Program structure & Detailed Syllabus

2023

For

Under Graduate Programme (B.Tech)

MECHANICAL ENGINEERING

(Applicable For Batches Admitted From 2023 – 2024)

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY (AUTONOMOUS)

DUVVADA - VISAKHAPATNAM – 530 049

(An Autonomous Institute, Accredited by NAAC, Affiliated to JNTUGV, Vizianagaram, AP)

VIGNAN'S INSTITUTE OF INFORMATION TECHNOLOGY(A)
VISAKHAPATNAM
Academic Regulations (VR23) for B. Tech (Regular/Honors)
(Effective for the students admitted into I year from the Academic
Year **2023-24** onwards)

The admissions of the students into B.Tech. course shall be as per the Govt. of Andhra Pradesh rules.

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 program 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.
   For lateral entry scheme admission: Pursue a program of study
   For not less than three academic years and not more than six Academic years.

   (iii)   Lateral entry candidate has to register for 120 credits from second year onwards and shall secure 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., 160 credits.
   (ii)   Registering for Honors is optional.
   (iii)   Honors is to be completed simultaneously with B.Tech. programme.

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 obtained by 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 of teaching (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. **Programs of Study**

The following B.Tech. Programs are offered:

S. No.	Program Code	Program & Abbreviation
01	01	Civil Engineering (CE)
02	02	Electrical and Electronics Engineering (EEE)
03	03	Mechanical Engineering (ME)
04	04	Electronics and Communication Engineering (ECE)
05	05	Computer Science and Engineering (CSE)
06	12	Information Technology (IT)
07	19	Electronics and Computer Engineering (E. Com E)
08	54	Artificial Intelligence and Data Science (AI&DS)
09	43	CSE–Artificial Intelligence
10	44	CSE –Data Science
11	46	CSE–Cyber Security

And any other Programs as approved by the authorities of the Institute from time to time.

6. Registration:

A student shall register for courses in each semester as per the courses offered in the specific B.Tech Program.

7. Curricular Program

The Curriculum of the four-year B. Tech Program has been designed to achieve a Healthy balance between theory and laboratory courses and Skills required for Industry. Further, focus is given to develop technical skills, Inter disciplinary skillsetc.,

8. Semester/Credits:

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

ii) The summer term is for minimum 4 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 for elective courses.

9. Structure of the Undergraduate Programme

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

S.No.	Category	Breakup of Credits (Total 160)	Percentage of total 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	-

10. Course Classification:

All subjects/ courses offered for the undergraduate programme in Engineering & Technology (B.Tech. degree programmes) 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
3.	Elective Courses	Professional Elective Courses (PE)	Includes elective subjects related to the parent discipline/department/branch of Engineering
		Open Elective Courses (OE)	Elective subjects which include interdisciplinary 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 are relevant 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

11. Programme Pattern

i. Total duration of the of B. Tech (Regular/Honors) Programme 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 freshers, before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by 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 /NSS /Scouts & Guides / Communityservice 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 the elective component of the curriculum, with 5 Professional Elective courses and 5 Open Elective courses.

ix.   Professional Elective Courses, include the elective courses relevant to the chosen 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 4 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 5 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 weeks duration at the end of second and third year of the programme. The internship 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 programme along with the project work.

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

xvi.   Institution 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.   Faculty shall assign as 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. 25% of course work for the theory courses in every semester may be conducted in the blended mode of learning.

12 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 400 marks, mandatory courses with no credits shall be evaluated for 30 mid semester marks.

For any course, student is considered to be passed upon securing minimum 35% marks in the external examination alone and minimum 40% marks from both internal and external examination put 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 examination question 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 10 marks for objective paper, 15 marks for subjective paper and 5 marks for assignment.

ii)   Objective paper shall contain for 05 short answer questions with 2 marks each for 10 marks. Subjective paper shall contain 3 either or type questions (totally six questions from 1 to 6) of which student has to answer one from each either-or type of questions. Each question carries 10 marks. The marks obtained in the subjective paper are condensed to 15 marks.

Note:

- The objective paper shall be prepared in line with the quality of competitive examinations questions.

- The subjective paper shall contain 3 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 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.

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 mid term examination shall be conducted for Two and Half units of syllabus with one either or type question from each unit. The second mid term examination shall be conducted for remaining two and half units with one either or type question from each unit.

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: 20
> Final mid semester Marks: (25x0.8) + (20x0.2) = 24

If the student is absent for any one mid term examination, the final mid semester marks shall 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: Absent
> Marks obtained in second mid: 25
> Final mid semester Marks: (25x0.8) + (0x0.2) =20

(b) 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 I shall contain 10 compulsory short answer questions for a total of 20marks such that each question carries 2 marks.

iii) There shall be 2 short answer questions from each unit.
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.

iv) The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.

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 total of 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 marks each. Student shall answer any one of them.

iii) The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

Practical Courses

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

b) For practical courses, there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks.

c) Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the record/viva and 15 marks for the internal test.

d) The 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.

e) 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 based on 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.

f) 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 secures 40% or more in the internal examinations. In case, the student fails, a reexamination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.

g) The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years and shall be produced to the Committees as and when the same are asked for.

13 Skill oriented Courses

a. There shall be five skill-oriented courses offered during III to VII semesters.

b. 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.

c. 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 conducted by the concerned teacher and an expert in the subject nominated by the principal.

d. 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.

e. 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 at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades.

f. The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the Institution at the beginning of the semester.

g. In case a student fails in any skill course, he/she may be permitted to register for same course or alternative course decided by department committee. For the course opted by department committee minimum 32 hrs of the class work will be conducted. The internal marks secured earlier will be nullified if the course is changed. The assessment procedure of skill-oriented course remains same.

h. 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 Institution.

14. Massive Open Online Courses (MOOCs):

A Student has to pursue and complete one course compulsorily through MOOCs approved by the institution. 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 for 2 credits or 12 weeks for 3 credits) 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) conducted by the Institution

To award credits the student should get certificate after they have registered for written exam and successfully passed

(Or)

College will conduct the written examination / Viva – voce and award the credits and grades.

In case a student fails in any online course, he/she may be permitted to register for the same course or an alternate course decided by the department committee. For course opted by the department committee minimum 48 hours of class work will be conducted. The internal marks secured earlier will be nullified if the course is changed. The assessment procedure of MOOCs course remains same as general theory course.

Note:

1. The registered course must not be same as any of the courses listed in the program structure of their regulation till final year including electives.

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

15. 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, the Institution shall allow up to a maximum of 20% of the total courses being offered in a particular programme i.e., maximum of 32 credits through MOOCs platform.

i.   The University 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 courses only.

iv. The concerned department shall identify the courses permitted for credit transfer.

v.   The institution 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 Institution shall ensure no overlap of MOOC exams with that examination schedules.

viii. Student pursuing courses under MOOCs shall acquire the required credits only after successful 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 maintain the following to the examination section:

    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 institution 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 institution from time to time.

16. Academic Bank of Credits (ABC)

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

    i.   provide option of mobility for learners across the institutes 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 and credit acceptance from students' account.

17. Mini project (EPICS/CSP):

It is to be carried out during the second year. Students have an option to choose their own area of interest related to problems impacting the society. It is evaluated for 50 marks.

i) Internal assessment - 20 marks

ii) Project submission and Viva-Voce - 30 marks

18. Mandatory Internships

Summer Internships:

Two summer internships either onsite or virtual each with a minimum of 4 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 in the 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 Head of the Department, supervisor of the internship and a senior faculty member of the department. 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 50% 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 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.

18.1. Evaluation Procedure for Main Project:

Main project work shall be carried out in the IV-year, second semester and evaluated for **200 marks**. Out of a total of **200 marks** for the project work, **80 marks** shall be for Internal Evaluation and **120 marks** for the End Semester Examination.

18.2. Evaluation Procedure for Internship:

Internship work shall be carried out in the IV-year, second semester and evaluated for **200** marks. Out of a total of **200 marks** for the project work, **80** marks shall be for Internal Evaluation and **120 marks** for the End Semester Examination.

19. Attendance Requirements:

a. It is desirable for a candidate to have 100% attendance in the class in all the courses. However, a candidate shall be permitted to appear for the end semester examination if he/she has a minimum of 75% aggregate attendance in the semester. Student will not be permitted to write Mid examination if the attendance percentage is less than 75 % during the stipulated instruction duration. However, Academic Committee in the institute level shall review the situation and take appropriate decision.

   Note: Special cases for students having extra ordinary performance at National and International level will be considered by the Academic Committee.

b. Condonation of shortage of attendance may be considered on Medical grounds maximum up to 10%, if the student provides the medical certificate to the HOD immediately after he /she recovers from the illness. Medical Certificate submitted afterwards shall not be permitted. Shortage of attendance equal to or above 65% and below 75%will be condoned on payment of fee as fixed by the competent authority and the student concerned will be permitted to take the end semester examination. ***This privilege is given only three times for regular student and only two times for lateral entry student during the entire program of study***.

c. Shortage of attendance may be considered for the students who participate in prestigious sports, co and extra-curricular activities if their attendance is in the minimum prescribed limit.

d. A student will be promoted to the next semester if satisfies attendance and credits requirement.

20. Academic Requirements:

The following academic requirements have to be satisfied in addition to the attendance requirements. For any course, student is considered to be passed upon securing minimum 40% marks in the external examination alone and minimum 50% marks from both internal and external examination put together

21. Promotion Policy:

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

b. To promote to III year, a student has to secure minimum 40% of total credits from I &II- year courses

c. To promote to IV year, a student has to secure minimum 40% of total credits from I, II&III- year courses

d. In case of Lateral entry students, to promote to IV year, a student has to secure minimum 40% of total credits from II & III –year courses

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 programme /to establish startups. 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. An evaluation committee constituted by the Institution 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. Supplementary examinations:

Supplementary examinations for the odd Semester shall be conducted with the regular examinations of even semester and vice versa. In case a student fails in online courses/ industrial lecture(s), he/she may be permitted to register for another course /lecture(s).

24. Transitory Regulations

i. The student has to continue the course work along with the regular students of the respective semester in which the student getsre-admission.

ii. The student has to register for Substitute / Compulsory courses offered in place of courses studied earlier.

iii. The mode of internal evaluation and end-semester examinations shall be on par with the regular students, i.e., the student has to follow the mode of

internal evaluation and the then question paper model for the end – semester examinations along with the regular students of the respective semester in which the student gets re-admission. The marks secured in the internal and end-semester examinations will be pro-rated in accordance with the regulations under which the student was first admitted.

iv. For the courses studied under earlier regulations but failed, the student has to appear, pass and acquire credits from the supplementary examinations as and when conducted. The question paper model shall remain same as the one in which the student took examination during previous regulations.

v. The promotion criteria based on attendance as well as credits shall be in accordance with the regulations under which the student was first admitted.

vi. All other academic requirements shall be in accordance with the regulations under which the student was first admitted.

vii. The decision of the Principal is final on any other clarification in this regard.

viii. Transcripts: After successful completion of the entire program of study, a transcript containing performance of all academic years will be issued as a final record. Partial transcript will also be issued up to any point of study to a student on request, after payment of requisite fee.

25. Minimum Instruction Days

The minimum instruction days for each semester shall be 16 weeks.

There shall be no branch transfers after the completion of the admission process.

26. Examinations and Evaluation

a. General guidelines

i. All the semester end examinations are conducted for duration of three hours

ii. External examination shall be conducted for 70 marks consist of five questions of internal choice carrying 12 marks each.

iii. For laboratory examinations, the evaluation is done by internal examiner and an external examiner.

b. Revaluation There is a provision for revaluation of theory courses if student fulfils the following norms.

The request for revaluation must be made in the prescribed format duly recommended by the Chief Superintendent of Examinations through Additional Controller along with the prescribed revaluation fee.

27. Grading System:

Structure of Grading of Academic Performance

Range in which the marks in the subject fall	Grade	Grade Point 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
	Ab (Absent)	0

Computation of SGPA

The following procedure is to be adopted to compute the Semester Grade Point Average.

(SGPA) and Cumulative Grade Point Average (CGPA):

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses under gone by a student,i.e.

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

Where C_i is the number of credits of the ith course and G_i is the grade point scored by the student in the ith course.

Computation of CGPA

- The CGPA is also calculated in the same manner considering all the courses undergone by a student overall the semesters of a programme, i.e.

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

Where S_i is the SGPA of the ith semester and C_i is the total number of credits in that semester.

Conversion of CGPA to Percentage:

Equivalent Percentage= (CGPA– 0.75) X 10

28. 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 three classes:

Regular:

Class Awarded	CGPA to be secured	From the CGPA secured from160 Credits.
First Class with Distinction	≥7.75with no failures	
First Class	≥ 6.75	
Second Class	≥5.75to<6.75	

Lateral – entry scheme

Class Awarded	CGPA to be secured	From the CGPA secured
First Class with Distinction	≥7.75with no failures	
First Class	≥ 6.75	**From 121 credits from**
Second Class	≥5.75to<6.75	**II Year to IV Year**

29. General Instructions

i. Where the words 'he', 'him', 'his', occur, they imply 'she', 'her', 'hers', also.

ii. The academic regulations should be read as a whole for the purpose of any interpretation.

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

iv. The college may change or amend the academic regulations or syllabi from time to time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the institution.

30. With holding of Results

If the student has not paid the dues, if any, to the institute or in any case of indiscipline is pending against him, the result of the student will be withheld. His degree will be withheld in such cases.

Note: All other regulations including attendance requirements related to four year **B.Tech Regular program will be applicable for B.Tech. Lateral Entry Scheme.**

31. Malpractices Rules

DISCIPLINARY ACTION FOR   MAL PRACTICES /   IMPROPER
CONDUCT IN EXAMINATIONS

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

3	If the candidate impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the courses of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester / year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection withfor feature of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	If the candidate smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester / year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with for feature of seat.
5	If the candidate uses objection able, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6	If the candidate refuses too by the orders of the Chief Superintendent/Assistant - Superintendent / any Officer on dutyor misbehaves or creates disturbance of any kind in and around the examination hall or organizes a Walkout or instigates others to walkout,	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester / year. The candidates also

	or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation , assaults the officer – in –charge ,or any person on duty in or outside the examination hall or any of his relations, or in dulges in any other act of mis conduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	If the candidate leaves the exam hall taking away answer script or intentionally tears of the script or any part there of inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester / year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with for feature of seat.
8	If the candidate possesses any lethal weapon or fire are min the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester / year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6to8.	Student of the college, expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses

		of that semester / year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and. A police case will be registered against them.
10	If the candidate comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester / year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during specials crutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that semester / year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Academic committee of the Institute for further action to award suitable punishment.	

32. UGC RECOMMENDED PUNISHMENT FOR RAGGING

i.   Suspension from attending classes and academic privileges
ii. With holding / withdrawing scholarships / fellowship and other benefits.
iii. Debarring from appearing in any test / examination or other evaluation process with holding results
iv. Debarring from representing the institution in any regional, national or international meet, tournament, youth festival etc.
v.   Suspension / expulsion from the hostel
vi. Cancellation of admission
vii. Rustication from the institution for period ranging from 1 to 4 semesters.
viii. Expulsion from the institution and consequent debarring from admission to any other institution for a specified period.
ix. Fine may extend upto Rs. 2.5lakh.

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B.TECH. - MECH –COURSE STRUCTURE–VR23

			I Year I Semester				
S. No.	Course Code	Category	Course Name	L	T	P	Credits
1.	1000231101	BS	Linear Algebra & Calculus	3	0	0	3
2.	1000231102	BS	Engineering Physics	3	0	0	3
3.	1000231104	HS	Communicative English	2	0	0	2
4.	1001231101	ES/CIVIL	Basic Civil & Mechanical Engineering	3	0	0	3
5.	1003231101	ES/MECH	Engineering Graphics	1	0	4	3
6.	1000231110	BS	Engineering Physics Lab	0	0	2	1
7.	1000231111	HS	Communicative English Lab	0	0	2	1
8.	1003231110	ES/MECH	Engineering Workshop	0	0	3	1.5
9.	1005231110	PC/CSE	IT Workshop	0	0	2	1
10.	1000231120	MC	NSS/NCC/Scouts &Guides/Community Service	0	0	1	0.5
			Total Credits				19

			I Year II Semester				
S.No.	Course Code	Category	Course Name	L	T	P	Credits
1.	1000231201	BS	Differential Equations and Vector calculus	3	0	0	3
2.	1000231202	BS	Engineering Chemistry	3	0	0	3
3.	1005231101	ES/CSE	Introduction to Programming	3	0	0	3
4.	1002231101	ES/EEE	Basic Electrical &Electronics Engineering	3	0	0	3
5.	1003231201	PC/MECH	Engineering Mechanics	3	0	0	3
6.	1000231210	BS	Engineering Chemistry Lab	0	0	2	1
7.	1005231111	ES/CSE	Computer Programming Lab	0	0	3	1.5
8.	1002231110	ES/EEE	Electrical &Electronics Engineering workshop	0	0	3	1.5
9.	1003231210	PC/MECH	Engineering Mechanics Lab	0	0	3	1.5
10.	1000231121	MC	Health and Wellness, Yoga and Sports	0	0	1	0.5
			Total Credits				21

I Year I Semester

SYLLABUS

Vignan's Institute of Information Technology (Autonomous) B. Tech. VR23

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I Year – I Semester	**LINEAR ALGEBRA& CALCULUS**	L	T	P	C
Course Code (1000231101)	**(Common to All Branches of Engineering)**	3	0	0	3

Course Objectives:

To equip the students with standard concepts and tools of mathematics to handlevarious real-world problems and their applications.

Course Outcomes: At the end of the course, the student will be able to
- Develop matrix algebra techniques that is needed by engineers for practical applications.
- Familiarize with functions of several variables which is useful in optimization.
- Learn important tools of calculus in higher dimensions.
- Familiarize with double and triple integrals of functions of several variable sin two and three dimensions.

UNIT I Matrices

Rank of a matrix by echelon form, normal form. Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous andNon-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

UNIT II Linear Transformation and Orthogonal Transformation:

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

UNIT III Mean Value Theorems

Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), and problems on the above theorems.

UNIT IV   Partial differentiation and Applications

Partial derivatives, total derivatives, chain rule, change of variables, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT V Multiple Integrals

Double integrals, triple integrals, change of order of integration, change of variables to Polar coordinates. Finding areas and volumes in Cartesian coordinates.

Textbooks:
1. B. S. Grewal, Higher Engineering Mathematics,44/e,Khanna Publishers,2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.

Reference Books:
1. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
2. George B.Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
3. Glyn James, Advanced Modern Engineering Mathematics, 5/e, Pearson publishers, 2018.
4. Michael Green berg, Advanced Engineering Mathematics, 9th edition, Pearson edn
5. H. K Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand,2021

I Year – I Semester	**ENGINEERING PHYSICS** (Common for all branches of Engineering)	L	T	P	C
Course Code: (1000231102)		3	0	0	3

COURSE OBJECTIVES

1. Bridging the gap between the Physics in school at 10+2 level and UG level engineering courses.
2. To identify the importance of the optical phenomenon. interference, diffraction and polarization related to its Engineering applications
3. Enlighten the periodic arrangement of atoms in Crystalline solids by Bragg's law
4. To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
5. Enlightenment of the concepts of Quantum Mechanics and to provide fundamentals of DE Broglie matter waves, quantum mechanical wave equation and its application, the importance of free electron theory for metals.
6. To Understand the Physics of Semiconductors and their working mechanism, Concept utilization of transport phenomenon of charge carriers in semiconductors.

COURSE OUTCOMES

CO1.   **Explain** the need of coherent sources and the conditions for sustained interference (L2).
Identify the applications of interference in engineering (L3).
Analyze the differences between interference and diffraction with applications (L4).
Illustrate the concept of polarization of light and its applications (L2). **Classify** ordinary refracted light and extraordinary refracted rays by their states of polarization (L2)

CO2.   **Classify** various crystal systems (L2). **Identify** different planes in the crystal structure (L3).
Analyze the crystalline structure by Bragg's X-ray diffractometer (L4).

CO3.   **Explain** the concept of dielectric constant and polarization in dielectric materials (L2).
Summarize various types of polarization of dielectrics (L2).
Interpret Lorentz field and Claussius - Mosotti relation in dielectrics (L2).
Classify the magnetic materials based on susceptibility and their temperature dependence (L2).

CO4.   **Describe** the dual nature of matter (L1).
Explain the significance of wave function (L2).
Identify the role of Schrodinger's time independent wave equation in studying particle in one- dimensional infinite potential well (L3).
Identify the role of classical and quantum free electron theory in the study of electrical conductivity (L3).

CO5.   **Classify** the crystalline solids (L2). **Outline** the properties of charge carriers in semiconductors (L2).
Identify the type of semiconductor using Hall Effect (L2).
Apply the concept of effective mass of electron (L3).

Unit-I: Wave Optics

Interference: Introduction **-** Principle of superposition –Interference of light - 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 & Diffraction Grating (Qualitative).

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

Unit Outcomes:
The students will be able to

  ➢ **Explain** the need of coherent sources and the conditions for sustained interference (L2)
  ➢ **Identify** engineering applications of interference (L3)
  ➢ **Illustrate** the concept of polarization of light and its applications (L2)
  ➢ **Classify** ordinary polarized light and extraordinary polarized light (L2)

Unit II: Crystallography

Crystallography: 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. Bragg's law - X-ray Diffractometer.

Unit Outcomes:
The students will be able to
  ➢ **Classify** various crystal systems (L2)
  ➢ **Identify** different planes in the crystal structure (L3)
  ➢ **Analyze** the crystalline structure by Bragg's X-ray diffractometer (L4)

Unit-III: Dielectric and Magnetic Materials

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector- Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative)
- Lorentz internal field - Clausius-Mossotti equation.

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability - Classification of magneticmaterials: Dia, para, Ferro, antiferro & Ferri magnetic materials - Domain concept for Ferromagnetism (Qualitative) - Hysteresis - soft and hard magnetic materials.

Unit Outcomes:

The students will be able to

- ➢ **Explain** the concept of dielectric constant and polarization in dielectric materials (L2)
- ➢ **Summarize** various types of polarization of dielectrics (L2)
- ➢ **Interpret** Lorentz field and Claussius- Mosotti relation in dielectrics(L2)
- ➢ **Classify** the magnetic materials based on susceptibility and their temperature dependence(L2)

Unit-IV: Quantum Mechanics and Free electron theory

Quantum Mechanics: 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.

Free Electron Theory: 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 and its temperature dependence.

Unit Outcomes:

The students will be able to

- ➢ **Explain** the concept of dual nature of matter (L2)
- ➢ **Understand** the significance of wave function (L2)
- ➢ **Interpret** the concepts of classical and quantum free electron theories (L2)

Unit – V: Semiconductors

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Extrinsic semiconductors: density of charge carriers - Drift and diffusion currents – Einstein's equation - Hall effect and its Applications.

Unit Outcomes:
The students will be able to

- ➢ **Outline** the properties of charge carriers in semiconductors (L2)
- ➢ **Understand** the carrier transportation in semiconductors (L2)
- ➢ **Identify** the type of semiconductor using Hall effect (L2)

Text books:

- A Text book of Engineering Physics" - M. N. Avadhanulu, P.G.Kshirsagar & TVS ArunMurthy, S.Chand Publications, 11th Edition 2019.
- "Engineering Physics" - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015).
- "Engineering Physics" - P.K.Palanisamy SciTech publications.

Reference Books:

- "Fundamentals of Physics" - Halliday, Resnick and Walker, John Wiley &Sons.
- "Engineering Physics" - M.R. Srinivasan, New Age international publishers (2009).
- "Engineering Physics" - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
- "Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.
- "Semiconductor physics and devices:Basic principle" - A. Donald, Neamen, Mc GrawHill.
- "Engineering Physics" - B.K. Pandey and S. Chaturvedi, Cengage Learning
- "Solid state physics" – A.J.Dekker ,Pan Macmillan publishers
- "Introduction to Solid State Physics" -Charles Kittel, Wiley

I Year – I Semester	COMMUNICATIVE ENGLISH	L	T	P	C
Course Code (**1000231104**)	(Common to All Branches of Engineering)	2	0	0	2

Course Objectives:

The main objective of introducing this course, *Communicative English,* is to facilitate using Listening, Reading, Speaking and Writing skills effectively by the students. It should result in their better comprehending abilities, oral presentations, reporting useful information and with enhanced knowledge of grammatical structures and vocabulary. This course helps the students in using speaking and writing (productive) skills more efficiently and to make them industry-ready.

Course Outcomes

- **By the end of the course the students will have** Learned how to understand the context, topic, and specificinformation from social or transactional dialogues.
- Remedially learn applying grammatical structures to formulate sentence sand use appropriate words andcorrect word forms.
- Using discourse markers to speak clearly on a specific topic in formal as well as informal discussions.
  (notrequired)
- Improved communicative competence in formal and informal contexts and for social and academicpurposes.
- Critically comprehending and appreciating reading/listening texts and to write summaries and reviews based on global comprehension of these texts.
- Writing coherent paragraphs, paraphrase, essays, letters/e-mails and resume.

Instructions:

1. The reading texts can be given as podcasts to the students so that their listening skills can be enhanced.
2. While listening and reading to the text can be given as homework, the class work for the students can be to discuss and critically evaluate the texts based on the context, purpose or writing the text and understandingit from the author's as well as reader's point of view.
3. Reading as habit for both academic and non-academic (pleasure) purposes has to be inculcated in the students. So, training has to be given in intensive and extensive reading strategies.
4. Writing for both academic (assignments, examinations, reports, e-mails/letters etc)
5. The writing tasks given in the class are to be self and peer evaluated by the students before they are finally graded by the faculty.
   Note: Please note that the texts given here are just contexts for teaching various language skills and sub skills. The students' ability to use language cannot be confined to comprehending or using the language related to the given texts (textbooks). The given texts can be used only for practice.
6. All the activities to develop language skills have to be integrated and interconnected, within each unitand across the units.
7. Use as many supplementary materials as possible in various modes (Audio, visual and printed versions) in the classroom so that the students get multimode input and will know how to use language skills in the absence of the teacher.

UNIT I

Lesson: HUMAN VALUES: A Power of a Plate of Rice by Ifeoma Okoye (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: E-Mail writing

Mechanics of Writing-Capitalization, Spellings, and Punctuation- Parts of Sentences. (*That has to be part of the bridge course- 2 weeks before the actual academic programme starts*)

Grammar: Parts of Speech, Basic Sentence Structures-forming questions

Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II

Lesson: NATURE: Night of the Scorpion by Nissim Ezekiel (Indian and contemporary)

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 and Book/movie/article review.

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

UNIT III

Lesson: BIOGRAPHY: Steve Jobs

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 specificcontext clues; strategies to use text clues for comprehension.

Writing: Summarizing, Note-making, Paraphrasing.

Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations.

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 graphical elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

Writing: Letter Writing: Official Letters

Grammar: 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 testcomprehension.

Speaking: Formal oral presentations on topics from academic contexts.

Reading: Reading comprehension.

Writing: Writings structured essays on specific topics.

Grammar: Editing short texts, identifying and correcting common errors in grammar and usage. (Articles,prepositions, tenses, subject-verb agreement).

Vocabulary: Technical Jargons.

Text books:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition,Orient Black Swan, 2023 (Units 1, 2 & 3).
2. Empowering English by Cengage Publications, 2023 (Units 4 & 5).
   Suggestion: Instead of giving the syllabus in the form of textbooks it would be better to procure the soft copies of individual texts (stories or poems or biographies and non-fiction texts) by the university and make them available on the university website for registered students to access and download.

Reference Books:

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020.
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge,2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. 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**

   https://dictionary.cambridge.org/grammar/british-grammar/

I Year – I Semester	**BASIC CIVIL & MECHANICAL ENGINEERING** (Common to CE, ME, IT, CSE, CSE(DS), CSE(CS), CSE(AI))	**L**	**T**	**P**	**C**
Course Code (1001231101)		**3**	**0**	**0**	**3**

Course Objectives:
- Get familiarized with the scope and importance of Civil Engineering sub - divisions.
- Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on
- Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance and storage of water.
- Introduction to basic civil engineering materials and construction techniques.

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.

CO2: Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.

CO3: Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.

CO4: Understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated.

CO5: Understand the basic characteristics of Civil Engineering Materials and attain knowledge on prefabricated technology.

UNITI

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. Introduction to Prefabricated construction Techniques.

UNITII

Surveying : Objectives of Surveying - Horizontal Measurements – Angular Measurements- Introduction to Bearings leveling instruments used for level ling-Simple problem son leveling and bearings-Contour mapping.

UNITIII

Transportation Engineering Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements-Simple Differences. Basics of Harbour , Tunnel, Airport, and Railway Engineering

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water-Specifications- Introduction to Hydrology– Rain water Harvesting-Water Storage and

Conveyance Structures (Simple introduction to Dams and Reservoirs).

Textbooks:
1. Basic Civil Engineering, M. S. Palanisamy, , Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S.Bhavikatti, New Age International Publishers. 2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:
1. Surveying,Vol-I and Vol-II, S.K.Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi.2016
3. Irrigation Engineering and Hydraulic Structures-Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S. K. Khanna, C.E.G. Justoand Veeraraghavan, Nemchandand Brothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500 -2012.

PARTB: BASIC MECHANICAL ENGINEERING

Course Objectives: The students after completing the course are expected to
- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

Course Outcomes: On completion of the course, the student should be able to
CO1: Understand the different manufacturing processes.
CO2: Explain the basics of thermal engineering and its applications.
CO3: Describe the working of different mechanical power transmission systems and power plants
CO4: Describe the basics of robotics and its applications.

UNITI

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.

UNITII

Manufacturing Processes: Principles of Casting**,** Forming, and joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.
Thermal Engineering–working principle of Boilers, Ottocycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric 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 their applications.
Introduction to Robotics- Joints & links, configurations, and application so frobotics.
(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)

Textbooks:

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

Reference Books:

1. Appuu Kuttan K K, Robotics, I. K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology-L. Jyothish Kumar, Pulak M Pandey, 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.

I Year – I Semester	**ENGINEERING GRAPHICS** (Common to All branches of Engineering)	L	T	P	C
Course Code (1003231101)		1	0	4	3

Course Objectives:

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

Course Outcomes:

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: Understand and draw projection of solids in various positions in first quadrant.

CO4: Explain principles behind development of surfaces.

CO5: Prepare isometric and perspective sections of simple solids.

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.

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 another plane.

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*).

Textbook:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 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, TataMcGraw Hill, 2017.

I Year – I Semester	**ENGINEERING PHYSICS LAB**	L	T	P	C
Course Code : (1000231110)	**(Common to All Branches of Engineering)**	0	0	2	1

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: At the end of the course, the student will be able to:
CO1: Identify the mechanical behavior and mechanical parameters of materials.
CO2: Interpret some of the physical parameters based on optical phenomena.
CO3: Identify the characteristics of semiconducting materials, magnetic materials and dielectrics.
CO4: Estimate the parameters by diffraction techniques

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 configuration.
3. Verification of Brewster's law
4. Determination of dielectric constant for a dielectric substance using dielectric constant apparatus
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 cell.
8. Determination of the resistivity of semiconductors by four probe methods.
9. To study V-I characteristics of a PN junction diode in forward and reverse biasing conditions.
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 susceptibility 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. Study of V-I characteristics of solar cell
20. Determine of laser bean divergence and spot size of a diode laser beam

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

References:

- A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.
  - Physics Laboratory Manual for Undergraduate students – Dr. Santosh Kumar Alla, Dr. Ch. V. V. Ramana, Dr. T. Lakshmana Rao, Dr. R. Hanumantha Rao.

Web Resources
- www.vlab.co.in
- https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

I Year – I Semester	COMMUNICATIVE ENGLISH LAB	L	T	P	C
Course Code : (1000231111)	(Common to All Branches of Engineering)	0	0	2	1

Course Objectives:

The main objective of introducing this course, *Communicative English Laboratory*, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. (That can be for theory paper) is to train the students in oral communication skills in real situations.Students will get trained in the basic communication skills and also make them ready to face job interviews. They will be helped to overcome the mother tongue/local language influence and neutralize their accent which makes their speech more intelligible to all listeners.

Course Outcomes:

By the end of the course, the students will be having

- Understand the different aspects of the English language oral communication with emphasis on Listening and Speaking Skills.
- Apply communication skills through various language learning activities.
- Analyze the English speech sounds, stress, rhythm and intonation for better listening and speaking comprehension.
- Evaluate and exhibit professionalism in participating in debates and group discussions with polite turn taking strategies and sound more professional while communicating with others.
- Create effective resonate and prepare them to face interviews communicate appropriately in corporate settings.

List of Topics:

1. Vowels & Consonants (Not rules but use of them in various syllable structures)
2. Neutralization/Accent Rules (No rules again, required more practice)
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. Resume Writing
6. Group Discussions-Methods & Practice
7. Debates- Methods & Practice
8. PPT Presentations/ Poster Presentation
9. Interviews Skills

Suggested Software:

- Walden InfoTech
- Young India Films

Reference Books:

1. Meenakshi Raman, Sangeeta-Sharma. Technical Communication. Oxford Press.2018. (This can be fortheory and not for lab)
2. Samson T: Innovate with English, Foundations
3. Grant Taylor: English Conversation Practice, Tata McGraw-Hill Education India, 2016.

4. Jaya shree, M Let's Hear them speak: Developing Listening-Speaking skills in English.Sage Publications.

5. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012. (T h a t is for reading and writingand can be used in theory classes but not in Lab)
6. T.Bala Subramanyam, A Textbook of English Phonetics for Indian Students,(3rd Ed) Trinity Press. (Thisis all theory and can be for MA English students but not for B.Tech students)

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
12. https://www.linguahouse.com/en-GB
13. https://www.ted.com/watch/ted-ed

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/UCNfm92h83W2i2ijc5XwpIA

I Year – I Semester	**ENGINEERING WORKSHOP**	L	T	P	C
Course Code : (1003231110)	(Common to All branches of Engineering)	0	0	3	1.5

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, foundry and welding.
CO3: Apply fitting operations in various applications.
CO4: Apply basic electrical engineering knowledge for House Wiring Practice

SYLLABUS

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in wood working 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 metal working, Developments of following sheet metal job from GI sheets.
   a) Tapered tray   b) Conical funnel   c) Elbow pipe   d) Brazing
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) Parallel and 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 of Green 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.

Textbooks:

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.; AtulPrakashan, 2021-22.

I Year – I Semester	**IT WORKSHOP** (Common to All branches of Engineering)	L	T	P	C
Course Code : (1005231110)		0	0	2	1

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

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

Task 4: Every 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: Every 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 is

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 TeXand word – Accessing, overview of toolbars, saving files, Usinghelp 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.

AI TOOLS – Chat GPT

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 KenQuamme. – CISCO Press, Pearson Education, 3rd edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCOPress, Pearson Education, 3rd edition

I Year – I Semester	NSS/NCC/SCOUTS & GUIDES/COMMUN SERVICE	L	T	P	C
Course Code : (1000231120)	(Common to All branches of Engineering)	0	0	1	0.5

Course Objectives:
The objective of introducing this course is to impart discipline, character, fraternity, team work, 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 talents and skills
  ii) Conducting orientations programs for the students –future plans-activities- releasing road map 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) Organising 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- Survey in 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, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., ―Introduction to Environmental Engineering‖, McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. ―Introduction to Environmental Engineering 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, totaling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voice on the subject.

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I Year II Semester

SYLLABUS

I Year – II Semester	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS (Common to All Branches of Engineering)	L	T	P	C
Course Code: (1000231201)		3	0	0	3

Course Objectives:

- To enlighten the learners in the concept of differential equations and multivariable 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: At the end of the course, the student will be able to

- Solve the differential equations related to various engineering fields.
- Identify solution methods for partial differential equations that model physical processes.
- Interpret the physical meaning of different operators such as gradient, curl and divergence.
- 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   Higher order linear differential equations with Constant Coefficients

Definitions, homogenous and non-homogenous, complimentary function – particular integral ((x) $= e^{ax}$, $\sin ax$, $\cos a$, x^m), general solution, method of variation of parameters. Simultaneous linear equations.

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. Second order Homogeneous Linear Partial differential equations with constant coefficients.

UNIT   IV   Vector differentiation

Scalar and vector point functions, del operator, Gradient – unit normal vector, angle between surfaces, directional derivative, Divergence - Solenoidal vector and Curl– irrotational., scalar potential.

UNIT   V   Vector integration

Linear integral – circulation – work done, - flux, Green's theorem in the plane (withoutproof), Stoke's theorem (without proof), Divergence theorem (without proof) and problems on above theorems.

Text books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. B.S.Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

Reference Books:

1. Dennis G.Zilland Warren S.Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2018.
2. Michael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
5. B.V.Ramana, Higher Engineering Mathematics, McGraw Hill Education, 2017

I Year – II Semester	**Engineering Chemistry** (Common to Civil and Mechanical Engineering)	L	T	P	C
Course Code (1000231202)		3	0	0	3

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: At the end of the course, the students will be able to
CO1: Demonstrate the corrosion prevention methods and factors affecting corrosion.
CO2: Explain the preparation, properties, and applications of thermoplastics & thermosetting, elastomers & conducting polymers.
CO3: Explain calorific values, octane number, refining of petroleum and cracking of oils.
CO4: Explain the 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, Ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

UNIT- II

Electrochemistry and Applications
Electrodes –electrochemical cell, Nernst equation, 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.
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).

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, Octane and Cetane number- alternative fuels- propane, methanol, ethanol and bio fuel-bio diesel.

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- Portland cement, constituents, Setting and Hardening of cement.

UNIT- V

Surface Chemistry and Nanomaterials

Introduction to surface chemistry, colloids, nanometals and nanometal oxides, micelle formation, 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.

Textbooks:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.

2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

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. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition

I Year – II Semester	**INTRODUCTION TO PROGRAMMING**	**L**	**T**	**P**	**C**
Course Code : **(**1005231101)	**(Common to All branches of Engineering)**	**3**	**0**	**0**	**3**

Course Objectives:

The objectives of this course is to acquire knowledge on the
i. To impart adequate knowledge on the need of programming languages and problem-solving techniques and develop programming skills.
ii. To enable effective usage of Control Structures and Implement different operations on arrays.
iii. To demonstrate the use of Strings and Functions.
iv. To impart the knowledge of pointers and understand the principles of dynamic memory allocation.
v. To understand structures and unions and illustrate the file concepts and its operations.
vi. To impart the Knowledge Searching and Sorting Techniques

UNIT-I Introduction to Computer Problem Solving:
Programs and Algorithms, Computer Problem Solving Requirements, Phases of Problem Solving, Problem. Solving Strategies, Top-Down Approach, Algorithm Designing, Program Verification, Improving Efficiency, Algorithm Analysis and Notations.

UNIT-II Introduction to C Programming:
Introduction, Structure of a C Program. Comments, Keywords, Identifiers, Data Types, Variables, Constants, Input/output Statements. Operators, Type Conversion. Control Flow, Relational Expressions: Conditional Branching Statements: if, if-else, if-else— if, switch. Basic Loop Structures: while, do-while loops, for loop, nested loops, The Break and Continue Statements, go to statement.

UNIT-III Arrays:
Introduction, Operations on Arrays, Arrays as Function Arguments, Two Dimensional Arrays, Multidimensional Arrays. Pointers: Concept of a Pointer, Declaring and Initializing Pointer Variables, Pointer Expressions and Address Arithmetic, Null Pointers, Generic Pointers, Pointers as Function Arguments, Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation, Dangling Pointer, Command Line Arguments.

UNIT-IV Functions:
Introduction Function : Declaration, Function Definition, Function Call, Categories of Functions,Passing Parameters to Functions, Scope of Variables, Variable Storage Classes. Recursion. Strings: String Fundamentals, String Processing with and without Library Functions, Pointersand Strings.

UNIT-V
Structures, Unions, Bit Fields: Introduction, Nested Structures, Arrays of Structures, Structures

and Functions, Self-Referential Structures, Unions, Enumerated Data Type —Enum variables, Using Type def keyword, Bit Fields. Data Files: Introduction to Files, Using Files in C, Readingfrom Text Files, Writing to Text Files, Random File Access.

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

Course Outcomes:

At the end of the Course, Student should be able to:

i. Illustrate the Fundamental concepts of Computers and basics of computer programming and problem-solving approach

ii. Understand the Control Structures, branching and looping statements

iii. Use of Arrays and Pointers in solving complex problems.

iv. Develop Modular program aspects and Strings fundamentals.

v. Demonstrate the ideas of User Defined Data types, files. Solve real world problems using the concept of Structures, Unions and File operations.

Text Books:

1. A Structured Programming Approach Using C, Forouzan, Gilberg, Cengage.

2. How to solve it by Computer, R. G. Dromey, and Pearson Education.

3. Programming In C A-Practia1 Approach. Ajay Mittal, Pearson

References:
1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
2. Computer Programming. Reema Thareja, Oxford University Press
3. The C Programming Language, Dennis Richie And Brian Kernighan, Pearson Education.
4. Programming In C, Ashok Kamthane, Second Edition, Pearson Publication.
5. Let us C ,YaswanthKanetkar, 16th Edition,BPB Publication.
6.Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill
Education,2008
Web References:
1. http://www.c4learn.com/
2. http://www.geeksforgeeks.org/c/
3. http://nptel.ac.in/courses/122104019/
4. http://www.learn-c.org/
5. https://www.tutorialspoint.com/cprogramming/

I Year – II Semester	BASIC ELECTRICAL & ELECTRONICS ENGINEERING (Common to All branches of Engineering)	L	T	P	Credits
Course Code 1002231101		3	0	0	3

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

	Course Outcome
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   **(8 Hours)**
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, peak factor, 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   **(8 Hours)**
Machines: Construction, principle and operation of (i) DC Generator, (ii) Single Phase Transformer and (iii) Three Phase Induction Motor, 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: Electricity Bill & Safety Measures   **(8 Hours)**
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.

E-Resources:

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

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

- To teach the fundamentals of semiconductor devices and its applications, principles ofdigital electronics

UNIT I   SEMICONDUCTOR 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.

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. 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-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of BooleanAlgebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XORand XNOR. Simple combinational circuits–Half and Full Adders.

Textbooks:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, PearsonEducation, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. R. S. Sedha, A Textbook 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

I Year – II Semester	**ENGINEERING MECHANICS**	L	T	P	C
Course Code : (1003231201)	(Common to Civil and Mechanical Engineering)	3	0	0	3

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: Underset and 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, Analysis of plane trusses by using method of joints.

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.
Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Momentsof 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 and plane motion, Work Energy method and Impulse Momentum method.

Text books:
1. Engineering Mechanics, S. Timoshenko, D.H. Young, J.V. Rao, S. Pati, McGraw Hill Education 2017. 5th Edition.
2. Engineering Mechanics, P.C. Dumir- S. Sengupta and Srinivas V Veera valli, University press. 2020. First Edition.
3. A Text book of Engineering Mechanics, S. S Bhavikatti. New age international publications 2018. 4th Edition.

Reference Books:
1. Engineering Mechanics, Statics and Dynamics, Rogers and MA. Nelson., McGraw Hill Education. 2017. First Edition.
2. Engineering Mechanics, Statics and Dynamics ,I.H. Shames., PHI, 2002. 4thEdition.
3. Engineering Mechanics, Volume-I:Statics,Volume-II: Dynamics, J.L. Meriam and L. G. Kraige., John Wiley,2008.6thEdition.
4. Introduction to Statics and Dynamics, Basudev Battachatia, Oxford University Press,2014. Second Edition
5. Engineering Mechanics: Statics and Dynamics, Hibbeler R. C., Pearson Education, Inc., New Delhi, 2022, 14th Edition

I Year – II Semester	**Engineering Chemistry Laboratory** (Common to Civil and Mechanical Engineering)	L	T	P	C
Course Code (1000231210)		0	0	3	1.5

Course Objectives:
- To verify the fundamental concepts with experiments

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.
CO5: Calculate the hardness of water.

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

Reference:
- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar

I Year – II Semester	**COMPUTER PROGRAMMING LAB** (Common to All branches of Engineering)	L	T	P	C
Course Code (1005231111)		0	0	3	1.5

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 like pointers.
CO4: Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers 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.
   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

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

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, null- else, 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.

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.

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.

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

UNIT IV WEE K 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 alongwith the total.
   v)   Write a C program to implement realloc()

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
Lab 10 : 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.

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.

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 othercharacters 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-linearguments.
   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.

Textbooks:
   1. Ajay Mittal, Programming in C: A practical approach, Pearson.
   2. Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill
Reference Books:
   1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language,
      Prentice-Hall of India
   C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

IYear-II Semester	**ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP** (Common to All branches of Engineering)	**L**	**T**	**P**	**Credits**
Course Code: 1002231110		0	0	3	1.5

Course Objectives:
To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

Course Outcomes:

	Course Outcome
CO1	Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.
CO2	Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.
CO3	Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.
CO4	Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.
CO5	Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.

Activities:
1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, 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 hardware 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, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using 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

Reference Books:

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

Note: Minimum Six Experiments to be performed.

PART B: ELECTRONICS ENGINEERING LAB

Course Objectives:

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

Course Outcomes: At the end of the course, the student 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 electron devices.
CO4: Explain the operation of a digital circuit.

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. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gatesusing ICs.
6. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

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

References:

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

Note: All the experiments shall be implementedusing both Hardware and Software

IYear-II Semester	**ENGINEERING MECHANICS LAB** (Common to Civil and Mechanical Engineering)	L	T	P	Credits
Course Code(1003231210)		0	0	3	1.5

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

- Verify the Law of Parallel ogram and Triangle of Forces.
- Determine the coefficients of friction of Static and Rolling friction and Centre of gravity of different plane Lamina.
- Analyse the system of Pulleys and Moment of Inertia of Compound Pendulum and Fly wheel.

Course Outcomes:

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.

Students have to perform any 10 of the following

Experiments: List of Experiments:

1. Verification of Law of Parallel ogram 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 coplanarr non –con current, parallel force system with the help of a simply 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 centre of mass.
10. Determine the Moment of Inertia of a Fly wheel.
11. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever.

References:

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, 14thEdition, Pearson Education, Inc., New Delhi, 2022.

I Year – II Semester	HEALTH AND WELLNESS, YOGA AND SPORTS (Common to All branches of Engineering)	L	T	P	C
Course Code (1000231121)		0	0	1	0.5

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

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as manyas Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher 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, totaling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voIce on the subject.

Department Of Mechanical Engineering PROGRAM STRUCTURE

(Applicable from the academic year 2023-24 onwards)

II Year I Semester

S.No.	Course Code	Title	L	T	P	Credits
1	1000232101	Numerical and Statistical Methods	3	0	0	3
2	1099232101	Universal Human Values– Understanding Harmony & Ethical human conduct	2	1	0	3
3	1003232101	Material Science and Metallurgy	2	0	0	2
4	1003232102	Mechanics of Solids	3	0	0	3
5	1003232103	Thermodynamics	3	0	0	3
6	1003232110	Mechanics of Solids and Materials Science Lab	0	0	3	1.5
7	1003232111	Computer-aided Machine Drawing	0	0	3	1.5
8	1012232110	Python Programming Lab	0	0	2	1.0
9	1003232180	Embedded Systems and IoT	0	1	2	2
10	1003232104	Design Thinking & Innovation	1	0	2	2
		Total	**14**	**2**	**12**	**22**

II Year II Semester

S.No.	Course Code	Title	L	T	P	Credits
1	1099232204	Industrial Management	2	0	0	2
2	1000232201	Probability and Complex Variables	3	0	0	3
3	1003232201	Manufacturing Processes	3	0	0	3
4	1003232202	Fluid Mechanics & Hydraulic Machines	3	0	0	3
5	1003232203	Design of Machine Members	3	0	0	3
6	1003232210	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
7	1003232211	Manufacturing Processes Lab	0	0	3	1.5
8	1003232280	Soft Skills	0	1	2	2
9	1001232125	Environmental Science	2	0	0	0
		Total	**16**	**1**	**8**	**19**
		Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation				

NUMERICAL &S   NUMERICAL & STATISTICAL METHODS

After successful completion of this course, the students should be able to:
Apply numerical methods to solve algebraic and transcendental equations
Derive interpolating polynomials using interpolation formulae.
Solve differential and integral equations numerically.
To identify real life problems into Mathematical Models.
To apply the probability theory and testing of hypothesis in the field of civil engineering Applications.

Pre-requisite: Basic algebraic Equations, Probability, random variables (discrete and continuous) and probability distributions.

UNIT- I: Solution of Algebraic & Transcendental Equations
Introduction-Bisection Method-Iterative method, Regula-falsi method and Newton Raphson method.
Interpolation: Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae.

UNIT- II: Curve fitting:
Fitting of straight line, second-degree and Exponential curve by method of least squares.
Numerical Differentiation and Integration-Trapezoidal rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule

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: Estimation and Testing of hypothesis, large sample tests
Estimation-parameters, statistics, sampling distribution, point estimation, 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

UNIT- V: Small sample tests
Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), χ^2 - test for goodness of fit, χ^2 - test for independence of attributes.

Textbooks:

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
3. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.India.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2018, 10th Edition.
2. R.K.Jainand S.R.K.Iyengar, Advanced Engineering Mathematics, Alpha Science International Publishers.

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UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT

Course Objectives:

- 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.

- 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.

- 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:

- Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)

- Identify one's self, and one's surroundings (family, society nature) (L1, L2)

- Apply what they have learnt to their own self in different day-to-day settings in real life (L3)

- Relate human values with human relationship and human society. (L4)

- Justify the need for universal human values and harmonious existence (L5)

- Develop as socially and ecologically responsible engineers (L3, L6)

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I

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

Lecture 1: 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: 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

Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)

Lecture 23: Natural Acceptance of Human Values

Lecture 24: Definitiveness of (Ethical) Human Conduct

Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct

Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order

Lecture 26: Competence in Professional Ethics

Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education

Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies

Lecture 28: Strategies for Transition towards Value-based Life and Profession

Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for

UNIT I – Introduction to Value Education

PS1 Sharing about Oneself

PS2 Exploring Human Consciousness

PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being

PS4 Exploring the difference of Needs of self and body

PS5 Exploring Sources of Imagination in the self

PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society

PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)

PS10 Exploring the Four Orders of Nature

PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

Readings:

Textbook and Teachers Manual

a. The Textbook

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: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book).

4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

5. Small is Beautiful - E. F Schumacher.

6. Slow is Beautiful - Cecile Andrews

7. Economy of Permanence - J C Kumarappa

8. Bharat Mein Angreji Raj – Pandit Sunderlal

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)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content.

Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources:

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf

2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf

3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf

4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%202023.pdf

5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf

6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf

7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%202023-25%20Ethics%20v1.pdf

8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385

9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

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THERMODYNAMICS

Course Objectives

- Familiarize concepts of heat, work, energy and governing rules for conversion of one form to other.

- Explain relationships between properties of matter and basic laws of thermodynamics.

- Teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process.

- Introduce the concept of available energy for maximum work conversion.

- Provide fundamental concepts of Refrigeration and Psychrometry.

Unit - I

Introduction: Basic Concepts: 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

Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroeth 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, 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, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

Unit - IV

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.

Unit – V

Introduction to Refrigeration: working of Air, Vapour compression, VCR system Components, COP Refrigerants.

Introduction to Air Conditioning: Psychrometric properties & processes – characterization of sensible and latent heat loads – load concepts of SHF.

Requirements of human comfort and concept of effective temperature- comfort chart – comfort air conditioning, and load calculations.

Text Books:
1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7/e, Wiley, 2009.

Reference Books

1. J.B. Jones, and R.E. Dugan, Engineering Thermodynamics, 1/e, Prentice Hall, 1995.
2. Y.A.Cengel & M.A.Boles ,Thermodynamics – An Engineering Approach, 7/e, McGraw Hill, 2010.
3. P.Chattopadhyay, Engineering Thermodynamics, 1/e, Oxford University Press, 2011.
4. CP Arora, Refrigeration and Air-conditioning, 4/e, McGraw Hill, 2021.

Online 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

Course Outcomes:

- Explain the importance of thermodynamic properties related to conversion of heat energy into work.
- Apply the Zeroeth and First Law of Thermodynamics.
- Understand Second Law of Thermodynamics.
- Analyze the Mollier charts, T-S and h-s diagrams, Steam calorimetry, Phase Transformations.
- Evaluate the COP of refrigerating systems and properties, processes of psychrometry and sensible and latent heat loads.

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MECHANICS OF SOLIDS

Course Objectives:

The objectives of the course are to

- Understand the behaviour of basic structural members subjected to uni axial and bi axial loads.
- Apply the concept of stress and strain to analyse and design structural members and machine parts under axial, shear and bending loads, moment and torsional moment.
- Students will learn all the methods to analyse 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 analyse beams and draw correct and complete shear and bending moment diagrams for beams.
- Students attain a deeper understanding of the loads, stresses, and strains acting on a structure and their relations in the elastic behavior
- Design and analysis of Industrial components like pressure vessels.

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 elasticconstants, 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 diameter, 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 Publications, 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
- https://www.coursera.org/learn/mechanics-1
- https://www.edx.org/learn/engineering/massachusetts-institute-of-technology-mechanical-behavior-of-materials-part-1-linear-elastic-behavior
- https://archive.nptel.ac.in/courses/112/107/112107146/

Course Outcomes:
- 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.
- Analyse beams and draw correct and complete shear and bending moment diagrams for beams.
- Apply the concept of stress and strain to analyze and design structural members and machine parts under axial, shear and bending loads, and moments.
- Model & Analyse the behavior of basic structural members subjected to various loads.
- Design and analysis of Industrial components like pressure vessels.

MATERIAL SCIENCE & METALLURGY

Course Objective:
- Understand the crystalline structure of different metals and study the stability of phases in different alloy systems.
- Study the behavior of ferrous and non ferrous metals and alloys and their application in different domains
- Able to understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals.
- Grasp the methods of making of metal powders and applications of powder metallurgy
- 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, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of binary phase diagrams such as Cu-Ni and Fe-Fe$_3$C.

UNIT–II
Ferrous metals and alloys: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal 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$_3$C system, annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface - hardening methods, age hardening treatment, Cryogenic treatment.

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.
3. William D. Callister Jr, Materials Science and Engineering: An Introduction, 8/e, John Wiley and Sons, 2009.
4. George E. Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.
5. Yip-Wah Chung, Introduction to Material Science and Engineering, 2/e, CRC Press, 2022.
6. A V K Suryanarayana, Material Science and Metallurgy, B S Publications, 2014.
7. U. C. Jindal, Material Science and Metallurgy, 1/e, Pearson Publications, 2011.

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.

Course Outcomes:
- Understand the crystalline structure of different metals and study the stability of phases in different alloy systems
- Study the behavior of ferrous and non-ferrous metals and alloys and their application in different domains
- Understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals
- Grasp the methods of making of metal powders and applications of powder metallurgy
- Comprehend the properties and applications of ceramic, composites and other advanced methods

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MECHANICS OF SOLIDS & MATERIAL SCIENCE LAB

Course Objective:

- Evaluate the values of yield stress, ultimate stress and bending stress of the given specimen under tension test and bending test
- Conduct the torsion test to determine the modulus of rigidity of given specimen.
- Justify the Rockwell hardness test over with Brinell hardness and measure the hardness of the given specimen.
- Examine the stiffness of the open coil and closed coil spring and grade them.
- Analyze the microstructure and characteristics of ferrous and non ferrous alloy specimens.

NOTE: Any 6 experiments from each section A and B.

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 Jominy End Quench Test.

Virtual lab:

1. To investigate the principal stresses σ_a and σ_b 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).

Course Outcomes:

- Understand the stress strain behavior of different materials.
- Evaluate the hardness of different materials.
- Explain the relation between elastic constants and hardness of materials.
- Identify various microstructures of steels and cast irons.
- Evaluate hardness of treated and untreated steels.

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COMPUTER-AIDED MACHINE DRAWING

Course Objectives

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

1. The following are to be done by any 2D software package:

a. Conventional representation of materials and components

b. 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.

c. Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, doubleriveted double strap joints.

d. Welded joints: Lap joint and T joint with fillet, butt joint with conventions.

e. Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.

f. Couplings: rigid – Muff and flange couplings.

2. The following exercises are to be done by any 3D software package:

Assembly drawings: (Any two of the following using solid model software)

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, universal coupling.

Production drawing:

Representation of limits, fits and tolerances for mating parts. Use two parts of any one 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.

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 Outcomes:

- Demonstrate the conventional representations of materials and machine components.
- Model riveted, welded and key joints using CAD system.
- Create solid models and sectional views of machine components
- Generate solid models of machine parts and assemble them.
- Translate 3D assemblies into 2D drawings.

****

PYTHON PROGRAMMING LAB

Course Objective: To understand the PYTHON environment and make numerical computations and analysis.

Write Programs in PYTHON Programming for the following:

1. To find the roots of non-linear equation using Newton Raphson's method.
2. Curve fitting by least – square approximations
3. To solve the system of linear equations using Gauss - elimination method
4. To solve the system of linear equations using Gauss - Siedal method
5. To solve the system of linear equations using Gauss - Jordan method
6. To integrate numerically using Trapezoidal rule
7. To integrate numerically using Simpsons rule
8. To find the largest eigen value of a matrix by Power – method
9. To find numerical solution of ordinary differential equations by Euler's method
10. To find numerical solution of ordinary differential equations by Runge-Kutta method
11. To find numerical solution of ordinary differential equations by Milne's method
12. To find the numerical solution of Laplace equation
13. To find the numerical solution of Wave equation
14. To find the solution of a tri-diagonal matrix using Thomas algorithm
15. To fit a straight using least square technique

Online Learning Sources

- https://www.udemy.com/course/python-the-complete-python-developer-course/?matchtype=e&msclkid=0584dfb54dc715f39c0bb9aaf74033be&utm_campaign=BG-Python_v.PROF_la.EN_cc.INDIA_ti.7380&utm_content=deal4584&utm_medium=udemyads&utm_source=bing&utm_term=_._ag_1220458320107116_._ad_._kw_Python+language_._de_c_._dm_._pl_._ti_kwd-76278984197882%3Aloc-90_._li_116074_._pd_._&couponCode=IND21PM
- https://www.w3schools.com/python/python_intro.asp
- https://www.youtube.com/watch?v=eWRfhZUzrAc
- https://onlinecourses.nptel.ac.in/noc20_cs83/preview
- https://www.edx.org/learn/python
- Virtual Labs - https://python-iitk.vlabs.ac.in/
- Virtual Labs - https://virtual-labs.github.io/exp-arithmetic-operations-iitk/
- Virtual Labs - https://cse02-iiith.vlabs.ac.in/
- https://mlritm.ac.in/assets/cse/cse_lab_manuals/R20_cse_manuals/Python%20Lab%20Manual.pdf

Course Outcomes:

- Solve the different methods for linear, non-linear and differential equations

- Learn the PYTHON Programming language

- Familiar with the strings and matrices in PYTHON

- Write the Program scripts and functions in PYTHON to solve the methods

- Evaluate different methods of numerical solutions

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EMBEDDED SYSTEMS & IoT

Course Objectives:

- To comprehend Microcontroller-Transducers Interface techniques
- To establish Serial Communication link with Arduino
- To analyse basics of SPI interface.
- To interface Stepper Motor with Arduino
- To analyse Accelerometer interface techniques
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of distance sensor on IoT devices.

Embedded Systems Experiments: (Any 5 experiments from the following)

1. Measure Analog signal from Temperature Sensor.
2. Generate PWM output.
3. Drive single character generation on Hyper Terminal.
4. Drive a given string on Hyper Terminal.
5. Full duplex Link establishment using Hyper terminal.
6. Drive a given value on a 8 bit DAC consisting of SPI.
7. Drive Stepper motor using Analog GPIOs.
8. Drive Accelerometer and Display the readings on Hyper Terminal.

COMPONENTS/ BOARDS: 1. Arduino Duemilanove Board 2. Arduino Software IDE.

Text Books:

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu. K.V-Tata McGraw Hill Education Private Limited, 2013.
3. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
4. Embedded Systems-Lyla B.Das-Pearson Publications, 2013.

Internet of Things Experiments: (Any 5 experiments from the following)

1. Getting started with Raspberry Pi, Install Raspian on your SD card.
2. Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace
3. and debug Python code on the device.
4. Using Raspberry pi a. Calculate the distance using distance sensor. b. Basic LED functionality.
5. Raspberry Pi interacts with online services through the use of public APIs and SDKs.
6. Study and Install IDE of Arduino and different types of Arduino.
7. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
8. Calculate the distance using distance sensor Using Arduino.

9. Basic LED functionality Using Arduino.

10. Calculate temperature using temperature sensor Using Arduino.

11. Calculate the distance using distance sensor Using Node MCU.

12. Basic LED functionality Using Node MCU.

Text Books:

1. Arsheep Bahga & Vijay Madisetti, Internet of Things - A Hands-on Approach, 1/e, Orient Blackswan Private Limited - New Delhi, 2015.

2. Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.

3. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014.

Online Learning Sources

1. https://onlinecourses.nptel.ac.in/noc21_cs17/preview
2. https://onlinecourses.nptel.ac.in/noc20_ee98/preview
3. https://archive.nptel.ac.in/courses/108/105/108105057/
4. https://www.edx.org/learn/embedded-systems/the-university-of-texas-at-austin-embedded-systems-shape-the-world-microcontroller-input-output?index=product&objectID=course-785cf551-7f66-4350-b736-64a93427b4db&webview=false&campaign=Embedded+Systems+-+Shape+The+World%3A+Microcontroller+Input%2FOutput&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fembedded-systems
5. https://www.edx.org/learn/iot-internet-of-things/universitat-politecnica-de-valencia-introduction-to-the-internet-of-things?index=product&queryID=e1322674dcb3d246be981d0669265399&position=4&linked_from=autocomplete&c=autocomplete
6. https://www.edx.org/learn/iot-internet-of-things/curtin-university-iot-sensors-and-devices?index=product&queryID=94ff5bcb80b8e4f427a0985bb2a5e07f&position=3&results_level=first-level-results&term=IOT&objectID=course-967eee29-87e8-4f2d-9257-a1b38ec07e85&campaign=IoT+Sensors+and+Devices&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch
7. Virtual Labs - http://vlabs.iitkgp.ac.in/rtes/
8. Virtual Labs - https://cse02-iiith.vlabs.ac.in/
9. Virtual Labs - https://iotvirtuallab.github.io/vlab/Experiments/index.html

Course Outcomes:

- Comprehend Microcontroller-Transducers Interface techniques
- Establish Serial Communication link with Arduino
- Analyse basics of SPI interface
- Understand the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor
- Realize the revolution of internet in mobile devices, cloud and sensor networks

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DESIGN THINKING & INNOVATION

Course Objectives:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes:

- Define the concepts related to design thinking. (L1, L2)

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

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

- Analyse to work in a multidisciplinary environment (L4)

- Evaluate the value of creativity (L5)

- Formulate specific problem statements of real time issues (L3, L6)

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

Art of innovation, 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 modelling, 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 for Strategic Innovation, 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

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Department Of Mechanical Engineering

PROGRAM STRUCTURE

(Applicable from the academic year 2023-24 onwards)

II Year II Semester

S. No	Course Code	Name of the Course	L	T	P	Credits
1	1099232204	Industrial Management	2	0	0	2
2	1000232201	Probability and Complex Variables	3	0	0	3
3	1003232201	Manufacturing Processes	3	0	0	3
4	1003232202	Fluid Mechanics and Hydraulic Machines	3	0	0	3
5	1003232203	Design of Machine Members	3	0	0	3
6	1003232210	Fluid Mechanics and Hydraulic Machines Lab	0	0	3	1.5
7	1003232211	Manufacturing Processes Lab	0	0	3	1.5
8	1000232280	Soft Skills	0	1	2	2
9	1001232125	Environmental Science	2	0	0	0
		Total	**16**	**1**	**8**	**19**
	Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation					

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II Year – II Semester	INDUSTRIAL MANAGEMENT	L	T	P	C
1099232204		3	0	0	3

Course Objectives:

The objectives of the course are to
- Introduce the scope and role of industrial engineering and the techniques for optimal design of layouts
- Illustrate how work study is used to improve productivity
- Explain TQM and quality control techniques
- Introduce financial management aspects and
- Discuss human resource management and value analysis.

UNIT– I
Introduction: Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, differences between production management and industrial engineering, quantitative tools of IE and productivity measurement. concepts of management, importance, functions of management, scientific management, Taylor's principles, theory X and theory Y, Fayol's principles of management.
Plant Layout: Factors governing plant location, types of production layouts, advantages and disadvantages of process layout and product layout, applications, quantitative techniques for optimal design of layouts, plant maintenance, preventive and breakdown maintenance.

UNIT–II
Work Study: Importance, types of production, applications, work study, method study and time study, work sampling, PMTS, micro-motion study, rating techniques, MTM, work factor system, principles of Ergonomics, flow process charts, string diagrams and Therbligs.

UNIT–III
Statistical Quality Control: Quality control, Queuing assurance and its importance, SQC, attribute sampling inspection with single and double sampling, Control charts – $\bar{X}$ and R – charts $\bar{X}$ and S charts and their applications, numerical examples.
Total Quality Management: zero defect concept, quality circles, implementation, applications, ISO quality systems. Six Sigma–definition, basic concepts

UNIT– IV
Financial Management: Scope and nature of financial management, Sources of finance, Ratio analysis, Management of working capital, estimation of working capital requirements, stock management, Cost accounting and control, budget and budgetary control, Capital budgeting – Nature of Investment Decisions – Investment Evaluation criteria- NPV, IRR, PI, Payback Period, and ARR, numerical problems.

UNIT–V

Human Resource Management: Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job-evaluation, its importance and types, merit rating, quantitative methods, wage incentive plans, and types.

Project Management: PERT, CPM–differences and applications. Determination of critical path and its importance, numerical examples.

Value Analysis: Value engineering, implementation procedure, enterprise resource planning and supply chain management.

Text Books:
1. O.P Khanna, Industrial Engineering and Management, Dhanpat Rai Publications (P) Ltd, 2018.
2. Mart and Telsang, Industrial Engineering and Production Management, S. Chand &Company Ltd. New Delhi, 2006.

Reference Books:
1. Bhattacharya DK, Industrial Management, S. Chand, publishers, 2010.
2. J.G Monks, Operations Management, 3/e, McGraw Hill Publishers1987.
3. T.R. Banga, S.C. Sharma, N. K. Agarwal, Industrial Engineering and ManagementScience, Khanna Publishers, 2008.
4. Koontz O'Donnell, Principles of Management, 4/e, McGraw Hill Publishers, 1968.
5. R.C. Gupta, Statistical Quality Control, Khanna Publishers, 1998.
6. NVS Raju, Industrial Engineering and Management, 1/e, Cengage India Private Limited, 2013.

Online Learning Sources

- https://onlinecourses.nptel.ac.in/noc21_me15/preview
- https://onlinecourses.nptel.ac.in/noc20_mg43/preview
- https://www.edx.org/learn/industrial-engineering
- https://youtube.com/playlist?list=PL299B5CC87110A6E7&si=TghLCbEobuxjEaXi
- https://youtube.com/playlist?list=PLbjTnj-t5Gkl0z3OHOGK5RB9mvNYvnImW&si=oaX_5RG69hS3v2ll

Course Outcomes:

- Learn about how to design the optimal layout.
- Demonstrate work study methods.
- Explain Quality Control techniques.
- Discuss the financial management aspects and,
- Understand the human resource management methods.

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II Year – II Semester	PROBABILITY AND COMPLEX VARIABLES	L	T	P	C
1000232201		3	0	0	3

Course Outcomes:

After successful completion of this course, the students should be able to:
- acquire knowledge in finding the analysis of the data quantitatively or categorically and various statistical elementary tools.
- develop skills in designing mathematical models involving probability, random variables and the critical thinking in the theory of probability and its applications in real life problems.
- apply the theoretical probability distributions like binomial, Poisson, and Normal in the relevant application areas.
- analyze limit, continuity and differentiation of functions of complex variables and Understand Cauchy-Riemann equations, analytic functions and various properties of analytic functions
- understand Cauchy theorem, Cauchy integral formulas and apply these to evaluate complex contour integrals. Classify singularities and poles; find residues and evaluate complex integrals using the residue theorem.

UNIT- I: Descriptive statistics
Statistics Introduction, Population vs Sample, Collection of data, primary and secondary data, Measures of Central tendency, Measures of Variability (spread or variance) Skewness, Kurtosis, correlation, correlation coefficient, rank correlation, regression coefficients, regression lines.

UNIT –II: Probability
Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

UNIT - III: Probability distributions
Probability distributions: Binomial, Poisson and Normal-their properties (Chebyshevs inequality). Approximation of the binomial distribution to normal distribution.

UNITI-IV: Complex Variable – 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.

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UNIT- V: Complex Variable – Integration

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

Textbooks:

1. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

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II Year – II Semester	**MANUFACTURING PROCESSES**	L	T	P	C
1003232201		3	0	0	3

Course Objective: The objectives of the course are to

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

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

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

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

- Know about the Additive manufacturing.

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.
Heat affected zones in welding; pre & post heating, 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, VAT photopolymerization AM Processes, Extrusion - Based AM Processes, Powder Bed Fusion AM Processes, Direct Energy Deposition AM Processes, Post Processing of AM Parts, Applications

Textbooks:
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.
8. Ian Gibson, David W Rosen, Brent Stucker., Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, 2/e, Springer, 2015.

Online 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/
- https://elearn.nptel.ac.in/shop/nptel/principles-of-metal-forming-technology/?v=c86ee0d9d7ed

Course Outcomes:

- Design the patterns and core boxes for metal casting processes.
- Understand the different welding processes.
- Demonstrate the different types of bulk forming processes.
- Understand sheet metal forming processes.
- Learn about the different types of additive manufacturing processes.

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(Approved by AICTE-New Delhi & Affiliated to JNTUGV, Vizianagaram)
Beside VSEZ, Duvvada, Vadlapudi Post, Gajuwaka, Visakhapatnam - 530 049.

II Year – II Semester	FLUID MECHANICS AND HYDRAULIC MACHINES	L	T	P	C
1003232202		3	0	0	3

Course Objectives:

The students completing this course are expected to

- Understand the properties of fluids, manometry, hydrostatic forces acting on differentsurfaces

- Understand the kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations, energy and momentum equations.

- Understand the theory of boundary layer, working and performance characteristics of various hydraulic machines like pumps 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.
Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies. Calculation of metacenter height. Stability analysis and applications.

UNIT II
Fluid kinematics: Introduction, flow types. Equation of continuity for one dimensional flow, circulation 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, flownet, source and sink, doublet 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.
Dimensional Analysis: Dimensions and Units, Dimensional Homogeneity, Non dimensionalization of equations, Method of repeating variables and Buckingham Pi Theorem.

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 – draft tube- 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.

Text Books:
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.

Reference Books:

1. P N Modi and S M Seth, Hydraulics & Fluid Mechanics including Hydraulics Machines, Standard Book House, 2017.
2. RK 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. Rama Durgaiah, Fluid Mechanics and Machinery, 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

Course Outcomes:

- Understand the basic concepts of fluid properties.
- Estimate the mechanics of fluids in static and dynamic conditions.
- Apply the Boundary layer theory, flow separation and dimensional analysis.
- Estimate the hydrodynamic forces of jet on vanes in different positions.
- Understand the working Principles and performance evaluation of hydraulic pump and turbines.

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II Year – II Semester	**DESIGN OF MACHINE MEMBERS**	L	T	P	C
1003232203		**3**	**0**	**0**	**3**

Course Objectives:

- Provide an introduction to design of machine elements.
- Familiarize with fundamental approaches to failure prevention for static and dynamic loading.
- Explain design procedures to different types of joints.
- Teach principles of clutches and brakes and design procedures.
- Instruct different types of bearings and design procedures.

UNIT I: Introduction, Design for Static and Dynamic loads

Mechanical Engineering Design: Design process, design considerations, codes and standards of designation of materials, selection of materials.

Design for Static Loads: Modes of failure, design of components subjected to axial, bending, torsional and impact loads. Theories of failure for static loads.

Design for Dynamic Loads: Endurance limit, fatigue strength under axial, bending and torsion, stress concentration, notch sensitivity. Types of fluctuating loads, fatigue design for infinite life. Soderberg, Goodman criterion for fatigue failure.

UNIT II: Design of Bolted and Welded Joints

Design of Bolted Joints: Threaded fasteners, preload of bolts, various stresses induced in the bolts. Eccentrically loaded bolted joints.

Welded Joints: Strength of lap and butt welds, Joints subjected to bending and torsion. Eccentrically loaded welded joints.

UNIT III: Power transmission Shafts and Couplings

Power Transmission Shafts: Design of shafts subjected to bending, torsion and axial loading. Shafts subjected to fluctuating loads using shock factors.

Couplings: Design of flange and bushed pin couplings, universal coupling.

UNIT IV: Design of Clutches, Brakes and Springs

Friction Clutches: Torque transmitting capacity of disc and centrifugal clutches. Uniform wear theory and uniform pressure theory.

Brakes: Different types of brakes. Concept of self-energizing and self-locking of brake. Band and block brakes, disc brakes.

Springs: Design of helical compression, tension, torsion and leaf springs.

UNIT V Design of Bearings and Gears

Design of Sliding Contact Bearings: Lubrication modes, bearing modulus, McKee's equations, design of journal bearing. Bearing Failures.

Design of Rolling Contact Bearings: Static and dynamic load capacity, Stribeck's Equation, equivalent bearing load, load-life relationships, load factor, selection of bearings from manufacturer's catalogue.

Design of Spur Gears: Spur gears, beam strength, Lewi's equation, design for dynamic and wear loads.

Data Books:

The following data books must be permitted for the examination.

1. Design Data book PSG College of Technology, Coimbatore.
2. K. Mahadevan and K. Balaveera Reddy, Design data handbook, CBS Publications, 4/e, 2018.

Textbooks:

1. V.B. Bhandari, Design of Machine Elements, 3/e, Tata McGraw Hill, 2010.
2. R.S. Khurmi and J.K. Gupta, Machine Design, Eurasia Publishing Ltd., 2005.

Reference Books:

1. R.K. Jain, Machine Design, Khanna Publications, 1978.
2. J.E. Shigley, Mechanical Engineering Design, 2/e, Tata McGraw Hill, 1986.
3. M.F.Spotts and T.E. Shoup, Design of Machine Elements, Prentice Hall 2013.
4. N.C. Pandya and C.S. Shah, Machine design, Charotar Publishing Ltd, 2009.
5. R.L.Norton, Machine Design an Integrated approach, Pearson Education,2004.

Online 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

Course Outcomes:

- Estimate safety factors of machine members subjected to static and dynamic loads.
- Design the fasteners subjected to variety of loads.
- Select of standard machine elements such as keys, shafts, couplings, springs and bearings
- Design of clutches, brakes and springs.
- Design of bearing and gears.

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II Year – II Semester	FLUID MECHANICS AND HYDRAULIC MACHINERY LAB	L	T	P	C
1003232210		3	0	0	3

Course Objective:

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

List of Experiments

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipeline.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Turbine flowmeter.

Virtual Lab:

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).

Course Outcomes:

- Demonstrate the devices used for measuring flow.
- Compute major losses in pipes.
- Illustrate the operating parameters of turbines
- Explain the working of different types of pumps.
- Explain the devices used for measuring flow.

II Year – II Semester	**MANUFACTURING PROCESSES LAB**	L	T	P	C
1003232211		**3**	**0**	**0**	**3**

Course Objective:

Acquire practical knowledge on Metal Casting, Welding, Press Working and Processing of Plastics.

List of Experiments

1. Design and making of pattern
   A. Single piece pattern
   B. Split pattern
2. Sand properties testing
   A. Sieve analysis (dry sand)
   B. Clay content test
   C. Moisture content test
   D. Strength test (Compression test & Shear test)
   E. Permeability test
3. Mould preparation
   A. Straight pipe
   B. Bent pipe
   C. Dumble
   D. Gear blank
4. Gas cutting and welding
5. Manual metal arc welding
   A. Lap joint
   B. Butt joint
   6. Injection Molding
   7. Blow Molding
   8. Simple models using sheet metal operations
   9. Study of deep drawing and extrusion operations
   10.To make weldments using TIG/MIG welding
   11.To weld using Spot welding machine
   12.To join using Brazing and Soldering
   13. To make simple parts on a 3D printing machine
   14. Demonstration of metal casting.

Virtual Lab:

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

Course Outcomes:

- Make moulds for sand casting.
- Fabricate different types of components using various manufacturing techniques.
- Adapt unconventional manufacturing methods.
- Develop Different Weld joints.
- Explain different types of 3D Printing techniques.

II Year – II Semester	**SOFT SKILLS**	L	T	P	C
1000232280		**3**	**0**	**0**	**3**

Course Objectives:

- To prepare to face global competition for employment and excellence in profession.
- To help the students understand and build interpersonal and interpersonal skills that will enable them to lead meaningful professional life.

UNIT – 1:
Introduction

Introduction- Emergence of life skills, Definition & Meaning, Importance& need, reasons for skill gap, Analysis--Soft Skills vs Hard skills, Linkage between industry and soft skills, Challenges, Personality Developments. Soft Skills, Soft Skills vs English - Improving Techniques.

UNIT – II:
Intra-Personal:

Definition-Meaning – Importance - SWOT analysis, Johari windows - Goal Setting- quotient skills - Emotional Intelligence - Attitudinal skills - Right thinking- Problem Solving - Time management, stress management.

UNIT – III:
Inter-Personal:

Definition – Meaning – Importance - Communications skills - Team Work, managerial skills - Negotiation skills - Leadership skills, corporate etiquettes.

UNIT – IV:
Verbal Skills:

Definition and Meaning - Listening skills, need - types, advantages, Importance - Improving Tips for Listening, Speaking, need - types, advantages, Importance - Improving Tips, Reading - Writing Skills, Report, Resume, statement of purpose, need - types, advantages, Importance - Improving Tips .

UNIT – V:
Non-Verbal Skills & Interview skills

Definition and Meaning – Importance - Facial Expressions - Eye Contact – Proxemics - Haptics - Posture, cross cultural body language, body languagein interview room, appearance and dress code – Kinetics - Para Language - tone, pitch, pause, neutralization of accent, use of appropriate language, Interview skills, interview methods and questions.

Text Books:

1) Sherfield, M. Robert at al, Cornerstone Developing Soft Skills, 4/e, Pearson Publication, New Delhi, 2014.
2) Alka Wadkar, Life Skills for Success, 1/e, Sage Publications India Private Limited, 2016.

Reference Books:

1. Sambaiah. M. Technical English, Wiley publishers India. New Delhi. 2014.
2. Gangadhar Joshi, From Campus to Corporate, SAGE TEXT.
3. Alex. K, Soft Skills, 3rd ed. S. Chand Publication, New Delhi, 2014.
4. Meenakshi Raman and Sangita Sharma, Technical Communication: Principle and Practice, Oxford University Press, 2009.
5. Shalini Varma, Body Language for Your Success Mantra, 4/e, S. Chand Publication, New Delhi, 2014.
6. Stephen Covey, Seven Habits of Highly Effective People, JMD Book, 2013.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc20_hs60/preview
- http://www.youtube.com/@softskillsdevelopment6210
- https://youtube.com/playlist?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q&si=Fs05Xh8ZrOPsR8F4
- https://www.coursera.org/learn/people-soft-skills-assessment?language=English
- https://www.edx.org/learn/soft-skills

Course Outcomes:

- Assimilate and understood the meaning and importance of soft skills and learn how to develop them.
- Understand the significance of soft skills in the working environment for professional excellence.
- Prepare to undergo the placement process with confidence and clarity.
- Ready to face any situation in life and equip themselves to handle them effectively.
- Understand and learn the importance of etiquette in both professional and personal life.

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II Year – II Semester	**ENVIRONMENTAL SCIENCE**	L	T	P	C
1001232125		3	0	0	3

Course Objectives:

- To make the students to get awareness on environment.

- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life

- To save earth from the inventions by the engineers.

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, water logging, salinity, case studies. – Energy resources:

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)

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.

UNIT III

Environmental Pollution: Definition, Cause, effects and control measures of:

        a. Air Pollution.
        b. Water pollution
        c. Soil pollution
        d. Marine pollution
        e. Noise pollution
        f. Thermal pollution
        g. Nuclear hazards

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

UNIT IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT V

Human Population and the Environment: 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.

Textbooks:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.

2. Palaniswamy, "Environmental Studies", Pearson education

3. S.Azeem Unnisa, "Environmental Studies" Academic Publishing Company

4. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt. Ltd.

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References:

1. Deeksha Dave and E. Sai Baba Reddy, "Textbook of Environmental Science", Cengage Publications.

2. M. Anji Reddy, "Text book of Environmental Sciences and Technology", BS Publication.

3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications.

4. J. Glynn Henry and Gary W. Heinke, "Environmental Sciences and Engineering", Prentice Hall of India Private limited

5. G.R. Chatwal, "A Text Book of Environmental Studies" Himalaya Publishing House

6. Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science, Prentice Hall of India Private limited.

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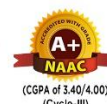
DEPARTMENT OF MECHANICAL ENGINEERING

B.TECH. ME –PROGRAM STRUCTURE–VR23

B.Tech. III Year I Semester

S.No	Course Code	Category	Course Title	L	T	P	Credits
1	1003233101	PC	Machine Tools and Metrology	3	0	0	3
2	1003233102	PC	Thermal Engineering	3	0	0	3
3	1003233103	PC	Theory of Machines	3	1	0	3
			Professional Elective – I				
4	1003233130	PE-1	1. Instrumentation & Control Systems	3	0	0	3
	1003233131		2. Nano Technology				
	1003233132		3. Design for Manufacturing				
	1003233133		4. Thermal Management of Electronic Systems				
	1003233134		5. Joining Processes				
			Open Elective – I				
5	1002233153	OE-1	1. Sustainable Energy Technologies	3	0	0	3
	1002233154		2. Industrial Safety				
6	1003233110	PC Lab-1	Thermal Engineering Lab	0	0	3	1.5
7	1003233111	PC Lab-2	Theory of Machines Lab	0	0	3	1.5
8	1003233180	SEC	1. Machine Tools & Metrology Lab	0	0	4	2
	1003233181		2. Mechatronics Lab				
9	1003233112	ES	Computational Fluid Dynamics Lab	0	0	2	1
10	1003233170	Internship Evaluation	Community Service Internship (II-II Summer Vacation – 8 Weeks)	-	-	-	2
			Total	15	1	12	23
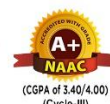
DEPARTMENT OF MECHANICAL ENGINEERING

III Year I Semester	MACHINE TOOLS AND METROLOGY	L	T	P	C
1003233101	(Professional Core)	3	0	0	3

Course Objectives:

The students will acquire the knowledge

- To interpret the fundamental principles in material removal processes.

- To apply the fundamentals and principles of metal cutting to machining process using lathes, milling machines, grinding machines, drill presses, Computer Numerical Control machines etc

- To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.

- To develop knowledge and importance of metal cutting parameters and demonstrate the fundamentals of machining processes and machine tools.

- To analyze the concepts of finishing processes and the system of limits and fits.

- To illustrate the concepts of surface roughness and optical measuring instruments

UNIT-1

FUNDAMENTALS OF MACHINING: Elementary treatment of metal cutting theory – element of cutting process – Single point cutting tools, nomenclature of single point cutting tool, tool signature, tool angles, mechanism of metal cutting, types of chips and chip formation – built up edge and its effects, chip breakers, mechanics of orthogonal and oblique cutting – Merchant's force diagram, cutting forces, velocity ratio, cutting speeds, feed, depth of cut, tool life, Taylor's tool life equation, simple problems – Tool wear, tool wear mechanisms, heat generation in metal cutting, coolants, machinability, tool materials and properties.

UNIT-2

LATHE MACHINES: Introduction- types of lathe – Engine lathe – principle of working – construction – specification of lathe – work holders and tool holders – accessories and attachments – lathe operations – taper turning methods and thread cutting – drilling on lathes – cutting speed and feed-depth of cut.

SHAPING, SLOTTING AND PLANNING MACHINES: Introduction – principle of working – main parts – specifications – operations performed – slider crank mechanism – machining time calculations.
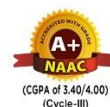
DEPARTMENT OF MECHANICAL ENGINEERING

UNIT-3

DRILLING & BORING MACHINES: Introduction – construction of drilling machines – types of drilling machines – principles of working – specifications- types of drills – geometry of twist drill – operations performed –cutting speed and feed – machining time calculations – Boring Machines – fine Boring Machines – jig boring machines – deep hole Drilling Machines.

MILLING MACHINES: Introduction – principle of working – specifications – milling methods – classification of Milling Machines –types of cutters – geometry of milling cutters – methods of indexing, accessories to milling machines – cutting speed and feed – machining time calculations

UNIT-4

FINISHING PROCESSES: Introduction – theory of grinding – classification of grinding machines- cylindrical and surface grinding machines- tool and cutter grinding machines.

SYSTEMS OF LIMITS AND FITS: Introduction, nominal size, tolerance, limits, deviations, different types of fits -Unilateral and bilateral tolerance system, hole and shaft basis systems interchangeability, deterministic & statistical tolerances, selective assembly-International standard system of tolerances, selection of limits and tolerances for correct functioning, simple problems related to limits and fits.

UNIT-5

SURFACE ROUGHNESS MEASUREMENT: Differences between surface roughness and surface waviness –Numerical assessment of surface finish-CLA, Rt., R.M.S. Rz, R10 values, simple problems – method of measurement of surface finish – Profilograph, Talysurf, ISI symbols for indication of surface finish.
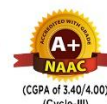
OPTICAL MEASURING INSTRUMENTS: Tools maker's microscope, Autocollimators, Optical projector, Optical flats-working principle, construction, merits, demerits and their uses. optical comparators

TEXT BOOKS:

1. Manufacturing Processes / JP Kaushish/ PHI Publishers-2 nd Edition
2. Manufacturing Technology Vol-II/P.N Rao/Tata McGraw Hill
3. Engineering Metrology – R.K. Jain/Khanna Publishers.

DEPARTMENT OF MECHANICAL ENGINEERING

REFERENCE BOOKS:

1. Metal cutting and machine tools /Geoffrey Boothroyd, Winston A.Knight/ Taylor & Francis
2. Production Technology / H.M.T. Hand Book (Hindustan Machine Tools).
3. Production Engineering/K.C Jain & A.K Chitaley/PHI Publishers
4. Technology of machine tools/S.F. Krar, A.R. Gill, Peter SMID/ TMH
5. Manufacturing Processes for Engineering Materials-Kalpak Jian S & Steven R Schmid/Pearson Publications 5th Edition

Course Outcomes:

CO1: Interpret the concepts of machining processes.
CO2: Apply the principles of lathe, shaping, slotting and planning machines.
CO3: Apply the principles of drilling, milling and boring processes.
CO4: Analyze the concepts of finishing processes and the system of limits and fits.
CO5: Illustrate the concepts of surface roughness and optical measuring instruments.

DEPARTMENT OF MECHANICAL ENGINEERING

III Year I Semester	**THERMAL ENGINEERING**	L	T	P	C
1003233102	(Professional Core)	3	0	0	3

Course Objectives:

The students will acquire the knowledge

1. To interpret the different processes in air-standard cycles and differences between Air Standard and Actual Cycles
2. To interpret the basic principles of vapour power cycles
3. To illustrate combustion phenomenon and identify the functions of boilers and draught systems and evaluate their performance.
4. To demonstrate the performance of an IC engine based on the performance parameters.
5. To summarize the classification and basic principles of compressors.

UNIT – I

Air standard Cycles: Power Cycles: Otto, Diesel, Dual Combustion cycles. Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

Actual Cycles and their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down -Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

UNIT – II

I. C. Engines: Classification - Working principles, Valve and Port Timing Diagrams, - Engine systems – Fuel, Carburettor, Fuel Injection System, Ignition, Cooling and Lubrication, principles of supercharging and turbo charging.

Measurement, Testing and Performance: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart.

UNIT III

Vapour Power Cycles: Carnot, Rankine cycle - schematic layout, thermodynamic analysis, concept of mean temperature of heat addition, methods to improve cycle performance – regeneration & reheating.

Boilers: Fuels for boilers, Classification of boilers – working principles of L.P & H.P boilers with sketches – mountings and accessories – working principles, boiler horse
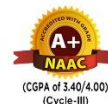
power, equivalent evaporation, efficiency and heat balance – **Draught**: classification – artificial draught, induced and forced. Height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney.

UNIT – IV

Steam Nozzles: Function of a nozzle – applications - types, flow through nozzles, thermodynamic analysis – assumptions -velocity of fluid at nozzle exit-Ideal and actual expansion in a nozzle, velocity coefficient.

Steam Turbines: Classification – impulse turbine; mechanical details – velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-laval turbine – combined velocity diagram.

Reaction Turbines: Mechanical details – principle of operation, thermodynamic analysis of a stage, degree of reaction –velocity diagram – Parson's reaction turbine – condition for maximum efficiency.

Steam Condensers: Requirements of steam condensing plant – classification of condensers – working principle of different types of condensers – vacuum efficiency and condenser efficiency – air leakage, sources and its affects.

UNIT – V

Compressors – Classification – fan, blower and compressor - positive displacement and non-positive displacement type – reciprocating and rotary types.

Reciprocating: Principle of operation, work required, Isothermal efficiency, volumetric efficiency and effect of clearance, multi stage compression, saving of work, minimum work condition for two stage compression.

Rotary (Positive displacement type):

Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working.

Rotary (non positive displacement type)

Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient.

Text Books:

1. I.C. Engines - V. Ganesan- Tata McGraw Hill Publishers

2. Gas Turbines – V.Ganesan – Tata McGraw Hill Publishers

References:

1. Thermal Engineering - Mahesh Rathore- McGraw Hill publishers
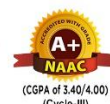
DEPARTMENT OF MECHANICAL ENGINEERING

2. I.C.Engines–Applied Thermosciences–C.R. Ferguson & A.T. Kirkpatrick-2nd Edition- Wiley Publishers

3. I.C. Engines - J.B. Heywood /McGraw Hill.

4. Heat Engines, Vasandani & Kumar - Thermal publications

5. Gas Turbine Theory – HIH Saravanamuttoo, Cohen, Rogers –Pearson Publishers

Course Outcomes:

The students will be able to

1. Interpret the different processes in air-standard cycles and differences between Air Standard and Actual Cycles
2. Analyze the basic principles of vapour power cycles
3. Identify the functions of boilers and draught systems and evaluate their performance.
4. Analyze the performance of an IC engine and gas turbine based on the performance parameters.
5. Illustrate the classification and basic principles of compressors.
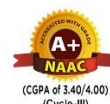
DEPARTMENT OF MECHANICAL ENGINEERING

III Year I Semester	**THEORY OF MACHINES**	L	T	P	C
1003233103	(Professional Core)	3	0	0	3

Course Objectives: The students will acquire the knowledge

1. To interpret the nature and role of the kinematics of machinery, mechanisms and machines
2. The course includes velocity and acceleration diagrams, analysis of mechanisms joints, it exposes the students to power transmission devices like gear drives and their working principles.
3. To analyze dynamic forces of slider, crank mechanism and design of flywheel
4. To analyze the methods of balancing reciprocating and rotary masses.
5. To illustrate the concept of vibrations and its significance on engineering design

UNIT – I

MECHANISMS: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained. Grashoff's law, Degrees of freedom, Kutzbach criterion for planar mechanisms, Mechanism and machines – classification of mechanisms – kinematic chain – inversion of mechanism – inversions of quadric cycle chain – single slider crank chains.

LOWER PAIR MECHANISM: Exact and approximate copiers and generated types – Peaucellier, Hart and– Grasshopper – Watt, T. Chebicheff and Robert Mechanisms–and straight-line motion, Pantograph. Conditions for correct steering – Davis Steering gear, Ackerman's steering gear.

UNIT – II

KINEMATICS: Velocity and acceleration – Motion of a link in machine – Determination of Velocity and acceleration diagrams – Graphical method – Application of relative velocity method for four bar chain. Velocity and acceleration analysis of for a single slider mechanism.

POWER TRANSMISSION (GEAR DRIVES): Classification of gears, Types of gear trains, Train value & velocity ratio for simple, compound, reverted and epicyclic gear trains. Problems on simple Gear Trains.
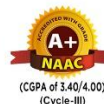
UNIT – III

CAMS: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion: Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases. Analysis of motion of followers: Roller follower and Knife edge follower.-

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

UNIT – IV

GOVERNERS: Watt, Porter and Proell governors, spring loaded governors – Hartnell with auxiliary springs. sensitiveness, isochronism and hunting.

BALANCING: Balancing of rotating masses, single and multiple – single and different planes, use analytical and graphical methods. Primary and secondary balancing of reciprocating masses.

UNIT – V

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

TEXT BOOKS:

1. Theory of Machines, Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 3rd Ed-2009

2. Theory of Machines, Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd Ed 2006.

REFERENCE BOOKS:

1. Theory of Machines & Mechanisms, J.J. Uicker, G.R. Pennock, J.E. Shigley, OXFORD 2009.
2. Theory of Machines, Thomas Bevan, CBS Publication 1984.
3. Design of Machinery, Robert L. Norton, McGraw Hill, 2001.
4. Mechanisms and Dynamics of Machinery, J. Srinivas, Scitech Publications, Chennai,2002.
5. Dynamics of machinery, J. B. K. Das & P. L. S. Murthy.

Course outcomes:

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

1. Interpret a mechanism for a given plane motion. Analyze motion of different planar mechanisms with lower and higher pairs
2. Select a power transmission system for a given application and analyze different transmission systems.
3. Analyze dynamic forces of slider crank mechanism and design of flywheel
4. Analyze the methods of balancing reciprocating and rotary masses.
5. Illustrate the concept of vibrations and its significance on engineering design.
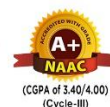
DEPARTMENT OF MECHANICAL ENGINEERING

III Year I Semester	**INSTRUMENTATION &**	**L**	**T**	**P**	**C**
	CONTROL SYSTEMS				
1003233130	**(Professional Elective-I)**	**3**	**0**	**0**	**3**

Course Objectives:

The students will acquire the knowledge

1. To learn basic principles of measurement systems, errors occurred in measurement systems and measurement of displacement
2. To learn the operating principles and working of different instruments used for temperature and pressure measurement
3. To learn the operating principles and working of different instruments used for level, flow and speed measurement
4. To learn the operating principles and working of different instruments used for acceleration, strain and humidity measurement
5. To learn the operating principles and working of different instruments used for force, torque and power and concepts of control systems.

UNIT – I

Introduction: Definition–Basic principles of measurement-measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics–sources of error, classification and elimination of error.

Measurement of Displacement: Theory and construction of various transducers to measure displacement – piezo electric, inductive, capacitance, resistance, ionization and photo electric transducers, calibration procedures.

UNIT – II

MEASUREMENT OF TEMPERATURE: Classification – ranges – various principles of measurement – expansion, electrical resistance – thermistor – thermocouple – pyrometers.

MEASUREMENT OF PRESSURE: Units – classification – different principles used. Manometers, bourdon pressure gauges, bellows – diaphragm gauges. Low pressure measurement – thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge.

UNIT – III

MEASUREMENT OF LEVEL: Direct method – indirect methods – capacitive, ultrasonic, magnetic, cryogenic fuel level indicators – bubbler level indicators.
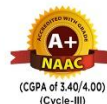
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FLOW MEASUREMENT: Rotameter, magnetic, ultrasonic, turbine flow meter, hot – wire anemometer, laser Doppler anemometer (LDA).

MEASUREMENT OF SPEED: Mechanical tachometers – electrical tachometers – stroboscope, noncontact type of tachometer

UNIT – IV

MEASUREMENT OF ACCELERATION AND VIBRATION: Different simple instruments – principles of seismic instruments – Vibrometer and accelerometer using this principle.

STRESS STRAIN MEASUREMENTS:

Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, strain gauge rosettes.

MEASUREMENT OF HUMIDITY – Moisture content of gases, sling psychrometer, absorption psychrometer, dew point meter.

UNIT – V

MEASUREMENT OF FORCE, TORQUE AND POWER- Elastic force meters, load cells, torsion meters, dynamometers.

ELEMENTS OF CONTROL SYSTEMS: Introduction, importance – classification – open and closed systems, servomechanisms–examples with block diagrams–temperature, speed & position control systems.

Text Books:

1. Measurement Systems: Applications & design / D.S Kumar/

2. Mechanical Measurements / Beck with, Marangoni, Line hard, Pearson

References:

1. Measurement systems: Application and Design/Doeblin Earnest. O. Adaptation/ TMH

2. Experimental Methods for Engineers / J. P. Holman/McGraw Hill

3. Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers.

4.Instrumentation, measurement & analysis / B. C. Nakra and K. K. Choudhary/TMH

Course outcomes:

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

1. Build the principles of measurement systems and construction of various transducers for displacement measurement

2. Classify and study the different types of temperature and pressure measuring devices
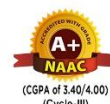
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3. Interpret the working principles of level, flow and speed measuring instruments

4. Utilize the principles of various types of acceleration and vibration, stress and strain and humidity measuring instruments

5. Illustrate the operating principles of force, torque and power measurements and different types of control systems and application of servo mechanisms

DEPARTMENT OF MECHANICAL ENGINEERING

III Year I Semester	NANO TECHNOLOGY	L	T	P	C
1003233131	(Professional Elective-I)	3	0	0	3

Course Objectives:

The students will acquire the knowledge:

1. To interpret the classification of nano structured Materials

2. To describe the unique properties of nano materials

3. To interpret the Synthesis Routes - Bottom up and Top-down approaches

4. To identify the tools to characterize nano materials

5. To illustrate the applications of nano materials

Unit I

Introduction: History and Scope, Classification of Nano structured Materials, Fascinating Nanostructures, applications of nanomaterials, challenges and future prospects.

Unit II

Unique Properties of Nano materials: Microstructure and Defects in Nano crystalline Materials: Dislocations, Twins, stacking faults and voids, Grain Boundaries, triple and disclinations. Effect of Nano-dimensions on Materials Behavior: Elastic properties, Melting Point, Diffusivity, Grain growth characteristics, enhanced solid solubility. Magnetic Properties: Soft magnetic nanocrystalline alloy, Permanent magnetic nanocrystalline materials, Giant Magnetic Resonance, Electrical Properties, Optical Properties, Thermal Properties and Mechanical Properties.

Unit III

Synthesis Routes: Bottom-up approaches: Physical Vapor Deposition, Inert Gas Condensation, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Sol-gel method, Self-assembly. Top-down approaches: Mechanical alloying, Nano-lithography. Consolidation of Nano powders: Shock wave consolidation, Hot isostatic pressing and Cold isostatic pressing Spark plasma sintering.

UNIT –IV

Tools to Characterize nanomaterials: X-Ray Diffraction (XRD), Small Angle X-ray scattering, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM),
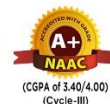
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Atomic Force Microscopy (AFM), Scanning Tunneling Microscope (STM), Field Ion Microscope (FEM), Three-dimensional Atom Probe (3DAP), Nano indentation

UNIT – V

Applications of Nano materials: Nano-electronics, Micro- and Nano-electromechanical systems (MEMS/NEMS), Nano sensors, Nano catalysts, Food and Agricultural Industry, Cosmetic and Consumer Goods, Structure and Engineering, Automotive Industry, Water-Treatment and the environment, Nano-medical applications, Textiles, Paints, Energy, Defense and Space Applications, Concerns and challenges of Nanotechnology

TEXT BOOKS:

1. Introduction to Nano Technology by Charles. P. Poole Jr& Frank J. Owens. Wiley India Pvt. Ltd.

2. Nano Materials- A. K. Bandyopadhyay/ New Age Publishers.

3. Nano Essentials- T. Pradeep/TMH

REFERENCE BOOKS:

1. Solid State physics by Pillai, Wiley Eastern Ltd.

2. Introduction to solid state physics 7th edition by Kittel. John Wiley & sons (Asia) Pvt Ltd.

Course Outcomes:

The students will be able to:

1. Interpret the classification of nano structured Materials

2. Describe the unique properties of nano materials

3. Interpret the Synthesis Routes - Bottom up and Top-down approaches

4. Identify the tools to characterize nano materials

5. Illustrate the applications of nano materials.
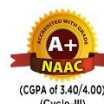
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III Year I Semester	**DESIGN FOR MANUFACTURING**	L	T	P	C
1003233132	**(Professional Elective-I)**	3	0	0	3

Course Objectives:

The students will acquire the knowledge:

1. To analyze the basic concepts of design for manual assembly

2. To interpret basic design procedure of machining processes

3. To analyze design considerations metal casting, extrusion and sheet metal work

4. To interpret the design considerations of various metal joining process.

5. To interpret the basic design concepts involved in the assembly automation

UNIT – I

Introduction to Design for Manufacturing and Assembly (DFMA): How Does DFMA Work? Reasons for Not Implementing DFMA, What Are the Advantages of Applying DFMA During Product Design? Typical DFMA Case Studies, Overall Impact of DFMA on Industry.

Design for Manual Assembly: General Design Guidelines for Manual Assembly, Development of the Systematic DMA Methodology, Assembly Efficiency, Effect of Part Symmetry, Thickness, Weight on Handling Time, Effects of Combinations of Factors, Application of the DMA Methodology.

UNIT - II

Machining Processes: Overview of various machining processes-general design rules for machining dimensional tolerance and surface roughness-Design for machining – ease – redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

UNIT - III

Metal Casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

UNIT - IV

Metal Joining: Appraisal of various welding processes, factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld
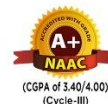
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joints-design of brazed joints. Forging: Design factors for forging – closed die forging design – parting lines of dies –drop forging die design – general design recommendations.

UNIT – V

Design for Assembly Automation: Fundamentals of automated assembly systems, System configurations, parts delivery system at workstations, various escapement and placement devices used in automated assembly systems, Quantitative analysis of Assembly systems, Multi station assembly systems, single station assembly lines.

TEXT BOOKS:

1. Design for manufacture, John cobert, Adisson Wesley. 1995

1. Design for Manufacture by Boothroyd,

2. Design for manufacture, James Bralla

REFERENCE:

ASM Hand book Vol.20

Course Outcomes:

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

   The students will acquire the knowledge:

1. Analyze the basic concepts of design for manual assembly

2. Interpret basic design procedure of machining processes

3. Analyze design considerations metal casting, extrusion and sheet metal work

4. Interpret the design considerations of various metal joining process.

5. Interpret the basic design concepts involved in the assembly automation
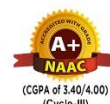
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III Year I Semester	THERMAL MANAGEMENT OF ELECTRONIC SYSTEMS (Professional Elective-I)	L	T	P	C
1003233133		3	0	0	3

Course objectives:

1) To interpret the basics of heat transfer and analyze heat transfer through fins

2) To analyze the basics of convection and radiation modes of heat transfer.

3) To illustrate concepts the thermal analysis of printed circuit boards and their cooling.

4) To analyze the principles of two-phase cooling and heat pipes.

5) To interpret knowledge about the thermoelectric coolers.

UNIT– I

Introduction of Heat Transfer and Conduction: Modes – Conduction, Convection and Radiation – Basic Laws – Applications of Heat Transfer Basics of Conduction –Conduction equation – Thermal analogy – Lumped heat capacity analysis - Heat conduction with phase change - Thermal Resistance – Extended Surfaces – Uniform cross section fins – Fin efficiency – Selection and design of fins.

UNIT– II:

Convection and Radiation: Forced and Free Convection – Heat transfer coefficient - Parameters effecting heat transfer – Thermal Properties of fluids - Combined Modes, Radiation– Stefan- Boltzmann Law – Kirchoff's law and Emissivity – Radiation between Black Isothermal Surfaces – Radiation between Grey Isothermal Surfaces – Extreme Climatic conditions - Radiation at normal ambient. Temperature measurement and its Instrumentation.

UNIT– III:

Printed Circuit Boards and Cooling – Chip packaging – thermal Resistance – Board Cooling methods – Board thermal Analysis – Equivalent thermal Conductivity Air Cooling – Fans – Heat transfer Enhancement – Air handling systems – Blowers. Single Phase Cooling – Coolant Selection – Natural Convection – Forced Convection - Air Cooling - Convective cooling in small systems – Forced cooling in medium and large systems – Liquid cooling in high power modules – Case Studies.

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UNIT– IV:

Two Phase Cooling and Heat pipes – Direct Immersion Cooling – Basics of Pool Boiling – Enhancement of Pool Boiling – Flow Boiling Heat Pipes – Operation Principles – Useful Characteristics – Operating Limits and Temperatures – Operation Methods – Applications – Micro Heat Pipes.

UNIT– V:

Thermo Electric coolers: Basics theories – Thermo electric effect – Operation Principles Phase change materials, Thermal Interface materials, Heat Spreaders and Heat Sinks – Working Principles, Mini and Micro Channels. Use of nano fluids in electronic cooling.

Text Books:

1. Thermal Analysis and Control of Electronic Equipment – Allan D. Kraus and Avram Bar Cohen, McGraw Hill, New York, NY, 1983.

2. Fundamentals of Microelectronics Packaging – Ed: Rao Tummala, McGraw Hill, New York, NY, 2001.

Reference Books

1. Packaging of Electronic Systems – James W. Dally, McGraw Hill, New York, NY, 1990.

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

1. Interpret the basics of heat transfer and analyze heat transfer through fins
2. Analyze the basics of convection and radiation modes of heat transfer.
3. Illustrate concepts the thermal analysis of printed circuit boards and their cooling.
4. Analyze the principles of two-phase cooling and heat pipes.
5. Interpret knowledge about the thermoelectric coolers.

DEPARTMENT OF MECHANICAL ENGINEERING

III Year I Semester	JOINING PROCESSES	L	T	P	C
1003233134	(Professional Elective-I)	3	0	0	3

Course Objectives:

The students will acquire the knowledge

1. To describe basic principles of metal joining process
2. To interpret the theory and procedure involved in the fusion welding process
3. To analyze the basic concepts of the pressure welding
4. To analyze the basic steps of soldering operational steps of brazing.

5. To illustrate the concepts of modern welding processes

Unit-I:

Metal Joining Processes: Joining process as a manufacturing route, relevance of joining process to metallurgy. Different types of joining process, classification of joining process, safety aspects in Metal joining processes, types of joints used in welding.

Unit – II:

Fusion Welding Process: Classification of welding process, gas welding, arc welding process (equipment, fluxes, electrodes, procedures, limitations and advantages of various arc welding process), relative advantages and limitations and applications of gas welding and arc welding, thermit welding.

Unit – III:

Pressure Welding: Resistance welding, cold welding, forge welding. relative advantages, limitation and applications of pressure welding. spot welding, explosion welding, flash welding.

Unit – IV: Soldering and Brazing: Basic operational steps of Soldering, Basic operational steps of Brazing, flux and its role in joining process, different types of fluxes, metallurgical aspects of soldering and brazing, applications of soldering and brazing, soldering and Brazing Alloys, adhesive joining.

Unit – V: Modern Welding Processes: Electron beam welding, Laser beam welding, Submerged arc welding, Ultrasonic welding, Under water welding, Magnetic pulse welding.

Text Books:

1. Welding Technology O.P.Khanna Dhanpat Rai Publications Ltd. New Delhi
2. Soldering, welding and brazing Lankester George Allen and Unwin, London.
3. Modern arc welding techniques S.V. Nadkarni Oxford IBH Publishers.

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References:

1. Engineering Metallurgy I and II, R. A. Higgins, The English University Press Ltd.
2. Welding Technology, R. S. Parmar, Khanna Publishers, New Delhi
3. Welding Engineering, Richard little, Tata McGraw Hill, New Delhi

Course Outcomes

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

1. Describe basic principles of metal joining process
2. Interpret the theory and procedure involved in the fusion welding process
3. Analyze the basic concepts of the pressure welding
4. Analyze the basic steps of soldering operational steps of brazing.
5. Discuss the concepts of modern welding processes

DEPARTMENT OF MECHANICAL ENGINEERING

III Year I Semester	SUSTAINABLE ENERGY TECHNOLOGIES (Open Elective-I)	L	T	P	C
1002233153		3	0	0	3

Course Objectives:

The students will acquire the knowledge:

1. To demonstrate the importance and solar radiation, solar energy collection and storage
2. To analyze the energy sources and potential from wind energy, bio-mass, geothermal energy and ocean energy
3. To interpret energy efficient electrical and mechanical systems
4. To develop energy efficient processes
5. To illustrate features and benefits of green buildings

UNIT-I

SOLAR RADIATION: Overview of Global and Indian energy scenario, Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun- earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells- MPPT, standalone PV system.

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation, Solar Tracker.

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

UNIT – II

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy.

OCEAN ENERGY: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques.
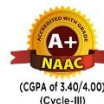
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UNIT –III

ENERGY EFFICIENT SYSTEMS:

(A) ELECTRICAL SYSTEMS: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management.

(B) **MECHANICAL SYSTEMS**: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, Environmental friendly and Energy efficient compressors and pumps, Fuel cell electric vehicles and applications.

UNIT-IV

ENERGY EFFICIENT PROCESSES: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing.

UNIT – V

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

Text Books:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH

2. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006

3. Green Manufacturing Processes and Systems - J. Paulo Davim/Springer 2013

References:

1. Alternative Building Materials and Technologies - K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Rao/New age international

2. Principles of Solar Engineering - D.Yogi Goswami, Frank Krieth& John F Kreider / Taylor &Francis

3. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd

4. Renewable Energy Technologies -Ramesh & Kumar /Narosa
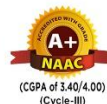
5. Non-conventional Energy Source- G.D Roy/Standard Publishers

6. Renewable Energy Resources-2nd Edition/ J. Twidell and T. Weir/ BSP Books Pvt.Ltd

7. Fuel Cell Technology -Hand Book / Gregor Hoogers / BSP Books Pvt. Ltd

Course Outcomes:

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

1. Demonstrate the importance and solar radiation, solar energy collection and storage
2. Analyze the energy sources and potential from wind energy, bio-mass, geothermal energy and ocean energy
3. Interpret energy efficient electrical and mechanical systems
4. Develop energy efficient processes
5. Illustrate features and benefits of green buildings.
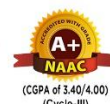
DEPARTMENT OF MECHANICAL ENGINEERING

III Year I Semester	INDUSTRIAL SAFETY	L	T	P	C
1002233154	(Open Elective-I)	3	0	0	3

Course Objectives:

1. To provide information regarding different elements of industrial water pollution and Methods of treatment.
2. To expose to the various industrial applications, maintenance, preventive measures taken against wear and tear.

UNIT- I

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT- II

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT- III

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, wear prevention methods.

Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT- IV

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like,

   i.   Lathe,
  ii.   Pump
 iii.   Air compressor
 iv.   Internal combustion engine,
  v.   Boiler

Types of faults in machine tools and their general causes.
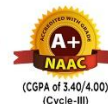
DEPARTMENT OF MECHANICAL ENGINEERING

UNIT- V

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of:

i.   Machine tools
ii. Pumps,
iii. Air compressors,

Program and schedule of preventive maintenance of mechanical and electrical equipment, Advantages of preventive maintenance. Repair cycle concept and importance

REFERENCE BOOKS:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.

2. Maintenance Engineering, H. P. Garg, S. Chand and Company.

3. Pump-hydraulic Compressors, Audels, McGraw Hill Publication.

 4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

Course Outcomes:

At the end of the course, student will be able to
1. Know how to take safety measures in executing works
2. Identify the need for maintenance (or) replacement of equipment
3. Illustrate the need for periodic and preventive maintenance
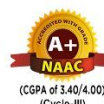
DEPARTMENT OF MECHANICAL ENGINEERING

III Year I Semester	**THERMAL ENGINEERING LAB**	L	T	P	C
1003233110	**(Professional Core)**	0	0	3	1.5

Course Objective: To provide hands on experience in operating various types of internal combustion engines and understands their functioning and performance.

**Students should perform any ten experiments from the following**.

List of experiments:

1. I.C. Engines valve / port timing diagrams.
2. Testing of Fuels – Viscosity, flash point/fire point, carbon residue, calorific value.
3. I.C. Engines performance test and Exhaust emission measurements (4 -stroke diesel engine)
4. I.C. Engines performance test and Exhaust emission measurements (2-stroke petrol engine)
5. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrol engine.
6. Determination of FP by retardation and motoring test on IC engine.
7. I.C. Engines heat balance at different loads and show the heat distribution curve.
8. Economical speed test of an IC engine.
9. Performance test on variable compression ratio engines.
10. Performance test on reciprocating air compressor unit.
11. Dis-assembly / assembly of different parts of two wheelers. 3 wheelers & 4 wheelers. Tractor &Heavy-duty engines covering 2-stroke and 4 stroke, SI and CI engines.
12. Study of boilers, mountings and accessories

Course outcomes:

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

1. Identify the valves and ports opening and closing of IC engines and Assembly and Dis-assembly of IC Engines. (BL-3)
2. Find the performance characteristics of an internal combustion engines (BL-1)
3. Solve the heat load by drawing the Heat Balance sheet (BL-3)
4. Demonstrate the performance of engine by economical speed tests and Study of Boilers (BL-2)
5. Analyze the performance parameters like IP, BP and FP for multi cylinder engines (BL-2)
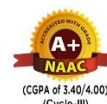
DEPARTMENT OF MECHANICAL ENGINEERING

III Year I Semester	THEORY OF MACHINES LAB	L	T	P	C
1003233111	(Professional Core)	0	0	3	1.5

Course objective:

The students will acquire the knowledge

To analyze gyroscope, frequency of free and forced vibration and study static and dynamic

balancing.

**Students will conduct any ten experiments from the list below.**
List of experiments:

1. To determine whirling speed of shaft theoretically and experimentally.

2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.

3. To analyze the motion of a motorized gyroscope when the couple is applied along its spin axis

4. To determine the frequency of undamped free vibration of an equivalent spring mass system.

5. To determine the frequency of damped force vibration of a spring mass system

6. To study the static and dynamic balancing using rigid blocks.

7. To find the moment of inertia of a flywheel

8. To plot follower displacement vs cam rotation for various Cam Follower systems.

9. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism/Four bar mechanism

10. To study simple and compound screw jack and determine the mechanical advantage, velocity ratio and efficiency

11. To study various types of gears- Spur, Helical, Worm and Bevel Gears

Course outcomes:

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

1. Examine the motion of a motorized gyroscope when the couple is applied along its spin axis. (BL-4)
2. Find the frequency of undamped and damped free vibration of an equivalent spring mass system. (BL-1)
3. Find the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation (BL-1)
4. Interpret the static and dynamic balancing using rigid blocks (BL-2)
5. Interpret the moment of inertia of a flywheel and determine whirling speed of shaft theoretically and experimentally (BL-2)
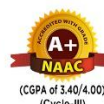
DEPARTMENT OF MECHANICAL ENGINEERING

III Year I Semester	MACHINE TOOLS AND METROLOGY LAB (Skill Oriented Course)	L	T	P	C
1003233180		0	0	4	2

Course Objectives:
1. To interpret the working principles of various machines viz lathe, Drilling, milling, shaping.
2. To illustrate the usage of CNC in Lathe and Milling machines.
3. To learn about basic measuring instruments vernier callipers, screw gauge, vernier height gauge.
4. To learn the measurement of the angle and taper by Bevel protractor, Sine bar, etc.
5. To learn about Mechanical parameter measuring systems and different alignment techniques.

Students will conduct any ten experiments from the list below.

Part A -List of Experiments
1. Introduction of general-purpose machines -Lathe, drilling machine, Milling machine, Shaper,
1. Planning machine, slotting machine, Cylindrical Grinder, surface grinder and tool and cutter
2. grinder.
3. To perform Step turning and taper turning on lathe machine
4. To perform Thread cutting and knurling on lathe machine.
5. To perform spur gear cutting using milling machine.
6. To perform flat surface operation on a block using shaper.
7. To perform Drilling & Tapping operations.
8. To perform precise surface grinding operations.
9. To perform precision cylindrical grinding operations.
10. To perform splines on a block using slotting machine.
11. To perform step turning operation using CNC lathe.

Part B - List of Experiments
1. Measurement of lengths, heights, diameters by vernier callipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. To Study the Angle and taper measurements by Bevel protractor, Sine bars, etc.
4. Measurements by Gear Tooth Vernier Callipers.
5. To study about the Tool makers microscope and its application
6. Surface Roughness Measurement

Course Outcomes:
Students get exposure to
1. Perform step, taper turning, knurling and threading operations on lathe.
2. Practical exposure on Flat Surface machining, Shaping, Slotting, Milling and grinding
3. operations.
4. Develop programs on CNC lathe and Milling machines.
5. Apply the procedures to measure length, width, depth, bore diameters, external tapers, tool angles, and surface roughness by using different instruments.
6. Demonstrate knowledge of different machine tools used in machine shops.

DEPARTMENT OF MECHANICAL ENGINEERING

III Year I Semester	**MECHATRONICS LAB**	L	T	P	C
1003233181	**(Skill Oriented Course)**	0	0	4	2

Course Objectives:

The students will acquire the knowledge:

1. To measure load and temperature using analogue and digital sensors.
2. To measure displacement using analogue and digital sensors.
3. To develop PLC programs for control of traffic lights, water level, lifts and conveyor belts.
4. To simulate and analyze PID controllers for a physical system using MATLAB.
5. To develop pneumatic and hydraulic circuits using Automaton studio.

List of Experiments

1. DYNA 1750 Transducers Kit
    1. Characteristics of LVDT
    2. Principle & Characteristics of Strain Gauge
    3. Characteristics of Summing Amplifier
    4. Characteristics of Reflective Opto Transducer
2. PLCPROGRAMMING
    1. Ladder programming on Logic gates, Timers &counters
    2. Ladder Programming for digital & Analogy sensors
    3. Ladder programming for Traffic Light control, Water level control and Lift control Modules
3. AUTOMATION STUDIO software
    1. Introduction to Automation studio & its control
    2. Draw & Simulate the Hydraulic circuit for series & parallel cylinders connection
    3. Draw & Simulate Meter-in, Meter-out and hydraulic press and clamping.
4. MATLAB Programming
    1. Sample Programs on MATLAB
   2. Simulation and analysis of PID controller using SIMULINK

Course outcomes:

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

1. Measure load using analogue and digital sensors (BL-5)
2. Measure displacement using analogue and digital sensors (BL-5)
3. Develop PLC programs for control of traffic lights, water level and lift system (BL-3)
4. Analyze PID controllers for a physical system using MATLAB(BL-4)
5. Develop pneumatic and hydraulic circuits (BL-3)
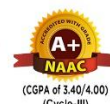
DEPARTMENT OF MECHANICAL ENGINEERING

III Year I Semester	COMPUTATIONAL FLUID DYNAMICS LAB (Engineering Science Course)	L	T	P	C
1003233112		0	0	2	1

Course Objectives:

The students will acquire the knowledge

1. To solve problems of fluid mechanics and heat transfer by writing programs in C-language and MATLAB.
2. To solve ANSYS-FLUENT build geometry, mesh that geometry, Perform CFD method on the mesh, perform the calculation, and post-process the results.
3. To interpret the validation of the numerical result by comparison with known analytical results.
4. To analyze the numerical result by invoking the physical principles of fluid mechanics and heat transfer.
5. To solve Elliptical, Parabolic, Partial and Hyperbolic partial differential equations.

Notes: Using ANSYS-FLUENT solve any Ten from the following problems of heat transfer analysis.

1. Steady state conduction
2. Lumped heat transfer
3. Convective heat transfer – Internal flow (study both velocity and thermal boundary layers)
4. Convective heat transfer – External flow (study both velocity and thermal boundary layers)
5. Radiation heat transfer–Emissivity
6. Fluid Flow inside a bend pipe
7. Flow inside a cyclone / scrubber
8. External flow over a airfoil
9. Pressure drop analysis in a valve
10. Heat transfer analysis in heat exchanger
11. Heat transfer analysis in solar flat plate collector
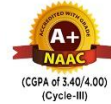12. Heat transfer analysis in solar air heater.

Course Outcomes:

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

1. Solve problems of fluid mechanics and heat transfer by writing programs in C-language and MATLAB.
2. Solve ANSYS-FLUENT build geometry, mesh that geometry, Perform CFD method on the mesh, perform the calculation, and post-process the results.
3. Interpret the validation of the numerical result by comparison with known analytical results.
4. Analyze the numerical result by invoking the physical principles of fluid mechanics and heat transfer.
5. Solve Elliptical, Parabolic, Partial and Hyperbolic partial differential equation.

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