.

M2: To induce critical thinking attitude and inculcate the use of modern tools through inter-disciplinary research and develop entrepreneurial skills through industry-institute interaction.

M3: To provide opportunities/platforms for students to nurture leadership abilities and ethical values.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1: To apply engineering principles to develop products, processes or knowledge to solve mechanical and associated engineering problems for successful career in mechanical engineering and allied fields.

PEO2: To pursue higher education, research and development and engage in the process of life-long learning.

PEO3: To demonstrate leadership qualities, professional ethics, and communication skills and adapt current technologies to meet the societal requirements.

PROGRAM OUTCOMES

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

PO2 - Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 - Design/Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 - Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 - Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 - The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 - Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

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

PO10 - Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 - Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 - Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

PSO1: To apply their knowledge in the domain of engineering mechanics, thermal and fluid sciences to solve engineering problems utilizing advanced technology.

PSO2: To successfully apply the principles of design, analysis and implementationof mechanical systems/processes which have been learned as a part of the curriculum.

PSO3: To Develop and implement new ideas on product design and development with thehelp of modern CAD/CAM tools, while ensuring best manufacturing practices.

Academic Regulations (R23UG) for B. Tech (Regular-Full time)

(Effective for the students admitted into I year from the Academic Year **2023-24** onwards)

1. Award of the Degree

(a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:

(i) Pursues a course of study for not less than four academic years and not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Eight years).

(ii) Registers for 160 credits and secures all 160 credits.

(b) Award of B.Tech. degree with Honors if he/she fulfils the following:

(i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 160 credits.

(ii) Registering for Honors is optional.

(iii) Honors is to be completed simultaneously with B.Tech. program.

2. Students, who fail to fulfil all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled. This clause shall be read along with clause 1(a) (i).

3. Admissions

Admission to the B. Tech Program shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government/University from time to time. Admissions shall be made either based on the merit rank obtainedby the student in the common entrance examination conducted by the A.P. Government/University or any other order of merit approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time.

4. Program related terms

Credit: A unit by which the course work is measured. It determines the number of hours of instruction required per week. One credit is equivalent to one hour ofteaching (Lecture/Tutorial) or two hours of practical work/field work per week.

Credit Definition:

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

a) Academic Year: Two consecutive (one odd + one even) Semesters constitute one academic year.

b) Choice Based Credit System (CBCS): The CBCS provides a choice for students to select from the prescribed courses.

5. Semester/Credits:

i) A Semester comprises 90 working days and an academic year is divided into two Semesters.

ii) The summer term is for eight weeks during summer vacation. Internship/ apprenticeship / work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two Semesters or four Semesters of study.

iii) Regular courses may also be completed well in advance through MOOCs satisfying prerequisites.

6. Structure of the Undergraduate Program

All courses offered for the undergraduate program (B. Tech.) are broadly classified as follows:

S. No.	Category	Breakup of Credits (Total 160)	Percentage oftotal credits	AICTE Recommendation (%)
1.	Humanities and Social Science including Management (HM)	13	8 %	8 – 9%
2.	Basic Sciences (BS)	20	13 %	12 - 16%
3.	Engineering Sciences (ES)	23.5	14%	10 – 18%
4.	Professional Core (PC)	54.5	34 %	30 – 36%
5.	Electives – Professional (PE) & Open (OE); Domain Specific Skill Enhancement Courses (SEC)	33	21 %	19 - 23%
6.	Internships & Project work(PR)	16	10 %	8 – 11%
7.	Mandatory Courses (MC)	Non-credit	Non-credit	-

7. Course Classification:

All subjects / courses offered for the undergraduate program in Engineering & Technology (B.Tech degree programs) are broadly classified as follows:

S. No.	Broad Course Classification	Course Category	Description
1.	Foundation Courses	Foundation courses	Includes Mathematics, Physics and Chemistry; fundamental engineering courses; humanities, social sciences and management courses
2.	Core Courses	Professional Core Courses (PC)	Includes subjects related to the parent discipline / department / branch of Engineering
		Professional Elective Courses (PE)	Includes elective subjects related to the parent discipline / department / branch of Engineering
		Open Elective Courses (OE)	Elective subjects which include inter disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering
		Domain specific skill enhancement courses (SEC)	Interdisciplinary / job-oriented / domain courses which arerelevant to the industry
4.	Project & Internships	Project	B.Tech. Project or Major Project
		Internships	Summer Internships – Community based and Industry Internships; Industry oriented Full Semester Internship
5.	Audit Courses	Mandatory non-credit courses	Covering subjects of developing desired attitude among the learners

8. Program Pattern

i. Total duration of the of B. Tech (Regular) Program is four academic years.
ii. Each academic year of study is divided into two Semesters.
iii. Minimum number of instruction days in each Semester is 90 days.
iv. There shall be mandatory student induction program for fresher's, with a three-week duration before the commencement of first Semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lecturesby Eminent People, Visits to local Areas, Familiarization to Dept. / Branch & Innovations etc., are included as per the guidelines issued by AICTE.
v. Health/wellness/yoga/sports and NSS /Scouts & Guides / Community service activities are made mandatory as credit courses for all the under graduate students.
vi. Courses like Environmental Sciences, Indian Constitution, Technical Paper Writing & IPR are offered as non-credit mandatory courses for all the undergraduate students.
vii. Design Thinking for Innovation & Tinkering Labs are made mandatory as credit courses for all the undergraduate students.
viii. Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 04 Open Elective courses.

ix. Professional Elective Courses, include the elective courses relevant to thechosen specialization/branch. Proper choice of professional elective courses can lead to students specializing in emerging areas within the chosen field of study.

x. A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for B.Tech. Degree with a Minor within the 160 credits by opting for the courses offered through various verticals/tracks under Open Electives.

xi. While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.

xii. A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines. There shall be 05 skill-oriented courses offered during III to VII Semesters. Among the five skill courses, four courses shall focus on the basic and advanced skills related to the domain/interdisciplinary courses and the other shall be a soft skills course.

xiii. Students shall undergo mandatory summer internships, for a minimum of eight weeks duration at the end of second and third year of the program. Theinternship at the end of second year shall be community oriented and industry internship at the end of third year.

xiv. There shall also be mandatory full internship in the final Semester of the program along with the project work.

xv. Undergraduate degree with Honors is introduced for the students having good academic record.

xvi. The college shall take measures to implement Virtual Labs (https://www.vlab.co.in) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.

xvii. The Principal shall assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration /career growth/placements/opportunities for higher studies/GATE/other competitive exams etc.

xviii. Preferably 25% of course work for the theory courses in every Semester shall be conducted in the blended mode of learning.

9. Evaluation Process

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. Summer Internships shall be evaluated for 50 marks, Full Internship & Project work in final Semester shall be evaluated for 200 marks, mandatory courses with no credits shall be evaluated for 30 mid Semester marks.

A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid Semester and end examination marks taken together for the theory, practical, design, drawing subject or project etc. In case of a mandatory course, he/she should secure 40% of the total marks.

Theory Courses

Assessment Method	Marks
Continuous Internal Assessment	30
Semester End Examination	70
Total	**100**

i) For theory subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End-Examination.
ii) For practical subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for the End- Examination.
iii) If any course contains two different branch subjects, the syllabus shall be written in two parts with 3 units each (Part-A and Part-B) and external examinationquestion paper shall be set with two parts each for 35 marks.
iv) If any subject is having both theory and practical components, they will be evaluated separately as theory subject and practical subject. However, they will be given same subject code with an extension of 'T' for theory subject and 'P' for practical subject.

a) Continuous Internal Evaluation

i) For theory subjects, during the Semester, there shall be two midterm examinations. Each midterm examination shall be evaluated for 30 marks of which 5 marks for objective paper (20 minutes duration), 20 marks for subjective paper (100 minutes duration) and 5 marks for assignment.
ii) Objective paper shall contain 05 short answer questions with 2 marks each or maximum of 20 bits for 10 marks. Subjective paper shall contain 4 either or type questions (totally eight questions from 1 to 8) of which student has to answer one from each either-or type questions. Each question carries 10 marks. The marks obtained in the subjective paper are condensed to 20 marks, the marks obtained in the objective paper is condensed to 5 marks.

Note:

- The objective paper shall be prepared in line with the quality of competitive examinations questions.
- The subjective paper shall contain 4 either or type questions of equal weightage of 10 marks. Any fraction shall be rounded off to the next higher mark.
- The objective paper shall be conducted by the institution on the day of subjective paper test.
- Assignments shall be in the form of problems, mini projects, design problems, slip tests, quizzes etc., depending on the course content. It should be continuous assessment throughout the Semester and the average marks shall be considered.

Assignments:

The assignments shall aid and hone the daily routine of students.

Assignments shall be stimulating and thought provoking to the student. While some questions may test student's understanding of the subject, there shall be questions that imply connect to real world applications. A variety of questions can posed in assignments.

i. *Number:* A minimum of four assignments shall be given in each subject with one assignment from Unit I to IV of syllabus of that subject.
ii. *Quantum of work*: An assignment shall take about four to six hours of study / work per week. Assignments shall not be overloaded nor under loaded. As a guideline, each assignment may contain five questions, each question taking an hour to answer.
iii. *Marks*: Each assignment must be evaluated for fifty marks. Final marks are obtained by averaging all the assignment marks and reducing it to five marks.
iv. *Deadlines*: Students shall be given at least one-week time to complete and submit assignments. Assignments shall be submitted within deadline. Late submissions should be awarded zero marks.
v. *General*: It is advised to administer assignments using Google Classroom.

iii) If the student is absent for the mid Semester examination, no re-exam shall be conducted and mid Semester marks for that examination shall be considered as zero.

iv) First midterm examination shall be conducted for I, II and III units of syllabus with one / two either or type questions from each unit. The second midterm examination shall be conducted for III, IV and V units with one/two either or type questions from each unit. (Each midterm test shall cover 50% of the syllabus approximately).

v) Final mid Semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage given to the better mid exam and 20% to the other.

For Example:

Marks obtained in first mid: 25 Marks obtained in second mid: 20Final mid Semester Marks: (25x0.8) + (20x0.2) = 24

If the student is absent for any one midterm examination, the final mid Semester marksshall be arrived at by considering 80% weightage to the marks secured by the student in the appeared examination and zero to the other. For Example:

Marks obtained in first mid: AbsentMarks obtained in second mid: 25Final mid Semester Marks: (25x0.8) + (0x0.2) =20

vi) After the course work is over, the student is permitted to improve his / her internal marks of any 3 theory subjects in the entire course. However he/she will have to attend the course work.

b) Semester-End Examination Evaluation:

End examination of theory subjects shall have the following pattern:

i) There shall be 6 questions and all questions are compulsory.
ii) Question ‘1’ shall contain 10 compulsory short answer questions for a total of 20 marks such that each question carries 2 marks. There shall be 2 short answer questions from each unit.
iii) The questions from ‘2’ to ‘6’ shall be set by covering one unit of the syllabus for each question. In each of the questions from ‘2’ to ‘6’, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.

End examination of theory subjects consisting of two parts of different subjects, for Example: Basic Electrical & Electronics Engineering shall have the following pattern:

i) Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.
ii) In each part, question 1 shall contain 5 compulsory short answer questions for a totalof 5 marks such that each question carries 1mark.
iii) In each part, questions from 2 to 4, there shall be either/or type questions of 10 markseach. Student shall answer any one of them.
iv) The questions from 2 to 4 shall be set by covering one unit of the syllabus for eachquestion.

Practical Courses

a) Practical courses shall be evaluated as tabulated below

Assessment Method	**Marks**
Continuous Internal Assessment	30
Semester End Examination	70
Total	**100**

a) For practical courses, there shall be a continuous evaluation during the Semester for 30 sessional marks and end examination shall be for 70 marks.
b) For Continuous internal assessment, Day-to-day work in the laboratory shall be evaluated for 30 marks by the concerned laboratory teacher based on the lab observation, record and performance of student in the laboratory.
c) The semester-end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and a senior expert in the subject from the same department.
   - Procedure: 20 marks
   - Experimental work & Results: 30 marks
   - Viva-voce: 20 marks.

In a practical subject consisting of two parts (Eg. Basic Electrical & Electronics Engineering Lab), the end examination shall be conducted for 70 marks as a single laboratory in 3 hours. Mid Semester examination shall be evaluated as above for 30 marks in each part and final mid Semester marks shall be arrived by considering the average of marks obtained in two parts.

d) For the subject having design and/or drawing, such as Engineering Drawing, the distribution of marks shall be 30 for mid Semester evaluation and 70 for end examination.

Assessment Method	**Marks**
Continuous Internal Assessment	30
Semester End Examination	70
Total	**100**

Day-to-day work shall be evaluated for 15 marks by the concerned subject teacher basedon the reports/submissions prepared in the class. And there shall be two midterm examinations in a Semester for duration of 2 hours each for 15 marks with weightage of 80% to better mid marks and 20% for the other. The subjective paper shall contain 3 either or type questions of equal weightage of 5 marks. There shall be no objective paper in mid Semester examination. The sum of day- to-day evaluation and the mid Semester marks will be the final sessional marks for the subject. The end examination pattern for Engineering Graphics, shall consists of 5 questions, either/or type, of 14 marks each. There shall be no objective type questions in the end examination. However, the end examination pattern for other subjects related to design/drawing, multiple branches, etc is mentioned along with the syllabus.

e) There shall be no external examination for mandatory courses with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures40% or more in the internal examinations. In case, the student fails, a re-examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.

f) Three batches complete record of laboratory records and Internal and End Semester test papers shall be preserved in the college and shall be produced to the Committees of the University as and when the same are asked for.

g) Revaluation of End Examination Scripts

- Revaluation of End Examination scripts is allowed for theory subjects only by paying requisite fee.
- Procedure for Revaluation: The script will be revaluated by an examiner appointed by the principal. The maximum of revaluation and regular end examination marks will be awarded for that subject. If the deviation is more than 12 marks, the script isreevaluated second time.
- A student can apply for revaluation in a subject only once

h) **Curriculum Delivery:** The curriculum will also be delivered by the industry expert or adjunct faculties, who have industry experience if some MOU is signed between industry and institution.

i) Subjects taught in collaboration with the industry, the assessment will be done by eitherthe industry or the college as decided by the concerned Chairman of the Board

of Studies.

j) The question papers for theory subjects shall be set by faculty members outside of the Institute. The external faculty members for question paper setting shall be appointed bythe Principal.

k) Evaluation of answer scripts shall be done by either Internal or External examiners appointed by the Principal. A minimum of 50% of subjects will be evaluated by external examiners.

l) For laboratory subjects, end examination shall be conducted by a committee consisting of two internal examiners. One examiner shall be appointed by Head of Department of concerned Major, and the other examiner shall be appointed by the Principal.

m) For project work viva-voce, end examination shall be conducted by a committee consisting of one internal examiner, one external examiner, and the concerned guide of the student. Internal examiner shall be appointed by Head of Department of concerned Major, and the external examiner shall be appointed by the Principal.

10. Skill oriented Courses

i) There shall be five skill-oriented courses offered during III to VII Semesters.

ii) Out of the five skill courses two shall be skill-oriented courses from the same domain. Of the remaining three skill courses, one shall be a soft skill course and the remaining two shall be skill-advanced courses from the same domain / Interdisciplinary / Job oriented.

iii) The course shall carry 100 marks and shall be evaluated through continuous assessments during the Semester for 30 sessional marks and end examination shall be for 70 marks. Day-to-day work in the class / laboratory shall be evaluated for 30 marks by the concerned teacher based on the regularity/assignments/viva/mid Semester test. The end examination similar to practical examination pattern shall be conductedby the concerned teacher and an expert in the subject nominated by the principal.

iv) The Head of the Department shall identify a faculty member as coordinator for the course. A committee consisting of the Head of the Department, coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process. The marks / grades shall be assigned to the students by the above committee based on their performance.

v) The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course being offered by industries / Professional bodies or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. A committee shall be formed by the principal of the college to evaluate the grades /

marks given for a course by external agencies and convert to the equivalent marks / grades.

vi) The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the respective BoS chairman at the beginning of the Semester.

vii) If a student prefers to take a certificate course offered by external agency, the department shall mark attendance of the student for the remaining courses in that Semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the University.

11. Massive Open Online Courses (MOOCs):

A Student has to pursue and complete one course compulsorily through MOOCs approved by the University. A student can pursue courses other than core through MOOCs and it is mandatory to complete one course successfully through MOOCs for awarding the degree. A student is not permitted to register and pursue core courses through MOOCs.

A student shall register for the course (Minimum of either 8 weeks or 12 weeks) offered through MOOCs with the approval of Head of the Department. The Head of the Department shall appoint one mentor to monitor the student's progression. The student needs to earn a certificate by passing the exam. The student shall be awarded the credits assigned in the curriculum only by submission of the certificate. Examination fee, if any, will be borne by the student.

Students who have qualified in the proctored examinations conducted through MOOCs platform can apply for credit transfer as specified and are exempted from appearing internal as well as external examination (for the specified equivalent credit course only).

Necessary amendments in rules and regulations regarding adoption of MOOC courses would be proposed from time to time.

12. Credit Transfer Policy

Adoption of MOOCs is mandatory, to enable Blended model of teaching-learning as also envisaged in the NEP 2020. As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, a maximum of 20% ofthe total courses being offered in a particular program are allowed i.e., maximum of 32 credits through MOOCs platform.

i) The College shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses.
ii) Student registration for the MOOCs shall be only through the respective department of the institution, it is mandatory for the student to share necessary information with the department.
iii) Credit transfer policy will be applicable to the Professional & Open Elective and skill courses only.
iv) The concerned department shall identify the courses permitted for credit transfer.
v) The College shall notify at the beginning of Semester the list of the online learning courses eligible for credit transfer.

vi) The institution shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.

vii) The college shall ensure no overlap of MOOC exams with that of the end Semester examination schedule. In case of delay in results, the college will re-issue the marks sheet for such students.

viii) Student pursuing courses under MOOCs shall acquire the required credits only aftersuccessful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.

ix) The institution shall submit the following to the examination section of the college:
   a) List of students who have passed MOOC courses in the current Semester along with the certificate of completion.
   b) Undertaking form filled by the students for credit transfer.

x) The College academic council shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM, NPTEL and state government.

Note: Students shall be permitted to register for MOOCs offered through online platforms approved by the Head of the department from time to time.

13. Academic Bank of Credits (ABC)

The institution has implemented Academic Bank of Credits (ABC) to promote flexibility incurriculum as per NEP 2020 to

i. provide option of mobility for learners across the universities of their choice
ii. provide option to gain the credits through MOOCs from approved digital platforms.
iii. facilitate award of certificate/diploma/degree in line with the accumulated credits in ABC
iv. execute Multiple Entry and Exit system with credit count, credit transfer andcredit acceptance from students' account.

14. Mandatory Internships

Summer Internships: Two summer internships either onsite or virtual each with a minimum of 08 weeks' duration, done at the end of second and third years, respectively are mandatory. It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Power projects, software MNCs or any industries inthe areas of concerned specialization of the Undergraduate program. One of the two summer internships at the end of second year (Community Service Project) shall be society oriented and shall be completed in collaboration with government organizations / NGOs & others. The other internship at the end of third year is Industry Internship and shall be completed in collaboration with Industries. The student shall register for the internship as per course structure after commencement of academic year. The guidelines issued by the APSCHE / University shall be followed for carrying out and evaluation of Community Service Project and Industry Internship.

Evaluation of the summer internships shall be through the departmental committee. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee

comprising of Headof the Department, supervisor of the internship and a senior faculty member of thedepartment. A certificate of successful completion from industry shall be included in the report. The report and the oral presentation shall carry 50% weightage each. It shall be evaluated for 50 external marks. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when Semester supplementary examinations are conducted by the institution.

Full Semester Internship and Project work: In the final Semester, the student should mandatorily register and undergo internship (onsite/virtual) and in parallel he/she should work on a project with well-defined objectives. At the end of the Semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship.

The project report shall be evaluated with an external examiner. The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the Semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner appointed by the principal and is evaluated for 140 marks.

The college shall facilitate and monitor the student internship programs. Completion of internships is mandatory, if any student fails to complete internship, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the internship.

15. Guidelines for offering a Minor

To promote interdisciplinary knowledge among the students, the students admitted into B.Tech. in a major stream/branch are eligible to obtain degree in Minor in another stream.

i) The Minor program requires the completion of 12 credits in Minor stream chosen.
ii) Two courses for 06 credits related to a Minor are to be pursued compulsorily for the minor degree, but maybe waived for students who have done similar/equivalent courses. If waived for a student, then the student must take an extra elective course in its place. It is recommended that students should completethe compulsory courses (or equivalents) before registering for the electives.
iii) Electives (minimum of 2 courses) to complete a total of 12 credits.

Note: A total of 04 Open Electives are offered in the curriculum. A student can complete the requirement for Minor by opting for the courses offered through various verticals/tracks under Open Electives.

16. Guidelines for offering Honors

The objective of introducing B.Tech. (Hons.) is to facilitate the students to choose

additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The program is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

i) Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B. Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.

ii) A student shall earn additional 15 credits for award of B.Tech.(Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline (i.e., 160 credits).

iii) A student is permitted to register for Honors in IV Semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per Semester pertaining to the Honors from V Semester onwards.

iv) The concerned Principal of the college shall arrange separate class work and timetable of the courses offered under Honors program.

v) Courses that are used to fulfil the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.

vi) The attendance for the registered courses under Honors and regular courses offered for Major degree in a Semester are to be considered separately.

vii) A student shall maintain an attendance of 75% in all registered courses under Honors to be eligible for attending Semester end examinations.

viii) A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree program.

ix) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

x) The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering

Enrolment into Honors:

i) Students of a Department/Discipline are eligible to opt for Honors program offeredby the same Department/Discipline

ii) The enrolment of student into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to III Semester in case of regular entry students and only III Semester in case of lateral entry students. Students having 7 CGPA without any backlog subjects will be permitted to register for Honors.

iii) If a student is detained due to lack of attendance either in Major or in Honors,

registration shall be cancelled.

iv) Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.

v) Honors is to be completed simultaneously with a Major degree program.

Registration for Honors:

i) The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week before the start of every Semester. Selected students shall be permitted to register the courses under Honors.

ii) The selected students shall submit their willingness to the principal through his/herparent department offering Honors. The parent department shall maintain therecord of student pursuing the Honors.

iii) The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

iv) There is no fee for registration of subjects for Honors program offered in offline at the respective institutions.

17. Attendance Requirements:

i) A student shall be eligible to appear for the end Semester examinations if he/she acquires a minimum of 40% attendance in each subject and 75% of attendance in aggregate of all the subjects. b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each Semester may be granted by the College Academic Committee.

ii) Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.

iii) A stipulated fee shall be payable towards condonation of shortage of attendance to the institution.

iv) Students whose shortage of attendance is not condoned in any Semester are not eligible to take their end examination of that class and their registration shall stand cancelled.

v) A student will not be promoted to the next Semester unless he satisfies the attendance requirements of the present Semester. They may seek readmission for that Semester from the date of commencement of class work.

vi) If any candidate fulfils the attendance requirement in the present Semester, he shallnot be eligible for readmission into the same class.

vii) If the learning is carried out in blended mode (both offline & online), then the totalattendance of the student shall be calculated considering the offline and online attendance of the student.

viii) For induction program attendance shall be maintained as per AICTE norms.

18. Promotion Rules:

The following academic requirements must be satisfied in addition to the attendance requirements mentioned in section 16.

i) A student shall be promoted from first year to second year if he/she fulfils the minimum attendance requirement as per university norms.

ii) A student will be promoted from II to III year if he/she fulfils the academic requirement of securing 40% of the credits (any ***decimal*** fraction should be ***rounded off*** to ***lower*** digit) in the subjects that have been studied up to III Semester.

iii) A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any ***decimal*** fraction should be Rounded ***off*** to ***lower*** digit) in the subjects that have been studied up to V Semester. And in case a student is detained for want of credits for a particular academic year by

ii) & iii) above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the V Semester or VII Semester respectively as the case may be.

iv) When a student is detained due to lack of credits/shortage of attendance he/she may bere-admitted when the Semester is offered after fulfilment of academic regulations. In such case, he/she shall be in the academic regulations into which he/she is readmitted.

19. Grading:

As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed:

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

Structure of Grading of Academic Performance

Range in which the marks inthe subject fall	**Grade**	**Grade Points Assigned**
90 & above	S (Superior)	10
80 - 89	A (Excellent)	9
70 - 79	B (Very Good)	8
60 - 69	C (Good)	7
50 - 59	D (Average)	6
40 - 49	E (Pass)	5
< 40	F (Fail)	0
Absent	Ab (Absent)	0

i) A student obtaining Grade 'F' or Grade 'Ab' in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

ii) For non-credit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

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

$SGPA = \Sigma(C_i \times G_i)/\Sigma C_i$

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

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

$CGPA = \Sigma(C_i \times S_i)/\Sigma C_i$

Where "S_i" is the SGPA of the i^{th} Semester and C_i is the total number of credits up to that Semester.

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

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

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D and F.

Award of Class:

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

Class Awarded	**CGPA Secured**
First Class with Distinction	≥ 7.5
First Class	$\geq 6.5 < 7.5$
Second Class	$\geq 5.5 < 6.5$
Pass Class	$\geq 5.0 < 5.5$

CGPA to Percentage Conversion Formula – (CGPA – 0.5) x 10

20. With–holding of Results

If the candidate has any dues not paid to the college or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld in such cases.

21. Multiple Entry / Exit Option

(a) Exit Policy:

The students can choose to exit the four-year program at the end of first/second/third year.

i) **UG Certificate in (Field of study/discipline)** - Program duration: First year (first two Semesters) of the undergraduate program, 40 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6- credit job-specific internship/ apprenticeship that would help the candidates acquire job- ready competencies required to enter the workforce.

ii) **UG Diploma (in Field of study/discipline)** - Program duration: First two years (first four Semesters) of the undergraduate program, 80 credits followed by an additional exit 10-credit bridge course(s) lasting two months, including at least 6-credit job-specific internship/ apprenticeship that would help the candidatesacquire job-ready competencies required to enter the workforce.

iii) **Bachelor of Science (in Field of study/discipline)** i.e., **B.Sc. Engineering in (Field of study/discipline)**- Program duration: First three years (first six Semesters) of the undergraduate program, 120 credits.

(b) Entry Policy:

Modalities on multiple entry by the student into the B.Tech. program will be provided by the university in due course of time.

Note: The College Academic council shall resolve any issues that may arise in the implementation of Multiple Entry and Exit policies from time to time and shall review the policies in the light of periodic changes brought by UGC, AICTE and State government.

22. Gap Year Concept:

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship program / to establish start-ups. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. The Head of the department shall forward such proposals submitted by thestudents to the principal. An evaluation committee constituted by the College Academic Council shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not.

23. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the Semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished Semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

Candidates who are permitted to avail Gap Year shall be eligible for re-joining into the succeeding year of their B. Tech from the date of commencement of class work, subject to Section **2** and they will follow the academic regulations into which they are readmitted.

24. Minimum Instruction Days for a Semester:

The minimum instruction days including exams for each Semester shall be 90 days.

25. Medium of Instruction:

The medium of instruction of the entire B. Tech undergraduate program in Engineering &Technology (including examinations and project reports) will be in English only.

26. Student Transfers:

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

27. General Instructions:

i. The academic regulations should be read as a whole for purpose of any interpretation.
ii. Malpractices rules-nature and punishments are appended.
iii. Where the words “he”, “him”, “his”, occur in the regulations, they also include “she”, “her”, “hers”, respectively.
iv. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Head of the Institution is final.
v. The Institution may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified.
vi. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Head of the institution is final.

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ACADEMIC REGULATIONS (R23UG)

FOR B.TECH. (LATERAL ENTRY SCHEME)

*(Effective for the students admitted into II year through Lateral Entry Scheme from the Academic Year **2024-25** onwards)*

1. **Award of the Degree**
   (a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:
      (i) Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years).
      (ii) Registers for 120 credits and secures all 120 credits.

   (b) Award of B.Tech. degree with Honors if he/she fulfils the following:
      (i) Student secures additional 15 credits fulfilling all the requisites of a B.Tech. program i.e., 120 credits.
      (ii) Registering for Honors is optional.
      (iii) Honors is to be completed simultaneously with B.Tech. program.

2. Students, who fail to fulfil the requirement for the award of the degree within six consecutive academic years from the year of admission, shall forfeit their seat.

3. **Minimum Academic Requirements**
   The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.**2**
   i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid Semester evaluation and endexamination taken together.

   ii. A student shall be promoted from III year to IV year if he/she fulfils the academic requirements of securing 40% of the credits (any decimal fraction should berounded off to lower digit) in the subjects that have been studied up to V Semester.

   And in case if student is already detained for want of credits for particularacademic year, the student may make up the credits through supplementary examsof the above exams before the commencement of IV year I Semester class work of next year.

Course Pattern

i) The entire course of study is three academic years on Semester pattern.
ii) A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.
iii) When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the Semester is offered after fulfilment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.

All other regulations as applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

B.Tech. Course Structure (R23UG)

B.Tech. I-Semester

Sl. No.	Category	Course Code	Course Name	Common for	L/D	T	P	Credits
1	BS&H	2321101	Linear Algebra and Calculus	CE, EEE, ME, ECE, CSE & AIML	3	0	0	3
2	BS&H	2324101	Communicative English	CE, ME & ECE	2	0	0	2
3	BS&H	2322104	Engineering Physics	CE, ME & ECE	3	0	0	3
4	Engg Science	23EE106	Basic Electrical & Electronics Engineering	CE, ME & ECE	3	0	0	3
5	Engg Science	2303108	Engineering Graphics	CE, ME & ECE	1	0	4	3
6	BS&H	2324110	Communicative English Lab	CE, ME & ECE	0	0	2	1
7	Engg Science	23EE114	Electrical and Electronics Engineering Workshop	CE, ME & ECE	0	0	3	1.5
8	BS&H	2322115	Engineering Physics Lab	CE, ME & ECE	0	0	2	1
9	BS&H	2306116	NSS / NCC / Scouts & Guides / Community Service	CE, ME & ECE	-	-	1	0.5
				Total	**12**	**0**	**12**	**18**

B.Tech. II-Semester

Sl. No.	Category	Course Code	Course Name	Common for	L/D	T	P	Credits
1	BS&H	2321201	Differential Equations & Vector Calculus	CE, EEE, ME, ECE, CSE & AIML	3	0	0	3
2	BS&H	23EC202	Engineering Chemistry	CE & ME	3	0	0	3
3	PC	23EM204	Engineering Mechanics	CE & ME	3	0	0	3
4	Engg Science	23CM205	Basic Civil and Mechanical Engineering	CE, ME & ECE	3	0	0	3
5	Engg Science	2305207	Introduction to Programming	CE, ME & ECE	3	0	0	3
6	PC	2301206	Engineering Mechanics Lab	CE	0	0	3	1.5
7	Engg Science	2305209	IT Workshop	CE, ME & ECE	0	0	2	1
8	BS&H	23EC211	Engineering Chemistry Lab	CE & ME	0	0	2	1
9	Engg Science	2303212	Engineering Workshop	CE, ME & ECE	0	0	3	1.5
10	Engg Science	2305213	Computer Programming Lab	CE, ME & ECE	0	0	3	1.5
11	BS&H	2306217	Health And Wellness, Yoga and Sports	CE, ME & ECE	-	-	1	0.5
				Total	**15**	**0**	**14**	**22**

B.Tech. III-Semester

S.No.	Category	Course code	Title	L	T	P	Credits
1	BS	23HS301	Numerical Methods and Transforms techniques.	3	0	0	3
2	HSMC	23HS311	Understanding Harmony & Ethical human conduct	2	1	0	3
3	Engineering Science	2303301	Thermodynamics	2	0	0	2
4	Professional Core	2303302	Mechanics of Solids	3	0	0	3
5	Professional Core	2303303	Material Science and Metallurgy	3	0	0	3
6	Professional Core	2303351	Mechanics of Solids and Materials Science Lab	0	0	3	1.5
7	Professional Core	2303352	Computer-aided Machine Drawing	0	0	3	1.5
8	Engineering Science	2303353	Auto cad applications in mechanical engineering.	0	0	2	1.0
9	Skill Enhancement Course	2305353	Python programming	0	1	2	2
10	Audit Course	23HS331	Environmental Science	2	0	0	-
			Total	**15**	**2**	**10**	**20**

B.Tech. IV-Semester

S.No.	Category	Course code	Title	L	T	P	Credits
1	Management Elective- I	23HS421	MEFA	2	0	0	2
2	Basic Science	23HS401	Complex Variables, Probability and Statistics	3	0	0	3
3	Professional Core	2303401	Manufacturing processes	3	0	0	3
4	Professional Core	2303402	Fluid Mechanics & Hydraulic Machines	3	0	0	3
5	Professional Core	2303403	Theory of Machines	3	0	0	3
6	Professional Core	2303451	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
7	Professional Core	2303452	Manufacturing processes Lab	0	0	3	1.5
8	Skill enhancement course	23HS451	Soft Skills	0	1	2	2
9	Engineering Science	2304453	Design Thinking & Innovation	1	0	2	2
			Total	**15**	**1**	**10**	**21**

I Semester

Course Title	LINEAR ALGEBRA & CALCULUS				B. Tech. I Sem. *(Common to All Branches)*		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2321101	**BS&H**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	30	70	100
Mid Exam Duration : 2Hrs					**End Exam Duration : 3 Hrs.**			

Course Objectives:

- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

Course Outcomes: On successful completion of this course, the students will be able to

CO1	Develop and use of matrix algebra techniques that are needed by engineers for practical applications.
CO2	Utilize mean value theorems to real life problems.
CO3	Familiarize with functions of several variables which are useful in optimization.
CO4	Learn important tools of calculus in higher dimensions.
CO5	Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.

UNIT I: Matrices

Rank of a matrix by echelon form, normal form, **normal form in PAQ**. Cauchy–Binet formula (without proof). Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: **Consistency and inconsistency of system of equations,** solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method. **Iterative Methods**: Jacobi and Gauss Seidel Iteration Methods.

UNIT II: Eigenvalues, Eigenvectors and Orthogonal Transformation

Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms, Nature, **Signature and Index** of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT III: Calculus

Basic concepts of Calculus. Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof), Problems and applications on the above theorems.

UNIT IV: Partial differentiation and Applications (Multi variable calculus)

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT V: Multiple Integrals (Multi variable Calculus)

Double integrals: **Evaluation of double integrals in cartesian and polar coordinate**s, triple

integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition.
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10thEdition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, Pearson publishers, 9th Edition.
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications,2014, Third Edition (Reprint 2021).
6. A Text Book of Engineering Mathematics, N.P. Bali and Manish Goyal, Lakshmi Publications, Reprint 2008.

Course Title	COMMUNICATIVE ENGLISH				B. Tech. CE, ME & ECE (I Sem.)			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2324101	**BS&H**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		2	0	0	2	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

COURSE OBJECTIVES	
1	Facilitate effective listening, Reading, Speaking and Writing skills among the students
2	Enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary
3	Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing
4	Helps the students to make them effective in speaking and writing skills and to make them industry ready.
5	Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
COURSE OUTCOMES	
CO1	**Understand** the context, topic, and pieces of specific information from social or transactional dialogues.
CO2	**Apply** grammatical structures to formulate sentences and correct word forms.
CO3	**Analyze** discourse markers to speak clearly on a specific topic in informal discussions
CO4	**Evaluate** reading / listening texts and to write summaries based on global comprehension of these texts.
CO5	**Create** a coherent paragraph, essay, and resume.

UNIT I

Lesson : **HUMAN VALUES:** Gift of Magi (Short Story)
Listening : Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.
Speaking : Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.
Reading : Skimming to get the main idea of a text; scanning to look for specific pieces of information.
Writing : Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.
Grammar : Parts of Speech, Basic Sentence Structures-forming questions
Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words, **One word Substitutes.**

UNIT II

Lesson : **NATURE:** The Brook by Alfred Tennyson (Poem)
Listening : Answering a series of questions about main ideas and supporting ideas after listening to audio texts.
Speaking : Discussion in pairs/small groups on specific topics followed by short structure talks.

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

Writing : Structure of a paragraph - Paragraph writing (specific topics) Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions.

Vocabulary: Homonyms, Homophones, Homographs, **Idioms and Phrases.**

UNIT III

Lesson : **BIOGRAPHY:** Elon Musk

Listening : Listening for global comprehension and summarizing what is listened to.

Speaking : Discussing specific topics in pairs or small groups and reporting what is discussed

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

Writing : Summarizing, Note-making, paraphrasing

Grammar : Verbs - tenses; subject-verb agreement; Compound words, Collocations, **Question Tags**

Vocabulary: Compound words, Collocations

UNIT IV

Lesson : **INSPIRATION:** The Toys of Peace by Saki

Listening : Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking : Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

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

Writing : Letter Writing: Official Letters, Resumes and **Technical Report Writing**

Grammar : Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Jargons

UNIT V

Lesson : **MOTIVATION**: The Power of Intrapersonal Communication (An Essay)

Listening : Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Speaking : Formal oral presentations on topics from academic contexts

Reading : Reading comprehension.

Writing : Writing structured essays on specific topics.

Grammar : Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement) **Graphic Presentation**

Vocabulary: Technical Jargons

Text Books:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

Reference Books:

1. Raman, Meenakshi and Sangeeta Sharma, 2011. Technical Communication: Principlesand Practice. Second Edition. New Delhi: Oxford University Press.
2. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020

3. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
4. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
5. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

Web Resources:

GRAMMAR:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

VOCABULARY

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

Course Title	ENGINEERING PHYSICS				B. Tech. *CE, ME & ECE (I Sem.)*		
Course Code	**Category**	**Hours/Week**		**Credits**	**Maximum Marks**		
2322104	**BS&H**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	**0**	**0**	**3**	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc,
- Enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics.
- Introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

Course Outcomes:

CO1	Analyze the intensity variation of light due to interference, diffraction and polarization
CO2	Familiarize with the basics of crystals and their structures
CO3	Summarize various types of polarization of dielectrics and classify the magnetic materials.
CO4	Explain fundamentals of quantum mechanics and apply to one dimensional motion of particles.
CO5	Identify the type of semiconductor using Hall Effect.

UNIT I : Wave Optics

Interference: Introduction- Principle of superposition –Interference of light –**Conditions for sustained Interference**-Interference in thin films (Reflection Geometry) & applications - Colors in thin films- Newton's Rings- Determination of wavelength and refractive index. **Diffraction:** Introduction-Fresnel and Fraunhofer diffractions- Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative)- **Engineering applications of diffraction.**

Polarization: Introduction-Types of polarization- Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates- **Engineering applications of polarization.**

UNIT II : Crystallography and X-ray diffraction

Crystallography: Introduction - Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X-ray diffraction: Introduction - Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods- **applications**.

UNIT III : Dielectric and Magnetic Materials

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors- Types of polarizations-Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius-Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss- **applications.**

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, Para, Ferro, Anti-Ferro & Ferri magnetic materials - Domain concept for Ferro magnetism &Domain walls (Qualitative)-Hysteresis-soft and hard magnetic materials- **applications.**

UNIT IV : Quantum Mechanics and Free electron theory

Quantum Mechanics: Introduction **–** Dual nature of matter–Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well- **applications**.

Free Electron Theory: Introduction - Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory– electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy.

UNIT V : Semiconductors

Semiconductors: Introduction - Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity– Fermi level– Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature -Drift and diffusion currents–Einstein's equation–**Direct and indirect band gap of semiconductors-**Hall effect and its applications-**Formation of p-n junction.**

Text Books:

1. A Text book of Engineering Physics - M.N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, S. Chand Publications, 11th Edition2019.
2. Engineering Physics-D.K. Bhattacharya and Poonam Tandon, Oxford press (2015).

Reference Books:

1. Engineering Physics - B.K. Pandey and S.Chaturvedi, Cengage Learning
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education,2018.
3. Engineering Physics - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

Course Title	Basic Electrical & Electronics Engineering				B. Tech. *CE, ME & ECE (I Sem.)*			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
23EE106	**Engineering Science**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering and to acquire fundamental knowledge in the relevant field.

Course Outcomes: O\After the completion of this course students will be able to

CO1	Remember the fundamental laws, operating principles of motors, generators, MC and MI instruments.
CO2	Understand the problem solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments; different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.
CO3	Apply mathematical tools and fundamental concepts to derive various equations related to machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems.
CO4	Analyze different electrical circuits, performance of machines and measuring instruments.
CO5	Evaluate different circuit configurations, Machine performance and Power systems operation.

PART A: BASIC ELECTRICAL ENGINEERING

UNIT I : DC & AC Circuits

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peakfactor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT II : Machines and Measuring Instruments

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

UNIT III : Energy Resources, Electricity Bill & Safety Measures

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity Bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Text Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.

Web Resources:

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:	
➢ To understand the principles of digital electronics, basics of semiconductor devices like diodes & transistors, characteristics and its applications.	
Course Outcomes: On successful completion of this course, the students will be able to	
CO1	Understand the working mechanism of diodes, transistors, logic gates, different combinational, sequential circuits and their role in the digital systems.
CO2	Apply diodes, transistors in the electronic circuits and number systems, logic gates, Boolean algebra in logic circuits.
CO3	Analyze the circuits with diodes, transistors and logic circuits with logic gates.

UNIT I : SEMI CONDUCTOR DEVICES

Introduction - Evolution of electronics – Vacuum tubes to nano electronics Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction

Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

UNIT II : BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple Zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT III : DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates–NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adder, Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

Text Books:

1. R.L. Boylestad &Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education,2021.
2. R. P. Jain, Modern Digital Electronics, 4thEdition, Tata McGraw Hill, 2009

Reference Books:

1. R.S. Sedha, A Text book of Electronic Devices and Circuits, S. Chand & Co,2010.
2. Santiram Kal, Basic Electronics-Devices, Circuits and IT Fundamentals, Prentice Hall, India,2002.
3. R.T. Paynter, Introductory Electronic Devices & Circuits–Conventional Flow Version, Pearson Education,2009.

Course Title	Engineering Graphics				B. Tech. *CE, ME & ECE (I Sem.)*			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2303108	**Engineering Science**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		1	0	4	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives: The students completing the course are expected to:

- Understand the basic principles and conventions of engineering drawing use engineering instruments and draw engineering curves.
- Use orthographic projections and make the students draw the projections of lines and planes inclined to both the planes.
- Draw the projections of the solids in different positions with respect to the reference planes.
- Understand the importance of sectioning and concept of development of surfaces.
- Represent and convert isometric views to orthographic views and vice versa.

Course Outcomes: On completion of the course, the student should be able to

CO1	Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.
CO2	Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.
CO3	Apply concepts of sectional views to represent details of solids in simple positions.
CO4	Gain a clear understanding of the principles behind development of surfaces and to understand how to unfold basic geometric shapes into flat patterns.
CO5	Develop the ability to draw isometric views and orthographic views and should be able to convert isometric views to orthographic views and vice versa.

UNIT I

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

UNIT II

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one

reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

UNIT III

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

UNIT IV

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

UNIT V

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (*Not for end Examination*).

Text Books:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.
2. K. Vengopal Engineering Drawing & Graphics.2018
3. Harwinder Singh Engineering Drawing & Computer Graphics.2016

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe,Tata McGraw Hill, 2017.

Course Title	COMMUNICATIVE ENGLISH LAB				B. Tech. *CE, ME & ECE (I Sem.)*		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2324110	**BS&H**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		0	0	2	1	30	70	100
					End Exam Duration: 3Hrs			

Course Objectives

- Students will be exposed to a variety of self-instructional, learner friendly modes of language learning.
- The students will get trained in basic communication skills and also make them ready to face job interviews.
- Students will learn better pronunciation through stress, intonation and rhythm.
- Students will be initiated into greater use of the computer in resume preparation, report writing, format making etc.

Course Outcomes

CO1	**Understand** the different aspects of the English language proficiency with emphasis on LSRW skills.
CO2	**Apply** communication skills through various language learning activities.
CO3	**Analyze** the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.
CO4	**Evaluate** and exhibit professionalism in participating in debates and group discussions.
CO5	**Create** effective Course Objectives:

List of Topics:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills
11. Listening Skills
12. Describing Objects

Suggested Software:

- Walden Infotech
- Young India Films

Reference Books:

1. Raman Meenakshi, Sangeeta-Sharma. *Technical Communication*. Oxford Press.2018.
2. Taylor Grant: *English Conversation Practice*, Tata McGraw-Hill Education India, 2016
3. Hewing's, Martin. Cambridge *Academic English* (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. *A Course in Phonetics and Spoken English*, (2nd Ed) , Kindle, 2013

Web Resources:

Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent:

1. https://www.youtube.com/user/letstalkaccent/videos
2. https://www.youtube.com/c/EngLanguageClub/featured
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

Course Title	Electrical & Electronics Engineering Workshop				B. Tech. *CE, ME & ECE (I Sem.)*		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
23EE114	**Engineering Science**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		0	0	3	1.5	30	70	100
					End Exam Duration: 3Hrs			

Course Objectives:

To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

Course Outcomes: On successful completion of this course, the students will be able to

CO1	Identify &testing of various electronic components.
CO2	Understand the usage of electronic measuring instruments.
CO3	Plot and discuss the characteristics of various electronic devices.
CO4	Explain the operation of a digital circuit.

Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Breadboard, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife / blade, soldering iron, de-soldering pump etc.
   - Provide some exercises so that hard ware tools and instruments are learned to be used by the students.
2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
   - Provide some exercises so that measuring instruments are learned to be used by the students.
3. Components:
   - Familiarization / Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.
   - Testing of components like Resistor, Capacitor, Diode, Transistor, IC set, Comparevalues of components like resistors, inductors, capacitors etc with the measured values byusing instruments.

PART A: ELECTRICAL ENGINEERING LAB

List of experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises
8. OC and SC tests on single phase transformer
9. Brake test on DC Shunt Motor

PARTB: ELECTRONICS ENGINEERING LAB

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V–I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers.
4. Plot Input &Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K &D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multimeters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

Reference Books:

1. R.L. Boylestad & Louis Nashlesky, Electronic Devices &Circuit Theory, Pearson education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4thEdition, Tata Mc Graw Hill, 2009.
3. R.T. Paynter, Introductory Electronic Devices &Circuits–Conventional Flow Version, Pearson Education, 2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

Course Title	ENGINEERING PHYSICS LAB				B. Tech. *CE, ME & ECE (I Sem.)*		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2322115	**BSC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		0	**0**	**2**	**1**	30	70	100
					End Exam Duration: 3Hrs			

Course Objectives:

- To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

Course Outcomes:

CO1	Operate optical instruments like travelling microscope and spectrometer.
CO2	Estimate the wavelengths of different colors using diffraction grating.
CO3	Plot the intensity of the magnetic field of circular coil carrying current with distance.
CO4	Evaluate dielectric constant and magnetic susceptibility for dielectric and magnetic materials respectively.
CO5	Calculate the band gap of a given semiconductor. Identify the type of semiconductor using Hall Effect.

List of Experiments:

1. Determination of radius of curvature of a given Plano convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using Diffraction grating in normal incidence on figuration.
3. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photo electric effect.
8. Determination of the resistivity of semiconductors by four probe methods.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect.
12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
14. Determination of magnetic susptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non- uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.
19. Fraunhoffer diffraction due to single slit.

Note: Any **TEN** of the listed experiments are to be conducted. Out of which any **TWO** Experiments may be conducted in virtual mode.

Text Books:

1. A Text book of Practical Physics-S.Balasubramanian, M.N.Srinivasan, S.Chand Publishers, 2017.
2. Practical Physics by K.Venugopalan (Author), Vimal Saraswat (Author), Himanshu Publications (1 January 2018)

Reference Books:

1. Lab manual Physics, R Rangarajan, R P Manchanda, R K Gupta, Rajesh Kumar Neena Sinha-New Saraswati House.
2. Practical Physics by Kumar P. R. Sasi, Prentice-Hall of India Pvt. Ltd

URL:*www.vlab.co.in*

Course Title	NSS / NCC / SCOUTS & GUIDES / COMMUNITY SERVICE				B. Tech. CE, ME & ECE (I Sem.)			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2306116	**BS&H**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		0	0	1	0.5			
					6 X 15 = 90 + 10 Viva voce			

Course Objectives:

- The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

Course Outcomes: After completion of the course the students will be able to

CO1	Understand the importance of discipline, character and service motto.
CO2	Solve some societal issues by applying acquired knowledge, facts, and techniques.
CO3	Explore human relationships by analyzing social problems.
CO4	Determine to extend their help for the fellow beings and downtrodden people.
CO5	Develop leadership skills and civic responsibilities.

UNIT I : Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

i) Conducting –ice breaking sessions-expectations from the course-knowing personal talentsand skills
ii) Conducting orientations programs for the students –future plans-activities-releasing roadmap etc.
iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II : Nature & Care Activities:

i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition.
iv) Organizing Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
vii) Write a summary on any book related to environmental issues.

UNIT III : Community Service Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders- Surveyin the village, identification of problems- helping them to solve via media- authorities-experts-etc.
ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc.
iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.

v) Any other programmes in collaboration with local charities, NGOs etc.

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, DirectorateGeneral of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering",McGrawHill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. "Introduction to EnvironmentalEngineering and Science", Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India,* Rawat Publications, New Delhi.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting vivavoce on the subject.

II Semester

Course Title	Differential Equations and Vector Calculus				B. Tech. II Sem. (Common to All Branches)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
2321201	**BS&H**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	30	70	100
Mid Exam Duration: 2 Hrs					**End Exam Duration: 3 Hours**		

Course Objectives:

- To enlighten the learners in the concept of differential equations and Multi Variable Calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications

Course Outcomes: On successful completion of this course, the students will be able to

CO1	Solve the first order differential equations related to various engineering fields.
CO2	Solve the second and higher differential equations related to various engineering fields.
CO3	Identify solution methods for partial differential equations that model physicalprocesses.
CO4	Interpret the physical meaning of different operators such as gradient, curl and divergence.
CO5	Estimate the work done against a field, circulation and flux using vector calculus.

UNIT I: Differential equations of first order and first degree

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits.

UNIT II: Linear differential equations of higher order (Constant Coefficients)

Definitions, homogenous and non-homogenous, complementary function, general solution, particular integral **of the type e^{ax}, sinax, cosax, polynomials in x, e^{ax} V(x), x^nV(x)** , Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to **L-R Circuit** and L-C-R Circuit problems and Simple Harmonic motion.

UNIT III: Partial Differential Equations

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

UNIT IV: Vector differentiation

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions-Gradient, Directional derivative, **Solenoidal and Irrotational vectors,** del applied to vector point functions-Divergence and Curl, vector identities.

UNIT V: Vector integration

Line integral-circulation-work done - **Scalar Potential**, surface integral-flux, Green's theorem in

the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems.

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones and Bartlett, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
5. Higher Engineering Mathematics, B. V. Ramana, McGraw Hill Education, 2017
6. A Text Book of Engineering Mathematics, N.P. Bali and Manish Goyal, Lakshmi Publications, Reprint 2008.

Course Title	ENGINEERING CHEMISTRY				B. Tech. CE & ME (II Sem.)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
23EC202	BS&H	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To familiarize engineering chemistry and its applications
- To impart the concept of soft and hard waters, softening methods of hard water
- To train the students on the principles and applications of electrochemistry, polymers, surface chemistry, and cement

Course Outcomes (CO)

CO	On successful completion of this course, the students will be able to
CO1	Explain different boiler troubles, external treatment methods & estimation of different parameters in water sample
CO2	Demonstrate the working principle of batteries & factors effecting corrosion & itsprevention methods
CO3	Explain the preparation, properties, and applications of plastics, elastomers & Explain calorific values, octane number, refining of petroleum and cracking of oils
CO4	Explain the different constituents of composites, refractories, lubricants & setting and hardening of cement.
CO5	Summarize the concepts of colloids, micelle and nanomaterials

UNIT I : Water Technology

Soft and hardwater, Estimation of hardness of water by EDTA Method, Estimation of dissolved Oxygen - Boiler troubles –Priming, foaming**,** scale and sludge, Caustic embrittlement, Industrial water treatment – Specifications for drinking water, Bureau of Indian Standards (BIS) and World health organization (WHO) standards, **External Treatment methods-Permutit process,** Ion- exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

Learning outcomes:

The student will be able to

- List the differences between temporary and permanent hardness of water
- Explain the principles of reverse osmosis and electro dialysis
- Compare quality of drinking water with BIS and WHO standards
- Illustrate problems associated with hard water - scale and sludge
- Explain the working principles of different Industrial water treatment processes

UNIT II : Electrochemistry and Applications

Electrodes –electrochemical cell, Nernst equation, **Reference Electrodes-**cell potential calculations. Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad), and lithium ion batteries- working principle of the batteries including cell reactions; Fuel cells-Basic Concepts, the principle and working of hydrogen-oxygen Fuel cell. **Conductometric Titrations (Acid-Base Titrations).**

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion**,** cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

Learning Outcomes:
At the end of this unit, the students will be able to

- Apply Nernst equation for calculating electrode and cell potentials
- Apply Pilling Bed worth rule for corrosion and corrosion prevention
- Demonstrate the corrosion prevention methods and factors affecting corrosion
- Compare different batteries and their applications

UNIT III : Polymers and Fuel Chemistry

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth polymerization.
Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of poly styrene. PVC Nylon 6,6 and Bakelite.
Elastomers – Preparation, properties and applications of Buna S, Buna N, Thiokol rubbers
Fuels **–** Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid Fuels, refining of petroleum, Octaneand Cetane number- alternative fuels- propane, methanol, ethanol and bio fuel-bio diesel

Learning Outcomes:
At the end of this unit, the students will be able to

- Explain different types of polymers and their applications
- Solve the numerical problems based on Calorific value
- Select suitable fuels for IC engines
- Explain calorific values, octane number, refining of petroleum and cracking of oils

UNIT IV : Modern Engineering Materials

Composites- Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications
Refractories- Classification, Properties, Factors affecting the refractory materials and Applications.
Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils – Viscosity, Viscosity Index, Flash point, Fire point, Cloud point, saponification and Applications.
Building materials- **Classification of Cement & applications,** Portland Cement, constituents,Setting and Hardening of cement.

Learning Outcomes:
At the end of this unit, the students will be able to

- Identify the factors affecting the refractory material
- Illustrate the functions and properties of lubricants
- Identify the constituents of Portland cement
- Enumerate the reactions at setting and hardening of the cement

UNIT V : Surface Chemistry and Nanomaterials

Introduction to surface chemistry, colloids, nanometals and nanometal oxides, micelle formation, **Classification of Colloids,** synthesis of colloids (Braggs Method), chemical and biological methods of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, adsorption isotherm (Freundlich and Longmuir), BET equation (no derivation) applications of colloids and nanomaterials – catalysis, medicine, sensors, etc.

Learning Outcomes:

At the end of this unit, the students will be able to

- Summarize the concepts of colloids, micelle and nanomaterials
- Explain the synthesis of colloids with examples
- Outline the preparation of nanomaterials and metal oxides
- Identify the application of colloids and nanomaterials in medicine

Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpat Rai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e,Oxford University Press, 2010.
3. A Text book of Engineering chemistry by Shashi Chawla, Dhanpat Rai & Co publications

Reference Books:

1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry,Butterworth-Heineman, 1992.
3. Text book of Polymer Science, Fred W. Billmayer Jr, 3rd Edition
4. Water Technology, 2nd Edition, N.F. Gray, Elsevier publications, 2005
5. An Introduction to Electrochemistry, Glasstone, Arihant Publications.
6. Text Book of Physical Chemistry,

Course Title	Engineering Mechanics				B. Tech. CE & ME (II Sem.)		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
23EM204	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	0	3	30	70	100
Mid Exam Duration: 2 Hrs					End Exam Duration: 3 Hours		

Course Objectives:

- To get familiarized with different types of force systems.
- To draw accurate free body diagrams representing forces and moments acting on a body to analyze the equilibrium of system of forces.
- To teach the basic principles of center of gravity, centroid and moment of inertia and determine them for different simple and composite bodies.
- To apply the Work-Energy method to particle motion.
- To understand the kinematics and kinetics of translational and rotational motion of rigid bodies.

Course Outcomes: On Completion of the course, the student should be able to

CO1	Understand the fundamental concepts in mechanics and determine the frictional forces for bodies in contact.
CO2	Analyze different force systems such as concurrent, coplanar and spatial systems and calculate their resultant forces and moments.
CO3	Calculate the centroids, center of gravity and moment of inertia of different geometrical shapes.
CO4	Apply the principles of work-energy and impulse-momentum to solve the problems of rectilinear and curvilinear motion of a particle,
CO5	Solve the problems involving the translational and rotational motion of rigid bodies

UNIT I

Introduction to Engineering Mechanics – Basic Concepts. Scope and Applications **Systems of Forces:** Coplanar Concurrent Forces – Components in Space – Resultant –Moment of Force and its Application – Couples and Resultant of Force Systems.

Friction: Introduction**,** limiting friction and impending motion, Coulomb's laws of dry friction, coefficient of friction, Cone of Static friction.

UNIT II

Equilibrium of Systems of Forces: Free Body Diagrams, Lami's Theorem, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces, converse of the law of polygon of forces condition of equilibrium, Equations of Equilibrium for Spatial System of forces, Numerical examples on spatial system of forces using vector approach, Analysis of plane trusses.
Principle of virtual work with simple examples

UNIT III

Centroid: Centroids of simple figures (from basic principles) – Centroids of Composite Figures
Centre of Gravity: Centre of gravity of simple body (from basic principles), Centre of gravity of composite bodies, Pappus theorems.

Area Moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.

Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia,Mass Moment of Inertia of composite bodies.

UNIT IV

Rectilinear and Curvilinear motion of a particle: Kinematics and Kinetics –D'Alembert's Principle - Work Energy method and applications to particle motion- Impulse Momentum method.

UNIT V

Rigid body Motion: Kinematics and Kinetics of translation, Rotation about fixed axis andplane motion, Work Energy method and Impulse Momentum method.

Text Books:

1. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5th Edition,McGraw Hill Education.
2. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, Inc., New Delhi, 2022
3. S.S. Bhavikatti Engineering Mechanics New Age International Publishers 2017.

Reference Books:

1. Engineering Mechanics, Statics and Dynamics, Rogers and M A. Nelson., McGraw Hill Education.
2. Engineering Mechanics, Statics and Dynamics, I.H. Shames., 4th Edition, PHI, 2002.
3. Engineering Mechanics, Volume-I: Statics, Volume-II: Dynamics, J. L. Meriam and L.G. Kraige., 6th Edition, John Wiley, 2008.
4. Engineering Mechanics: Principles of Statics and Dynamics, R.C. Hibbler., Pearson Press, 2006.
5. Introduction to Statics and Dynamics, Andy Ruina and Rudra Pratap., Oxford University Press, 2011.

Course Title	BASIC CIVIL AND MECHANICAL ENGINEERING				B. Tech. CE, ME & ECE (II Sem.)			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
23CM205	**Engineering Science**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**			

Course Objectives:

- Get familiarized with the scope and importance of Civil and Mechanical Engineering in different sectors and industries.
- Introduce the preliminary concepts of Building Planning, Building Construction, Materials and the related tests.
- Acquire preliminary knowledge of surveying and understand the importance of the quality of the drinking water.
- Explain different engineering materials and manufacturing processes.
- Provide an overview of different thermal and mechanical systems; introduce basics of robotics and its applications.

Course Outcomes: On completion of the course, the student should be able to

CO1	Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society. Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.
CO2	Realize the importance of Transportation in nation's economy and the engineering measures related to highways in terms of geometrics.
CO3	Understand the importance of water resources and storage structures so that the social responsibilities of water conservation will be appreciated. Understand the different manufacturing processes and explain the basics of thermal engineering and its applications.
CO4	Describe the working of different mechanical and power plants; learn basics of robotics.
CO5	Analyze various power transmission systems applications.

PART A: BASIC CIVIL ENGINEERING

UNIT I

Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering -Scope of each discipline - Building Construction and Planning- Construction Materials-Cement – Aggregate Bricks - Cement concrete- Steel-Tests on these materials.

Factors to be considered in Building Planning- Nature of Buildings- Typical Layouts of a Residential Building- Industrial Building- Commercial Building like a Supermarket / Hotel / Theatre.

UNIT II

Surveying: Objectives of Surveying- Horizontal Measurements- Vertical Measurements- Angular Measurements- Leveling instruments used for leveling- Introduction to Bearings- Simple problems on leveling and bearings-Contour mapping.

UNIT III

Transportation Engineering, Water Resources and Environmental Engineering: Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences - Basic geometric design elements of a highway- Camber- Stopping Sight Distance- Super elevation- Introduction.

Water Resources and Environmental Engineering: Sources of water- Quality of water- Specifications and Tests- Introduction to Hydrology- Hydrograph –Rain water Harvesting- Rain water runoff- Water Storage Structures (Simple introduction to Dams and Reservoirs).

Text Books:

1. G. Shanmugam and M.S. Palanisamy, Basic Civil and the Mechanical Engineering, TataMcGraw Hill publications (India) Pvt. Ltd.
2. Basic Civil Engineering, S.S. Bhavikatti, New Age International Publishers.
3. Engineering Materials, Dr. S.C. Rangwala, Charotor Publishing House.
4. Highway Engineering, S.K. Khanna, C.E.G. Justo and Veeraraghavan, Nemchand andBrothers Publications.
5. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi.
6. Building Construction, Dr. B. C. Punmia, Lakshmi Publications, Delhi.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, KhannaPublishers, Delhi.

PART B: BASIC MECHANICAL ENGINEERING

UNIT I:

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

UNIT II

Manufacturing Processes: Principles of Casting**,** Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components ofElectric and Hybrid Vehicles.

UNIT III

Power plants – working principle of Steam, Diesel, Hydro, Nuclear power plants. **Mechanical Power Transmission -** Belt Drives, Chain, Rope drives, Gear Drives and theirapplications.
Introduction to Robotics - Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject)

Text Books:

1. Internal Combustion Engines by V. Ganesan, By Tata McGraw Hill publications (India) Pvt.Ltd.
2. A Text book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications,(India) Pvt. Ltd.
3. An introduction to Mechanical Engineering by Jonathan Wicker and Kemper Lewis, Cengage Learning India Pvt. Ltd.

Reference Books:

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I.
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak MPandey, Springer publications.
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt.Ltd.
4. G. Shanmugam and M.S. Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd.

Course Title	ENGINEERING MECHANICS LAB				B. Tech. ME (II Sem.)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2303206	PC	L	T	P	C	Continuous Internal Assessment	End lab Exams	Total
		0	0	3	1.5	30	70	100
						End Exam Duration: 3Hrs		

Course Objectives: The students completing the course are expected to:

- Verify the Law of Parallelogram and Triangle of Forces.
- Determine the coefficients of friction of Static and Rolling friction and Centre of gravity of different plane Lamina.
- Analyze the system of Pulleys and Moment of Inertia of Compound Pendulum and Flywheel.

Course Outcomes: On completion of the course, the student should be able to

CO1	Evaluate the coefficient of friction between two different surfaces and between the inclined plane and the roller.
CO2	Verify Law of Polygon of forces and Law of Moment using force polygon and bell crank lever
CO3	Determine the Centre of gravity and Moment of Inertia of different configurations.
CO4	Verify the equilibrium conditions of a rigid body under the action of different force systems.
CO5	

Students have to perform any 10 of the following Experiments:

List of Experiments:

1. Verification of Law of Parallelogram of Forces.
2. Verification of Law of Triangle of Forces.
3. Verification of the Law of polygon for coplanar-concurrent forces acting on a particle in equilibrium and to find the value of unknown forces considering particle to be in equilibrium using universal force table.
4. Determination of coefficient of Static and Rolling Frictions
5. Determination of Centre of Gravity of different shaped Plane Lamina.
6. Verification of the conditions of equilibrium of a rigid body under the action of coplanar non-concurrent, parallel force system with the help of asimply supported beam.
7. Study of the systems of pulleys and draw the free body diagram of the system.
8. Determine the acceleration due to gravity using a compound pendulum.
9. Determine the Moment of Inertia of the compound pendulum about an axis perpendicular to the plane of oscillation and passing through its center of mass.
10. Determine the Moment of Inertia of a Flywheel.
11. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever.

Reference Books:

1. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5th Edition, Mc Graw Hill Education.
2. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, Inc., New Delhi, 2022.

Course Title	INTRODUCTION TO PROGRAMMING				B. Tech. CE, ME & ECE (II Sem.)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
2305207	**Engineering Science**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	0	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- To introduce students to the fundamentals of computer programming.
- To provide hands-on experience with coding and debugging.
- To foster logical thinking and problem-solving skills using programming.
- To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
- To encourage collaborative learning and teamwork in coding projects.

Course Outcomes: A student after completion of the course will be able to

CO1	Understand basics of computers, the concept of algorithm and algorithmic thinking.
CO2	Analyse a problem and develop an algorithm to solve it.
CO3	Implement various algorithms using the C programming language.
CO4	Understand more advanced features of C language.
CO5	Develop problem-solving skills and the ability to debug and optimize the code.

UNIT I : Introduction to Programming and Problem Solving

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Program Development Life Cycle,Basics of a Computer Program Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.

Problem solving techniques: Algorithmic approach, characteristics of algorithm.
Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

UNIT II : Control Structures
Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, dowhile) Break and Continue. Go to statement, Nested Loops.

UNIT III : Arrays and Strings
Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings. String handling functions, and Command line arguments.

UNIT IV : Pointers & User Defined Data types
Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, Dynamic Memory Allocation, Storage classes – auto, register, static, extern.

User-defined data types-Structures and Unions.

UNIT V : Functions & File Handling

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, Parameter Passing techniques, Recursion, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling.

Note: The syllabus is designed with C Language as the fundamental language of implementation.

Text Books:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education,1996
3. Computer Science: A Structured Programming Approach Using C 3rd Edition by Behrouz A. Forouzan, Richard F. Gilberg)

Reference Books:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition.
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition.

Course Title	IT WORKSHOP				B. Tech. CE, ME & ECE (II Sem.)			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2305209	**Engineering Science**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		0	0	2	1	30	70	100
					End Exam Duration: 3Hrs			

Course Objectives:

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables.
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS.
- To teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning.
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such asWord processors, Spread sheets and Presentation tools.

Course Outcomes:

CO1	Perform Hardware troubleshooting.
CO2	Understand Hardware components and inter dependencies.
CO3	Safeguard computer systems from viruses/worms.
CO4	Document/ Presentation preparation.
CO5	Perform calculations using spreadsheets.

PC Hardware & Software Installation

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

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

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

Task 4: Student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva.

Task 5: Student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva.

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email. If there are no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop-up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

Task 1 – Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using La TeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeXand Word.

Task 3: Creating project abstract Features to be covered:- Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

LOOKUP/VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

POWER POINT

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

ADOBE PHOTOSHOP

Task 1: Scanning images, editing their resolution and size, learning about bitmap and vector images, creating new images, and placing files are the basic concepts that are covered here.

Task 2: The students learn about the colour modes, colour management, colour mode conversion, colour picker functions, etc., in this module.

Task 3: An exposure to painting tools, brush tools, pencils, erasers, magic erasers, blending modes, etc.

AI TOOLS – ChatGPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

- Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition.

Course Title	ENGINEERING CHEMISTRY LAB				B. Tech. CE & ME (II Sem.)		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
23EC211	BS&H	L	T	P	C	Continuous Internal Assessment	End lab Exams	Total
		0	0	2	1	30	70	100
					End Exam Duration: 3Hrs		

Course Objectives:

- To verify the fundamental concepts with experiments.
- The student will have exposure to various experimental skills and hand-on experience which is very essential for an Engineering student.

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

CO1	Determine the cell constant and conductance of solutions
CO2	Prepare advanced polymer materials.
CO3	Determine the physical properties like surface tension, adsorption and viscosity.
CO4	Estimate the Iron and Calcium in cement & rate of corrosion in Steel
CO5	Calculate the different parameters in water sample

Note: In the following list, out of 16 experiments, any 10 experiments must be performed in a Semester

List of Experiments:

1. Determination of Hardness of a groundwater sample.
2. Estimation of Dissolved Oxygen by Winkler's method
3. Determination of Strength of an acid in Pb-Acid battery
4. Preparation of a polymer (Bakelite)
5. Determination of percentage of Iron in Cement sample by colorimetry
6. Estimation of Calcium in port land Cement
7. Preparation of nanomaterials by precipitation method.
8. Adsorption of acetic acid by charcoal
9. Determination of percentage Moisture content in a coal sample
10. Determination of Viscosity of lubricating oil by Redwood Viscometer 1
11. Determination of Viscosity of lubricating oil by Redwood Viscometer 2
12. Determination of Calorific value of gases by Junker's gas Calorimeter
13. Conductometric titrations of Strong acid vs strong base
14. Conductometric titrations of Weak acid vs strong base
15. Determine the strength of chlorides present in water sample by AgNo3 solution.
16. Determination of Rate of Corrosion of mild steel in acidic environment

Text Books:

1. Vogel's Text book of Quantitative Chemical Analysis, J. Mendham et.al., Pearson Education, Sixth Edition, 2012.
2. Laboratory manual on Engineering Chemistry, Anupama Rajput, Dhanpat Rai& Co Publications.
3. Essentials of Experimental Engineering Chemistry, Shashi Chawla, Dhanpat Rai& Co Publications.

Reference Books:

1. Practical Engineering Chemistry by K. Mukkanti, et al, B.S. Publications, Hyderabad.
2. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.
3. Essentials of Physical Chemistry, Bhal & Tuli. (S. Chand Publications).
4. Advanced Inorganic Analysis, Agarwal & Keemtilal (Pragati prakashan)

Course Title	Engineering Workshop				B. Tech. CE, ME & ECE (II Sem.)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2303212	BS&H	L	T	P	C	Continuous Internal Assessment	End lab Exams	Total
		0	0	3	1.5	30	70	100
						End Exam Duration: 3Hrs		

Course Objectives:

- To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

Course Outcomes:

CO1	Identify workshop tools and their operational capabilities.
CO2	Practice on manufacturing of components using workshop trades including fitting, carpentry,and foundry and welding
CO3	Apply fitting operations in various applications.
CO4	Apply basic electrical engineering knowledge for House Wiring Practice
CO5	

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in woodworking and make following joints.
   (a) Half – Lap joint (b) Mortise and Tenon joint
   (c) Corner Dovetail joint or Bridle joint
3. **Sheet Metal Working**: Familiarity with different types of tools used in sheet metalworking, Developments of following sheet metal job from GI sheets.
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
   (a) V-fit (b) Dovetail fit
   (c) Semi-circular fit
   (d) Bicycle tire puncture and change of two-wheeler tyre
5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.
   (a) Paralleland series (b) Two-way switch
   (c) Godown lighting (d) Tube light
   (e) Three phase motor (f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation ofGreen Sand Moulds for given Patterns.
7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

Text Books:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

Course Title	Computer Programming Lab				B. Tech. CE, ME & ECE (II Sem.)			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2305213	**Engineering Sciences**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End lab Exams**	**Total**
		0	**0**	**3**	**1.5**	30	70	100
						End Exam Duration: 3Hrs		

Course Objectives:

- The course aims to give students hands – on experience and train them on the concepts of the C-programming language

Course Outcomes:

CO1	Read, understand, and trace the execution of programs written in C language.
CO2	Select the right control structure for solving the problem.
CO3	Develop C programs which utilize memory efficiently using programming constructs.
CO4	Develop, Debug and Execute programs to demonstrate the applications of arrays and functions.
CO5	Develop, Debug and Execute programs to demonstrate the applications of basic concepts of pointers and Structures in C

UNIT I

WEEK 1

Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

i) Basic Linux environment and its editors like Vi, Vim & Emacs etc., **MS-DOS Environment and its commands.**

ii) Exposure to Turbo C, gcc

iii) Writing simple programs using printf(), scanf()

WEEK 2

Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

Suggested Experiments /Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.

Lab 1: Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

i) Sum and average of 3 numbers

ii) Conversion of Fahrenheit to Celsius and vice versa

iii) Simple interest calculation

iv) Finding area of circle

WEEK 3

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Suggested Experiments/Activities:

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.

i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object
v) Find out $e=mc^2$

UNIT II

WEEK 4

Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:

Lab4: Simple computational problems using the operator' precedence and associativity

i) Evaluate the following expressions.

a. A+B*C+(D*E) + F*G
b. A/B*C-B+A*D/3
c. A+++B---A
d. J= (i++) + (++i)

ii) Find the maximum of three numbers using conditional operator

iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5

Objective: Explore the full scope of different variants of "if construct" namely if-else, nullelse, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions:

Lab 5: Problems involving if-then-else structures.

i) Write a C program to find the max and min of four numbers using if-else.
ii) Write a C program to generate electricity bill.
iii) Find the roots of the quadratic equation.
iv) Write a C program to simulate a calculator using switch case.
v) Write a C program to find the given year is a leap year or not.
vi) Write a C program to find out the given number is even or odd.
vii) Write a C program to find out the given phone number is valid or not.
viii) Write a C program to find out the given number is positive or negative.

WEEK 6

Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops

Lab 6: Iterative problems e.g., the sum of series

i) Find the factorial of given number using any loop.

ii) Find the given number is a prime or not.
iii) Compute sine and cos series
iv) Checking a number palindrome
v) Construct a pyramid of numbers.
vi) Find out sum of individual digits of a given positive integer
vii) Find out the given number is strong number or not.

UNIT III

WEEK 7:

Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.

Lab 7:1D Array manipulation, linear search

i) Find the min and max of a 1-D integer array.
ii) Perform linear search on1D array.
iii) The reverse of a 1D integer array
iv) Find 2's complement of the given binary number.
v) Eliminate duplicate elements in an array.
vi) Find out smallest and biggest element in an 1D Float Array.
vii) Count frequency of each element.

WEEK 8:

Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:

Tutorial 8: 2 D arrays, sorting and Strings.

Lab 8: Matrix problems, String operations, Bubble sort

i) Addition of two matrices
ii) Multiplication two matrices
iii) Sort array elements using bubble sort
iv) Concatenate two strings without built-in functions
v) Reverse a string using built-in and without built-in string functions
vi) String palindrome or not

UNIT IV

WEEK 9:

Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C

Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation

Lab 9: Pointers and structures, memory dereference.

i) Write a C program to find the sum of a 1D array using malloc()
ii) Write a C program to find the total, average of n students using structures
iii) Enter n students data using calloc() and display failed students list

iv) Read student name and marks from the command line and display the student details along
with the total.
v) Write a C program to implement realloc()
vi) C program to calculate employee gross salary using structures

WEEK 10:

Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures
Suggested Experiments/Activities:
Tutorial 10: Bitfields, Self-Referential Structures, Linked lists

Lab10 : Bitfields, linked lists
Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

i) Create and display a singly linked list using self-referential structure.
ii) Demonstrate the differences between structures and unions using a C program.
iii) Write a C program to shift/rotate using bitfields.
iv) Write a C program to copy one structure variable to another structure of the same type.
v) Demonstrate nested structures using a C program.

UNIT V

WEEK 11:

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration
Suggested Experiments/Activities:
Tutorial 11: Functions, call by value, scope and extent,
Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.

i) Write a C function to calculate NCR value.
ii) Write a C function to find the length of a string.
iii) Write a C function to transpose of a matrix.
iv) Write a C function to demonstrate numerical integration of differential equations using Euler's
method

WEEK 12:

Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.
Suggested Experiments/Activities:
Tutorial 12: Recursion, the structure of recursive calls
Lab 12: Recursive functions

i) Write a recursive function to generate Fibonacci series.
ii) Write a recursive function to find the lcm of two numbers.
iii) Write a recursive function to find the factorial of a number.
iv) Write a C Program to implement Ackermann function using recursion.
v) Write a recursive function to find the sum of series.
vi) Write a program in C to calculate the sum of numbers from 1 to n using recursion

WEEK 13:

Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

Lab 13: Simple functions using Call by reference, Dangling pointers.

i) Write a C program to swap two numbers using call by reference.

ii) Demonstrate Dangling pointer problem using a C program.

iii) Write a C program to copy one string into another using pointer.

iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK14:

Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

i) Write a C program to write and read text into a file.

ii) Write a C program to write and read text into a binary file using fread() and fwrite()

iii) Copy the contents of one file to another file.

iv) Write a C program to merge two files into the third file using command-line arguments.

v) Find no. of lines, words and characters in a file

vi) Write a C program to print last n characters of a given file.

Text Books:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill.

Reference Books:

2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
3. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

Course Title	HEALTH AND WELLNESS, YOGA AND SPORTS				B. Tech. CE, ME & ECE (II Sem.)			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2306217	BS&H	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	1	0.5			
					6 X 15 = 90 + 10 Viva voce			

Course Objectives:

- The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

Course Outcomes: After completion of the course the student will be able to

CO1	Understand the importance of yoga and sports for Physical fitness and sound health.
CO2	Demonstrate an understanding of health-related fitness components.
CO3	Compare and contrast various activities that help enhance their health.
CO4	Assess current personal fitness levels.
CO5	Develop Positive Personality.

UNIT I

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index(BMI) of all age groups.

Activities:

i) Organizing health awareness programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

UNIT II

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc. Practicing general and specific warm up, aerobics
ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Reference Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning,2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to SurvivingAnywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. HumanKinetics, Inc.2014

III Semester

Course Title	NUMERICAL METHODS & TRANSFORM TECHNIQUES				B. Tech. III Sem (ME)			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
23HS301	BS	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	0	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3 Hours			

Course Objectives:

To enable the students to apply the knowledge of mathematics in various engineering fields by making them to learn the following:

- Impart with numerical methods of solving the non-linear equations and interpolation.
- Solve differential and integral equations numerically.
- Laplace Transforms is used for making predictions and making analysis in data mining.
- Understand Fourier Transforms and apply them in solving problems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	**Apply** numerical methods to solve algebraic and transcendental equations.
CO 2	**Derive** interpolating polynomials using interpolation formulae.
CO 3	Solve differential and integral equations numerically.
CO 4	**Understand** the use of Laplace transform in system modeling, digital signal processing, process control, **solving** Boundary Value Problems.
CO 5	**Apply** Fourier transform in communication theory and signal analysis **solving** partial differential equations for problems on gravity.

UNIT I: **Solution of Algebraic & Transcendental Equations**

Introduction-Bisection Method-Iterative method, Regula-falsi method and Newton Raphson Method

UNIT II: Interpolation

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's Formulae, Inverse interpolation.

UNIT III: Solution of Initial value problems to Ordinary differential equations

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's and modified Euler's methods-Runge-Kutta methods (second and fourth order).

UNIT IV: Laplace Transforms

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, transforms of derivatives and integrals – Unit step function – Second shifting theorem– Convolution theorem – Laplace transform of Periodic function.

UNIT V: Fourier transforms

Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem.

Text Books:

1. S S Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited.

2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2017, 44th Edition

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley &Sons, 2018, 10th Edition.
2. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd.,2021 5th Edition (9th reprint).
3. H. K Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publications,2014, Third Edition (Reprint 2021)
4. Higher Engineering Mathematics, B. V. Ramana, McGraw Hill Education, 2017

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ma14/preview
2. https://onlinecourses.nptel.ac.in/noc24_ma05/preview
3. http://nptel.ac.in/courses/111105090

Course Title	UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT				B. Tech. III Sem (ME) (Common to all Branches)			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
23HS311	HUM	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		2	1	0	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

COURSE OBJECTIVES	
1	To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2	To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3	To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

COURSE OUTCOMES	
CO1	Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
CO2	Identify one's self, and one's surroundings (family, society nature) (L1, L2)
CO3	Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
CO4	Relate human values with human relationship and human society. (L4)
CO5	Justify the need for universal human values and harmonious existence (L5)
CO6	Develop as socially and ecologically responsible engineers (L3, L6)

SYLLABUS:

UNIT I Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: **General Introduction to Values** - Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: self-exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT II Harmony in the Human Being (6 lectures and 3 tutorials for practice session)

Lecture 7: **Human Nature Relationships** - Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health

Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)

Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

UNIT V HOLISTIC PERCEPTION OF HARMONY

(6 lectures and 3 tutorials for practice session)

Lecture 23: Understanding the Harmony in the society.
Lecture 24: Universal Order
Tutorial 12: Practice Session PS12 Understanding the Harmony in the society.
Lecture 25: **Critical appreciation of Human values**
Lecture 26: **Justice, Trust.**

Textbooks

- R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 b. The Teacher's Manual
- R R Gaur, R Asthana, G P Bagaria,Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, 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)

THERMODYNAMICS								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2303301	**Engineering Science (ESC)**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**Sem.-End Exam**	**Total**
		2	**1**		**2**	**30**	**70**	**100**
Mid Exam Duration: 2 Hours						**Sem.-End Exam Duration: 3 Hours**		
Pre-Requisites: Engineering Physics, Engineering Chemistry, Engineering Mathematics								

Course Objectives:

- **CEO1.** Understand the nature and roll of thermodynamic properties of matter and to familiarize the concepts of energy in general and heat and work in paricular
- **CEO2.** Identify and understand different forms of energy and restrictions imposed by the laws of thermodynamics on conversion of energy from one form to other.
- **CEO3.** Teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
- **CEO4.** Familiarize ideal gas properties to understand the working of IC engines and gas power plants.
- **CEO5.** Familiarize steam properties to understand the working of steam power plants.

Course Outcomes: On successful completion of this course, the students will be able to

- **CO1.** Explain the importance of thermodynamic properties related to conversion of heat energy into work.
- **CO2.** Apply the First Law of Thermodynamics to various engineering devices.
- **CO3.** Understand the concept of Second Law of Thermodynamics and Entropy
- **CO4.** Evaluate various properties of Ideal gases
- **CO5.** Analyse the Mollier chart, T-S and h-s diagrams, Steam calorimetry, Phase Transformations

UNIT-I: BASIC CONCEPTS OF THERMODYNAMICS:

Introduction to Thermodynamics, System, Boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi static Process, Irreversible Process, Causes of Irreversibility

UNIT-II: HEAT AND WORK TRANSFER, FIRST LAW OF THERMODYNAMICS AND ITS APPLICATIONS:

Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroth Law of Thermodynamics – PMM-I, Joule's Experiment – First law of Thermodynamics and applications. Limitations of the First Law – Enthalpy, Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance.

UNIT-III: SECOND LAW OF THERMODYNAMICS AND CONCEPT OF ENTROPY

Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM-II, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation.

UNIT-IV: IDEAL GASES:

Ideal gas, Real gas, Internal energy and Enthalpy of an ideal gas, Specific heats of an ideal gas, Equation of state, Law of Corresponding states, Boyle's Temperature, Dalton's Law of Partial Pressures, Thermodynamic Properties of Gas Mixtures, Gibb's Function of Ideal Gas Mixtures

UNIT-V: PROPERTIES OF PURE SUBSTANCES:

Pure Substances, P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

TEXT BOOKS:

1. P.K. Nag, Engineering Thermodynamics, 6/e, Tata McGraw Hill, 2017.

2. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7/e, Wiley Eastern, New Delhi, 2009.

REFERENCE BOOKS:

1. Y.A. Cengel & M.A. Boles, Thermodynamics – An Engineering Approach, 7/e, McGraw Hill, 2010.
2. J.B. Jones, and R.E. Dugan, Engineering Thermodynamics, 1/e, Prentice Hall, 1995.
3. P. Chattopadhyay, Engineering Thermodynamics, 1/e, Oxford University Press, 2011.

ADDITIONAL LEARNING RESOURCES:

- https://www.edx.org/learn/thermodynamics.
- https://archive.nptel.ac.in/courses/112/106/112106310.
- https://www.youtube.com/watch?v=7NI5P4KqrAs&t=1s
- https://kp.kiit.ac.in/pdf_files/02/Study-Material_3rd-Semester_Winter_2021_Mechanical-Engg.-_Thermal-Engineering-1_Abhijit-Samant.pdf
- https://www.coursera.org/learn/thermodynamics-intro

MECHANICS OF SOLIDS								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2303302	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**Sem.-End Exam**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Mid Exam Duration: 1.5 Hrs						**Sem.-End Exam Duration: 3 Hrs**		

Pre-Requisites: Fundamentals of chemistry

Course Objectives:

- **CE1:** Understand the behavior of basic structural members subjected to uni-axial and bi-axial loads.
- **CE2:** Apply the concept of stress and strain to analysis and design structural members and machine parts under axial, shear and bending loads, moment and torsional moment.
- **CE3:** Students will learn all the methods to analyze beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural components. Students are able to analyze beams and draw correct and complete shear and bending moment diagrams for beams.
- **CE4:** Students attain a deeper understanding of the loads, stresses, and strains acting on a structure and their relations in the elastic behavior
- **CE5:** Design and analysis of Industrial components like pressure vessels

Course Outcomes: On successful completion of this course, the students will be able to

CO6. Understand the simple stresses and strains

CO7. Analyze the bending moment and shear force diagrams

CO8. Learn about the flexural stresses

CO9. Understand the deflection of beams

CO10. Learn about the thin cylinders and thick cylinders pressure topics

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 – Temperature stresses- 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, 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 abeam.

UNIT–III

FLEXURAL STRESSES: Theory of simple bending, Derivation of bending equation, Determination of bending stresses – section modulus of rectangular, circular, I and T sections– Design of simple beam sections.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams

sections like rectangular, circular, triangular, I and T sections.

UNIT–IV

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, UDL and UVL. Mohr's theorem and Moment area method – application to simple cases.

TORSION: Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

UNIT– V

THIN AND THICK CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells. Wire wound thin cylinders. Lame's equation – cylinders subjected to inside & outside pressures –compound cylinders.

COLUMNS:

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

Text Books:

1. GH Ryder, Strength of materials, Palgrave Macmillan publishers India Ltd, 1961.
2. B.C. Punmia, Strength of materials, 10/e, Lakshmi publications Pvt.Ltd, New Delhi, 2018.

Reference Books:

1. Gere & Timoshenko, Mechanics of materials, 2/e, CBS publications, 2004.
2. U.C. Jindal, Strength of Materials, 2/e, Pearson Education, 2017.
3. Timoshenko, Strength of Materials Part – I& II, 3/e, CBS Publishers, 2004.
4. Andrew Pytel and Ferdinand L. Singer, Strength of Materials, 4/e, Longman Pulications, 1990.
5. Popov, Mechanics of Solids, 2/e, New Pearson Education, 2015.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc19_ce18/preview.
- https://youtube/iY_ypychVNY?si=310htc4ksTQJ8Fv6.
- https://www.youtube.com/watch?v=WEy939Rkd_M&t=2s
- https://www.classcentral.com/course/swayam-strength-of-materials-iitm-184204

MATERIAL SCIENCE & METALLURGY								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2303303	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**Sem.-End Exam**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Mid Exam Duration: 2 Hrs						**Sem.-End Exam Duration: 3 Hrs**		
Pre-Requisites:								

Course Objectives:

- CE1: Understand the crystalline structure of different metals and study the stability of phases in different alloy systems.
- CE2: Study the behavior of ferrous and non ferrous metals and alloys and their application in different domains .
- CE3: Able to understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals.
- CE4: Grasp the methods of making of metal powders and applications of powder metallurgy
- CE5: Comprehend the properties and applications of ceramic, composites and other

Course Outcomes: On successful completion of this course, the students will be able to

CO1. Understand the crystalline structure of different metals and study the stability of phases in different alloy systems.

CO2:Study the behavior of ferrous and non-ferrous metals and alloys and their application in different domains.

CO3:Understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals.

CO4:Grasp the methods of making of metal powders and applications of powder metallurgy.

CO5:Comprehend the properties and applications of ceramic, composites and other advanced methods.

UNIT-I: Structure of Metals and Constitution of alloys

Crystallization of metals, Packing Factor - SC, BCC, FCC & HCP- line density, plane density. Grain and grain boundaries, effect of grain boundaries – determination of grain size.Imperfections, Slip and Twinning.Necessity of alloying, types of solid solutions, Hume Rothery's rules, intermediate alloy phases, and electron compounds

Equilibrium Diagrams: Experimental methods of construction of equilibrium diagrams, equilibrium cooling and heating of alloys, Lever rule, eutectic systems, peritectic reaction. eutectoid, peritectoid reactions, Transformations in the solid state – allotropy, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of binary phase diagrams such as Fe-Fe_3C.

UNIT-II:

Ferrous metals and alloys: Structure and properties of White Cast iron, Malleable Cast iron, grey

cast iron, Spheriodal graphite cast iron, Alloy cast iron. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

Non-ferrous Metals and Alloys: Structure and properties of Copper and its alloys, Aluminium and its alloys, Titanium and its alloys, Magnesium and its alloys, Super alloys.

UNIT-III: Heat treatment of Steels:

Effect of alloying elements on Fe-Fe_3C system, annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface - hardening methods,

UNIT-IV: Powder Metallurgy:

Basic processes- Methods of producing metal powders- milling atomization- Granulation-Reduction-Electrolytic Deposition. Compacting methods – Sintering - Methods of manufacturing sintered parts. Secondary operations, Applications of powder metallurgical products.

UNIT-V: Ceramic and Advanced materials:

Crystalline ceramics, glasses, cermets, abrasive materials, Classification of composites, manufacturing methods, particle reinforced composites, fiber reinforced composites, PMC, MMC, CMC and CCCs. Introduction to Nanomaterials and smart materials.

TEXT BOOKS:

1. S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
2. Donald R.Askeland, Essentials of Materials science and Engineering, 4/e, CL Engineering publications, 2018.

REFERENCE BOOKS:

1. Dr. V.D.kodgire, Material Science and Metallurgy, 39/e, Everest Publishing House, 2017.
2. V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.

ADDITIONAL LEARNING RESOURCES:

Online Learning Resources:

- https://archive.nptel.ac.in/courses/113/106/113106032/
- https://www.edx.org/learn/mechanics/massachusetts-institute-of-technology-mechanical-behavior-of-materials-part-3-time-dependent-behavior.
- https://www.youtube.com/watch?v=9Sf278j1GTU
- https://www.coursera.org/learn/fundamentals-of-materials-science
- https://www.coursera.org/learn/material-behavior.

MECHANICS OF SOLIDS & MATERIAL SCIENCE LAB								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2303351	**Engineering Science (ESC)**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**Sem.-End Exam**	**Total**
		0	**0**	**2**	**1**	**40**	**60**	**100**

Pre-Requisites:

Title of the Pre-requisite Course(s)

Course Objectives:

CEO6. Evaluate the values of yield stress, ultimate stress and bending stress of the given specimen under tension test and bending test

CEO7. Conduct the torsion test to determine the modulus of rigidity of given specimen.

CEO8. Justify the Rockwell hardness test over with Brinell hardness and measure the hardness of the given specimen.

CEO9. Examine the stiffness of the open coil and closed coil spring and grade them.

CEO10. Analyze the microstructure and characteristics of ferrous and non-ferrous alloy specimens.

Course Outcomes: On successful completion of this course, the students will be able to

CO11. Understand the stress strain behavior of different materials.

CO12. Evaluate the hardness of different materials.

CO13. Explain the relation between elastic constants and hardness of materials.

CO14. Examine the stiffness of the open coil and closed coil spring and grade them.

CO15. Analyze the microstructure and characteristics of ferrous and non-ferrous alloy specimens

List of Exercises/List of Experiments:

Minimum **Ten** experiments are to be conducted.

A) MECHANICS OF SOLIDS LAB:

1. Tensile test
2. Bending test on
   a) Simply supported beam
   b) Cantilever beam
3. Torsion test
4. Hardness test
   a) Brinell's hardness test
   b) Rockwell hardness test
   c) Vickers hardness test
5. Test on springs
6. Impact test
   a) Charpy test
   b) Izod test
7. Punch shear test
8. Liquid penetration test

B) MATERIAL SCIENCE LAB:

1. Preparation and study of the Microstructure of pure metals.
2. Preparation and study of the Microstructure of Mild steel, medium carbon steels, and High carbon steels.

3. Study of the Microstructures of Cast Irons.
4. Study of the Microstructures of Non-Ferrous alloys.
5. Study of the Microstructures of Heat-treated steels.
6. Hardenability of steels by Jomeny End Quench Test.

REFERENCE BOOKS/LABORATORY MANUALS:

1. **"Mechanics of Materials Laboratory Manual" by Gary M. Swartz and C. Thomas VanPutte**

2. **"Materials Science and Engineering Laboratory Manual" by R. A. Higgins**

ADDITIONAL LEARNING RESOURCES:

1. To investigate the principal stresses σa and σb at any given point of a structural element or machine component when it is in a state of plane stress. (https://virtual-labs.github.io/exp-rockwell-hardness-experiment-iiith/objective.html)
2. To find the impact resistance of mild steel and cast iron.(https://sm-nitk.vlabs.ac.in/exp/izod-impact-test).
3. To find the impact resistance of mild steel.(https://sm-nitk.vlabs.ac.in/exp/charpy-impact-test/index.html)
4. To find the Rockwell hardness number of mild steel, cast iron, brass, aluminum and spring steel etc. (https://sm-nitk.vlabs.ac.in/exp/rockwell-hardness-test)
5. To determine the indentation hardness of mild steel, brass, aluminum etc. using Vickers hardness testing machine. (https://sm-nitk.vlabs.ac.in/exp/vickers-hardness-test).

COMPUTER-AIDED MACHINE DRAWING								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2303352	Professional Core **(PC)**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**Sem.-End Exam**	**Total**
		0	**0**	**3**	**1.5**	**30**	**70**	**100**
Mid Exam Duration: 1.5 Hrs						**Sem.-End Exam Duration: 3 Hrs**		

Pre-Requisites:

Title of the Pre-requisite Course(s)

Course Objectives:

- **CEO11.** Introduce conventional representations of material and machine components.
- **CEO12.** Train to use software for 2D and 3D modeling.
- **CEO13.** Familiarize with thread profiles, riveted, welded and key joints.
- **CEO14.** Teach solid modeling of machine parts and their sections.
- **CEO15.** Explain creation of 2D and 3D assembly drawings and Familiarize with limits, fits, and tolerances in mating components

Course Outcomes: On successful completion of this course, the students will be able to

COs	Statements	Blooms Level
CO1	Demonstrate the conventional representations of materials and machine components.	L3
CO2	Model riveted, welded and key joints using CAD system.	L6
CO3	Create solid models and sectional views of machine components.	L6
CO4	Generate solid models of machine parts and assemble them.	L5
CO5	Translate 3D assemblies into 2D drawings.	L6

UNIT-I: Conventional representation of materials and components (Using 2D):
Detachable joints: Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint and foundation bolts. .
(9 periods)

UNIT-II: Riveted joints:

Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints

UNIT-III: Welded joints: Lap joint and T joint with fillet, butt joint with conventions. **(Using 2D)**
Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.
Couplings: rigid – Muff, flange; flexible – bushed pin-type flange coupling, universal coupling, Oldham's' coupling.

UNIT-IV: Sectional views: Creating solid models of complex machine parts and sectional views.

UNIT-V: Assembly drawings: (Any four of the following using solid model software) (Using 3D)

Lathe tool post, tool head of shaping machine, tail-stock, machine vice, gate valve, carburetor, piston, connecting rod, eccentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, and universal coupling

Production drawing:

Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

Textbooks:

1 Machine Drawing by K.L.Narayana, P.Kannaiah and K.Venkat Reddy, New Age International Publishers, 3/e, 2014

2 Machine drawing by N.Sideshwar, P. Kannaiah, V.V.S.Sastry, TMH Publishers. 2014.

REFERENCE BOOKS:

1. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata McGraw-Hill, NY, 2000.
2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
3. N.D.Bhatt, Machine Drawing, Charotar Publishers, 50/e, 2014.

ADDITIONAL LEARNING RESOURCES:

Online Learning Resources:

- https://eeedocs.wordpress.com/wp-content/uploads/2014/02/machinedrawing.pdf
- https://archive.nptel.ac.in/courses/112/105/112105294/
- https://www.edx.org/learn/engineering/dassault-systemes-solidworks-solidworks-cad-fundamentals?index=product&queryID=c90b35a82a6ef58b0d6f89679c63f6a1&position=2&linked_from=autocomplete&c=autocomplete
- https://www.youtube.com/watch?v=0bQkS3_3Fq4

Course Title	Auto Cad Applications in Mechanical Engineering					B.Tech Mech II Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2303353	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		0	0	2	1	30	70	100
					End Exam Duration: 3Hrs			

Course Objectives:

- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Bring awareness that Engineering Drawing is the Language of Engineers
- Instruct the utility of drafting & modeling packages in orthographic and isometric drawings.Train the usage of 2D and 3Dmodeling.
- Instruct graphical representation of machine components

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Use computers as a drafting tool
CO 2	Draw isometric and orthographic drawings using CAD packages
CO 3	Analyze orthographic drawings using CAD packages

UNIT-I BASICS OF AUTOCAD
(9hours)

Introduction of AutoCAD-history of AutoCAD –interface-coordinates-page setup

UNIT II - COMMANDS OF AutoCAD:
(9hours)

Basic drawing and editing commands: line, circle, and rectangle, erase, view, undo, redo, snap, and object

Unit-III
(9hours)

Editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets,arrays, dimensions.

Dimensioning principles and conventional representations.

UNIT-IV
(9hours)

Orthographic Projections: Systems of projections, conventions and application to orthographic projections - simple objects.

UNIT-V Isometric Projections:
(9hours)

Principles of isometric projection- Isometric scale; Isometricviews: lines, planes, simple solids

Text Books:

1. K. Venugopal, V.Prabhu Raja, Engineering Drawing + Auto Cad, New AgeInternational Publishers.
2. Kulkarni D.M, AP Rastogi and AK Sarkar, Engineering Graphics with AutoCad, PHI Learning, Eastern Economy editions.

Reference Books:

1. T. Jayapoovan, Engineering Graphics using Auto Cad, Vikas PublishingHouse
2. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e,Scitech Publishers, Chennai, 2012.
3. Linkan Sagar, BPB Publications, Auto Cad 2018 Training Guide.
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill,Copy Right, 2008.

Additional Sources

1. Youtube: http-sewor,Carleton.cag, kardos/88403/drawings.htmlconic sections-online, red woods.edu

PYTHON PROGRAMMING
(Common to CSE, CSE(DS), AI&ML, CSE(AI&ML), ECE, EEE, ME)
(Skill Enhancement Course)

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	Sem.-End Exam	Total
2305353	Skill Enhancement Course	0	1	2	2	30	70	100

Pre-Requisites:

Programming in C Language.

Course Objectives:

CEO16. Introduce core programming concepts of Python programming language.
CEO17. Introduce core programming concepts of Python programming language.
CEO18. Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries.
CEO19. Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

Course Outcomes: On successful completion of this course, the students will be able to

CO16. Classify data structures of Python (L4)
CO17. Apply Python programming concepts to solve a variety of computational problems (L3)
CO18. Understand the principles of object-oriented programming (OOP) in Python, including classes, objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs (L3)
CO19. Become proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas (L2)
CO20. Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries (L3)

List of Exercises/List of Experiments:

Minimum Ten experiments are to be conducted.

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii) Relational Operators iii) Assignment Operators iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number
7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.
10. Write a program to check if the substring is present in a given string or not.
11. Write a program to perform the given operations on a list:
    i) Addition ii. Insertion iii. Slicing
12. Write a program to perform any 5 built-in-functions by taking any list
13. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
14. Write a program to count the number of vowels in a string (No control flow allowed).
15. Write a program to check if a given key exists in a dictionary or not.
16. Write a program to add a new key-value pair to an existing dictionary.

17. Write a program to sum all the items in a given dictionary.
18. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
19. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices.
23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.
24. Python program to check whether a JSON string contains complex object or not.
25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate basic slicing, integer and Boolean indexing.
27. Python program to find min, max, sum, cumulative sum of array
28. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
    a) Apply head () function to the pandas data frame
    b) Perform various data selection operations on Data Frame
29. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Text Books:

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

SOFTWARE/Tools used:

. Anaconda
. Jupyter Notebook**.**

ADDITIONAL LEARNING RESOURCES:

Online Learning Resources/Virtual Labs:

- https://www.coursera.org/learn/python-for-applied-data-science-ai
- https://www.coursera.org/learn/python?specialization=python#syllabus

Course Title	ENVIRONMENTAL SCIENCE					B. Tech. ME, CSE & AI & ML (III Sem) CE, ECE, EEE (IV Sem)		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
23HS331	**BS & H**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		2	0	0	0	30	-	-
Mid Exam: 2 Hrs.								

Course Objectives:

- To make the students to get awareness on environment.
- To stress the importance of protecting natural resources, ecosystems for future generations and pollution cause due to the day-to -ay activities of human life
- To save earth from the inventions by the engineers.

Course Outcomes: On successful completion of this course, the students will be able to

CO.1	**Influence** the society in proper utilization of Natural resources
CO.2	**Quantify** the interconnection of human dependence on this ecosystem.
CO.3	**Recall** the concepts of biodiversity & gain knowledge on distribution at different levels.
CO.4	**Analyze** the impact of environmental pollution on environment & solving environmental problems
CO.5	**Discuss** environmental laws & analyze the environmental concerns and follow sustainable developmental activities.

UNIT I

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.
Natural Resources: Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, waterlogging, salinity, case studies. – Energy resources:

Learning Outcomes:
At the end of this unit, student will be able to
appreciate the multidisciplinary nature of the environment
discuss the importance of natural resources
analyze the problems associated with excess usages of natural resources
express the role of individual in protection of environment
UNIT II
Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food

chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:
a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem.
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Learning Outcomes:
At the end of this unit, student will be able to
articulate the basic structure and functions of ecosystem
provides knowledge on interrelationship of one organism with another organism
get awareness on different types of ecosystems present in our surroundings and their importance.

UNIT III

Biodiversity and its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India –Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Learning Outcomes:
At the end of this unit, student will be able to
explains the concept of genetic diversity
explain endangered and endemic species of India.
identify the threats to biodiversity due to human involvement
provide knowledge on conservation of biodiversity

UNIT IV

Environmental Pollution: Definition, Cause, effects and control measures of :
a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards
Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Learning Outcomes:
At the end of this unit student will be able to
comprehend Cause, effects and control measures of air pollution.
explain soil, noise & water pollution.
get knowledge on management of solid waste.
explain disaster management cycle in India.

UNIT V
Social Issues and the Environment: From Unsustainable to Sustainable development. Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents. Environment Protection Act. – Air (Prevention and Control of Pollution) Act. -Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act.

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.
Field Work: Visit to a local area to document environmental assets River/forest grassland/ hill/ mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Learning Outcomes:
At the end of this unit student will be able to
explain the enforcement of Environmental legislation
get awareness on punishments associated with destruction of environment
get awareness on impact of global warming and acid rains on humans and environment.
measure the impact of growing population on welfare of society
get knowledge on how to increase public awareness on protection of environment

Text Books:

Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
Environmental studies by Benny Joseph, Mc, Graw Hill Publications.
Principles and a basic course of Environmental science for under graduate course by Kousic, KouShic.
Text book of Environmental science and Technology by M. Anji Reddy, BS Publication.

Reference Books:

Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Printice hall of India Private limited.
Environmental Studies by Anindita Basak – Pearson education.

Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.
Environmental Science, A Global Concerns, William P. Cunningham, Mary Ann Cunningham, Mc Graw Hill publications

IV Semester

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to all Branches)								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
23HS421	**Humanities (Management)**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**Sem.-End Exam**	**Total**
		2	**0**	**0**	**2**	**30**	**70**	**100**
Mid Exam Duration: 2 Hrs						**Sem.-End Exam Duration: 3 Hrs**		

Pre-Requisites:

Title of the Pre-requisite Course(s)

Course Objectives:

CEO20. To inculcate the basic knowledge of microeconomics and financial accounting

CEO21. To make the students learn how demand is estimated for different products, input- output relationship for optimizing production and cost minimization.

CEO22. To Know the Various types of market structure and pricing methods and strategy

CEO23. To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.

CEO24. To provide fundamental knowledge on accounting and to explain the process of preparing financial statemen

Course Outcomes: On successful completion of this course, the students will be able to

CO21. Define the concepts related to Managerial Economics, financial accounting and management(L2)

CO22. Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets (L2)

CO23. Apply the Concept of Production cost and revenues for effective Business decision (L3)

CO24. Analyzing and evaluating investment decisions using Capital budgeting techniques to maximize the returns. (L5)

CO25. Able to prepare financial statements and evaluate the financial performance of business firms (L5)

UNIT-I: Managerial Economics

Introduction –Meaning, Nature and scope, significance. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Methods. Managerial Economics and Financial Accounting and Management.

UNIT - II Production and Cost Analysis

Introduction – Nature, meaning, significance. Production Function with one variable and two variables– Least- cost combination– - Isoquants and Iso costs, Break-Even Analysis - Cost concepts - Determination of Break-Even Point (Simple Problems).

UNIT - III Capital Budgeting

Capital Budgeting - Nature, meaning, significance, Features, Proposals, Methods and Evaluation of Projects – Pay Back period (PBP) Accounting Rate of Return (ARR), Net Present Value (NPV), Internal Rate of Return (IRR) Method and Profitability Index (P/I) (simple problems)

UNIT - IV Business Organizations and Markets

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock

Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition– Oligopoly-Price-Output Determination.

UNIT - V Financial Accounting and Analysis

Introduction – Meaning, Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Financial Ratios – Types of Ratios.

Textbooks:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH.

Reference Books:

1. Ahuja Hl Managerial economics, S. Chand.
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage.

Online Learning Resources:

https://www.slideshare.net/123ps/managerial-economics-ppt
https://www.slideshare.net/rossanz/production-and-cost-45827016
https://www.slideshare.net/darkyla/business-organizations-19917607
https://www.slideshare.net/balarajbl/market-and-classification-of-market

Course Title	COMPLEX VARIABLES, PROBABILITY AND STATISTICS				B. Tech. IV Sem (ME)			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
23HS401	**BS**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	0	--	3	30	70	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3 Hours**			

Course Objectives:

- To equip the students' concepts of complex variables to solve application problems.
- To help the students in getting a thorough understanding of the fundamentals of probability.
- To enable the students in getting a thorough understanding and usage of statistical techniques like testing of hypothesis.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	**Analyze** limit, continuity and differentiation of functions of complex variables and Understand Cauchy-Riemann equations, analytic functions and various properties of analytic functions.
CO 2	**Understand** Cauchy theorem, Cauchy integral formulas and apply these to evaluate complex contour integrals. find residues and evaluate complex integrals using the residue theorem.
CO 3	**Apply** Probability theory to find the chances of happening of events.
CO 4	**Understand** various probability distributions and calculate their statistical constants.
CO 5	**Analyze** to test various hypotheses included in theory and types of errors for large samples.

UNIT I: Complex Variables – Differentiation

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method.

UNIT II: Complex Variables – Integration

Line integral-Contour integration, Cauchy's integral theorem (Simple Case), Cauchy Integral formula, zeros of analytic functions, singularities, Pole, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

UNIT III: Probability theory

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem.

UNIT IV: Random variables & Distributions

Random variables (discrete and continuous), probability density functions, properties, mathematical expectation. Probability distribution - Binomial, Poisson approximation to the binomial distribution, Normal distribution and their properties.

UNIT V: Testing of hypothesis, large sample tests

Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test.

Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers,2017, 44th Edition
2. Miller and Freund's, Probability and Statistics for Engineers,7/e, Pearson, 2008.

Reference Books:

1. R.K. Jainand S.R.K. Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd.,20215th Edition (9th reprint).
2. B.V. Ramana, Higher Engineering Mathematics, McGraw Hill publishers
3. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.
4. Statistical Methods by S.P.Gupta, S Chand Publications, 44th revised edition 2014.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc20_ma50/preview
2. https://archive.nptel.ac.in/courses/111/106/111106111/

MANUFACTURING PROCESSES								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2303401	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**Sem.-End Exam**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Mid Exam Duration: 1.5 Hrs						**Sem.-End Exam Duration: 3 Hrs**		
Pre-Requisites: Fundamentals of chemistry								

Course Objectives:

CE1: Know the working principle of different metal casting processes and gating system.

CE2: Classify the welding processes, working of different types of welding processes and welding defects.

CE3: Know the nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.

CE4: Understand the principles of forging, tools and dies, working of forging processes.

CE5: Know about the Additive manufacturing.

Course Outcomes: On successful completion of this course, the students will be able to

CO1: Design the patterns and core boxes for metal casting processes .

CO2: Understand the different welding processes.

CO3: Demonstrate the different types of bulk forming processes.

CO4: Understand sheet metal forming processes.

CO5: Learn about the different types of additive manufacturing processes.

UNIT-I: Casting:

Steps involved in making a casting – Advantage of casting and its applications. Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Molding, different types of cores , Principles of Gating, Risers, casting design considerations. Methods of melting and types of furnaces, Solidification of castings and casting defects- causes and remedies. Basic principles and applications of special casting processes - Centrifugal casting, Die casting, Investment casting and shell molding.

UNIT-II: Welding:

Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, power characteristics, Manual metal arc welding, submerged arc welding, TIG& MIG welding. Electro–slag welding. Resistance welding, Friction welding, Friction stir welding, Forge welding, Explosive welding; Thermit welding, Plasma Arc welding, Laser welding, electron beam welding, Soldering &Brazing. welding defects –causes and remedies

UNIT-III: Bulk Forming:

Plastic deformation in metals and alloys-recovery, recrystallization and grain growth.

Hot working and Cold working-Strain hardening and Annealing. Bulk forming processes: Forging-Types of Forging, forging defects and remedies; Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements. Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing.

UNIT-IV: Sheet metal forming

Blanking and piercing, Forces and power requirement in these operations, Deep drawing, Stretch forming, Bending, Spring back and its remedies, Coining, Spinning, Types of presses

and press tools.High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.

UNIT-V: Additive manufacturing

Steps in Additive Manufacturing (AM), Classification of AM processes, Advantages of AM, and types of materials for AM, Extrusion - Based AM Processes, Powder Bed Fusion AM Processes, Direct Energy Deposition AM Processes, Post Processing of AM Parts, Applications

TEXT BOOKS:

1. Kalpakjain S and Steven R Schmid, Manufacturing Processes for Engineering Materials, 5/e, Pearson Publications, 2007.
2. P.N. Rao, Manufacturing Technology -Vol I, 5/e, McGraw Hill Education, 2018.

REFERENCE BOOKS:

1. A.Ghosh & A.K.Malik, Manufacturing Science, East West Press Pvt. Ltd, 2010.
2. Lindberg and Roy, Processes and materials of manufacture, 4/e, Prentice Hall India Learning Private Limited, 1990.
3. R.K. Jain, Production Technology, Khanna Publishers, 2022.
4. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.
5. H.S. Shaun, Manufacturing Processes, 1/e, Pearson Publishers, 2012.
6. WAJ Chapman , Workshop Technology, 5/e, CBS Publishers & Distributors Pvt.Ltd, 2001.
7. Hindustan Machine Tools, Production Technology, Tata McGraw Hill Publishers, 2017.

ADDITIONAL LEARNING RESOURCES:

- https://www.edx.org/learn/manufacturing/massachusetts-institute-of-technology-fundamentals-of-manufacturing-processes
- https://onlinecourses.nptel.ac.in/noc21_me81/preview
- www.coursera.org/learn/introduction-to-additive-manufacturing-processessera
- https://archive.nptel.ac.in/courses/112/103/112103263/

FLUID MECHANICS AND HYDRAULIC MACHINES								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2303402	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**Sem.-End Exam**	**Total**
		3	**0**	**0**	**3**	**30**	**70**	**100**
Mid Exam Duration: 2 Hrs						**Sem.-End Exam Duration: 3 Hrs**		
Pre-Requisites: Fundamentals of Physics and Mathematics								
Course Objectives: • CE1: Understand the properties of Fluids, manometry, hydrostatic forces acting on different surfaces. • CE2: Understand the kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations, energy and momentum equations. • CE3: Understand the theory of boundary layer, working and performance characteristics of various hydraulic machines like pumps and turbines.								
Course Outcomes: On successful completion of this course, the students will be able to **CO26.** Understand the basic concepts of fluid properties **CO27.** Estimate the mechanics of fluids in static and dynamic conditions. **CO3.** Apply the Boundary layer theory, flow separation and dimensional analysis. **CO4.** Estimate the hydrodynamic forces of jet on vanes in different positions **CO5.** Understand the working Principles and performance evaluation of hydraulic pump and turbines.								

UNIT-I: Fluid statics:

Dimensions and units: physical properties of fluids - specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric, gauge and vacuum pressure, Measurement of pressure – Manometers - Piezometer, U-tube, inverted and differential manometers. Pascal's& hydrostatic laws.

UNIT-II: Fluid kinematics:

Introduction, flow types. Equation of continuity for one dimensional flow, circula tion and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flow net, source and sink, double and vortex flow.

Fluid dynamics: surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend.

Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel-total energy line-hydraulic gradient line.

UNIT-III:

Boundary Layer Theory: Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.

UNIT-IV:

Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams , work done and efficiency, flow Over radial vanes.

Hydraulic Turbines: classification of turbines, impulse and reaction turbines, Pelton wheel,Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design – draftube-theory-functions and efficiency.

UNIT-V:

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. Hydraulic systems- hydraulic ram, hydraulic lift, hydraulic coupling. Fluidics – amplifiers, sensors and oscillators. Advantages, limitations and applications.

Centrifugal pumps: classification, working, work done – manometric head- losses and efficiencies-specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

Textbooks:

1. Y.A.Cengel,J.M.Cimbala, Fluid Mechanics, Fundamentals and Applications,6/e,McGraw Hill Publications, 2019.
2. Dixon,Fluid Mechanics and Thermodynamics of Turbomachinery,7/e, Elsevier Publishers, 2014.

ReferenceBooks:

1. P N Modi and S M Seth, Hydraulics & Fluid Mechanics including Hydraulics Machines, Standard Book House, 2017.
2. R K Bansal, Fluid Mechanics and Hydraulic Machines, 10/e,Laxmi Publications(P)Ltd, 2019.
3. Rajput, Fluid Mechanics and Hydraulic Machines, S Chand & Company, 2016.
4. D.S.Kumar, Fluid Mechanics and Fluid Power Engineering, S K Kataria &Sons, 2013.
5. D.RamaDurgaiah,FluidMechanicsandMachinery,1/e, New Age International, 2002.

Online Learning Resources:

- https://archive.nptel.ac.in/courses/112/105/112105206/
- https://archive.nptel.ac.in/courses/112/104/112104118/
- https://www.edx.org/learn/fluid-mechanics
- https://onlinecourses.nptel.ac.in/noc20_ce30/previewnptel.ac.in
- www.coursera.org/learn/fluid-powerera

THEORY OF MACHINES								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2303403	Professional Core	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**Sem.-End Exam**	**Total**
		2	**1**	**1**	**3**	**30**	**70**	**100**
Mid Exam Duration: 1.5 Hrs						**Sem.-End Exam Duration: 3 Hrs**		
Pre-Requisites: Engineering Mechanics & Strength of materials								

Course Objectives: The objectives of the course are to make the students learn about

- **CEO1.** Introduce various basic mechanisms and their applications.
- **CEO2.** Explain importance of degree of freedom.
- **CEO3.** Familiarize velocity and acceleration in mechanisms.
- **CEO4.** Describe the cams and follower motions.
- **CEO5.** Explain the importance of gyroscopic couples, Introduce the equation of motion for single degree of freedom system.

Course Outcomes: On successful completion of this course, the students will be able to

- **CO1.** Understand different mechanisms and their inversions. Provide an introduction to design of machine elements
- **CO2:** Calculate velocity and acceleration of different links in a mechanism
- **CO3:** Apply the effects of gyroscopic couple in ships, aero planes and road vehicles.
- **CO4:** Evaluate unbalance mass in rotating machines.
- **CO5:** Analyze free and forced vibrations of single degree freedom systems.

UNIT-I: Simple Mechanisms: Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, mobility – Grashof's law, kinematic inversions of four bar chain and slider crank chains- Limit positions – Mechanical advantage- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line mechanisms – UniversalJoint – Rocker mechanisms.

UNIT-II: Plane and motion analysis

Plane and motion analysis: Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations – kinematicanalysis of simple mechanisms – slidercrank mechanism dynamics – Coincidentpoints – Corioliscomponent of acceleration.

UNIT-III: Gyroscope & Gear Profile

Gyroscope: Principle of gyroscope, gyroscopic effect in an aeroplane, ship, car and two wheeler, simple problems

Gear Profile: Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting – helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics.

UNIT-IV: Balancing of Rotating masses & Cams

Balancing of Rotating masses: Need for balancing, balancing of single mass and several masses in different planes, using analytical and graphical methods.

Cams: Classification of cams and followers- Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions – derivatives of follower motions- specified contour cams- circular and tangent cams –pressure angle and undercutting.

UNIT-V: Vibrations & Turning Moment Diagrams and Flywheels

Vibrations: Introduction, degree of freedom, types of vibrations, free natural vibrations, Newton method and energy method for single degree of freedom. Damped vibrations- under damped, critically damped; and over damped systems, forced vibrations with and without damping in single degree of freedom; Vibration isolation and transmissibility.

Turning Moment Diagrams and Flywheels: Turning moment diagrams for steam engine, I.C engine and Multi Cylinder Engine. Crank effort – coefficient of fluctuation of energy, coefficient of fluctuation of speed – Fly Wheel and their design, fly wheels for punching press.

TEXT BOOKS:

Textbooks:

1. S.S.Rattan, Theory of Machines, 4/e, Tata Mc-Graw Hill, 2014.
2. P.L.Ballaney, Theory of Machines & Mechanisms, 25/e, Khanna Publishers, Delhi, 2003.

Reference Books:

1. F. Haidery, Dynamics of Machines, 5/e, NiraliPrakashan, Pune, 2003.
2. J.E.Shigley, Theory of Machines and Mechanisms, 4/e, Oxford, 2014.
3. G.K.Groover, Mechanical Vibrations, 8/e, Nemchand Bros, 2009.
4. Norton, R.L., Design of Machinery – An Introduction to Synthesis and Analysis of Mechanisms and Machines, 2/e, McGraw Hill, New York, 2000.
5. William T. Thomson, Theory of vibration with applications, 4/e, Englewood Cliffs, N.J.: Prentice Hall, 1993.

ADDITIONAL LEARNING RESOURCES:

- https://www.yumpu.com/en/document/view/18818306/lesson-3-course-name-design-ofmachine-elements-1-nptel
- https://www.digimat.in/nptel/courses/video/112105124/L01.html
- https://dokumen.tips/documents/nptel-design-of-machine-elements-1.html
- https://archive.nptel.ac.in/courses/112/105/112105125/
- https://www.coursera.org/learn/machine-design1

B.Tech. IV-Semester
FLUID MECHANICS & HYDRAULIC MACHINERY LAB

Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	Sem.-End Exam	Total
2303451	Engineering Science (ESC)	0	0	2	1	40	60	100

Pre-Requisites:

Title of the Pre-requisite Course(s)

Course Objectives:

To impart practical exposure on the performance evaluation methods of variousflow measuring equipment and hydraulic turbines and pumps.

Course Outcomes: On successful completion of this course, the students will be able to

CO1: Demonstrate the devices used for measuring flow.
CO2: Compute major losses in pipes.
CO3: Illustrate the operating parameters of turbines.
CO4: Explain the working of different types of pumps.
CO5: Explain the devices used for measuring flow.

List of Exercises/List of Experiments:

Minimum **Ten** experiments are to be conducted.

a) Impact of jets on Vanes.
b) Performance Test on Pelton Wheel.
c) Performance Test on Francis Turbine.
d) Performance Test on Kaplan Turbine.
e) Performance Test on Single Stage Centrifugal Pump.
f) Performance Test on Multi Stage Centrifugal Pump.
g) Performance Test on Reciprocating Pump.
h) Calibration of Venturi meter.
i) Calibration of Orifice meter.
j) Determination of friction factor for a given pipeline.
k) Determination of loss of head due to sudden contraction in a pipeline.
l) Turbine flow meter.

REFERENCE BOOKS/LABORATORY MANUALS:

1. **Fluid Mechanics Laboratory Manual" by M. Rafiqul Islam**
2. **"Hydraulic Laboratory Manual" by D. M. V. Prasad**

ADDITIONAL LEARNING RESOURCES:

1. To study different patterns of a flow through a pipe and correlate them with the Reynolds number of the flow. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/reynolds/introduction.html)
2. To calculate Total Energy at different points of venture meter. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/bernoulli/introduction.html).
3. To calculate the flow (or point) velocity at center of the given tube using different flow rates. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/pitot/introduction.html)
4. To determine the hydrostatic force on a plane surface under partial submerge and full submerge condition. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/cop/introduction.html).
5. To determine the discharge coefficient of a triangular notch. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/notch/introduction.html)
6. To determine the coefficient of impact of jet on vanes. (https://fm-nitk.vlabs.ac.in/exp/impact-of-jet).
7. To determine friction in pipes. (https://fm-nitk.vlabs.ac.in/exp/friction-in-pipes/index.html).

MANUFACTURING PROCESSES LAB								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2303452	**Professional core**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**Sem.-End Exam**	**Total**
		0	**0**	**3**	**1.5**	**30**	**70**	**100**

Pre-Requisites:

Title of the Pre-requisite Course(s)

Course Objectives:

COE1: Acquire practical knowledge on Metal Casting

COE2: Acquire practical knowledge on Welding.

COE3: Acquire practical knowledge on Press Working

COE4: Acquire practical knowledge on Processing of Plastics.

Course Outcomes: On successful completion of this course, the students will be able to

CO2. Make molds for sand casting

CO3. Fabricate different types of components using various manufacturing techniques

CO4. Adapt unconventional manufacturing methods.

CO5. Develop Different Weld joints.

List of Exercises/List of Experiments:

Minimum Ten experiments are to be conducted.

1. Design and making of pattern
   i. Single piece pattern
   ii. Split pattern
2. Sand properties testing
   i. Sieve analysis (dry sand)
   ii. Clay content test
   iii. Moisture content test
   iv. Strength test (Compression test & Shear test)
   v. Permeability test
3. Mould preparation
   i. Straight pipe
   ii. Gear blank
4. Gas cutting and welding
5. Manual metal arc welding
   i. Lap joint
   ii. Butt joint
6. Simple models using sheet metal operations
7. To make weld ments using TIG/MIG welding
8. To weld using Spot welding machine
9. To join using Brazing and Soldering
10. Demonstration of metal casting.

REFERENCE BOOKS/LABORATORY MANUALS

1. Kalpakjain S and Steven R Schmid, Manufacturing Processes for Engineering Materials, 5/e, Pearson Publications, 2007.
2. P.N. Rao, Manufacturing Technology -Vol I, 5/e, McGraw Hill Education, 2018.

ADDITIONAL LEARNING RESOURCES:

To study and observe various stages of casting through demonstration of casting process. (https://virtual-labs.github.io/exp-sand-casting-process-dei/theory.html)

1. To weld and cut metals using an oxyacetylene welding setup. (https://virtual-labs.github.io/exp-gas-cutting-processes-iitkgp/index.html).
2. To simulate Fused deposition modelling process (FDM) (https://3dpdei.vlabs.ac.in/exp/simulation-modelling-process)
3. https://altair.com/inspire-mold/
4. https://virtual-labs.github.io/exp-simulation-cartesian-system-dei/theory.html

Course Title	Soft skills Lab				IV Sem (Common to all Branches)		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
23HS451	HUM	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	1	2	2	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

COURSE OBJECTIVES	
1	To encourage all round development of the students by focusing on soft skills
2	To make the students aware of critical thinking and problem-solving skills
3	To enhance healthy relationship and understanding within and outside an organization
4	To function effectively with heterogeneous teams
COURSE OUTCOMES	
CO1	Engage with readings critically by evaluating the various contexts (social, historical, or personal) surrounding and underpinning each text
CO2	Effectively summarize and analyze various texts while identifying and highlighting their main ideas and messages
CO3	Develop independent perspectives and arguments via persuasive support and successful incorporation of research thus developing their own voice and creating a balance between their own voice and source summaries
CO4	Practice the revision skills necessary for the accomplishment of a writing project
CO5	Constructively critique their own and peers' writing, with an awareness of the collaborative and social aspects of the writing process

UNIT I Soft Skills & Communication Skills

Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills -Significance, process, types - Barriers to communication - Improving techniques.
Activities:
Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self-expression – articulating with felicity.
(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)
Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.
Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches convincing- negotiating- agreeing and disagreeing with professional grace. Barriers to communication –Activity
Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation.

UNIT II Critical Thinking

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open mindedness – Creative Thinking - Positive thinking - Reflection
Activities:

Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues –placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

UNIT III Problem Solving & Decision Making

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles

Activities:

Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision. Case Study & Group Discussion

UNIT IV Emotional Intelligence & Stress Management

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

Activities:

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

UNIT V Corporate Etiquette

Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity – Negotiations and meeting management- **Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette - Corporate grooming tips -Overcoming challenges**

Activities

Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games

Prescribed Books:

1. Mitra Barun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012
2. Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow, I K International Publishing House, 2018
3. Communication Skills for Engineers & Scientists by Sangeeta Sharma and .Binod Mishra (Author) 2nd Edition- PHI Publications

Reference Books

1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018.
2. Alex K, Soft Skills S.Chand & Co, 2012 (Revised edition)
3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013
4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018
5. Soft Skills for a Big Impact (English, Paperback, Renu Shorey) Publisher: Notion Press

DESIGN THINKING AND INNOVATION								
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
2304453	**Engineering Science (ESC)**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**Sem.-End Exam**	**Total**
		1	**0**	**2**	**2**	**30**	**70**	**100**

Pre-Requisites:

Management science

Course Objectives:

CEO1. To familiarize students with design thinking process as a tool for breakthrough innovation.

CEO2. To equip students with design thinking skills and ignite

CEO3. To create innovative ideas, develop solutions for real-time problems.

Course Outcomes: On successful completion of this course, the students will be able to

CO1: Define the concepts related to design thinking (L1, L2)

CO2: Explain the fundamentals of Design Thinking and innovation (L1, L2)

CO3: Apply the design thinking techniques for solving problems in various sectors. (L3)

CO4: Analyse to work in a multidisciplinary environment(L4)

CO5: Evaluate the value of creativity(L5)

Unit I :

Introduction to Design Thinking: Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

Unit II :

Design Thinking Process: Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development.

Activity: Every student presents their idea in three minutes, every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

Unit III :

Innovation: Artofinnovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

Unit IV :

Product Design: Problem formation, introduction to product design, Product strategies, Product value, Product planning, product Specifications-Innovation towards product design-Case studies

Activity: Importance of modeling, how to set specifications, Explaining their own product design.

Unit V :

Design thinking in Business Processes: Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing &

testing prototypes.
Activity: How to market our own product, about maintenance, Reliability and plan for startup.

TEXTBOOKS:

1. Tim Brown, "*Change by design*", Harper Bollins (2009)
2. Idris Mootee, "*Design Thinking in Business Processes*", 2013, John Wiley & Sons.

REFERENCE BOOKS:

1. David Lee, "*Design Thinking in the Classroom*", Ulysses press
2. Shrutin N Shetty, "*Design the Future*", Norton Press
3. William Lidwell, "*Universal Principles of Design*"- Kritinaholden, Jill Butter.
4. Chesbrough.H, "*The Era of Open Innovation*"– 2013

Online Learning Resources:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1_noc19_mg60/preview