ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

MECHANICAL ENGINEERING

B.Tech Four Year Degree Course

(Applicable for the batches admitted from 2020-21)

GUDLAVALLERU ENGINEERING COLLEGE

(An Autonomous Institute with Permanent Affiliation to JNTUK, Kakinada)

Seshadri Rao Knowledge Village

GUDLAVALLERU - 521 356, Krishna District, Andhra Pradesh

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VISION & MISSION OF THE COLLEGE

Vision

To be a leading institution of engineering education and research, preparing students for leadership in their fields in a caring and challenging learning environment.

Mission

- To produce quality engineers by providing state-of-the-art engineering education.
- To attract and retain knowledgeable, creative, motivated and highly skilled individuals whose leadership and contributions uphold the college tenets of education, creativity, research and responsible public service.
- To develop faculty and resources to impart and disseminate knowledge and information to students and also to society that will enhance educational level, which in turn, will contribute to social and economic betterment of society.
- To provide an environment that values and encourages knowledge acquisition and academic freedom, making this a preferred institution for knowledge seekers.
- To provide quality assurance.
- To partner and collaborate with industry, government, and R and D institutes to develop new knowledge and sustainable technologies and serve as an engine for facilitating the nation's economic development.
- To impart personality development skills to students that will help them to succeed and lead.
- To instil in students the attitude, values and vision that will prepare them to lead lives of personal integrity and civic responsibility.
- To promote a campus environment that welcomes and makes students of all races, cultures and civilizations feel at home.
- Putting students face to face with industrial, governmental and societal challenges.

VISION & MISSION OF THE DEPARTMENT

Vision

To become a competent centre in moulding students as professional mechanical engineers having ethical standards and social consciousness

Mission:

- To impart value based education and to enhance competencies of students through effective design and delivery of the curriculum that fulfils the needs of the industry.

- To instill desire and confidence in the students to cater the needs of the society through their activities of excellence.
- To impart technical skills and nurture values, and mould the students as professionals to offer solutions to the technological challenges.
- To guide and support the students for enhancing nation's wealth through entrepreneurship.

III. PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- Graduates of the program will have bright careers in Mechanical Engineering domain and allied areas.
- Graduates of the program will have life skills, sense of ethical conduct and social responsibility.
- Graduates of the program will continue to learn and update their competencies to face dynamically changing technological environment.

IV. PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

V. PROGRAM SPECIFIC OUTCOMES (PSOs)

- design and analyze thermal systems related to power generation and human comfort for sustainable environment.
- develop eco friendly products and manufacturing processes.
- effectively use various mechanical engineering software tools for design, analysis and optimization.

V. ACADEMIC REGULATIONS

Applicable for the students of B.Tech. from the Academic Year 2020-21.

1. UG – B.Tech. Programs

The following B.Tech. Programs are offered at present

i. Civil Engineering (CE)
ii. Electrical and Electronics Engineering (EEE)
iii. Mechanical Engineering (ME)
iv. Electronics and Communication Engineering (ECE
v. Computer Science and Engineering (CSE)
vi. Information Technology (IT)
vii. Artificial Intelligence and Data Science (AI&DS)
viii. Internet of Things (IoT)

2. Duration of the Program

The duration of the program is four academic years consisting of eight semesters. However, a student is permitted to complete the course work of B.Tech. program in the stipulated time frame of **EIGHT** years from the date of joining. Students admitted into third semester of B.Tech. program directly, through Lateral Entry (LE), shall have to complete the course work of B.Tech. program in the stipulated time frame of **SIX** years from the date of joining.

3. Minimum Instruction Days

Each semester consists of a minimum of ninety instruction days.

4. Award of B.Tech. Degree

i) Each discipline of the B.Tech. program is designed to have a total of **160** credits and the student shall have to complete the four year course work and earn all the **160** credits for the award of B.Tech. Degree.

il) Students, who fail to complete their four years' course of study within eight years from the year of their admission or fail to acquire the **160** credits within this period shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

iii) Students joining the B.Tech. program into the II year 1st semester directly through Lateral Entry (LE) Scheme shall have to complete the three year course work and earn **120** credits for the award of B.Tech. degree.

iv) Students, who fail to complete their three years course of study within six years from the year of their admission or fail to acquire the **120** credits for the award of degree within this period shall forfeit their seat in B.Tech. course and their admission shall stand cancelled.

v) **Award of B. Tech. (Honors) / B. Tech. (Minor):** B. Tech. with Honors or a B.Tech. with a Minor will be awarded if a student earns 20 additional credits as per the regulations/guidelines. Registering for Honors / Minor degree is optional.

5. Duration and Pattern of the Program

i) The duration of the program is four academic years consisting of eight semesters for regular students and three academic years consisting of six semesters for lateral entry students.

ii) Each semester consists of a minimum of ninety instructional days.

iii) Three week induction program is mandatory for all the first year UG students and shall be conducted as per AICTE/UGC/APSCHE guidelines.

iv) A student has to register for all the courses in a semester.

v) Grade points, based on percentage of marks awarded for each course will be the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).

vi) Award of division shall be based on the CGPA acquired.

vii) A pool of interdisciplinary, skill development courses, industry internship, socially relevant projects etc., which are relevant to the industry are integrated into the curriculum of the branch of engineering concerned.

viii) As a mandatory rule, all the students shall be registered for the mandatory non-credit courses as per AICTE/UGC/APSCHE guidelines.

6. Attendance Regulations

i) A student is eligible to write the semester end examinations if he acquires a minimum of 40% attendance in each subject and a 75% of attendance in aggregate of all the subjects.

ii) Condoning of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester will be considered for genuine reasons, such as on medical grounds and participation in co-curricular and extra-curricular activities and shall be granted only after the approval by a committee duly appointed by the college. For medical reasons, the student should submit application for medical leave along with medical certificate from a registered medical practitioner within three days from the day of reporting to the classwork after the expiry of the Medical Leave. In the case of participation in co-curricular and extra-curricular activities, either within the college or in other colleges, students must take prior permission in the written form from HoD concerned and should also submit the certificate of participation from the organizers of the event within three days after the completion of the event. Only such cases will be considered for condoning attendance shortage.

iii) A student shall be eligible to claim for condonation of attendance shortage for a maximum of two times during the four year (eight semesters) course work of B.Tech. (Regular) / three year (six semesters) course work of B.Tech. (Lateral).

iv) A student will not be promoted to the next semester unless he satisfies the attendance requirement of the current semester. He may seek re-admission for that semester when offered within 4 weeks from the date of commencement of classwork.

v) Shortage of Attendance below 65% in aggregate shall in *NO* case be condoned.

vi) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end-examinations of current semester and their registration shall stand cancelled.

vii) A fee stipulated by the college shall be payable towards condonation of attendance shortage.

viii) A student is required to put up a minimum of 75% of attendance in the mandatory non-credit courses for getting the satisfactory grade. However, condonation of the shortage of attendance upto 10% shall be applicable for all mandatory non credit courses and a fee stipulated by the college shall be payable towards condonation fee.

7. Distribution and Weightage of marks - Evaluation

The distribution of Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) marks for each course is given in the table:

Sl.No.	Components	Internal	External	Total
1	Theory / Integrated Theory and Laboratory/ Project Based Theory	30	70	100
2	Engineering Graphics/ Design/ Drawing	30	70	100
3	Practical / Skill Development Courses	15	35	50
4	Community Service Project / Internship	-	100	100
5	Project Work	60	140	200
6	Mandatory Non-Credit Courses			
	i) Environmental Studies and Constitution of India	30	70	100
	ii) Sports & Games/ Cultural and NSS/Fine Arts /Yoga /Self Defence	100	-	100

(i) Continuous Internal Evaluation

Theory Courses:

a) For theory subjects, during a semester, there shall be two mid-term examinations. Each mid-term examination consists of (i) one online objective examination(OE) consisting of 20 multiple choice questions for 10 marks for a duration of 20 minutes (ii) one descriptive examination(DE) consisting of 3 descriptive questions for 5 marks each a total of 15 marks for a duration of 90 minutes and (iii) one assignment(AT) for 5 marks.

b) First mid-term examination(Mid-I) shall be conducted from first 50% of the syllabus and second mid-term examination(Mid-II) shall be conducted from the rest of the 50% of syllabus.

c) The total marks secured by the student in each mid-term examination are evaluated for 30 marks. The final marks of each mid-term examination shall be displayed in the respective department notice boards within 10 days of completion of last examination.

d) Internal marks can be calculated with the sum of the 80% marks of better scored mid-term examination and 20% marks of less scored mid-term examination .

Example:

Mid-1 marks = Marks secured in (online examination-1 + descriptive examination-1 + one assignment-1)

Mid-2 marks = Marks secured in (online examination-2 + descriptive examination-2 + one assignment-2)

Final internal Marks = (Best of (Mid-1/Mid-2) marks x 0.8 + Least of (Mid-1/Mid-2) marks x 0.2)

e) *For subjects like Functional English and Professional Communication, the pattern of mid-term examination is given along with the syllabus of the respective subject.*

Integrated Theory and Lab Courses

For the integrated theory and laboratory course, the distribution of 30 marks for internal evaluation shall be, 15 marks for theory based on two descriptive examinations and 15 marks for laboratory. The pattern for the descriptive examination is as same as the pattern for the regular theory courses. Sum of the 80% marks of better scored descriptive examination and 20% marks of less scored descriptive examination are considered. Of the 15 marks for the laboratory, 5 marks for the day-to-day performance, 5 marks for record and 5 marks for the semester end internal examination.

Project Based Theory Courses

For the project based theory course, the distribution of 30 marks for internal evaluation shall be, 15 marks for the theory based on two descriptive examinations and 15 marks for project. The pattern for descriptive examination is as same as the pattern for the regular theory courses. Sum of the 80% marks of better scored descriptive examination and 20% marks of less scored descriptive examination are considered. 15 marks for project shall be awarded by the department review committee based on the project report and the performance in oral presentation.

Drawing / Design Courses

For the subjects such as Engineering Graphics, Engineering Drawing, Building Planning and Drawing, Estimation, Costing & Valuation, Design & Drawing of Steel Structures etc., the distribution of 30 marks for internal evaluation shall be,

15 marks for day-to-day work, and 15 marks based on two descriptive examinations. The pattern for the descriptive examination is as same as the pattern for regular theory courses. Sum of the 80% marks of better scored descriptive examination and 20% marks of less scored descriptive examination are considered.

Practical Courses

For the practical courses the distribution of 15 internal marks shall be, 5 marks for day-to-day performance, 5 marks for record and 5 marks for an internal laboratory test conducted at the end of a semester.

Skill Development Courses

Each student shall register for seven skill development courses (total 10 credits) offered by the department concerned. The distribution of 15 internal marks shall be 10 marks for day-to-day performance, and 5 marks for an internal examination conducted at the end of a semester.

For courses like Logic Building and Basic Coding Principles, Logic Building and Algorithmic Programming and Programming for corporate distribution of 15 internal marks shall be 10 marks for day-to-day performance(these marks will be awarded by taking no. of assignments completed, no. of quizzes attempted and amount of time spent in learning each topic on the LMS prescribed) and 5 marks for an internal laboratory test (internal Lab examination will be conducted on the assessment portal) conducted at the end of a semester.

Project Work

Of the 60 internal marks for a project work, 30 marks shall be awarded by the supervisor based on the student's involvement and 30 marks shall be awarded by the project review committee consisting of a supervisor, a senior faculty member and the HoD concerned based on the performance in Viva-Voce examination at the end of the semester.

Mandatory Non-Credit Courses

a) Each student shall register for four mandatory non-credit courses like Environmental Studies, Constitution of India, Sports & Games/Cultural and NSS/Fine arts/Yoga/Self Defense offered by the respective departments as per the course structure.

b) For courses like Environmental Studies and Constitution of India, two descriptive examinations shall be conducted for 30 marks each along with the mid-term examinations of regular theory courses.

c) Each descriptive examination consists of 3 descriptive questions for 10 marks each with a total of 30 marks for a duration of 90 minutes.

d) Sum of the 80% marks of better scored descriptive examination and 20% marks of less scored descriptive examination are considered.

e) For courses like Sports & Games/Cultural and NSS/Fine arts/Yoga/Self Defense, 100 marks for continuous internal evaluation shall be awarded by the respective class teacher based on the day-to-day participation and performance in the activities organized under each event.

II) Semester End Examinations – Evaluation:

Theory/ Drawing/ Integrated theory and laboratory/ Project based theory Courses

i) For all Theory/Drawing/Integrated theory and laboratory/Project based theory Courses, the semester end examination shall be conducted for 70 marks consisting of five internal choice questions (i.e "either" "or" choice), carrying 14 marks each. There will be two questions from each unit and the student should answer either of the two questions.

ii) There will not be any external assessment for laboratory and project components for integrated theory and laboratory course and project based theory course respectively.

iii) For design courses like Estimating, Costing & Valuation, Design of steel structures, Design of RC structures, Design of Irrigation structures, etc., the pattern for the semester end examination is given along with the syllabus of the respective subject.

iv) *For subjects like Functional English, Professional Communication, etc, the pattern of semester end examination is given along with the syllabus of the respective subject.*

Practical Courses:

The semester end examination shall be conducted for 35 marks by the teacher concerned and an external examiner appointed by the controller of examinations.

Skill Development Courses:

The semester end examination shall be conducted for 35 marks along with the practical examinations in the presence of an external and an internal examiner (course instructor or mentor).

For courses like Logic Building and Basic Coding Principles, Logic Building and Algorithmic Programming and Programming for corporate, semester end examination paper shall consists of 3 sets of questions and student has to choose any one set of Questions. Each set shall have three questions with three levels of complexity and evaluated for a total of 35 marks.

Community Service Project

i) Every student should put in a minimum of **180 hours** for the community service project during the summer vacation.
ii) Each class/section shall be assigned with a mentor.
iii) Departments shall concentrate on their major areas of respective departments concerned. For example, Dept. of Computer Science can take up activities related to computer Literacy to different sections of people like - youth, women, housewives, etc
iv) A log book to record the activities undertaken / involved shall be maintained by every student.
v) The log book has to be countersigned by the mentor concerned.
vi) A report shall be submitted by each student at the end of the semester.
vii) Based on the report and active participation of the student the semester end examination for 100 marks shall be awarded by a committee consisting of a mentor and a senior faculty member of the department.

Internship:

i) It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs in the area of specialization of the UG programme.
ii) Students shall pursue this course during summer vacation just before it is offered as per course structure. The minimum duration of this course is at least 6 weeks.
iii) A supervisor shall be allotted to each batch of students to guide and for taking up the summer internship. The supervisor shall monitor the attendance of the students during the internship. Attendance requirements are as per the norms of the college.
iv) After successful completion, students shall submit a summer internship technical report to the department concerned.
v) A certificate from industry / skill development centre shall be included in the report.
vi) Semester end examination for 50 marks shall be conducted by a committee consisting of an external examiner, head of the department and supervisor for the internship. The report and the oral presentation shall carry 40% and 60% weightage respectively.

Project Work:

i) The major project work shall be carried out during the IV year 2nd semester.
ii) The project evaluation and semester end Viva–Voce examination for 140 marks shall be awarded by the committee consisting of an external examiner, head of the department and the supervisor of the project based on the report submitted and performance in Viva-Voce examination.

iii) The evaluation of project work shall be conducted at the end of the fourth year second semester.

Mandatory Non-Credit Courses:

i) For courses like Environmental Studies and Constitution of India, semester end examination shall be conducted by the respective departments internally for 70 marks.

ii) The pattern for examination is same as the regular theory courses.

iii) There is no semester end examination for courses, such as Sports & Games/ Cultural and NSS/Fine arts/Yoga/Self Defense.

Massive Open Online Courses (MOOCs):

i) Each student shall register for one Massive Open Online Course (MOOC) as per the course structure.

ii) A student shall register for MOOC offered by NPTEL, CISCO, MICROSOFT and SAYLOR or any other agency with a prior approval from the departmental committee.

iii) The duration of the course shall be a minimum of 12 weeks.

iv) The Head of the Department shall appoint one mentor for each course.

v) The courses should be other than those offered under regular curriculum and are to be approved by the departmental committee consisting of the head of the department, mentor and one/two senior faculty members before the commencement of each semester.

vi) During the course, the mentor monitors the students' assignment submissions given by the agency.

vii) Students need to submit all the assignments given and need to take final exam at the proctor centre.

viii) The required credits shall be awarded on submission of certificate from the approved agency.

ix) In case if student does not qualify in the chosen subject, the same or an alternative equivalent subject may be registered again in the next semester with the recommendation of the HoD concerned and shall pass.

8. Criteria for Passing a Course, Award of Grades and Award of Division:

i) Criteria for Passing a Course:

a) A candidate shall be declared to have passed in individual theory / integrated theory and laboratory / project based theory / drawing course/design course/ practical/ mini project/main project, if he/she secures a minimum of 40% aggregate marks (continuous internal evaluation & semester end examination marks put together), subject to securing a minimum of 35% marks in the semester end examination.

b) A candidate shall be declared to have passed in skill development courses/ industrial internship/socially relevant project if he/she secures a minimum of 40% marks in the semester end examination.

c) For non-credit mandatory courses, like environmental studies and constitution of India, the student has to secure minimum 40% aggregate marks (continuous internal evaluation & semester end examination marks put together) for passing the course. For courses like Sports & Games/Cultural and NSS/Fine arts/ Yoga/Self Defense, student shall be declared to have passed in the courses if he/she secures a minimum 40% of marks in continuous internal evaluation. No marks or letter grade shall be printed in the grade cards for all mandatory non-credit courses, but only Completed (Y)/Not-completed (N) will be specified. A student has to repeat the course whenever it is offered; if he does not get satisfactory grade or does not fulfill the attendance requirements in each non-credit course for getting the degree awarded.

d) On passing a course of a program, the student shall earn the credits assigned to that course.

ii) Method of Awarding Letter Grade and Grade Points for a Course:

a) A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range A+ to E as given below.

b) Letter grade 'F' in any course implies failure of the student in that course and no credits earned. Absent is also treated as no credits earned.

A letter grade and grade points will be awarded to a student in each course based on his/her performance as per the grading system given below.

Marks Range Theory (Max - 100)	Marks Range Lab (Max. - 50)	Level	Letter Grade	Grade Points
≥ 90	≥ 45	Outstanding	A+	10
≥ 80 & ≤ 89	≥ 40 & 44	Excellent	A	9
≥ 70 & 79	≥ 35 & 39	Very Good	B	8
≥ 60 & 69	≥ 30 & 34	Good	C	7
≥ 50 & 59	≥ 25 & 29	Above Average	D	6
≥ 40 & 49	≥ 20 & 24	Average	E	5
< 40	< 20	Fail	F	0
		Absent	AB	0

iii) Calculation of Semester Grade Point Average (SGPA)* for Semester:

The performance of each student at the end of the each semester is indicated in terms of SGPA. The SGPA is calculated as given below:

SGPA = $\frac{\sum(CR\ X\ GP)}{\sum CR}$ for each semester.

where CR = Credits of a course
GP = Grade Points awarded for a course

* SGPA is calculated for a candidate who passed all the courses in that semester.

Illustration of SGPA: Let us assume there are 6 subjects in a semester. The grades obtained as follows:

Course	Credits (CR)	Grade Point (GP)	CR x GP
Subject 1	3	8	24
Subject 2	2	9	18
Subject 3	4	7	28
Subject 4	3	6	18
Subject 5	3	9	27
	∑CR=15		**∑CR x GP = 115**

iv) Calculation of Cumulative Grade Point Average (CGPA) for Entire Program:

The CGPA is calculated as given below:

CGPA = $\frac{\sum (CR\ X\ GP)}{\sum CR}$ for entire program.

where CR = Credits of a course
GP = Grade points awarded for a course

$SGPA = \frac{\sum CRxGP}{\sum CR} = \frac{115}{15} = 7.67$

Illustration of CGPA:

Semester1	Semester2	Semester3	Semester4	Semester5	Semester6	Semester7	Semester8
Credits:15	Credits:22	Credits:24	Credits:22	Credits:23	Credits:21	Credits:20	Credits:20
SGPA:7.67	SGPA:7.86	SGPA:7.87	SGPA:8.67	SGPA:8.78	SGPA:8.50	SGPA:8.60	SGPA:9.00

$$CGPA = \frac{(15x7.67) + (22x7.86) + (24x7.87) + (22x8.67) + (23x8.78) + (21x8.50) + (20x8.60) + (20x9.00)}{(15 + 22 + 24 + 22 + 23 + 21 + 20 + 20)} = 8.38$$

v) Award of Division:

After satisfying the requirements prescribed for the completion of the program, the student shall be eligible for the award of B.Tech. Degree and shall be placed in one of the following grades:

Class of Award	CGPA to be Secured	Remarks
First Class with Distinction	≥ 7.75 (Without any Supplementary Appearance)	From the CGPA secured from 160 Credits
First Class	≥ 6.75	
Second Class	≥ 5.75 & < 6.75	
Pass Class	≥ 5.00 & < 5.75	

9. Grade Card and Consolidated Grade Card

i) A grade card shall be issued for each semester separately both for regular and supplementary examinations irrespective of passing the examination.

ii) A grade card consists of a letter grade and credits earned for all courses of that semester along with SGPA and CGPA.

iii) A consolidated grade card consisting of all semesters' courses with the letter grade and credits secured for each course, CGPA and award of division shall be issued if he/she fulfills the academic regulations B.Tech. program.

10. Supplementary Examinations

Supplementary examinations will be conducted twice in a year at the end of odd and even semesters.

11. Conditions for Promotion

i) A student shall be eligible for promotion to next Semester of B.Tech. program, if he satisfies the conditions as stipulated in Regulation 6.

ii) The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in Regulation 6 for promotion into III Year I semester and IV year I semester.

a) 4 Year B.Tech Program:

i) A student shall be promoted from II year to III year only if he acquires the academic requirement of a minimum of 40% credits up to second year second semester as shown below.

1.Two regular and two supplementary examinations of I year I semester,

2.Two regular and one supplementary examinations of I year II semester,

3.One regular and one supplementary examinations of II year I semester

4.One regular examination of II year II semester,

irrespective of whether the candidate takes the examination or not.

ii) A student shall be promoted from III year to IV year only if he acquires the academic requirement of a minimum of 40% credits upto third year second semester as shown below.

1. Three Regular and three supplementary examinations of I year I sem.,

2. Three Regular and two supplementary examinations of I year II sem.,

3.Two Regular and two supplementary examinations of II year I semester,

4.Two Regular and one supplementary examinations of II Year II semester,

5.One Regular and one supplementary examinations of III Year I semester,

6.One regular examination of III Year II semester,

irrespective of whether the candidate takes the examination or not.

b) 3 Year B.Tech Program under Lateral Entry Scheme:

i) A student shall be promoted from III to IV year only if he acquires the academic requirement of a minimum of 40% credits up to third year second semester as shown below.

1. Two regular and two supplementary examinations of II year I semester,
2. Two Regular and one supplementary examinations of II year II semester,
3. One regular and one supplementary examinations of III year I semester
4. One regular examination of III year II semester,

irrespective of whether the candidate takes the examination or not.

12. Revaluation

i) Students can apply for revaluation of his/her answer script(s) of theory course(s) as per the notification issued by the Controller of Examinations.

ii) The Controller of Examinations shall arrange for revaluation of such answer script(s).

iii) An examiner, other than the first examiner, shall revaluate the answer script(s).

iv) If the variation in marks of two evaluations is less than 15% of total marks, the best mark of two evaluations shall be taken into consideration.

v) If the variation in marks of two evaluations is more than 15% of total marks, there shall be third evaluation by an examiner other than the first two examiners. The best marks of two evaluations (which are nearer) shall be taken into consideration.

vi) There is no revaluation for practical/ Mini Project/ Skill Development Courses/ Social relevant Project/ Main Project courses.

13. Re-admission Criteria

i) A candidate, who is detained in a semester due to the lack of attendance has to obtain written permission from the Principal for readmission into the same semester after duly fulfilling the required norms stipulated by the college and by paying the required tuition fee and special fee in addition to paying an administrative fee of Rs.1,000/-.

ii) A candidate who is not promoted either to III year or IV year due to lack of required credits can seek admission into III / IV year in subsequent years after obtaining the required credits as stipulated in regulation 11 by paying the required tuition fee & special fee in addition to paying an administrative fee of Rs.1000/-

14. Break in Study

Student, who discontinues the studies for what-so-ever reason, can get readmission into appropriate semester of B.Tech program only with the prior permission of the Principal of the College, provided such candidate shall follow the transitory regulations applicable to the batch he joins. An administrative fee

of Rs.2,000/- per each year of break in study in addition to the prescribed tuition fee and special fees should be paid by the candidate to condone his break in study.

15. Transitory Regulations

When a student is detained due to lack of credits or shortage of attendance, he/she may be readmitted into the same semester in which he/she has been detained. However, the academic regulations under which the detained student was first admitted shall continue to be applicable to him/her.

Transfer candidates (from an Autonomous College affiliated to JNTUK)

A student who has secured the required credits up to previous semesters as per the regulations of other Autonomous Institutions shall only be permitted to be transferred to this college. A student who is transferred from the other Autonomous colleges to this college in second year first semester or subsequent semesters shall join with the autonomous batch in the appropriate semester. Such candidates shall be required to pass in all the courses in the program prescribed by the Board of Studies concerned for that batch of students from that semester onwards to be eligible for the award of degree. However, exemption will be given in the courses of the semester(s) of the batch which he had passed earlier and substitute subjects are offered in their place as decided by the Board of Studies. The total number of credits to be secured for the award of the degree shall be equal to 160 for regular students and 120 for lateral entry students.

16. Withholding of Results

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

17. Malpractices and Punishments

i) Every student appearing for the Examinations is liable to be charged with committing malpractice(s), if he/she is observed as committing any one or more of the acts mentioned in of examination malpractices and punishments.

ii) The Principal shall refer the cases of malpractices in internal assessment tests and semester end examinations to a malpractice enquiry committee constituted by him for the purpose. Such committee shall follow the approved levels of punishment. The Principal shall take necessary action against the erring students based on the recommendations of the committee.

iii) Any action by the candidate trying to get undue advantage in the performance or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder.

DISCIPLINARY ACTION FOR MALPRACTICES/IMPROPER CONDUCT IN EXAMINATIONS

Nature of Malpractices / Improper conduct		Punishment
If the candidate		
1.a	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination.)	Expulsion from the examination hall and cancellation of the performance in that subject only.
b	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through Cell phones with any candidates or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The hall ticket of the candidate shall be cancelled.

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

6.	Refuses to obey the orders of the Chief Superintendent/Assistant Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in or around the examination hall or organises a walkout or instigates others to walkout 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 of any of his relations or indulges in any other act of misconduct or mischief which results in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the Officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidate is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidate is also debarred and forfeits the seat.

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

iv) Malpractices identified at spot centre during valuation

The involvement of the staff, who are in charge of conducting examinations, valuing examination papers and preparing / keeping records of documents related to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and appropriate disciplinary action will be taken after thorough enquiry.

18. Other Matters

i) Physically challenged candidates who have availed additional examination time and a scribe during their Intermediate/EAMCET examinations will be given similar concessions on production of relevant proof/documents. Students who are suffering from contagious diseases are not allowed to appear either for internal or semester end examinations.

ii) The students who participated in coaching / tournaments held at State / National / International levels through University / Indian Olympic Association during semester end external examination period will be promoted to subsequent semesters as per the guidelines of University Grants Commission Letter No. F.1-5/88 (SPE/PES), dated 18-08-1994.

iii) The Principal shall deal in an appropriate manner with any academic problem which is not covered under these rules and regulations, in consultation with the Heads of the Departments and subsequently such actions shall be placed before the Academic Council for ratification. Any emergency modification of regulation, approved in the meetings of the Heads of the Departments shall be reported to the Academic Council for ratification.

18. General

i) The Academic Council may, from time to time, revise, amend or change the regulations, schemes of examination and /or syllabi.

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 of the Academic Council is final.

iv) Wherever the word he, him or his occurs, it will also include she, her and hers.

Honors Degree Guidelines

I. Introduction

The goal of introducing B.Tech. (Honors) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The programme is a best choice for academically excellent students having good academic record and interest towards higher studies and research. All the students pursuing regular B.Tech. with prerequisite CGPA are eligible to register Honors degree course. A student has to acquire 20 more credits, in addition to 160 credits required, for the award of the B.Tech. Honors degree. The additional courses shall be advanced subjects in the concerned department/discipline. The department concerned will determine required courses for award of Honor degree. The subjects in the Honor degree would be a combination of core (theory and lab) and some electives.

II. Objectives

The objectives of initiating the B.Tech. (Honors) degree certification are:

a) To encourage the under graduates towards higher studies and research
b) To prepare the students to specialize in core Engineering streams
c) To attain the high-level competence in the specialized area of under graduate programme
d) To learn the best educational and professional skills in the specialized area after the completion of his under graduate courses.
e) To provide the opportunity to learn the post graduate level courses in the specified under graduate programme

III. Eligibility

a) The following departments are offering B.Tech. (Honors);
   - Civil Engineering
   - Electrical and Electronics Engineering
   - Mechanical Engineering
   - Electronics and Communication Engineering
   - Computer Science and Engineering

b) B. Tech students (both Regular and Lateral Entry) pursuing a major degree programme can register for Honors degree at their choice in the same department offering major degree from IV semester onwards.

c) Students registering for Honors degree shall select the subjects from same branches/department based on the recommendations of BoS committee. For example, if a student pursuing major degree in Electrical and Electronics Engg. shall the selects subjects in Electrical and Electronics Engg. only and he/she will get major and Honors degree in Electrical and Electronics Engineering.

d) Students registered for honors shall not be permitted to register for B. Tech (Minor).

e) Students who have a CGPA of 8.00 or above, without any backlogs, up to III semester for regular students and only III semester for lateral entry students will be permitted to register for honors degree.

f) CGPA of more than 8.00 has to be maintained in the subsequent semesters of regular degree and also 8.00 GPA has to be maintain in Honors degree to keep the Honor degree registration active.

g) Student registered for Honors degree in a discipline must register and pass in all subjects with a minimum CGPA of 8.0 that constitute requirement for award of Honors degree.

h) The subjects completed under Honors degree programme shall not be considered as equivalent subjects in case the student fails to complete the major degree programme.

IV. Registering for Honor degree

a) Total number of seats offered for a Honors programme shall be a maximum of 35% of sanctioned intake of major degree programme.

b) There is no fee for registration of subjects for Honors degree programme

c) The department offering the honors degree will declare courses offered before the start of the semester.

d) The eligible list of students shall be displayed in the respective department notice board before the start of the semester.

e) The eligible interested students shall submit a registration form to the HoD of concerned department and the department shall maintain the record of students pursing the Honors degree. The process of registration should be completed within one week before the start of every semester.

f) If the student wishes to withdraw, he/she shall inform the same to HoD of concerned department within two weeks after registration of the Honors degree.

V. Attendance Requirements

a) The overall attendance in each semester of regular B. Tech courses and Honors courses shall be computed separately.

b) A student shall maintain an overall attendance of 75% in all registered courses of Honors to be eligible for attending semester end examinations. However, condonation for shortage of attendance up to 10% may be given as per college norms. On the recommendations of College Academic Committee, the student concerned will be permitted to take the semester end examinations, on payment of condonation fee of Rs. 500/-.

c) Student having less than 65% attendance in Honors courses shall not be permitted for end semester examinations.

d) A student detained due to lack of attendance in major B. Tech programme shall not be permitted to continue Honors programme.

e) If a student is detained due to lack of attendance in Honors degree courses, he/she shall not be permitted to continue Honors programme.

VI. Credits requirement

a) Honors degree shall not be awarded at any circumstances without completing the regular major B.Tech. programme in which a student got admitted.

b) A Student will be eligible to get Honors degree along with major degree engineering, if he/she gets an additional 20 credits offered through Honors degree courses.

c) Of the 20 additional credits to be acquired, 16 credits shall be earned by undergoing specified courses of Honors degree, with four courses(both theory and lab), each carrying 4 credits. The remaining 4 credits must be acquired with two courses through online from platforms like NPTEL, etc., which shall be domain specific, each with 2 credits and with a minimum duration of 12 weeks as recommended by the Board of Studies.

d) Students shall produce a certificate issued by the online platforms like NPTEL, etc. as a proof of credit attainment.

e) Transfer of credits from a particular Honors to regular B.Tech. and Vice-Versa shall not be permitted.

f) If a student fails in any registered course of the Honors degree, he/she shall not be eligible to continue the B.Tech. Honors degree. However, the additional credits and grades thus far earned by the student shall be included in the separate grade card but shall not be considered to calculate the CGPA.

VII. Examinations

a) The examination for the Honors courses offered shall be conducted along with regular B.Tech. programme.

b) The pattern of internal and semester end examinations for Honors degree courses will be similar to regular B.Tech. courses.

c) A separate grade card shall be issued for the Honors subjects passed in each semester.

d) There is no supplementary examination for the failed subjects in a Honors programme.

e) Examination Fee to be paid will be as per the college norms.

Note: ***In the event of any tie during the seat allotment for a Honors degree, the concerned major degree department offering Honors shall conduct a test on the prerequisite subjects of Honors degree and final decision shall be taken.***

Minor Degree Guidelines

I. Introduction

Looking to global scenario, engineering students should have knowledge of subjects from other branches and some advanced subjects of their respective branch in which they are perusing the degree. To complement the same college has decided to take an initiative from 2020-21 in academics by introducing minor degree to the undergraduate students enrolled in the B.Tech. This gives a provision to the students to pursue minor other than the discipline in which student got admitted. An aspiring student can choose the courses and laboratories in any other discipline and can get a minor degree in the chosen specialization in addition to regular major B.Tech. degree. This way undergraduates are not restricted to learn about courses only in the discipline they get admitted to, but can choose courses of their interest to later on take up a career path of their liking. The students taking up a minor degree course will get additional credits. A student has to acquire 20 more credits, in addition to 160 credits required, for the award of the minor degree. The department concerned will determine the required courses for award of minor degree. The subjects in minor programme would be a combination of mostly core and some electives.

II. Objectives

The objectives of initiating the minor degree certification are:

a) To diversify the knowledge of the undergraduates.
b) To make the undergraduates more employable.
c) To have more educational and professional skills after the completion of his undergraduate courses.
d) To give a scope to specialize students in other streams of engineering in addition to the ones they are currently pursuing.

III. Eligibility

a) The following departments are offering B.Tech. (Minor);
   - Civil Engineering
   - Electrical and Electronics Engineering
   - Mechanical Engineering
   - Electronics and Communication Engineering
   - Computer Science and Engineering
   - Information Technology

b) The B.Tech. students (both Regular and Lateral Entry) pursuing a major degree programme can register for minor degree at their choice in any other department offering minor from IV semester onwards.

c) Student pursuing major degree in any engineering branch is eligible to register for minor in any other engineering branch. For example, if a student pursuing major degree in Electrical and Electronics Engineering shall complete minor in Civil Engineering and he/she will get major degree of Electrical and Electronics Engineering with minor of Civil Engineering.

d) However, students pursuing major degree in a particular engineering branch are not allowed to register for minor in the same branch.

e) The students are permitted to opt for only a single minor degree in his/her entire tenure of B.Tech. programme.

f) The students registered for minor degree shall not be permitted to register for B.Tech. (Honors.)

g) Students who have a CGPA of 7.75 or above, without any backlogs, up to III semester for regular students and only III semester for lateral entry students will be permitted to register for a minor.

h) CGPA of more than 7.75 has to be maintained in the subsequent semesters of regular degree and also 7.75 GPA has to be maintain in Minor degree to keep the Minor degree registration active.

i) A student registered for minor in a discipline must register and pass in all subjects with a minimum CGPA of 7.75 that constitute requirement for award of minor.

j) The subjects completed under minor degree shall not be considered as equivalent subjects in case the student fails to complete the major degree programme.

IV. Registering for Minor Degree

a) Total number of seats offered for a minor degree programme shall be a maximum of 35% of sanctioned intake of major degree programme.

b) There is no fee for registration of subjects for minor degree programme

c) The department offering the minor will declare courses offered before the start of the semester.

d) The eligible list of students shall be displayed in the respective department notice board before the start of the semester.

e) The eligible interested students shall apply to the HoD offering the minor degree through HoD of his/her parent department and after scrutiny the department offering minor will announce the final list of the selected students for the minor degree.

f) The selected students shall submit a registration form to the HoD offering the minor degree through HoD of his/her parent department. The process of registration should be completed within one week before the start of every semester.

g) Both parent department and department offering minor shall maintain the record of students pursing the minor degree.

h) If the student wishes to withdraw, he/she shall inform the same to HoD of department offering minor degree through HoD of parent department within two weeks after registration of the minor degree.

V. Attendance Requirement

a) The overall attendance in each semester of regular B.Tech. courses and minor courses shall be computed separately.

b) A student shall maintain an overall attendance of 75% in all registered courses of minor degree to be eligible for attending semester end examinations. However, condonation for shortage of attendance up to 10% may be given as per college norms. On the recommendations of College Academic Committee, the student concerned will be permitted to take the semester end examinations, on payment of condonation fee of Rs. 500/-.

c) Student having less than 65% attendance in minor courses shall not be permitted for end semester examinations.

d) A student detained due to lack of attendance in major B.Tech. programme shall not be permitted to continue minor degree programme

e) If a student is detained due to lack of attendance in minor degree courses, he/she shall not be permitted to continue minor programme

VI. Credits requirement

a) Minor degree shall not be awarded at any circumstances without completing the regular major B.Tech programme in which a student got admitted.

b) A Student will be eligible to get minor degree along with major degree engineering, if he/she gets an additional 20 credits offered through minor degree courses.

c) Of the 20 additional credits to be acquired, 16 credits shall be earned by undergoing specified courses of minor degree, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired with two courses through online platforms like NPTEL, etc., which shall be domain specific, each with 2 credits and with a minimum duration of 12 weeks as recommended by the Board of Studies.

d) Students shall produce a certificate issued by the online platforms like NPTEL, etc. as a proof of credit attainment.

e) Transfer of credits from a minor to regular B.Tech and Vice-Versa shall not be permitted.

f) If a student fails in any registered course of the minor degree, he/she shall not be eligible to continue the B.Tech. minor degree. However, the additional credits and grades thus far earned by the student shall be included in the separate grade card but shall not be considered to calculate the CGPA.

VII. Examinations

a) The examination for the minor courses offered shall be conducted along with regular B.Tech. programme.

b) The pattern of internal and semester end examinations for minor degree courses will be similar to regular B.Tech. courses.

c) A separate grade card shall be issued for the minor degree subjects passed in each semester.

d) There is no supplementary examination for the failed subjects in a minor degree programme.

e) Examination Fee to be paid will be as per the College norms.

Note: ***In the event of any tie during the seat allotment for a Minor degree, the concerned department offering Minor degree shall conduct a test on the prerequisite subjects of Minor degree and final decision shall be taken.***

COURSE STRUCTURE

&

SYLLABUS

COURSE STRUCTURE

I Year - I Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	EG3501	Functional English	3	-	-	3
2	MA3501	Linear Algebra and Calculus	3	1	-	4
3	PH3502	Physics for Engineers	3	-	-	3
4	CT3501	Problem Solving Using C *	3	-	2	4
5	ME3503	Engineering Graphics *	2	-	4	4
6	EG3502	Functional English Lab	-	-	2	1
7	PH3503	Engineering Physics Lab	-	-	2	1
		Total	**14**	**1**	**10**	**20**
8	EN3501	Environmental Studies (Mandatory Non-Credit Course)	2	-	-	-

* **Integrated Course with Theory and Laboratory**

I Year - II Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	EG3503	Professional Communication	2	-	-	2
2	MA3505	Integral Transforms and Vector Calculus	3	1	-	4
3	CH3504	Chemistry for Engineers	3	-	-	3
4	ME3504	Engineering Mechanics	3	1	-	4
5	UH3501	Universal Human Values 2: Understanding Harmony	2	1	-	3
6	EG3504	Professional Communication Lab	-	-	4	2
7	ME3505	Engineering Workshop	-	-	2	1
8	ME3506	Engineering Mechanics Lab and Fuel & Lubricants Lab	-	-	2	1
		Total	**13**	**3**	**8**	**20**
9	BA3501	Constitution of India (Mandatory Non-Credit Course)	2	-	-	-

L : Lecture **T : Tutorial** **P : Practical**

II Year - I Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	CT3508	Python Programming *	2	-	2	3
2	EE3505	Elements of Electrical and Electronics Engineering	3	-	-	3
3	ME3508	Engineering Thermodynamics	2	1	-	3
4	ME3509	Kinematics of Machines	2	1	-	3
5	ME3510	Mechanics of Solids	2	1	-	3
6	ME3511	Materials Engineering	3	-	-	3
7	EE3506	Electrical & Electronics Engineering Lab	-	-	2	1
8	ME3512	Mechanics of Solids Lab and Materials Lab	-	-	2	1
9	SD3501	Logic Building and Basic Coding Principles	-	-	2	1
		Total	**14**	**3**	**8**	**21**
10	SG3501	Sports and Games / Cultural (Mandatory Non-Credit Course)	-	-	2	-

* **Integrated Course with Theory and Laboratory**

II Year - II Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	MA3513	Numerical & Statistical Methods	2	1	-	3
2	ME3513	Manufacturing Science	3	-	-	3
3	ME3514	Applied Thermodynamics	2	1	-	3
4	ME3515	Dynamics of Machines	2	1	-	3
5	ME3516	Fluid Mechanics & Hydraulic Machines	2	1	-	3
6		**Open Elective - I**	3	-	-	3
7	ME3519	Thermal Engineering Lab	-	-	2	1
8	MA3515	Numerical & Statistical Methods Lab	-	-	2	1
9	ME3520	Manufacturing Processes Lab & Machine Dynamics Lab	-	-	2	1
10	SD3503	Programming for Corporate	-	-	2	1
		Total	**14**	**4**	**8**	**22**
11	NS3501	NSS / Fine Arts / Yoga / Self Defense (Mandatory Non-Credit Course)	-	-	2	-

* **Integrated Course with Theory and Laboratory**

L : Lecture T : Tutorial P : Practical

III Year - I Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	ME3521	Metal Cutting and Machine Tools	2	1	-	3
2	ME3522	Industrial Engineering	3	-	-	3
3	ME3523	Steam and Gas Turbines	2	1	-	3
4		**Professional Elective - I**	3	-	-	3
5		**Open Elective - II**	3	-	-	3
6	ME3530	Machine Tools Lab	-	-	2	1
7	ME3531	Fluid Mechanics and Hydraulic Machines Lab	-	-	2	1
8	ME3532	Solid Modeling Lab	-	-	4	2
9	SD3504	Problems Solving Enhancement	-	-	2	1
10	ME3533	Community Service Project	-	-	8	4
		Total	**13**	**2**	**18**	**24**

III Year - II Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	CT3541	Artificial Intelligence and Machine Learning	3	-	-	3
2	ME3534	Measurements and Mechatronics	2	1	-	3
3	ME3535	Heat Transfer	2	1	-	3
4	ME3536	Design of Machine Elements	2	1	-	3
5		**Professional Elective - II**	3	-	-	3
6		**Open Elective - III**	3	-	-	3
7	CT3542	Artificial Intelligence and Machine Learning Lab	-	-	4	2
8	ME3543	Heat Transfer Lab	-	-	2	1
9	SD3506	Linguistic Competency Building	-	-	2	1
		Total	**15**	**3**	**8**	**22**

* **Integrated Course with Theory and Laboratory**

L : Lecture **T : Tutorial** **P : Practical**

IV Year - I Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	ME3544	CAD / CAM	3	-	-	3
2	ME3545	Design of Transmission Elements *	2	-	2	3
3		**Professional Elective - III**	3	-	-	3
4		**Professional Elective - IV**	3	-	-	3
5		**Professional Elective - V**	3	-	-	3
6	ME3558	Measurements and Mechatronics Lab	-	-	2	1
7	ME3559	Computer Aided Engineering Analysis and Manufacturing Lab	-	-	4	2
8	ME3560	Internship/ Industrial Training/ Practical Training	-	-	6	3
9.	ME3561	MOOCs	-	-	-	2
		Total	**14**	**-**	**14**	**23**

IV Year - II Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	ME3562	Project Work	-	-	16	8
		Total	**-**	**-**	**16**	**8**

Open Elective - I

Sl. No.	Course Code	Name of the Course / Laboratory	Department Offering the Subject	No.of Periods per week			No.of Credits
				L	T	P	
1	CE3513	Elements of Civil Engineering (other than CE)	CE	3	-	-	3
2	CE3514	Environment Laws and Policies (other than CE)	CE	3	-	-	3
3	EE3513	Electrical Materials (other than EEE)	EEE	3	-	-	3
4	EE3514	Control Systems Engineering(other than EEE&ECE)	EEE	3	-	-	3
5	ME3517	Automotive Engineering (other than ME)	ME	3	-	-	3
6	ME3518	Elements of Mechanical Transmission (other than ME)	ME	3	-	-	3
7	EC3520	Introduction to Embedded Systems (other than ECE/IoT)	ECE	3	-	-	3
8	EC3521	Fundamentals of Communication Systems (other than ECE/IoT)	ECE	3	-	-	3
9	CS3503	Information Retreival Systems (Other than CSE & AI&DS)	CSE	3	-	-	3
10	CT3522	Computer Graphics (Other than CSE, IT & AI&DS)	CSE	3	-	-	3
11	IT3504	System Software (Other than IT)	IT	3	-	-	3
12	IT3505	Free & Open Source Software (Other than IT)	IT	3	-	-	3
13	MA3516	Fuzzy Mathematics	BS&H	3	-	-	3

Open Elective - II

Sl. No.	Course Code	Name of the Course / Laboratory	Department Offering the Subject	No.of Periods per week			No.of Credits
				L	T	P	
1	CE3524	Remote Sensing & GIS (other than CE)	CE	3	-	-	3
2	CE3525	Green Building Technology (other than CE)	CE	3	-	-	3
3	EE3524	Modeling & Simulation of Engineering Systems (other than EEE)	EEE	3	-	-	3
4	EE3525	Power Systems Engineering (other than EEE)	EEE	3	-	-	3
5	ME3528	Renewable Energy Sources (other than ME)	ME	3	-	-	3
6	ME3529	Venture Development (other than ME)	ME	3	-	-	3
7	EC3535	Automotive Electronics (other than ECE & IoT)	ECE	3	-	-	3
8	EC3536	Introduction to Signal Processing (other than ECE&IoT)	ECE	3	-	-	3
9	CS3504	Network Programming (Other than CSE)	CSE	3	-	-	3
10	CT3529	Social Network Analysis(Other than CSE/CSE(AI&ML))	CSE	3	-	-	3
11	CT3530	Cyber Security (Other than IT)	IT	3	-	-	3
12	IT3508	E-Commerce (Other than IT)	IT	3	-	-	3
13	AD3502	Intelligent Systems (Other than AI&DS)	AI&DS	3	-	-	3
14	CT3531	Recommender Systems(Other than CSE, IT, CSE(AI&ML) & AI&DS)	AI&DS	3	-	-	3
15	IN3514	Introduction to IoT Architecture (Other than IoT)	IoT	3	-	-	3
16	IN3515	Introduction to Smart Sensors (Other than IoT)	IoT	3	-	-	3

Open Elective - III

Sl. No.	Course Code	Name of the Course / Laboratory	Department Offering the Subject	No.of Periods per week			No.of Credits
				L	T	P	
1	CE3538	Basics of Environmental Engineering (other than CE)	CE	3	-	-	3
2	CE3539	Disaster Preparedness, Planning & Management (other than CE)	CE	3	-	-	3
3	EE3535	Principles of Special Electric Machines (other than EEE)	EEE	3	-	-	3
4	EE3536	Electrical Instrumentation (other than EEE)	EEE	3	-	-	3
5	ME3541	Green Engineering (other than ME)	ME	3	-	-	3
6	ME3542	3D Printing Technologies (other than ME)	ME	3	-	-	3
7	EC3548	Assistive Technologies(other than ECE)	ECE	3	-	-	3
8	EC3549	Introduction to Bio-Medical Engineering (other than ECE&IoT)	ECE	3	-	-	3
9	CS3511	DevOps (Other than CSE and IT)	CSE	3	-	-	3
10	CS3512	Object Oriented Analysis & Design (Other than CSE)	CSE	3	-	-	3
11	IT3515	Scripting Languages (Other than IT)	IT	3	-	-	3
12	IT3516	Fundamentals of Software Project Management(Other than CSE&IT)	IT	3	-	-	3
13	AD3505	Web Mining (Other than AI&DS)	AI&DS	3	-	-	3
14	AD3506	AI Chatbots (Other than AI&DS and CSE (AI&ML))	AI&DS	3	-	-	3
15	IN3521	Trends in IoT (Other than IoT)	IoT	3	-	-	3
16	EG3505	Academic Communication	ENG	3	-	-	3

Professional Electives

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1		**Professional Elective - I**	3	-	-	3
	ME3524	i) Automobile Engineering				
	ME3525	ii) Non Destructive Evaluation				
	ME3526	iii) Mechanical Vibrations				
	ME3527	iv) Operations Research				
2		**Professional Elective - II**	3	-	-	3
	ME3537	i) Non Conventional Sources of Energy				
	ME3538	ii) Automation in Manufacturing				
	ME3539	iii) Finite Element Method				
	ME3540	iv) Quality Governance				
3		**Professional Elective - III**	3	-	-	3
	ME3546	i) Design of Heat Transfer Equipment**				
	ME3547	ii) Robotics **				
	ME3548	iii) Tribology **				
	ME3549	iv) Computational Fluid Dynamics **				
4		**Professional Elective - IV**	3	-	-	3
	ME3550	i) Refrigeration & Air Conditioning				
	ME3551	ii) Unconventional Machining Processes				
	ME3552	iii) Design for Manufacturing and Assembly				
	ME3553	iv) Entrepreneurship				
5		**Professional Elective - V**	3	-	-	3
	ME3554	i) Power Plant Engineering				
	ME3555	ii) Additive Manufacturing				
	ME3556	iii) Condition Monitoring				
	ME3557	iv) Operations Management				

** **Project based Theory Course**

L : Lecture T : Tutorial P : Practical

HONORS DEGREE COURSE STRUCTURE

Sl. No.	Code	Year & Sem.	Name of the Course	No.of Periods per week			No.of Credits
				L	T	P	
1	HME3501	II - II	Advanced Mechanics of Solids	4	-	-	4
2	HME3502	III - I	Analysis and Synthesis of Mechanisms	3	-	2	4
3	HME3503	III - II	Fracture Mechanics	3	1	-	4
4	HME3504	III - II	MOOCs	-	-	-	2
5	HME3505	IV - I	Mechanics of Composite Materials	3	-	2	4
6	HME3506	IV - I	MOOCs	-	-	-	2
			Total	**13**	**1**	**4**	**20**

* Integrated Course with Theory and Laboratory

** Project Base Theory Course

SYLLABUS

FUNCTIONAL ENGLISH
(Common to All Branches)
I Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To equip the students for their present and future academic pursuits involving the following:
  - listening to (and viewing) classroom lectures and other academic presentations with a reasonable degree of accuracy, understanding, and appreciation, and responding to them appropriately;
  - speaking in academic (e.g. classroom discussions) and social contexts with a fair degree of fluency, accuracy and intelligibility, and with due attention to factors such as purpose, audience, context, and culture;
  - reading a wide range of informational and functional texts, including course books and reference materials, from print and non-print sources and using them for a variety of purposes; and
  - writing for academic purposes (e.g. assignments, examination answers) in an organized way following the rules of discourse and using vocabulary and grammar appropriately and accurately; and
- To develop in them the communication strategies and social graces necessary for functioning effectively in social, academic, and other situations in which they may be called upon to use English.

Course Outcomes

Upon successful completion of Functional English, the students will be able to

- speak with a reasonable degree of fluency using communication strategies (i.e. using language appropriately to carry out functions such as greeting, requesting information, seeking confirmation, disagreeing) as well conventions of politeness and courtesy
- speak with a reasonable degree of fluency and accuracy in contexts requiring tasks such as narrating and describing
- listen to short audio and video clips
  - in standard Indian accent with understanding of the types listed in D (1) (a) below; and
  - in native English accent (British and American), especially clips in which the speakers or voice actors speak slowly, and gain both understanding of messages and sensitivity to native-speaker accents
- read fluently comprehending texts of different kinds using multiple strategies to understand explicitly-stated information as well as underlying meanings

- write coherent paragraphs with attention to elements of writing such as content, organization, language, style, and mechanics and the conventions of academic writing
- write survey reports with attention to conventions of report writing
- guard against mistakes Indians typically make in their speech and writing in English

Course Content

UNIT – I:

Listening : Listening Comprehension – Task 1 (IWE - Chapt II)
Speaking : Communication Functions – Conversation between Raghu and Sridhar (IWE - Chapt II)
Reading : Reading Comprehension – Task 1 (DPM)
Vocabulary: (a) GRE Words – 1.1, (b) Collocations – 2.1 (VB)
Grammar : Tenses – Simple Present and Present Continuous (IWE - Chapt II)
Writing : Paragraph-Writing (IWE - Chapt II)

UNIT – II:

Listening : Listening comprehension – Task 2 (WR)
Speaking : Communication Functions – Exercise (DPM)
Reading : Reading Comprehension – Task 2 (DPM)
Vocabulary : (a) Words Often Confused–3.1, (b) One-Word Substitutes–4.1 (VB)
Grammar : (a) Indianism and (b) *Have to* (IWE - Chapt II)
Writing : Paragraph-Writing (IWE - Chapt II)

UNIT – III:

Listening : Listening Comprehension – Task 3 (IWE - Chapt III)
Speaking : Communication Functions – Conversation between Shreya and Kalpana (IWE - Chapt III)
Intensive Reading : Reading Comprehension Task – 3 (DPM)
Extensive Reading : *The Adventures of Huckleberry Finn* by Mark Twain
Vocabulary: (a)Idioms – 5.1, (b) Phrasal Verbs – 6.1 (VB)
Grammar : Tenses – Simple Past and Present Perfect (IWE - Chapt III)
Writing : Paragraph-Writing – Coherence (IWE - Chapt III)

UNIT – IV:

Listening : Listening Comprehension – Task 4 (IWE - Chapt IV)
Speaking : Communication Functions – Conversation between professor and Mayur (IWE - Chapt IV)
Reading : Reading Comprehension – Task 4 (DPM)
Vocabulary: (a) GRE words–1.2, (b) Collocations–2.2, (c) Words Often Confused–3.2(VB)
Grammar : Expressing Futurity (IWE - Chapt IV)
Writing : Clutter-Free Writing (IWE - Chapt IV)

UNIT – V:

Listening : Listening comprehension – Task 5 (WR)

Speaking : (a) Communication Functions and (b) Telephone Etiquette – Exercises (IWE - Chapt IV)

Intensive Reading : Reading Comprehension – Task 5 (DPM)

Extensive Reading : *More Tales from Shakespeare* by Charles and Mary Lamb

Vocabulary: (a) One-Word Substitutes – 4.2, (b) Idioms – 5.2, (c) Phrasal verbs – 6.2 (VB)

Grammar : Structure – *Going to* (IWE - Chapt IV)

Writing : Technical Report Writing (DPM)

- IWE – *Innovate with English* by T Samson (Foundation)
- Chapt – Chapter
- DPM – Department-produced materials (handouts)
- WR – Web-resources
- VB – *Vocabulary Builder for Students of Engineering and Technology* by Vijaya Lakshmi et al (Maruthi)

Text books

1. T. Samson, Innovate with English, First Edn., Cambridge University Press India Pvt. Ltd. under the imprint of Foundation Books, Hyderabad, 2010.
   - Units TWO, THREE and FOUR only
2. M. Vijaya Lakshmi, et al., Vocabulary Builder for Students of Engineering and Technology, Second Edn., Maruthi Publications, Hyderabad, 2017.
3. The following simplified classics, one for each mid-semester, from the series, Great Stories in Easy English, published by S. Chand & Company Limited:
   - The Adventures of Huckleberry Finn by Mark Twain
   - More Tales from Shakespeare
4. Audio and video clips carefully selected by the Department in order to sensitize the students to native-speaker accents
5. Department-produced material on survey report writing

Testing Pattern

First Mid-Term Examination

The paper consists of four questions. All questions are compulsory; there is no choice.

I. Reading an unseen passage and answering two sets of questions on it:

a) Eight comprehension questions. Critical questions requiring analysis, inference, prediction, evaluation, etc. are to be set. Four of the eight questions will be multiple-choice questions. In case of non-multiple-choice questions, the length of each answer should not exceed 50 words. **Marks: 8 x ½ = 4**

b) Writing a discussion either on an aspect related to the ideas expressed in the passage but not explicitly dealt with in it, or on an idea not fully dealt with, allowing scope for discussion. **Marks: 1 x 4 = 4**

II. Twelve contextualized questions of the following from *Vocabulary Builder*: GRE Words: 1.1; Collocations: 2.1; Commonly confused words: 3.1; One-word substitutes: 4.1; Idioms: 5.1; and Phrasal verbs: 6.1 **Marks: 12 x ½ = 6**

III.

a) Correction of grammatical errors: Eight sentences with grammatical errors of the following types (dealt with in Units 2 and 3 of *Innovate with English*) will be given: simple present, present continuous, use of *have to* structure and Indianism **Marks: 8 x ½ = 4**

b) Eight objective-type questions based on one retold classic: *The Adventures of Huckleberry Finn*. **Marks: 8 x ½ = 4**

IV.

a) Completing a conversation (in which informational and interactional functions are performed) with appropriate expressions. **Marks: 8 x ½ = 4**

b) Reading two poorly-written paragraphs and performing the following tasks:

i. Identifying the topic sentence of paragraph (a) and the sentences that do not support the topic sentence, and writing in the answer book the topic sentence and the irrelevant sentences. **Marks: 4 x ½ = 2**

ii. Re-writing paragraph (b), which is poorly organized, into a coherent paragraph choosing appropriate sequence signals or connectives. **Marks: 4 x ½ = 2**

Second Mid-Term Examination

The paper consists of four questions All questions are compulsory; there is no choice.

I.a) Eight contextualized questions on the following from *Vocabulary Builder*: GRE Words: 1.1; Collocations: 2.1; Commonly confused words: 3.1; One- word substitutes: 4.1; Idioms: 5.1; and Phrasal verbs: 6.1 **Marks: 8 x ½ = 4**

b) Analyzing a service encounter – an interaction, either a direct personal one, or over the telephone (e.g. *making enquires at the reception counter in a hotel, an interaction with a salesman at a mall, asking for information on the telephone)* – and

i. identifying the reasons for the failure or breakdown of communication in the conversation **Marks: 4 x ½ = 2**

ii. rewriting the conversation making the communication successful. In the rewritten conversation, the partners in the conversation must sound polite and positive, using the communication strategies listed in the question.**Marks: 4 x ½ = 2**

II. Reading an unseen passage and answering two sets of questions on it:

a) Eight comprehension questions. Critical questions requiring analysis, inference, prediction, evaluation, etc. are to be set. Four of the Eight questions will be multiple-choice questions. In case of non-multiple-choice questions, the length of each answer should not exceed 50 words. **Marks: 8 x ½ = 4**

b) Writing a discussion either on an aspect related to the ideas expressed in the passage but not explicitly dealt with in it, or on an idea not fully dealt with, allowing scope for discussion. **Marks: 1 x 4 = 4**

III.

a) Writing a technical report on the given situation. The report must:
follow the conventions of technical report writing
use language and style appropriate to technical report writing
Marks: 1 x 4 = 4

b) Writing a paragraph of 100 - 150 words on the given topic (e.g. *Should there be a dress code in colleges?*). The paragraph must have:
adequate and relevant ideas on the topic with the ideas properly organized using strategies such as coherence and cohesion;
a topic sentence; and
proper choice of vocabulary and grammatical accuracy. **Marks: 1 x 4 = 4**

IV.

a) Correction of grammatical errors: six sentences with grammatical errors of the following types (dealt with in Unit 4 of *Innovate with English*) will be given: futurity and Indianism. **Marks: 6 x ½ = 3**

b) Six objective-type questions based on one retold classic: *More Tales from Shakespeare.* **Marks: 6 x ½ = 3**

Semester End Examination

Answer any five questions. Question one is compulsory.

I. Reading an unseen (unfamiliar) passage, preferably one taken from a newspaper or a magazine, on a topical event or situation and answering three sets of questions on it:

a. Seven comprehension questions:
- Critical questions requiring analysis, inference, prediction, evaluation, etc. are to be set; 'information' questions involving a mere reproduction of the content should be avoided.
- Three of the seven questions should be multiple-choice questions.
- In case of non-multiple-choice questions, the length of each answer should not exceed 50 words. **Marks: 7 x 1 = 7**

b. Finding four one-word substitutes in the passage for the expressions given. **Marks: 4 x ½ = 2**

c. Writing a discussion either on an aspect related to the ideas expressed in the passage but not explicitly dealt with in it, or on an idea not fully dealt with, allowing scope for discussion. **Marks: 1 x 5 = 5**

II. Reading an incomplete conversation that takes place in an academic or social or professional context (where informational and interactional functions are performed) and answering the following questions on it:

a. Completing the conversation with appropriate expressions. The expressions are to be chosen from among the ones given in a box. In the answer book, the examinee is expected to number the blanks as 1, 2, 3, etc., and write against each the expression he/she has chosen. **Marks: 7 x 1 = 7**

b. Writing a dialogue extending the scope of the original conversation following the instructions given in the question on how it should be extended. The instructions must include five communication strategies/functions, and the examinee is expected to use them in his/her dialogue. **Marks: 1 x 7 = 7**

III. Analyzing a service encounter – an interaction, either a direct personal one, or over the telephone, e.g. *making enquiries at the reception counter in a hotel, an interaction with a salesman at a mall, asking for information on the telephone* – and

a. identifying the reasons for the failure or breakdown of communication in the conversation **Marks: 1 x 7 = 7**

b. rewriting the conversation making the communication successful. In the rewritten conversation, the partners in the conversation must sound polite and positive, using the communication strategies listed in the question. **Marks: 1 x 7 = 7**

IV. Reading two badly-written paragraphs and performing the following tasks:

a. Identifying the topic sentence of paragraph (a) and the sentences that do not support the topic sentence, and writing in the answer book the topic sentence and the irrelevant sentences. **Marks: 1 x 7 = 7**

b. Re-writing paragraph (b), which is poorly organized, into a cohesive paragraph choosing appropriate sequence signals. **Marks: 1 x 7 = 7**

V.

a. Writing a paragraph of 150 words on the given topic (e.g. *Should there be a dress code in colleges?*). The paragraph must have:

- adequate and relevant ideas on the topic with the ideas properly organized using strategies such as coherence and cohesion;
- a topic sentence; and
- proper choice of vocabulary and grammatical accuracy. **Marks: 1 x 7 = 7**

b. Writing a survey report using the data on the table(s)/graph(s) given. The report must:

- indicate acquaintance with the conventions of academic writing; and
- the ability to interpret data intelligently.

However, high standards of performance need not be expected as the students are in the first year of their course. It also follows that complex tables/graphs should be avoided. **Marks: 1 x 7 = 7**

VI. Contextualized vocabulary questions with two items on each one of the following from *Vocabulary Builder* (listed as 2 under F. TEXTBOOKS above):

- GRE Words (Units 1.1 and 1.2)
- Collocations (Units 2.1 and 2.2)
- Commonly Confused Words (Units 3.1 and 3.2)
- One-Word Substitutes (Units 4.1 and 4.2)
- Idioms (Units 5.1 and 5.2)
- Phrasal Verbs (Units 6.1 and 6.2)

For example, in the question on idioms, two sentences/contexts with an idiom in each may be given, and the examinee will have to identify the most appropriate meaning of the idiom from among the four options given. **Marks: 14 x 1 = 14**

VII. Correction of grammatical errors:

- Either a conversation with fourteen grammatical errors of the types dealt within the Textbook 1 (*Innovate with English*), or isolated sentences with fourteen grammatical errors will be given.
- The errors will include at least seven typical instances of Indianism widely believed to be inappropriate in standard English.
- If isolated sentences with errors are given, they are not to be given in isolation from their contexts; a conversation with errors of the kind specified above will serve the purpose better.
- The examinees are expected to rewrite the sentences in the answer book, correcting them. **Marks: 14 x 1 = 14**

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LINEAR ALGEBRA AND CALCULUS
(Common to CE, EEE, ME, ECE, IoT, CSE & IT)

I Year – I Semester

Lecture : 3	Tutorial : 1	Internal Marks	: 30
Credits : 4		External Marks	: 70

Course Objectives

- To understand the procedure to solve the system of linear equations.
- To know the method for finding eigenvalues and eigenvectors.
- To familiar with the knowledge of differential calculus to support their concurrent and subsequent engineering studies.
- To know how to find maxima and/or minima for a given surface.
- To understand the methods to evaluate areas and volumes using integrals.

Course Outcomes

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

- solve the system of linear equations in various engineering problems.
- evaluate the eigenvalues and eigenvectors.
- solve linear ordinary differential equations .
- apply the techniques of partial differentiation in optimization problems and solve first order partial differential equations.
- compute areas and volumes using double and triple integrals.

Course Content

UNIT– I: System of Linear Equations

Rank of a matrix – Echelon form, Normal form. System of linear equations – consistency and inconsistency - Gauss-elimination method.

UNIT– II: Eigenvalues and Eigenvectors

Finding eigenvalues and eigenvectors for a given matrix, Properties of Eigenvalues and Eigenvectors, Cayley –Hamilton theorem - finding inverse and powers of a matrix. Singular value decomposition.

UNIT– III: Ordinary Differential Equations

Review on first order ordinary differential equations. Application – Newton's Law of cooling. Solving Second and Higher Order Differential Equations : Homogeneous differential equations and Non-Homogeneous differential equations when RHS terms are of the form e^{ax}, sin ax, cos ax, polynomial in x, $e^{ax}v(x)$ and method of variation of parameters.

Overview of Cauchy's and legendre's differential equations.

UNIT– IV: Partial Differentiation and Equations

Introduction - total derivative, chain rule. Jacobian, Applications - finding maxima and minima (two & three variables).

Solutions of first order linear P.D.E. Solving Non-Linear P.D.E by charpit's method.

UNIT– V: Multi Integrals

Evaluation of double and triple integrals. Areas by double integrals and Volumes by triple integrals. Change the Order of integration.

Text Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, Maitrey Printech Pvt. Ltd, Noida, 2014.
2. B.S.Grewal, Higher Engineering Mathematics, 44th edition, Khanna Publishers, New Delhi, 2020.

Reference Books

1. Schaum's Series, Differential Equations, Tata-Mc Graw Hill Company Limited.
2. Bali & Iyengar,Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd.

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PHYSICS FOR ENGINEERS

I Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To impart the concept of periodic motion.
- To apply principles of optics for engineering applications.
- To analyze crystal parameters to investigate crystal structures.
- To explore various Non Destructive Techniques.

Course Outcomes

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

- derive expression for oscillations (SHM),
- explore lasers for engineering situations.
- recognize crystal structures and X-Ray crystallography.
- relate basic knowledge of NDT to carry out inspection in accordance with the established procedures.
- analyze the wave nature of light.

Course Content

UNIT – I: Simple Harmonic Oscillations

Introduction – Simple harmonic motion – Equation for simple harmonic motion – Theoretical analysis (a) Free vibrations, (b) Damped vibrations, (c) Forced vibrations – Resonance.

UNIT – II: Laser

Introduction– Basic characteristics –Spontaneous and stimulated emission – Einstein's coefficient and their relations – Pumping Schemes – Ruby laser – He-Ne Laser - Semi conductor laser – Application of LASER.

UNIT – III: Crystal Structures

Introduction – Crystal systems – SCC, BCC, FC – X-Ray diffraction – Bragg's law– Powder method– classification of Crystal imperfection – Point defects(qualitative) – Edge and Screw dislocation .

UNIT – IV: Non-Destructive Testing

Introduction to non-destructive testing- visual inspection tests process – Acoustic Emission Test – Flaw Detection – Surface and sub-surface flaws – Types of NDT methods – Working Principle and testing procedure for Liquid Penetration Test – ultrasonic testing and magnetic particle inspection.

UNIT – V: Physical Optics

Introduction – Interference in thin films – Newton's Rings. Fraunhofer Diffraction – single slit – Diffraction Grating. Polarization – Double refraction – Nicol's Prism – Wave Plates – Photo elasticity.

Text Books

1. RK Gaur & SL Gupta, Engineering Physics (Edition 2011), Dhanapat Rai publications.
2. M.N. Avadhanulu, P.G. Kshirsagar , Engineering Physics (9th Edition), S.Chand Publications.

Reference Books

1. Ajoy Ghatak, Optics(5th Edition), Tata McGraw-Hill
2. B.B. Laud, Laser and Non-Linear Optics, New Age international publishers
3. J. Prasad, C.G. Krishnadas Nair, Non-Destructive Test and Evaluation of Materials, 2nd edition, McGraw Hill Education.
4. Robert D. Finch, Introduction to Acoustics, 1st edition, Pearson Education India.

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PROBLEM SOLVING USING C
(Common to CE, EEE, ME, ECE & IoT)

I Year – I Semester

Lecture : 3	Practice : 2	Internal Marks	: 30
Credits : 4		External Marks	: 70

Course Objectives

- To emphasize the use of flowcharts and pseudo code in problem solving.
- To apply C Programmingin problem solving.

Course Outcomes

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

- outline problem solving steps and solve sample problems.
- use control statements for writing the programs.
- apply the concepts of arrays, strings and pointers in problem solving.
- decompose a problem into functions to develop modular reusable code.
- use structures and files for efficient handling of data.

Course Content

UNIT – I: Problem Solving Steps and Introduction of C

Problem Solving Steps: Understanding problem, developing algorithm, flow chart, coding, debugging and testing.

Introduction of C: General form of a C program, variable declaration, C tokens, basic data types, type conversion, console i/o statements, expressions precedence and associativity, order of evaluation.

Problem Solving: Sample Problems such as evaluating expressions, to calculate area of geometrical shapes.

Programs :

1. Write a C program to calculate the area of triangle using the formula area = $(s(s-a)\ (s-b)(s-c))^{1/2}$ where s= (a+b+c)/2.
2. Write a C Program to find the largest number and smallest among three numbers using ternary operator.

UNIT – II: Control Statements

Selection-Making Decisions – single-way, two-way selection, multi-way selection statements and conditional operator.

Iteration Statements – concept of loops, pre-test and post-test loops in C.

Jump Statements – return, goto, break, exit and continue.

Problem Solving: Calculate the sum of first N numbers, check the given number is prime, and generate Fibonacci series.

Programs :

1. Design and develop a flowchart or an algorithm that takes three coefficients (a, b, and c) of a quadratic equation (ax2+bx+c=0) as input and computes all possible roots. An equation is quadratic only if a is non zero. If a is zero and b is non zero in the above equation then it becomes a linear equation (bx + c = 0).If a and b are zeros then the it becomes a constant equation. Implement a C program for the developed flowchart / algorithm and execute the same to output the possible roots for a given set of coefficients with appropriate messages.
2. Read two integer operands and one operator form the user, perform the operation and then print the result. (Consider the operators +,-,*, /, % and use Switch Statement)
3. Write a C program to find the sum of n natural numbers and sum of squares of n natural numbers.
4. Read a number from the user input, print all the prime numbers up to that number and print their sum.
5. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print “Correct values”, otherwise print “Wrong values”

UNIT – III: Arrays and Strings

Arrays – Declaring, initializing, accessing and display of one dimensional and two dimensional arrays.

Strings – String Input /Output functions, string manipulation functions.

Problem Solving: Perform addition and multiplication of two matrices, C programs isomg string handling functions.

Programs:

1. Write a C programto search whether the given element is in the array or not.
2. Write a C programto perform addition and multiplication of two matrices.
3. Write a C program to find whether the given string is palindrome or not with and without string handling functions.

UNIT – IV: Pointers and Functions

Pointers – Declaration, Initialization and operations of Pointers.

Functions – General form of functions, categories of functions, types of functions, passing parameters by value and by address, recursive functions, dynamic memory allocation functions, arrays of pointers, pointers and strings.

Problem Solving: Programs on pointer arithmetic’s, Factorial and fibonacci calculation with recursion and without recursion.

Programs:

1. Write a C programto add two numbers using pointers.

2. Write a C programto find the factorial of a given integer using recursive function.
3 Write a C program to exchange (Swap) values of two integers using call by reference.

UNIT – V: Structures and Unions and File Handling

Structures and Unions: Definition, declaration, initialization, accessing members of structures and unions, nested structures, array of structures, array within structures, union within structure.

File Handling: Text and binary files, file operations, file handling functions, random access to files.

Problem Solving: Implement a structure to read and display the Name, date of Birth and salary of an Employee. Programs to access file content.

Programs :

1. Write a C Program using arrays of structures to read the Name, Date of Birth, Five subject marks of N students and display all the details of students along with calculated CGPA of each student.
2. Write a C program to append multiple lines at the end of a text file.
3. Write a C program to count the number of lines, words and characters in a file.

Text Books

1. Programming in C, Pradip Dey, Manas Ghosh, 2nd Edition, Oxford Higher Education.
2. Programming in C, Reema Thareja, 2nd Edition, Oxford Higher Education.

Reference Books

1. Programming for Problem Solving, Behrouz A. Forouzan, Richard F.Gilberg, Cengage, 2020.
2. Programming in ANSI C, E Balaguruswamy, 7thedition, McGrawHill.
3. Let Us C, Yashvant Kanetkar, 17th Edition, BPB publications.

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ENGINEERING GRAPHICS
(Common to CE & ME)
I Year – I Semester

Lecture : 2	Practical : 4	Internal Marks	: 30
Credits : 4		External Marks	: 70

Course Objectives

- To highlight the significance of universal language of engineers.
- To introduce the concepts of drawing 3-D objects in 2-D planes.
- To impart computer aided drafting skills.

Course Outcomes

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

- construct polygons and conic sections.
- draw projections of points, lines, planes and solids in different positions.
- draw orthographic and isometric views of different parts.
- create engineering drawing using drafting package.

Course Content

UNIT – I: Geometrical Constructions, Conics and Orthographic Projections

Geometrical Constructions: Bisecting a line and arc, division of a circle, construction of polygons

Conics: Construction of ellipse, parabola, hyperbola using general method

Orthographic Projections: Principles of orthographic projections, projections of points in various quadrants

Practice of basic drawing and editing commands using CAD Package.

UNIT – II: Projections of Straight Lines

Lines parallel to both planes, parallel to one and inclined to other plane, straight lines inclined to both planes, determination of true lengths and true angles , traces.

Drawing of projections of straight lines using CAD Package.

UNIT – III: Projections of Planes

Regular planes perpendicular / parallel to one reference plane and inclined to other reference plane, planes inclined to both the reference planes.

Drawing of projections of planes using CAD Package.

UNIT – IV: Projections of Solids

Regular solids with axis perpendicular to one reference plane, solids with axis inclined to one reference plane and perpendicular to other reference plane, solids with axis inclined to both reference plane.

Drawing of projections of solids using CAD Package

UNIT – V: Isometric and Orthographic Views

Isometric drawing of plane figures, prisms, pyramids, cylinders and cones, Conversion of isometric views to orthographic views and vice versa.

Drawing of orthographic views and isometric views using CAD Package.

Text Books

1. N.D. Bhatt, Engineering Drawing, 53rd edition , Chariot Publications.
2. K.VenuGopal and V Prabhu Raja , Engineering Drawing with AutoCAD, 5th edition, New Age International Publishers.

Reference Books

1. B.V.R.Gupta and M.Raja Roy, Engineering Drawing with Autocad,3rd edition, I.K. Publishers.
2. M. B. Shah and B. C. Rana, Engineering Drawing , 2nd edition, Pearson Education.
3. Dhanunjay A Jolhe ,Engineering Drawing , 2nd edition, Mc GrawHill Education.

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FUNCTIONAL ENGLISH LAB
(Common to All Branches)

I Year – I Semester

Practical	: 2	Internal Marks	: 30
Credits	: 1	External Marks	: 70

Course Objectives

- Functional English (Lab) seeks to develop in the students the communication strategies and social graces necessary in order to function effectively in social and other situations in which they may be called upon to speak in English; and
- It seeks to develop in them a greater awareness of English pronunciation and provides for focused practice with the sounds of English and intonation patterns improve their pronunciation skills and to enable them to speak with a reasonable degree of intelligibility.

Course Outcomes

Upon successful completion of Functional English (Lab), the students will be able to

- give short impromptu speeches with confidence and fluency.
- take part in conversations in different functional contexts using English following appropriate communication strategies.
- use conventions of politeness and courtesy in speech and enhance the effectiveness of their communication in English.
- articulate the sounds of English (vowels, consonants, and diphthongs) with accuracy.
- check the pronunciation of words in a dictionary using their knowledge of phonemic symbols.
- pause at appropriate places in their speech in English, enhancing thereby the comprehensibility of their communication.
- speak English with adequate attention to stress, rhythm, and intonation.
- speak without their pronunciation being marred by regional peculiarities, achieving thereby greater intelligibility in their communication with non-Telugu speakers of English.
- read out texts of different kinds fluently with appropriate pauses, stress, and intonation.

Course Content

UNIT – I: a.Greeting, introducing and taking leave b. Pure vowels

UNIT – II: a.Giving information and asking for information b. Diphthongs

UNIT – III: a. Inviting, accepting and declining invitations b. Consonants

UNIT – IV: a. Commands, instructions and requests b. Accent and rhythm

UNIT – V: a. Suggestions and opinions b. Intonation

Text Books

1. Hari Prasad, et al., *Strengthen Your Communication Skills*, First Edn., Maruthi Publications, Hyderabad, 2014.
2. Handouts produced by the Department on "difficult sounds," consonant clusters, the other problems of Telugu learners of English, listening comprehension, and oral reading.
3. The following pieces of software:
   - 'Multimedia Language Lab' provided by K-Van Solution, Hyderabad
   - 'Foundation Course in Communication Skills' provided by the Andhra Pradesh State Council of Higher Education (APSCHE), Government of Andhra Pradesh.
4. Audio and video clips such as 'BBC English'

Testing Pattern

I.	**Internal**	**30 marks**
a.	Regular performance in the Language/Communications Lab	15 marks
b.	Completing the tasks in the lab manual	05 marks
c.	Testing of listening : Listening to a short audio clip of a speech/conversation in British accent and answering questions at the 'information' level.	05 marks
d.	Test of reading: Role-playing a dialogue with proper pronunciation and with reasonable attention to tone groups, stress, rhythm and intonation.	05 marks
II.	**External**	**70 marks**
a.	Test of writing	
	Writing a dialogue on the situation set	10 marks
	Answering 'Yes/No' questions on pronunciation	05 marks
	Marking sentence stress and intonation	05 marks
	Writing English word for the word in phonetic transcription	05 marks
b.	Test of speaking	25 marks
	Role-playing a situational dialogue (e.g. 'At the railway station,' 'At the restaurant') with proper pronunciation and with reasonable attention to tone groups, stress, rhythm, and intonation	
c.	Viva voce (with an external examiner)	20 marks
	Speaking for one minute on a given topic	

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ENGINEERING PHYSICS LAB
(Common to CE & ME)
I Year – I Semester

Practical	: 2	Internal Marks	: 30
Credits	: 1	External Marks	: 70

Course Objectives

- To make the students gain practical knowledge to co-relate with the theoretical studies.
- To impart skills in measurements.
- To design and plan the experimental procedure and to record and process the results.

Course Outcomes

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

- use spectrometer, travelling microscope for making measurements.
- test optical components using principles of interference and diffraction of light
- determine the rigidity, coupling constant of vibrations.
- verify the width of narrow slits, spacing between close rulings using lasers and appreciate the accuracy in measurements.

List of Experiments

1. Determine the rigidity modulus of given wire-Torsional Pendulum.
2. Determine the coupling constant of Coupled oscillator.
3. Study of normal modes in string using Forced vibrations in rods-Melde's experiment.
4. Determination of lattice constant – lattice dimensions kit.
5. Determine the radius of curvature of plano convex lens-Newton Rings.
6. Determine the thickness of thin object-wedge method.
7. Laser beam divergence and spot size determination.
8. Determination of wave length of source using diffraction grating.
9. Determine the dispersive power of a given material of the prism.
10. Determine the specific rotation of sugar solution by using a Polarimeter.
11. The velocity of Ultrasonic Waves in Water by the Debye-Sears Effect
12. Ultrasonic Interferometer
13. Volume Resonator

Note: Any 8 experiments out of 13 experiments.

Reference Books

1. Vijay Kumar & T. Radha Krishna, Practical Physics for engineering students.
2. Dr. Y.Aparna and Dr. K.Venkateswara Rao, Lab manual of Engineering Physics, VGS Books links, Vijayawada.
3. R.Jayaraman,V.Umadevi,S.Maruthamuthu,B.Saravana Kumar, Engineering Physics laboratory manual(1st edition) Pearson publishers.

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ENVIRONMENTAL STUDIES
(Common to CE, ME, IoT & IT)
I Year – II Semester

Lecture	: 2	Internal Marks	: 30
Credits	: -	External Marks	: 70

Course Objectives

- To impart the basic knowledge about the environment and ecology.
- To develop an attitude of concern for biodiversity and its conservation.
- To create awareness on environmental pollution and waste management.

Course Outcomes

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

- create awareness among the people in protection of environment.
- analyze structure and functional attributes of an ecosystem.
- explain the values of biodiversity.
- identify the sources of environmental pollution, assess their effects and suggest suitable control measures.
- adopt sustainable waste management practices.

Course Content

UNIT – I: Multidisciplinary Nature of Environmental Studies

Definition – Scope – Importance - Need for Public Awareness – Multidisciplinary nature of Environmental Studies – Role of a citizen in protection of environment

UNIT – II: Ecosystem

Concept of an ecosystem – Structural features of an ecosystem – Functional attributes of an ecosystem: Trophic structure – Food Chains – Food Web – Ecological Pyramids – Energy Flow– Biogeochemical Cycles – Ecological Succession.

UNIT – III: Biodiversity & Its Conservation

Definition – Levels of Biodiversity – Bio-geographical zones of India – Values of biodiversity (Consumptive use value, Productive use value, Social value, Ethical value, Aesthetic value, Option values, Ecosystem service values) – India as a mega diversity nation–Hot spots of biodiversity-Threats to biodiversity – Endangered &Endemic species of India – Conservation of biodiversity.

UNIT – IV: Environmental Pollution

Definition, causes, effects & control measures of : Air pollution – Water pollution – Noise pollution-Soil pollution. Global climatic issues: IPCC- Introduction – Role of IPCC-Global warming – Acid rains – Ozone layer depletion.

UNIT – V: Waste Management

Waste water treatment – Municipal solid waste management – Biomedical waste

management – Hazardous waste management – E-waste management – Environmental legislations: Wild life (Protection) Act,1972 – Water (Prevention and Control of Pollution) Act, 1974 –Forest (Conservation) Act,1980 – Air (Prevention and Control of Pollution) Act, 1981 – Environmental(Protection) Act,1986.

Text Books

1. Anubha Kaushik, C.P.Kaushik, Environmental Studies, Fourth Edition, New Age International Publishers.
2. P.Anandan, R.Kumaravelan, Environmental Science & Engineering, Scitech Publications (INDIA) Pvt. Ltd.

Reference Books

1. Shashi Chawala, Environmental Studies, Tata McGraw Hill Education Private Limited.
2. Deeksha Dave & P. Udaya Bhaskar, Environmental Studies, Cengage Learning.
3. Dr.Suresh, K.Dhameja, Society and Environment, S.K. Kataria & Sons.
4. Benny Joseph, Environmental studies, Tata McGraw Hill Publishing Company Limited.

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PROFESSIONAL COMMUNICATION
(Common to All Branches)
I Year – II Semester

Lecture	: 2	Internal Marks	: 30
Credits	: 2	External Marks	: 70

Course Objectives

- To equip the students with common employability skills (the skills required for gaining employment and performing successfully in different careers) which can enable them to perform communication tasks of increasing length and complexity.
- To develop in them the interactional communication strategies and social graces which have the potential to add to the effectiveness of professional communication.

Course Outcomes

Upon successful completion of Professional Communication, the students will be able to

- speak with a reasonable degree of fluency and accuracy in professional communication situations (such as arriving at a consensus through discussion, making a presentation, and taking part in a telephone conversation)
- add to the effectiveness of their oral communication by using communication strategies, conventions of politeness and courtesy, and stress and intonation.
- listen to short audio and video clips in native English accent (British and American), and gain both understanding of messages and sensitivity to native-speaker accents
- read fluently, comprehending texts of different kinds using multiple strategies and higher-order skills
- produce written discourses of different kinds (e.g. texts expressing opinions and making a convincing case for one's standpoint, professional emails, and summaries of lengthy texts) with attention to elements of writing such as content, organization, language, style, and mechanics
- guard against grammatical errors Indians typically make in their speech and writing in English

Course Content

UNIT – I:

Listening : Listening comprehension – Task 1 (IWE – Chapt VII)
Speaking : Communication Strategies: Conversation Amith& Mahesh (IWE – Chap VII)
Reading : Reading Comprehension – Task 1 (IWE – Chapt VII)
Vocabulary: (a) GRE words – 1.3, (b) Collocations – 2.3 (VB)
Grammar : *If* Clause (IWE – Chapt VII)
Writing : Email writing (IWE – Chapt VII)

UNIT – II:

Listening : Listening comprehension – Task 2 (WR)
Speaking : Exercise on Communication Strategies (IWE – Chapt VII)
Reading : Reading Comprehension – Task 2 (DPM)
Vocabulary: Words often confused – 3.3, One-word substitutes – 4.3 (VB)
Grammar : Modal verbs (IWE – Chap VII)
Writing : Email writing and Argumentative Essay (IWE – Chapt VII)

UNIT – III:

Listening : Listening comprehension – Task 3 (WR)
Speaking : Communication Strategies – Exercise (DPM)
Intensive Reading : Reading Comprehension – Task 3 (DPM)
Extensive Reading: *Pride and Prejudice* by Jane Austen
Vocabulary: (a) Idioms – 5.3, (b) Phrasal verbs – 6.3 (VB)
Grammar : Indianism (IWE – Chapt VII)
Writing : Argumentative Essay (DPM)

UNIT – IV:

Listening : Listening comprehension – Task 4 (IWE – Chapt VIII)
Speaking : Communication Strategies and Presentation: Conversation between Suchitra, Lakshmi, Guhan and Karan ((IWE – Chapt VIII)
Reading : Reading Comprehension – Task 4 (DPM)
Vocabulary: (a) GRE Words – 1.4, (b) Collocations – 2.4, (c) Words Often Confused – 3.4 (VB)
Grammar : Indefinite Articles (IWE – Chapt VIII)
Writing : Presentation – Analysis (DPM)

UNIT – V:

Listening : Listening comprehension – Task 5 (WR)
Speaking : Communication Strategies – Exercise (IWE – Chapt VIII)
Intensive Reading : Reading Comprehension Task – 5 (DPM)
Extensive Reading : *Gulliver's Travels* by Jonathan Swift
Vocabulary: (a) One-Word Substitutes – 4.4, (b) Idioms – 5.4, (c) Phrasal-verbs – 6.4 (VB)
Grammar : Definite Articles (IWE – Chapt VIII)
Writing : Presentation – Rewriting

- IWE – *Innovate with English* by T Samson (Foundation)
- Chapt - Chapter
- DPM – Department-produced materials (handouts)
- WR – Web-resources
- VB– *Vocabulary Builder for Students of Engineering and Technology* by Vijaya Lakshmi et al (Maruthi)

Textbooks

1. T. Samson, *Innovate with English*, First Edn., Cambridge University Press India Pvt. Ltd. under the imprint of Foundation Books, Hyderabad, 2010.
   - Unit SEVEN and EIGHT only
2. M. Vijaya Lakshmi, et al., *Vocabulary Builder for Students of Engineering and Technology, Second Edn.,* Maruthi Publications, Hyderabad, 2017.
3. The following simplified classics, one for each mid-semester, from the series, *Great Stories in Easy English*, published by S. Chand & Company Limited:
   - *Pride and Prejudice* by Jane Austen
   - *Gulliver's Travels* by Jonathan Swift
4. Audio and video clips carefully selected by the Department in order to sensitize the students to native-speaker accents.
5. Department-produced materials on reading comprehension.

Testing Pattern

First Mid-Term Examination

The paper consists of four questions. All questions are compulsory; there is no choice.

I. Reading an unseen passage and answering two sets of questions on it:

a) Eight comprehension questions. Critical questions requiring analysis, inference, prediction, evaluation, interpretation of the writer's ideas, etc. are to be set. Four of the Eight questions will be multiple-choice questions. In case of non-multiple-choice questions, the length of each answer should not exceed 50 words. **Marks: 8 x ½ = 4**

b) Writing an essay expressing a point of view on one or more of the issues flagged up in the question and making a convincing case for the standpoint. Length: 100 – 150 words. **Marks: 1 x 4 = 4**

II. Reading a poorly-written e-mail message and doing the following tasks:

a) Analyzing the reasons for the e-mail failing to meet the standards of professional e-mail communication. The analysis must identify and discuss at least five reasons. (Length: 100 – 150 words) **Marks: 1 x 3 = 3**

b) Rewriting the e-mail using the standards of professional e-mail communication. **Marks: 1 x 3 = 3**

III.

a) Eight contextualized questions on the following from *Vocabulary Builder*: GRE Words: 1.3; Collocations: 2.3; Commonly confused words: 3.3; One- word substitutes: 4.3; Idioms: 5.3; and Phrasal verbs: 6.3 **Marks: 8 x ½ = 4**

b) Correction of grammatical errors: Eight sentences with grammatical errors of the following types (dealt with in Unit 7 of *Innovate with English*) will be given: *if*-clause and Indianism **Marks: 8 x ½ = 4**

IV.

a) Completing a conversation (where informational and interactional functions are performed) with suitable expressions. **Marks: 8 x ½ = 4**

b) Answering eight 'true-or-false' questions on communication strategies and functions given in form of short dialogues. **Marks: 8 x ½ = 4**

Second Mid-Term Examination

The paper consists of four questions. All questions are compulsory; there is no choice.

I. Reading a poorly-written e-mail message and doing the following

a) Analyzing the reasons for the e-mail failing to meet the standards of professional e-mail communication. The analysis must identify and discuss at least five reasons. (Length: 100 – 150 words) **Marks: 1 x 4 = 4**

b) Rewriting the e-mail using the standards of professional e-mail communication **Marks: 1 x 4 = 4**

II. Reading an unseen passage and answering two sets of questions on it.

a) Eight comprehension questions. Critical questions requiring analysis, inference, prediction, evaluation, interpretation of the writer's ideas, etc. are to be set. Four of the Eight questions will be multiple-choice questions. In case of non-multiple-choice questions, the length of each answer should not exceed 50 words. **Marks 8 x ½ = 4**

b) Writing an essay expressing a point of view on one or more of the issues flagged up in the question and making a convincing case for the standpoint. Length: 100 – 150 words. **Marks: 1 x 4 = 4**

III.

a) Eight contextualized questions on the following from *Vocabulary Builder*: GRE Words: 1.4; Collocations: 2.4; Commonly confused words: 3.4; One- word substitutes: 4.4; Idioms: 5.4; and Phrasal verbs: 6.4 **Marks: 8 x ½ = 4**

b) Correction of grammatical errors: Eight sentences with grammatical errors of the following types (dealt with in Unit 8 of *Innovate with English*) will be given: articles and Indianism. **Marks: 8 x ½ = 4**

IV. Reading an expository text and doing two tasks:

a) Making notes (identifying the main points of the text and writing them down in note form) **Marks: 1 x 3 = 3**

b) Summarizing the text using the notes already made **Marks: 1 x 3 = 3**

Semester End Examination

Answer any five questions: **Question I is compulsory.**

I. Reading a poorly-writen e-mail message and doing the following task: (Compulsory)

a. Analyzing the reasons for the email failing to meet the standards of professional email communication. The analysis must identify and discuss at least seven reasons. (Length: 100-150 words) **Marks: 1 x 7 = 7**

b. rewriting the email using the standards of professional email communication. **Marks: 1 x 7 = 7**

II. Reading the text of a presentation made in a professional context and answering the following questions:

a. Analysing the passage from the point of view of language and style and identifying the reasons for the presentation falling short of the standards of professional presentations (Length of the answer: 100 – 150 words) **Marks: 1 x 7 = 7**

b. Rewriting the text of the presentation in the light of the analysis made in (a) above and following the conventions of professional presentations as far as language and style are concerned. **Marks: 1 x 7 = 7**

III. Reading an unseen (unfamiliar) passage on an issue related to engineering and technology or on a professional issue or situation and answering two sets of questions on it:

a. Seven comprehension questions: **Marks: 7 x 1 = 7**

- Critical questions requiring analysis, inference, prediction, evaluation, interpretation of the writer's ideas, pinpointing the writer's attitude/bias, etc. are to be set; 'information' questions involving a *mere* reproduction of the content should be avoided.
- At least three of the seven questions should be multiple-choice questions.
- In case of non-multiple-choice questions, the length of each answer should not exceed 50 words.

b. Writing an essay expressing a point of view on one or more of the issues flagged up in the question and making a convincing case for the standpoint. Length: 200 – 250 words. **Marks: 1 x 7 = 7**

IV. Filling in blanks in sentences using GRE words, collocations, one-word substitutes, commonly-confused words, idioms, and phrasal verbs. The contexts will be clearly given for each expression, and the questions will be multiple-choice ones. **Marks: 14 x 1 = 14**

- GRE Words (Units 1.3 and 1.4)
- Collocations (Units 2.3 and 2.4)
- Commonly Confused Words (Units 3.3 and 3.4)
- One-Word Substitutes (Units 4.3 and 4.4)
- Idioms (5.3 and 5.4)
- Phrasal Verbs (Units 6.3 and 6.4)

V. Reading a on a professional or semi-professional issue and answering two questions on it:

a. Matching suitable expressions selected from the dialogue with the given communication strategies. **Marks: 7 x 1 = 7**

b. Extending the scope of the dialogue using at least five of the given communication strategies/functions. **Marks: 1 x 7 = 7**

VI. Correction of grammatical errors:

- Either a conversation with twelve grammatical errors (in the areas of articles, modal verbs, prepositions, phrasal verbs, and Indianism), or isolated sentences with twelve grammatical errors will be given.
- If isolated sentences with errors are given, they are not to be given in isolation from their contexts; a conversation with errors of the kind specified above will serve the purpose better.

The examinees are expected to rewrite the sentences in the answer book, correcting hem. **Marks: 14 x 1 = 14**

VII. Reading an expository text and doing two tasks:

a. Making notes (identifying the main points of the text and writing them down in note form) **Marks: 6 x 1 = 6**

b. Summarizing the text using the notes already made. **Marks: 1 x 8 = 8**

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INTEGRAL TRANSFORMS AND VECTOR CALCULUS
(Common to All Branches)

I Year – II Semester

Lecture : 3	Tutorial : 1	Internal Marks	: 30
Credits : 4		External Marks	: 70

Course Objectives

- To gain the knowledge of Laplace and inverse transforms.\
- To understand the concepts of Fourier series and Fourier Transforms.
- To know about vector differentiation and integration.

Course Outcomes

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

- evaluate improper integrals using Laplace transforms.
- apply Laplace transforms to find the solutions of initial and boundary value problems.
- find the Fourier series representation of a function in one variable and apply Fourier transform in various engineering problems.
- apply the concepts of vector differentiation in their engineering fields.
- verify the relation between line, surface and volume integrals using integral theorems.

Course Content

UNIT – I: Laplace Transforms

Laplace transforms of standard functions – Shifting Theorems - Multiplication and division by t, transforms of derivatives and Evaluation of Improper Integrals - Unit step function – Dirac Delta function.

UNIT – II: Inverse Laplace Transforms

Inverse Laplace transforms – by partial fractions –Convolution theorem (without proof).

Application: Solution of Initial value problems and Boundary value problems.

UNIT – III: Fourier Series and Fourier Transforms

Fourier Series: Fourier series in an arbitrary interval, Half-range sine and cosine series.

Fourier integral theorem (only statement). Fourier transforms and inverse Fourier transforms, Fourier sine and cosine transforms and inverses. Properties of Fourier transforms.

UNIT – IV: Vector Differentiation

Gradient – unit normal – angle between surfaces – directional derivative . Divergence – solenoidal vector. Curl – irrotational vector – scalar potential. Laplacian operator.

UNIT – V: Vector Integral theorems

Greens theorem , Stokes theorem and Gauss Divergence Theorem - related problems. Applications: Work done, flux across the surface.

Text Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, Maitrey Printech Pvt. Ltd, Noida, 2014.
2. B.S. Grewal, Higher Engineering Mathematics, 44th edition, Khanna Publishers, New Delhi, 2020.

Reference Books

1. Schaum's Series, Differential Equtions, Tata-Mc Graw Hill Company Limited.
2. Bali & Iyengar,Text Book of Engineering Mathemtics, Laxmi Publications (P) Ltd.

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CHEMISTRY FOR ENGINEERS

I Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To impart knowledge of electrochemical energy systems, corrosion and its prevention and water treatment methods.
- To impart the knowledge of chemical methods of synthesis and analysis of plastics,nanomaterials, fuels and lubricants.

Course Outcomes

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

- explain the electrochemistry of batteries, analyze the corrosion of metals and apply a suitable method of corrosion prevention.
- solve the numerical problems on hardness of water and explain water treatment methods and their significance in industry and daily life.
- explain synthesis, properties and applications of plastics and nanomaterials and fabrication methods of plastics.
- analyze the quality of coal using different processes, discuss synthesis of synthetic petrol and explain the composition of CNG and LPG.
- explain the mechanism of lubrication,experimental determination of properties and applications of lubricants.

Course Content

UNIT – I: Electrochemical Energy Systems and Corrosion

Electrochemical energy systems: Electrochemistry and applications of lead-acid battery, VRLA technology, lithium ion battery, Zinc-air battery and H_2- O_2 fuel cell.

Corrosion: Electrochemical theory of corrosion – galvanic corrosion, corrosion due to differential aeration cells and pitting corrosion. Factors influencing the rate of corrosion (position of metal in electro chemical series, temperature, pH) – cathodic protection method – impressed current method and sacrificial anode method. Surface coatings – hot dipping (galvanization and tinning).

UNIT – II: Hard Water and Boiler Troubles

Hardness of water – calculation of hardness, boiler troubles – priming and foaming, sludge and scale formation, caustic embrittlement, boiler corrosion. Water softening by Ion exchange resin and Phosphate conditioning. Potable water – WHO standards – municipal water treatment. Production of potable water from brackish water by RO method.

UNIT – III: Plastics and Nano Materials

Plastics: Types of plastics, moulding techniques – Compression and Blow film moulding, preparation, properties and applications of Teflon and Bakelite.

Nano materials: Classification, synthesis of nanomaterials – sol-gel method – characterization of nanomaterials by SEM and TEM methods. carbon nanotubes – types – properties and applications.

UNIT – IV: Fuels

Solid Fuels: Introduction – calorific value – HCV and LCV. Determination of calorific value by Bomb calorimeter – problems on calorific value. Analysis of coal – Proximate and Ultimate analysis. Combustion – Problems on air requirement.

Liquid Fuels: Synthesis of petrol – Bergius process and Fisher Tropsch process.

Gaseous Fuels: Composition of CNG and LPG.

UNIT – V: Lubricants

Classification of lubricants, mechanism of lubrication, properties – experimental determination and significance of Viscosity index, Aniline point, Flash and Fire point, Pour and Cloud point of a liquid lubricant – applications of lubricants.

Text Books

1. Engineering Chemistry - Fundamentals and Applications, Shikha Agarwal, 1st edition (2015), Cambridge University Press, New Delhi.
2. A Text book of Engineering Chemistry by Dr. Bharathi Kumari Yalamanchili. VGS Techno series, 6th Edn., 2019.

Reference Books

1. A Textbook of Engineering Chemistry, Sunita Rattan, First edition 2012, S.K. Kataria & Sons, New Delhi.
2. Text book of Engineering Chemistry by Jain & Jain. Dhanpat Rai Publishing Company, 16th Edn., 2015.
3. Essentials of Physical Chemistry, B.S. Bahl, G. D. Tuli and Arun Bahl, S.Chand and Company Limited, New Delhi.
4. Spectroscopic identification of organic compounds, Robert M.Silverstein, sixth edition ,Wiley, 2005.
5. Physical chemistry, Peter Atkins, Tenth edition, Oxford University Press, 2014.

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ENGINEERING MECHANICS

I Year – II Semester

Lecture : 3	Tutorial : 1	Internal Marks	: 30
Credits : 4		External Marks	: 70

Course Objectives

- To impart the basic concepts of force systems, free body diagram and equilibrium conditions and effect of friction in various systems.
- To familiarize with the calculation of the geometric properties like centroid, centre of gravity, moment of inertia of various sectional areas and bodies.
- To develop the knowledge on basic principles of kinematics and kinetics of a particle and rigid bodies.

Course Outcomes

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

- explain the concept on resultant and equilibrium of a force system.
- apply the principle of friction to connected bodies, wedges, and ladders.
- determine centroid, centre of gravity of standard and composite areas and bodies.
- determine moment of inertia of standard and composite areas and bodies.
- Apply fundamental concepts of kinematics and kinetics of a particle and rigid body to analyze the problems.

Course Content

UNIT – I: Force systems-Resultant and Equilibrium Conditions, Moment and Couple

Introduction to engineering mechanics–Types of forces-Coplanar, Concurrent and parallel forces–Resultant–Composition and resolution of forces, Types of supports, Free Body Diagrams, Equations of Equilibrium of Coplanar Systems. Lami's Theorem-Moment of force systems in plane and its Application–Couples- Equilibrium of Coplanar Non-concurrent force systems – Conditions of equilibrium and its Application.

UNIT – II: Friction

Introduction, limiting friction and impending motion - Coefficient of friction, Laws of static friction, cone of static friction, applications of friction- Impending motion of connected bodies between blocks, Wedge and Ladder friction.

UNIT – III: Centroid and Centre of Gravity

Centroids: Definition, Centroids of standard figures (from basic principles) – Centroids of Composite Figures, Centre of gravity of standard bodies (from basic principles), centre of gravity of composite bodies-Pappus–Guldinus theorem

UNIT – IV: Moment of Inertia

Area moment of inertia: Moment of Inertia – definition, Moment of Inertia of standard figures(from basic principles) – Parallel axis theorem – Polar Moment of Inertia, Moment of Inertia of composite figures.

Mass Moment of Inertia - Transfer Formula for Mass moment of Inertia, Mass moment of Inertia of standard (from basic principles) and composite bodies.

UNIT – V: Kinematics and Kinetics

Planar kinematics: Introduction-Rectilinear and Curvelinear motions – Plane Motion of Rigid Body, Velocity and Acceleration under Translation and Rotational Motion, Relative Velocity.

Kinetics of Rigid Body: Introduction, Force, Mass and Acceleration, D'Alembert's Principles and Dynamic Equilibrium, Work and Energy, Principle of Linear Impulse and momentum, collision of bodies – simple applications.

Text Books

1. Engineering Mechanics, Timoshenko, D. H.Young and J.V. Rao,, Tata Mc Graw – Hill education (India) Pvt. Ltd., 5th Edition.
2. Engineering. Mechanics,S.S.Bhavikatti and K.G.Rajashekarappa, New age International Pvt. Ltd., Publishers., 6th Edition.

Reference Books

1. Singer's Engineering Mechanics Statics and Dynamics,K.Vijay Kumar Reddy and J.Suresh Kumar, B.S publications, Hyderabad, 6th Edition.
2. Engineering Mechanics: statics and dynamics, A.Nelson, Tata Mc Graw – Hill publishing company limited, New Delhi, 5th Edition.
3. Engineering Mechanics, R.K.Bansal, Laxmi publications Pvt. Ltd., 4th Edition.

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UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY
(Common to CE, ME, IoT & IT)

I Year – II Semester

Lecture : 2	Tutorial : 1	Internal Marks	: 30
Credits : 3		External Marks	: 70

Course Objectives

- To help students understand the need, basic guidelines, content and process of value education.
- To help students initiate a process of dialog with in themselves to know what they really want to be in their life and profession.
- To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
- To understand the harmony in nature and existence.
- To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

Course Outcomes

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

- be aware of themselves and surroundings
- be responsible in life
- develop personality to be happy continuously and prosper
- handle the problems with sustainable solutions.
- possess human nature in mind
- apply what they have learnt to their own self in real life situations

Course Content

UNIT – I : Value Education

Significance of Universal human values, Value Education – Importance, content, Process. Self-exploration, Basic human aspirations, Right understanding, Natural acceptance.

Suggested topics for Tutorial/Practice sessions:

Learning HVLS from the Inspiring Life Sketches of great personalities:
Isaac Newton, Michael Faraday, JJ Thomson, Einstein, Madam Curie, Mahatma Gandhi, Abraham Lincoln, JF Kennedy, Martin Luther King, BR Ambedkar, Charles Darwin, Karl Marx, Helen Keller, Sam Pitroda, Mark Zuckerberg, SudhaMurty, Leonardo Davincy, Michelangelo, The eternal 3: Socrates, Plato, Aristotle, Alexander, Swami Vivekananda, Abdul Kalam, AB Vajapayee, Sergei Bubka.

UNIT – II: Harmony In Myself

Co-existence of the self and the Body, Understanding the needs of Self (I') and Body'-Sukh and Suvidha, Body as an instrument of 'I', Harmony in 'I' - Sanyam and Svasthya, correct appraisal of our Physical needs.

Suggested topics for Tutorial/Practice sessions:

Leadership through Literature: ValmikiRamayan, Vyasa MahaBharath- Bhagavad Gita, Answers of Yudhistir to Questions by Yaksha, Kaalidas- Raghu Vamsam, Abhignyana Saakuntalam and Maalavika Agnimitram, Homer- Iliad and Odyssey, Professionalism- Learning from the Jews, Buddha, The Bible- Jesus Christ, Solomon's wisdom, The Koran- Prophet Mohammad, Guru Nanak, John Milton, Shakespeare, Sigmond Freud, Robin Sharma, Ravindranath Tagore, Sadguru Jaggi Vasudev, War and Peace by Leo Tolstoy, Unto the Last by Ruskin, Social Contracts by Rousseu, If by Rudyard Kipling, The 7 Habits of highly effective people by Stephen R Covey. Art of Rhetoric by Aristotle.

UNIT – III: Harmony in the Family and Society

Family as the basic unit of human interaction, Harmony in the family, Justice, Trust, Respect, Intention vs competence, Respect is Differentiation.Extending relationship from family to society.Comprehensive human goal – identification, programs for achievement of the goal.Dimensions of Human endeavour, Harmony from family order to world family order.

Suggested topics for Tutorial/Practice sessions:

Ideal Home: Characteristics of Happy families, Personal hygiene and habits, Harmony, Health and happiness, Advantages of combined families.Vasudhaika Kutumbam- Universalism.Vilasa Vidya- Importance of hobbies, Music therapy. Influence of friends and peer groups- ideal friend, Friendship and faith, Avoiding vices, Advance Crime detection technologies, Law and legislation pertaining to students.

UNIT – IV: Harmony in the Nature and Existence

Harmony in the nature – orders in nature, existence as co-existence, co-existence of units in space, holistic perception of harmony at all levels of existence.

Suggested topics for Tutorial/Practice sessions:

Leadership through languages: Atleast 5 poems / rhymes and 10 Sentences of each among atleast 10 of the following languages: Sanskrit, Telugu, Tamil, Malayalam, Kannada, Oriya, Bengali, Hindi, Urdu, Punjabi, Maratthi, Gujarati, Latin, Greek, Chinese, Japanese, Italian, Spanish, French and German. Bionics: Technology from animals. Interpretation of Paintings.

UNIT – V: Implications of the Right Understanding

Values in different dimensions of Human living,definitiveness of ethical human conduct,development of Human consciousness ,implications of value based living. Identification of comprehensive Human goal, Humanistic Education,

humanistic constitution,humanistic universal order and its implications. Competence in professional Ethics, Holistic technologies and systems.

Suggested topics for Tutorial/Practice sessions:

Personality Traits: Ich Bin- Who am I? Know thyself. Self esteem, Sanyam: Self learning, self motivation, self control and self discipline, Thinking aloud, Team work, Discipline, Courage, Creativity, Sense of humour, Equanimity- love for animals and nature, Gratitude, Time and money management, Leadership skills, Importance of sports and games, Importance of Swimming, Writing and Public speaking skills, Quotable quotations: Those who quote only are quoted. Mpemba Effect – The Rags to riches concept. Commonalities of great personalities. Estimation of value of a person and his habits. SWOT Analysis.

Text Books

1. R.R Gaur, R.Sangal and G.P.Bagaria; "A Foundation Course in Human Values and Professional Ethics", 2011, Excel Books, New Delhi.

Reference Books

1. A N Tripathy, 2003, Human Values, New Age International Publishers.
2. KVSG Murali Krishna, Mastering LIFE SKILLS ,Environmental Protection Society, Kakinada, 2015.
3. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

Note: Tutorial/Practice sessions may be conducted with reference to Many Historical aspects, having relevance to the topic of discussion. Few of such topics are suggested.

Methodology Suggested for Instruction:

- Teacher is a mentor or guide or Supervisor
- Student –Teacher interactive sessions in the class.
- Student must be made to think and express his views boldly.
- Every student has to present individual PPT about the content of the subject
- Assignments need to be submitted by students and evaluated by teacher into dedication specifying critical review.

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PROFESSIONAL COMMUNICATION LAB
(Common to All Branches)

I Year – II Semester

Practical	: 4	Internal Marks	: 30
Credits	: 2	External Marks	: 70

Course Objectives

- Professional Communication (Lab) is a career-oriented programme. It seeks to develop in the students the competence required to perform professional communication tasks of increasing length and complexity, which can help them secure employment and perform successfully in their careers.

Course Outcomes

Upon successful completion of Professional Communication Lab, the students will be able to

- enhance the effectiveness of their communication through body language;
- take part in interactional communication (i.e. communication that serves the purpose of social interaction or small talk) with fluency
- take part in transactional communication (i.e. communication that serves the purpose of carrying out functions such as giving directions, complaining, and apologizing) with fluency
- speak professionally in telephone conversations;
- make effective presentations using a range of strategies, including a good organization of the content, impressive opening and closing, the use of suitable visual aids, the use of stories/anecdotes to illustrate a point, effective use of body language, and good handling of the question-and-answer session;
- take part in group discussions and debates successfully;
- answer questions at an elementary level in job interviews (e.g. Can you tell us something about yourself? What kinds of things do you worry about? What are your key skills? What skills do you need to improve? What do you see as your strengths? What do you like doing in your spare time? How would you describe the way you work? Tell us about a time when you showed strong leadership skills. Tell us about a time when you had to make a difficult decision. How do you see yourself in five years' time?) ;and
- use team-building skills with impact in different situations.

Course Content

UNIT–VI : Body Language
UNIT–VII : Dialogues
UNIT–VIII : Presentation Skills
UNIT–IX : Group Discussion
UNIT–X : Interviews and Telephonic Interviews
UNIT–XI : Debates

Text Books

1. Hari Prasad, et al., *Strengthen Your Communication Skills*, First Edn., Maruthi Publications, Hyderabad, 2014.
2. The following pieces of software:
   - 'Multimedia Language Lab' provided by K-Van Solution, Hyderabad
   - 'Foundation Course in Communication Skills' provided by the Andhra Pradesh State Council of Higher Education (APSCHE), Government of AP.

Testing Pattern

1. Internal **30 marks**

a. Regular performance in the Communications Lab 15 marks
b. Completing the tasks in the lab manual 05 marks
c. Making a PowerPoint presentation (Pair/Group) 10 marks
(Note: A hard copy of the presentation is to be submitted)

2. External **70 marks**

a. Test of writing
A telephone conversation 10 marks
The minimum number of exchanges to be specified
- Writing a resume 10 marks

The length (1page / 2 pages) is to be specified. The features to be included in the resume are also to be specified; the examinees will, however, have the option of including more features within the length specified.
- Answering 3 job-interview questions 15 marks

Questions at an elementary level. In other words, questions that require candidates to talk about themselves, their ambitions, , why they chose to study engineering, their strengths and weaknesses, their hobbies and interests, their personality, their perception of their leadership skills, and their key skills. Industry/job-related questions could be avoided.

Sample questions:

Can you tell us something about yourself?
What kinds of things do you worry about?
What are your key skills?
What skills do you need to improve?
What do you see as your strengths?
What do you like doing in your spare time?
How would you describe the way you work?
Tell us about a time when you showed strong leadership skills.
Tell us about a time when you had to make a difficult decision.
How do you see yourself in five years' time?

b. Test of speaking
Group discussion 20 marks
Time: 10-15 minutes (approx.) per group

c. Viva voce with an external examiner 15 marks

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ENGINEERING WORKSHOP

I Year – II Semester

Practical	: 2	Internal Marks	: 30
Credits	: 1	External Marks	: 70

Course Objectives

- To impart hands-on training on basic engineering trades.

Course Outcomes

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

- use various tools to prepare basic carpentry and fitting joints
- prepare jobs of various shapes using black smithy
- make basic house wire connections and
- fabricate simple components using tin smithy.

List of Trades

Practice any two experiments from each trade of any six trades

1) Carpentry :
- a) T-Lap Joint
- b) Cross Lap Joint
- c) Dovetail Joint.

2) Fitting
- a) V-Fit
- b) Square Fit
- c) Half Round Fit

3) Black Smithy
- a) Round to Square
- b) S-Hook
- c) Round to Ring.

4) House Wiring
- a) Parallel / Series Connection
- b) Stair Case wiring
- c) Florescent Lamp connection.

5) Tin Smithy
- a) Taper Tray
- b) L - Pipe
- c) Funnel

6) Welding
- a) Lap joint
- b) Butt joint
- c) T-joint

8) Plumbing
- a) Screwed pipe joint – For GI Pipes, PVC Pipes
- b) Glued pipe joint – for PVC pipes

9) Handling of Power Tools
- a) Jig Saw
- b) Circular Saw
- c) Hand Drill
- d) Hand Grinder

Reference Books

1. Elements of Workshop Technology vol.-1 & vol.-2 by A. K. Hajra Choudhury, S. K. Hajra Choudhury, Nirjhar Roy
2. Workshop Manual , P.Kannaih,K.L. Narayana , Scitech Publishers
3. Engineering Drawing by Dhananjay A. Jolhe, Tata McGraw Hill Publishers

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ENGINEERING MECHANICS LAB AND FUEL LUBRICANTS LAB

I Year – II Semester

Practical	: 2	Internal Marks	: 30
Credits	: 1	External Marks	: 70

Engineering Mechanics Lab

Course Objectives

- To impart knowledge on basic engineering applications.

Course Outcomes

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

- verify polygon law and lami's theorem
- determine moment of force on a member
- determine the coefficient of friction
- locate the centroid for plane lamina
- calculate axial forces in given trusses

List of Experiments (Any six of the below experiments may be perfomed)

1. Verification of polygon law of forces
2. Calculation of moment of a force using weight balancing technique and system of pulleys.
3. Verification of lami's theorem.
4. Determination of coefficient of friction of different surfaces.
5. Calculation of centroid of the plane lamina.
6. Determination of axial forces in members of a simple truss.
7. Analysis of trapezoidal trusses for different loads.

Text Books

1. Engineering Mechanics, Timoshenko, D. H.Young and J.V. Rao, Tata McGraw – Hill education (India) Pvt. Ltd.
2. Engineering Mechanics, R.K.Bansal, Laxmi publications Pvt. Ltd.

Fuels & Lubricants Lab

Course Objectives

- To impart skills in analyzing the quality of lubricating oils, fuels and water.
- To impart the skills in studying the corrosion of metals.

Learning Outcomes

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

- analyze the properties of lubricating oil.
- analyze the corrosion rate of a given metal in a given environment by gravimetric method
- estimate the total hardness of given water sample using EDTA method.

- operate the pH meter, conductivity meter for analyzing the water quality.
- operate the bomb calorimeter and Junker's gas calorimeter and determine the calorific value of a fuel.

List of Experiments (Any six of the below experiments may be perfomed)

1. Determination of viscosity index of the given lubricating oil by using redwood viscometer.
2. Determination of flash and fire point of the given lubricating oil.
3. Determination of pour and cloud point of the given lubricating oil.
4. Determination of total hardness of the given water sample by EDTA method.
5. Determination of aromatic content of a lubricant by Aniline point measurement.
6. Determination of rate of corrosion of carbon steel metal in acid medium in the absence and presence of Thiourea inhibitor by gravimetric method.
7. Determination of calorific value of fuel by bomb calorimeter.
8. (a) Determination of pH of the different water samples by using pH meter.
   (b) Determination of conductivity of different water samples by using conductivity meter.
9. Determination of calorific value of gaseous fuel by Junker's gas calorimeter.

Lab Manual

1. Vogel's Textbook of Quantitative Chemical Analysis, Fifth edition, John Wiley & Sons, Inc., New York.
2. Fernandez, A., Engineering Chemistry, Owl Book Publishers.
3. Engineering chemistry laboratory manual &record by Srinivasulu .D,Parshva publications.
4. Engineering Chemistry Lab Manual by K.Mukkanti, B.S publications, 2009.

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CONSTITUTION OF INDIA
(Common to CE, ME, IoT & IT)

I Year – II Semester

Lecture	: 2	Internal Marks	: 30
Credits	: -	External Marks	: 70

Course Objectives

- To impart knowledge on basic engineering applications.
- To enable the student to understand the importance of constitution.
- To understand the structure of Executive, Legislature and Judiciary.
- To understand Philosophy of fundamental rights and duties.
- To understand the autonomous nature of constitution bodies like Supreme Court and High Court Controller and Auditor General of India and Election Commission of India.
- To understand the Central and State relation, financial and administrative.

Course Outcomes

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

- understand history and philosophy of constitution with reference to Preamble, Fundamental Rights and Duties
- understand the concept of Unitary and Federal Government along with the role of President, Prime Minister and Judicial System.
- structure of the state government, Secretariat, Governor and Chief Minister and their functions.
- learn local administration viz. Panchayat, Block, Municipality and Corporation.
- learn about Election Commission and the process and about SC, ST, OBC and women.

Course Content

UNIT – I:

Introduction to Indian Constitution: 'Constitution' meaning of the term, Indian Constitution – Sources and Constitutional History, Features – Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT – II:

Union Government and its Administration Structure of the Indian Union: Federalism Centre – State relationship, President: Role, Power and Position. Prime Minister (PM) and Council of Ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha. The Supreme Court and High Court: Powers and Functions.

UNIT – III:

State Government and its Administration Governor – Role and Position – Chief Minister (CM) and Council of Ministers. State Secretariat: Organisation, Structure and Functions.

UNIT – IV:

A Local Administration – District's Administration Head – Role and Importance, Municipalities – Mayor and Role of Elected Representative – Chief Executive Officer (CEO) of Municipal Corporation Panchayati Raj : Functions Panchayati Raj Institution (PRI), Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: Block level orgnisational Hierarchy – (Different Departments), Village level – Role of Elected and Appointed officials – Importance of grass root democracy.

UNIT – V:

Election Commission: Election Commission – Role of Chief Election Commissioner and Election Commissionerate State Election Commission: Functions and Commissions for the welfare of SC/ST/OBC and Women.

Reference Books

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt.Ltd., New Delhi.
2. Subash Kashyap, Indian Constitution, National Book Trust.
3. J.A. Siwach, Dynamics of Indian Government and Politics.
4. D.C. Gupta, Indian Government and Politics.
5. H.M.Sreevai. Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication).
6. J.C. Johari, Indian Government and Politics Hans.
7. J.Raj, Indian Government and Politics.
8. M.V. Pylee, Indian Constitution, Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd., New Delhi.
9. Noorani, A.G. (South Asia Human Rights Documentation Centre), Challenges to Civil Right). Challenges to Civil Rights Guarantees in India, Oxford University Press 2012.

E-Resources:

1. nptel.ac.in/courses/109104074/8.
2. nptel.ac.in/courses/109104045.
3. nptel.ac.in/courses/101104065.
4. www.hss.iitb.ac.in/en/lecture-details.
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution.

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PYTHON PROGRAMMING

II Year – I Semester

Lecture : 2	Practical : 2	Internal Marks	: 30
Credits : 3		External Marks	: 70

Course Objectives

- To introduce Scripting Language.
- To explore various problems solving approaches of computer science.
- To be familiarized with general coding techniques to solve object-oriented programming concepts.

Course Outcomes

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

- solve coding tasks related to fundamental and control statements.
- design structured programs using functions.
- differentiate mutable and immutable data types.
- understand and apply the concepts of exceptions and file handling.
- analyze the importance of object-oriented programming over structured programming.

Course Content

UNIT – I: Basics of Python Programming and Control Statements

Features and History of Python, Literal Constants, Data Types, Variables, Operators, input operation.

Conditional and un-conditional branching, Iterative statements, Nesting of decision control statements and loops.

Problem Solving: Write a Python Program

1. to compute distance between two points taking input from the user (use Pythagorean Theorem)
2. to print out the decimal equivalents of 1/2, 1/3, 1/4, . . . ,1/10, using a while loop,
3. to find the factorial of given number using do-while loop,
4. find the sum of all the primes below hundred.

UNIT – II: Functions and Strings

Functions-Function Definition, Call, Return Statement, Types of Argument, Recursive Functions, Modules.

Strings -Basic String Operations, String Formatting Operator, Built-in functions.

Problem Solving: Write a Python Program

1. to create a function cumulative_product to compute cumulative product of a list of numbers.
2. to create a function compute_gcd and compute_lcm of two numbers (Each function shouldn't exceed one line).
3. that accepts a string from a user and re-displays the same after removing vowels from it.
4. to create a function to reverse a given string.

UNIT – III: Tuples, Lists and Dictionaries

Tuples – creating, accessing values, updating, deleting elements in a tuple, Basic Tuple operations.

Lists – accessing, updating values in Lists, Basic List operations, mutability of lists.

Dictionaries – Creating a Dictionary, adding an item, deleting items, sorting items, looping over a dictionary, Basic Dictionary operations, Built-in functions.

Problem Solving: Write a python program to

1. swap two values using Tuple assignments.
2. scan an email address and form a tuple of user name and domain name.
3. print sum and average of the elements present in the list.
4. form a list of first character of every word present in another list.
5. count the number of characters in the string and store them in a dictionary.
6. print maximum and minimum value in a dictionary.

UNIT – IV: Exception Handling and File Handling

Exception Handling-Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions

Files-File types, File path, File operations-open, close, read, write, file positions and command line arguments.

Problem Solving: Write a python program to

1. handle division by zero exception.
2. create a user-defined exception named "ShortInputException" that raises when the input text length is less than 3.
3. print each line of a file in reverse order.
4. compute the number of characters, words and lines in a file.
5. copy contents of one file into another file.

UNIT – V: Object Oriented Programming in Python

Classes, Objects, 'self' variable, Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding.

Problem Solving: Write a python program to

1. create a class that stores the name and marks of students using classes. (use list to store marks in 3 subjects).
2. to create a class having instance variables and then get and set those values using getter and setter methods.
3. implement multiple inheritance.

Text Books

1. Reema Thareja, "Python Programming – Using Problem Solving Approach ", Oxford University Press, 2014 Edition.
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.

Reference Books

1. Wesley J. Chun, "Core Python Programming", Second Edition, Prentice Hall.
2. Martin C. Brown, "Python: The Complete Reference", 2001 Edition, Osborne/ Tata McGraw Hill Publishing Company Limited.
3. Kenneth A. Lambert, 'Fundamentals of Python – first programs", 2012 Edition, CENGAGE publication.

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ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING

II Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the basic concepts of electrical circuits
- To familiarize with the constructional details, working principles of DC and AC machines.
- To familiarize with the operation of diode and transistors.

Course Outcomes

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

- apply the basic laws and theorems to solve any electrical circuit
- determine the operational characteristics of the DC machines & AC machines
- choose an appropriate machine to meet specified performance requirements for a particular application
- outline the working principles of special motors
- demonstrate the characteristics of diode and transistors.

Course Content

UNIT – I:

Electrical Circuits: Basic definitions, Classification of elements, Ohm's Law, Kirchhoff's Laws, Series, Parallel circuits, Mesh and nodal analysis, Superposition, Thevenin's and maximum power transfer theorems for simple dc circuits.

UNIT – II:

DC Machines: Operating principle of DC Generator, EMF equation, types of DC Generators, DC motor operating principle, types of DC motors, torque equation, applications, three point starter.

UNIT – III:

AC Machines: Transformers: Principle of operation of single phase transformer, types constructional features, EMF equation, losses, efficiency and regulation-Simple problems.

Three Phase Induction Motors: Principle of operation of three-phase induction motors, slip ring and squirrel cage motors, Torque Equation , slip-torque characteristics

UNIT – IV:

Special Purpose Motors: Construction, working principle and applications of variable reluctance and Permanent magnet stepper motors, A.C. and D.C Servomotors, Universal motors, Industrial applications.

UNIT – V:

Diode and Transistor: P-N junction diode, symbol, V-I Characteristics, Diode Applications, Rectifiers – Half wave, Full wave and Bridge rectifiers (simple Problems), PNP and NPN Junction transistor, Transistor as an amplifier(CE configuration). SCR Characteristics

Text Books

1. David V. Kerns, JR. J. David Irwin, Essentials of Electrical and Computer Engineering, Pearson Prentice Hall,2005.
2. Dr. P.S. Bimbhra, "Electrical Machines", Khanna Publications, 7th edition, 2018.
3. V.K. Mehta, Principles of Electrical and Electronics Engineering S. Chand & Co., 3rd edition, 2019

Reference Books

1. A. Sudhakar and Shyammohan S Palli "Electrical Circuits" Tata McGrawHill, 3rd edition.
2. I J Nagarath and D P Kothari, Basic Electrical Engineering, TMH Publications, 4th edition, 2019.
3. Prasad, Rajendra, Fundamentals of Electrical Engineering, PHI publications, 3rd edition.
4. M.S Naidu and S. Kamakshaiah, Introduction to Electrical Engineering, TMH Publications, 2017.

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ENGINEERING THERMODYNAMICS

II Year – I Semester

Lecture : 2	Tutorial : 1	Internal Marks	: 30
Credits : 3		External Marks	: 70

Course Objectives

- To introduce the laws of thermodynamics and their applications to various thermodynamic processes and cycles.
- To familiarize with various thermodynamic properties of a pure substance and the laws governing the ideal gases and their mixtures.

Course Outcomes

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

- distinguish between closed and open systems and work and heat energies.
- apply the conservation of energy principle to various thermodynamic processes.
- estimate the performance of heat engines, refrigerators and heat pumps and find the irreversibilities associated with various thermodynamic processes and cycles.
- plot P-V, P-T, T-s and h-s diagrams of a pure substance and find the work and heat energy interactions during the change of state.
- state the ideal gas equation and gas laws and calculate the specific work output and the thermal efficiency of different power cycles.

Course Content

UNIT – I:

Basic Concepts: Systems -Types, Surrounding, Macroscopic and Microscopic approaches, Concept of Continuum, properties-types, Thermodynamic Equilibrium, State, Path, Process, cycle, Quasi–static Process, energy in storage, energy in transit- Work and Heat, Point and Path functions, various forms of Work, temperature and Zeroth Law of Thermodynamics, temperature scales, Const. volume gas thermometer.

UNIT – II:

First Law of Thermodynamics: First law for a closed system undergoing a cycle and for a change of state, enthalpy, specific heats.

Steady flow energy equation and its application to engineering equipments, Perpetual Motion machine of first kind. (PMM-I). Limitations of First Law of Thermodynamics. The directional constraints on natural processes; Concept of reversibility, causes of Irreversibilities.

UNIT – III:

Second Law of Thermodynamics: Thermal reservoirs, Heat engines and Refrigerators and heat pumps, Kelvin- Planck and Clausius statements, and their equivalence, PMM-II, Carnot cycle, Carnot theorems, and corollaries. Absolute thermodynamic scale of temperature.

Entropy: Inequality of Clasius, Entropy change for various processes, entropy principle, Available and unavailable energies, Available energies for closed and open system. Maxwell relations; Tds Equations.

UNIT – IV:

Properties of Pure Substances: Definition of Pure Substance, P-V, P-T, T-S, and h-s diagrams of a Pure substance, Triple point, Critical point, P-V-T surfaces, Dryness Fraction, Steam Tables, Mollier chart, Analysis of various thermodynamic processes. Measurement of steam Quality: throttling and separating and throttling calorimeter.

UNIT – V:

Perfect Gases and Gas mixtures – Equation of State, Ideal gas equation, Universal and characteristic Gas constants, Mixtures of perfect Gases – Mole Fraction, Mass fraction, Dalton's Law of partial pressure, Avogadro's Laws of additive volumes.

Power cycles: Otto, Diesel, Dual Combustion cycles and comparison of Otto, diesel, Dual Cycles, Brayton cycle on Air standard basis. Simple Rankine cycle.

Text Books

1. PK Nag "Engineering Thermodynamics", Tata McGraw Hill Publishing Company Ltd., 6th Edition, 2017.
2. Claus Borgnakke, Richard E Sonntag, "Fundamentals of Thermodynamics", John Wiley & sons, 10th edition, 2020.

Reference Books

1. Yunus A. Cengel, Michael A. Boles, Mehmet Kanoglu, "Thermodynamics-An Engineering Approach" Tata McGraw Hill Education. 9th edition, 2019.
2. Micheal J Moran and Howard N Shapiro, "Fundamentals of Engineering Thermodynamics" Wiley Publications, 9th Edition, 2018.
3. Y.V.C.Rao,"Engineering Thermodynamics through examples"; University Press, 2003.

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KINEMATICS OF MACHINES

II Year – I Semester

Lecture : 2	Tutorial : 1	Internal Marks	: 30
Credits : 3		External Marks	: 70

Course Objectives

- To familiarize with the concepts of kinematic analysis of mechanisms.

Course Outcomes

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

- select a mechanism for a given application.
- determine the velocities and accelerations of links in mechanisms.
- synthesize mechanisms for prescribed function generation .
- construct cam profiles for different types of follower motions.
- perform kinematic analysis of gears and gear trains.

Course Content

UNIT – I:

Mechanisms: Link , kinematic pair, constrained motion, kinematic chain, mechanism, degrees of freedom, Kutzbach criterion for planar mechanism, Grashoff's law, inversion of mechanism , inversions of four bar, single slider and double slider mechanisms, Hooke's Joint - single and double Hooke's joints, polar velocity diagram.

UNIT – II:

Velocity Analysis of Mechanisms (Graphical Approach only): Instantaneous center, Kennedy theorem, velocity analysis using instantaneous centre method, absolute and relative velocities, velocity analysis using relative velocity method , analysis of six bar mechanisms.

UNIT – III:

Acceleration Analysis of Mechanisms(Graphical Approach only) : Types of acceleration **,** acceleration analysis of slider crank and four bar mechanism using relative acceleration method , Coriolis component of acceleration.

Synthesis of mechanisms: Types of synthesis, function generation for four bar mechanism- Frudensten's equation for four bar mechanism, Chebychev spacing.

UNIT – IV:

Cam And Followers: Types of cams and followers, cam terminology, types of follower motion- uniform velocity, simple harmonic motion, uniform acceleration and retardation, cycloidal motion, construction of cam profiles.

UNIT – V:

Gears: Types of gears, gear terminology, law of gearing, velocity of sliding, forms of teeth, path of contact, arc of contact, interference in gears.

Gear Trains: Types of gear trains - simple, compound, reverted and epicyclic gear train, analysis of gear trains using tabular method - differential of an automobile.

Text Books

1. S. S. Ratan, Theory of Machines, Mc.Graw Hill (India) Private Limited, 5th edition, 2019.
2. Design of Machinery, Robert Norton, Mc.Graw Hill (India) Private Limited, 6th edition, 2020.

Reference Books

1. Thomas Bevan, The Theory of Machines, Pearsons Education,4th edition, 2009.
2. J. S. Rao and R.V. Dukkipati, Mechanism and Machine Theory, New Age International Pvt. Ltd., 2nd edition, 2014.
3. Sadhu singh, Theory of Machines, Pearson Education , 3rd edition, 2011.

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MECHANICS OF SOLIDS

II Year – I Semester

Lecture	: 2	Tutorial	: 1	Internal Marks	: 30
Credits	: 3			External Marks	: 70

Course Objectives

- To impart knowledge on behavior of mechanical elements under the action of different loads.

Course Outcomes

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

- determine stresses and strains in structural members subjected to various loads.
- draw shear force and bending moment diagrams for beams.
- calculate the deflections in beams subjected to transverse loads.
- evaluate the crippling load for columns with different end conditions.
- design shafts subjected to torsion based on strength and rigidity.
- determine the stresses induced in thick and thin cylinders subjected to pressures.

Course Content

UNIT – I: Simple stresses and Strains

Mechanical properties of materials, Types of stresses and strains, stress-strain diagram of ductile and brittle materials, poisson's ratio, elastic constants and their relation, bars of uniform and varying sections, composite bars, thermal stresses, factor of safety.

Strain energy: Introduction, strain energy in gradual, sudden and impact loading.

UNIT – II: Shear force and Bending moment in Beams

Introduction, Types of beams, shear force and bending moment diagrams for cantilever, simply supported and overhanging beams subjected to point, uniformly distributed and uniformly varying loads, relation between shear force and bending moment.

UNIT – III: Stresses in Beams

Flexural Stresses: Theory of simple bending, derivation of bending equation, neutral axis , section modulus of different cross sections, bending stresses in simply supported, cantilever and over hanging beams subjected to point load and UDL across the section of the beam.

Shear Stresses: Shear stress equation, shear stress distribution across various beam sections.

UNIT – IV: Deflection of Beams and Columns

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, Mohr's moment area method, slope and deflection for cantilever and simply supported beams subjected to point, uniformly distributed and uniformly varying loads.

Columns & Struts: Combined bending and direct stresses in columns, crippling load, derivation of Euler's equation, Rankine's formulae.

UNIT – V: Torsion and Pressure Vessels

Torsion: Concept of pure torsion, derivation of torsion equation , torsion of circular shafts, transmission of power by circular shafts, shafts in series and parallel.

Pressure Vessels: Thin seamless cylindrical shells, stresses and strains in thin cylinders and spherical shells subjected to internal pressure . Lame's equation, thick cylinders subjected to inside & outside pressures, compound cylinders.

Text Books

1. S. Ramamrutam, R. Narayanan, Strength of materials", Dhanpat Rai Publications company, 20th edition, 2020.
2. James M. Gere, Barry Goodier," Mechanics of Materials", Cengage Learning Custom Publishing, 9th edition, 2018.

Reference Books

1. Beer and Johnson, "Mechanics of Materials", Tata Mc GrawHill Publications, 8th edition, 2020.
2. Popov and Egor P Popov., "Engineering Mechanics of Solids", Prentice Hall India, 1990.
3. S.S. Rattan, "Strength of Materials", Tata Mc Graw-Hill Publications, 3rd edition, 2016.
4. Dr. R K Bansal, "A Text Book of Strength of Materials", Lakshmi Publications, 4th edition, 2009.

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MATERIALS ENGINEERING

II Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the fundamentals of solidification, phase diagrams, heat treatment and properties of metallic and non metallic materials.

Course Outcomes

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

- illustrate crystallization and grain growth of metals.
- identify the effect of alloying elements and invariant reactions on the behavior of metals.
- choose a suitable heat treatment process to impart desired properties of metals.
- propose suitable conventional and advanced materials for the given application.

Course Content

UNIT – I: Solidification of Pure Metals and Alloys

Mechanism of solidification, nucleation-homogeneous and heterogenous nucleation- growth -single crystal -polycrystalline materials, crystal growth-planar growth – dendritic growth – solidification time - cooling curves - non-crystalline solids- glass transition temperature. crystal defects: one, two and three dimensional defects.

Solid solutions: Hume Rothary rule, substitutional and interstitial solid solutions, intermediate phases.

UNIT – II: Phase Diagrams and Iron Carbon Equilibrium Diagram

Phase Diagrams: Construction of equilibrium diagrams involving complete and partial solubility, Gibbs phase rule, lever rule. different types invariant reactions – eutectic, eutectoid, peritectic, peritectectoid reactions etc.

Iron Carbon Equilibrium Diagram: Description of phases- steels, cast iron, different reactions of the iron-iron carbide equilibrium system, alloy groups - properties, composition and uses (wrought iron, grey cast iron, malleable iron, SG iron and steels).

UNIT – III: Heat Treating of Steels

TTT curves, continuous cooling curves, heat treatment processes – annealing, normalizing, hardening, tempering, martempering, austempering, hardenability, surface hardening methods - carburizing, cyaniding, nitriding, flame hardening and induction hardening, age hardening.

UNIT – IV: Non Ferrous Metals and Alloys and Composite Materials

Non Ferrous Metals: Properties and applications of titanium - titanium alloys, copper – copper alloys, and aluminium – aluminium alloys.

Composite materials: Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal – matrix composites and C – C composites.

UNIT – V: Advanced Materials

Functionally Graded Materials: Types of functionally graded materials-classification different systems-properties and applications of functionally graded materials.

Nano Material: Introduction-properties at nano scales-advantages & disadvantages applications in comparison with bulk materials.

Text Books

1. Sidney H. Avener, "Introduction to Physical Metallurgy", Tata Mc Graw Hill Publications, 2nd edition, 1997.
2. Donald R. Askeland and Wendelin J. Wright, "Essential of Materials science and engineering", CL Engineering Publications, 3rd edition, 2012.
3. Sir Alan Cottrell, "An Introduction to Metallurgy", Universities Press, 2nd edition, 2000.

Reference Books

1. V.D.Kodgire, S.V Kodgire. "Material science and Metallurgy for Engineers", Everest Publishing House,45th edition.
2. William D. Collister, David G. Rethwich, "Materials Science and Engineering - An Introduction", Wiley Publications, 10th edition.
3. Nano Material , A.K. Bandyopadyay,New Age Publishers, 2nd Edition, 2020.

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ELECTRICAL AND ELECTRONICS ENGINEERING LAB

II Year – I Semester

Pratical : 2	Internal Marks : 15
Credits : 1	External Marks : 35

Course Objectives

- To conduct tests on various electrical & electronic circuits and to familiarize experimental procedures of those Circuits.

Course Outcomes

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

- apply the concepts of theorems for a given electrical circuit.
- evaluate the performance of AC and DC machines.
- relate physical observations and measurements involved in electrical circuits to theoretical principles.
- illustrate the characteristics of P-N junction diode and its application in rectifier circuits.
- illustrate the characteristics of SCR.

List of Experiments (Any 10 of the following experiments may be perfomed)

1. Verification of Kirchhoff's Laws
2. Verification of superposition theorem
3. Verification of maximum power transfer theorem
4. Experimental verification of Thevenin's theorem
5. Speed control of DC shunt motor
6. Open circuit and short circuit test on single phase transformer
7. Brake test on DC shunt motor
8. Brake test on three phase induction motor
9. P-N junction diode characteristics
10. Rectifiers with and without filters (Half wave and Full wave)
11. Transistor CE characteristics
12. SCR characteristics

MECHANICS OF SOLIDS LAB AND MATERIALS LAB

II Year – I Semester

Pratical : 2	Internal Marks : 15
Credits : 1	External Marks : 35

Course Objectives

- To impart hands on training to examine the mechanical properties of materials.
- To impart hands on training in preparation of metal specimen so as to observe the microstructure

Course Outcomes

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

- determine the young's modulus, rigidity modulus of materials and stresses induced in bars and beams of uniform cross section.
- determine the hardness number.
- determine the stiffness of spring.
- determine the impact strength of materials.
- prepare the specimen using rough grinding, finish grinding and polishing.
- use different types of etchants to expose the microstructure of metal and alloys.
- observe the microstructure and ascertaining the same.
- perform Jominy end quench test.

List of Experiments (Any 10 of the following experiments, 5 experiments from each lab are to be performed)

Mechanics Of Solids Lab:

1. Determination of modulus of elasticity using universal testing machine.
2. Determination of modulus of elasticity and bending stress in
   a) Simply Supported Beam b) Cantilever beam
3. Determination of modulus of rigidity using torsion testing machine.
4. Determination of Hardness number using
   a) Brinells hardness test b) Rockwell hardness test
5. Determination of stiffness of springs using spring testing machine.
6. Determination of impact strength using impact testing machine by
   a) Izod test b) Charpy test

Materials Lab:

1. Preparation and study of the microstructure of pure metals like Cu and Al.
2. Preparation and study of the microstructure of mild steels, low carbon steels, high – C steels.
3. Preparation and study of the micro structures of cast irons.
4. Preparation and study of the micro structures of non-ferrous alloys.
5. Preparation and study of the micro structures and hardness of heat treated steels.
6. Hardenability of steels by Jominy end quench test.

LOGIC BUILDING AND BASIC CODING PRINCIPLES
(Common to CE, EEE & ME)

II Year – I Semester

Practical	: 2	Internal Marks	: 15
Credits	: 1	External Marks	: 35

1. Understanding National Qualifier Test Patterns.
2. Practicing different patterns with different logics.

Frequent Patterns in NQTs: Practicing with Flow Chart —

Pseudo code and Programming in C

- To draw Right Staircase Pattern
- To draw Left Staircase Pattern
- To draw Pyramid Pattern
- To draw Inverse Pyramid Pattern
- To draw Inverse Right Staircase Pattern
- To draw Inverse Left Staircase Pattern
- To draw Pyramid Pattern like below
- To draw Interesting Pattern |
- To draw Diamond Pattern
- To draw Interesting Pattern II
- To draw Interesting Pattern III
- To draw Interesting Pattern IV
- To draw Interesting Pattern V

NUMERICAL AND STATISTICAL METHODS

II Year – II Semester

Lecture	: 2	Tutorial	: 1	Internal Marks	: 30
Credits	: 3			External Marks	: 70

Course Objectives

- To introduce the concepts of numerical and statistical methods for solving engineering problems.

Course Outcomes

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

- determine the solutions of algebraic and transcendental equations using numerical techniques.
- obtain interpolating polynomial for equal and unequal intervals.
- find the solutions of initial value problems using different methods.
- evaluate probabilites using statistical distributions and assess the relation using regression.
- draw the inferences for data using statistical methods.

Course Content

UNIT – I:

Algebraic and Transcendental Equations: Solution of algebraic and transcendental equations –Bisection method – Method of false position – Newton-Raphson Method.

UNIT – II:

Interpolation: Interpolation- Introduction – finite differences - forward, backward and central difference operators – relation between operators. Newton's formulae for interpolation and Lagrange's interpolation.

UNIT – III:

Numerical Solutions of 1st Order Ordinary Differential Equations : Solutions of 1st Order Ordinary Differential Equations by Taylor's series, Euler, modified Euler and fourth order Runge-Kutta methods.

UNIT – IV:

Random Variables – Correlation and Regression: Review on probability [addition and multiplication rules]. Introduction to random variables (discrete and continuous), concept of expectations (mean and variance) and properties – Applications. Normal distribution and its properties(statements only). Simple Correlation and linear Regression.

UNIT – V:

Sampling and Statistical Inference: Basic terminology in sampling, sampling techniques (with and without replacements). Central limit theorem - introduction to statistical inference - test for means and proportions (Large samples); Introduction to t-test, Chi-Square test for goodness of fit and F-test (test for population variances).

Text Books

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 44th edition,2018.
2. T. K. V. Iyengar, B. Krishna Gandhi, S. Ranganatham and M.V. S. S. N. Prasad, Probability and Statistics, S. Chand & Company Ltd, 2nd edition 2021.
3. Miller, John E. Freund, Probability and Statistics for Engineers, PHI, 9th edition, 2017.

Reference Books

1. Ravindranath.V, and Vijayalaxmi.A, A Text Book on Mathematical Methods, Himalaya Publishing House, 3rd edition, 2017.
2. B.V.Ramana, Engineering Mathematics, Tata McGraw Hill, New Delhi, 4th Edition, 2009.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Maitrey Printech Pvt. Ltd., Noida, 10th edition, 2010
4. S. C. Gupta & V. K. Kapoor, Fundamentals of Mathematical Statistics, S.Chand, 12th edition, 2020.

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MANUFACTURING SCIENCE

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the principles of manufacturing Science to convert materials into desired shapes and sizes.

Course Outcomes

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

- design a pattern and gating system for producing a casting.
- select an appropriate casting process based on product requirements.
- apply principles of welding to perform joining processes.
- choose a suitable forming process for the production of a mechanical component.
- compute force and power requirements in various forming processes.

Course Content

UNIT – I:

Introduction: Classification of manufacturing processes

Sand Casting: Steps involved in making casting

Patterns: Pattern Materials, types of patterns, pattern allowances, design of pattern for a given casting

Molding: Molding sand, types of molding sand and its properties, methods of molding.

Gating System-Types and design of gating system

UNIT – II:

Riser Design & Location: Types of risers, riser design (size & location), design considerations for casting.

Solidification: Progressive & directional solidification, solidification time .

Special Casting Processes: Centrifugal casting, investment casting, die casting, shell molding, slush casting.

Casting Defects: Cause and remedies.

Recent trends in Casting.

UNIT – III:

Metal Joining Processes: Classification of metal joining processes

Welding: Definition, types of weld joints and welds, welding techniques.

Fusion Welding: principle of oxy acetylene welding, applications, arc welding, Resistance welding, TIG welding, MIG welding, thermit welding, Heat Transfer in

various welding techniques, heat & power requirements in arc welding, resistance welding.

Welding Allied Processes: Soldering, brazing and braze welding

UNIT – IV:

Metal Forming: Classification- bulk deformations- sheetmetal working

Rolling: Principles-flat rolling and its analysis, forces and geometrical relationship in rolling, analysis of rolling load, torque and power , types of rolling mills, rolling defects and remedies.

Forging: Principle,types, open die forging,analysis,closed die forging-forging defect, and their removal.

Extrution: Principles, types, analysis of extrusion, defects.

UNIT – V:

Drawing: Wire and bar drawing,analysis of drawing-tube drawing.

Sheet metal process: Cutting operation,Shearing, blanking and punching,engineering analysis of sheet metal cutting.

Bending: V-Bending and edge bending-,engineering analysis of bending, sheetmetal drawing, mechanics, analysis.

Text Books

1. M.P.Groover "Fundamentals of Modern Manufacturing, Materials, Processing And Systems", John Wiley & Sons, inc., 7th edition, 2019.
2. H.S.Shan ,"Manufacturing Processes", Cambridge, 2nd edition, 2017.

Reference Books

1. Serope Kalpakjian and Steven R.Schmid, "Manufacturing Engineering & Technology", Pearson Education, Inc., 7th edition, 2013.
2. Roy A.Lindberg, "Process and Materials of Manufacturing ", PHI, 4th edition.
3. Richard Heine , Carl Loper ,Philip Rosenthal, "Principles of Metal Castings", Tata Mc. Graw Hill Publications, 2nd edition, 2017.

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APPLIED THERMODYNAMICS

II Year – II Semester

Lecture	: 2	Tutorial	: 1	Internal Marks	: 30
Credits	: 3			External Marks	: 70

Course Objectives

- To introduce the principles of operation of I.C engines and compressors and their performance metrics.
- To familiarize with various refrigeration systems and cycles and air conditioning processes.

Course Outcomes

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

- distinguish between 4-stroke and 2-stroke engines and determine the performance of I.C engines at various loads.
- design the single stage and multistage reciprocating compressors and estimate the power consumption.
- determine the performance of centrifugal and axial flow compressors and plot the performance characteristics.
- analyze various refrigeration cycles and evaluate their performance under various operating conditions.
- estimate various psychrometric properties and analyze different psychrometric processes applied to air conditioning.

Course Content

UNIT – I:

Heat Engines: Engine components, Basic engine nomenclature, Classification, Four Stroke and Two Stroke Engines, Valve and Port Timing Diagrams, S.I and C.I engines, comparison of SI and CI Engines.

Testing and Performance of I.C Engines: Indicated power, brake power, frictional power, Indicated and brake thermal efficiencies, Performance test, Heat balance sheet.

UNIT – II:

Compressors: Classification - Reciprocating and Rotary, Positive displacement and dynamic machines.

Reciprocating Compressors: Principle of operation, single stage compression - work required, Isothermal efficiency, volumetric efficiency and effect of clearance, Free Air Delivered, displacement. Multi stage compression - under cooling, saving of work, minimum work condition for Multistage stage compression. Root blower, soot blower, vane type blower.

UNIT – III:

Centrifugal Compressors: Mechanical details and principle of operation – velocity and pressure variation. Ideal energy transfer, blade shapes and velocity triangles, analysis of flow through the compressors, slip factor, performance parameters - power input factor, pressure coefficient, compressor efficiency. Surging and choking.

Axial Flow Compressors: Mechanical details and principle of operation – stage velocity triangles, work input to the compressor, work done factor, compressor stage efficiency, degree of reaction, comparison of centrifugal and axial compressors. Surging and stalling.

UNIT – IV:

Introduction: Introduction to refrigeration, Bell Coleman cycle.

Refrigerants: Desirable properties.

Vapor Compression Refrigeration: Working principle and essential components of the plant, actual cycle, effect of sub-cooling, super-heating, evaporator and condenser pressures on system performance – use of p-h charts.

Vapor Absorption System: Description and working of NH_3 – water system, Li Br –water System.

UNIT – V:

Psychrometry: Psychrometric Properties, **s**ensible heating, sensible cooling, humidification and de-humidification, cooling and dehumidification, cooling with adiabatic humidification, heating and humidification, adiabatic mixing of two air streams.

Air-Conditioning systems: summer air conditioning, winter air conditioning.

Text Books

1. M. L. Mathur, R. P. Sharma, " A Course in Internal Combustion Engines", Dhanpath Rai & Sons, 2014.
2. V.P. Vasandani and D.S. Kumar, "Heat Engineering", Metropolitan Book Company, NewDelhi, 4th edition,2012.
3. C P Arora, "Refrigeration and Air Conditioning", TMH., 4th edition, 2020.

Reference Books

1. V.Ganesan, "I.C. Engines", T.M.H., New Delhi, 4th edition, 2013.
2. Manohar Prasad, "Refrigeration and Conditioning", New Age publications, 3rd edition, 2021.
3. R. Yadav, "Thermodynamics and Heat Engines" Vol. II, Central Publishing House Allahabad, 7th edition, 2002.

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DYNAMICS OF MACHINES

II Year – II Semester

Lecture	: 2	Tutorial	: 1	Internal Marks	: 30
Credits	: 3			External Marks	: 70

Course Objectives

- To familiarize with the dynamic force analysis of machines and their effects.

Course Outcomes

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

- perform force analysis of mechanisms and design the flywheel for different applications
- assess the effect of gyroscopic couple on the stability of vehicles and perform the speed analysis of the governors.
- evaluate the effect of friction in devices like bearings , clutches, brakes and dynamometers
- analyze balancing problems in rotating and reciprocating machinery
- determine the natural frequency of vibrating systems.

Course Content

UNIT – I:

Force Analysis: Static force analysis - static equilibrium, static force analysis of four bar and slider crank mechanism, dynamic force analysis - slider crank mechanism, velocity and acceleration of piston, engine force analysis, turning moment on crank shaft.

Flywheel: Turning moment diagrams, fluctuation of energy and speed, fly wheels and their applications.

UNIT – II:

Gyroscope*:* Gyroscopic couple, gyroscopic effect on aeroplanes, gyroscopic effect on ship, stability of an automobile, stability of two wheeler.

Governor*s*: Types of governors- Watt, porter, proell, hartnell governor, governor performance - sensitiveness, hunting, isochronism, stability of governor.

UNIT – III:

Bearings & Clutches: uniform pressure theory, uniform wear theory-pivot and collar bearings, clutches - single disc, multiple disc clutch, cone clutch, centrifugal clutch.

Brakes and Dynamometers*:* Types of brakes - block brake, band brake, band and block brake,internal shoe brake, types of dynamometers - prony brake , rope brake , belt transmission, epi cyclic, Bevis Gibson torsion dynamometer.

UNIT – IV:

Balancing of Rotating Masses*:* Static balancing, dynamic balancing, balancing of rotating masses on same plane and different planes.

Balancing of Reciprocating Masses: Primary and secondary balancing, balancing of in line engines.

UNIT – V:

Vibrations: Vibratory motion terminology**,** types of vibrations, basic features of vibrating system, longitudinal vibrations - free longitudinal vibrations, inertia effect of mass of spring, free damped vibrations, logarithmic decrement, transverse vibrations - vibrations of beams carrying single concentrated load, uniformly distributed load, several loads, whirling of shafts, torsional vibrations - free torsional vibrations, single rotor system, effect of mass of shaft.

Text Books

1. S.S Ratan, Theory of Machines , McGraw Hill (India) Private Limited, 5th edition , 2019.
2. Design of Machinery, Robert Norton, McGraw Hill (India) Private Limited,6th edition, 2020.

Reference Books

1. Thomas Bevan, The Theory of Machines, Pearsons Education, 4th edition, 2009.
2. J.S.Rao and R.V.Dukkipati , Mechanism and Machine Theory, New Age International Pvt. Ltd., 2nd edition, 2014.
3. Sadhu Singh, Theory of Machines, Pearson Education, 3rd edition, 2012.

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FLUID MECHANICS AND HYDRAULIC MACHINES

II Year – II Semester

Lecture	: 2	Tutorial	: 1	Internal Marks	: 30
Credits	: 3			External Marks	: 70

Course Objectives

- To introduce the fluid properties, basic laws, principles of conservation of mass, momentum and energy and their application in the study of fluid flow.
- To introduce the principles of hydraulic turbines and pumps, along with their performance characteristics.

Course Outcomes

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

- elaborate the properties of fluid and determine the differential pressure head recorded by the pressure measuring devices.
- describe the types of fluid flow and fluid flow patterns and apply the principles of conservation of mass, momentum and energy to various engineering problems involving fluid flow.
- explain the concepts of boundary layer fluid flows and determine the various losses in a pipe.
- analyze the forces exerted by the jet of water on vanes.
- classify and analyze the perforance of hydraulic turbines under the various operating conditions.
- analyze the performance of centrifugal and reciprocating pumps.

Course Content

UNIT – I:

Introduction: Physical properties of fluids.

Pressure Measurement: Variation of fluid pressure in a fluid, Pascal's law, atmospheric, absolute, gauge and vacuum pressure. measurement of pressure – piezometer, U- tube and differential manometers.

Fluid kinematics: Flow fields and description of fluid Motion, types of fluid flows, stream line, path line, streak lines and stream tube. equation of continuity in differential form, acceleration of a fluid particle, translation and rotation, vorticity, velocity potential, stream function.

UNIT – II:

Fluid dynamics: Surface and body forces, forces acting on fluid in Motion – Euler's equations of motion, Bernoulli's equations for flow along a stream line, application of Bernoulli's equation: pitot tube, venturimeter, orifice meter.

Momentum equation and its applications-force on pipe bend.

UNIT – III:

Boundary Layer Concepts: Formation, growth of boundary layer, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers.

Laminar flow: Reynold's number, features of laminar and turbulent flows, relation between shear stress and pressure gradient, Hagen Poisuille flow

Closed conduit flow: Reynold's experiment, Darcy Weisbach equation, minor losses in pipes, pipes in series, equivalent pipe, pipes in parallel.

UNIT – IV:

Basics of hydraulic machines: Hydrodynamic force of jets on fixed flat, on stationary and moving curved vanes, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines: Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, draft tube theory- functions and efficiency, performance characteristic curves.

UNIT – V:

Centrifugal pumps: Classification, working, expressions for work done – total head- losses and efficiencies specific speed- performance characteristic curves, NPSH. pumps in series and pumps in parallel.

Reciprocating pumps: Working, discharge, slip, work done, effect of acceleration and friction on indicator diagrams, air vessels.

Text Books

1. Frank M. White, "Fluid Mechanics", McGraw-Hill Companies, Inc., 8th Edition, 2016.
2. S K Som, Gautam Biswas & Suman Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines",Tata McGraw Hill Education Pvt Ltd., 3rd edition, 2017.

Reference Books

1. P.N. Modi, S.M. Seth, "Hydraulics and Fluid Mechanics Including Hydraulics Machines", Rajsons Publication Pvt. Ltd., 22nd edition, 2019.
2. Yunus A. Cengel & John M. Cimbala, "Fluid Mechanics Fundamentals and Applications" Tata McGraw Hill Education Pvt Ltd., 4th edition, 2019.
3. D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K. Kataria & Sons, 9th edition, 2015.

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THERMAL ENGINEERING LAB

II Year – II Semester

Practical	: 2	Internal Marks	: 15
Credits	: 1	External Marks	: 35

Course Objectives

- To study experimentally the performance of IC engines, compressors, refrigeration and air conditioning systems.

Course Outcomes

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

- conduct various performance tests on I.C engines and plot the performance characteristic curves.
- conduct the load test and evaluate the performance of a reciprocating air compressor
- conduct a performance test on refrigerationand air conditioning test rigs and determine the C.O.P for the given conditions.

List of Experiments

(Any 10 of the following experiments are to be conducted)

1. Valve/port timing diagrams of a single cylinder diesel/petrol engine.
2. Disassembly / assembly of 4- stroke single cylinder petrol engine.
3. Load test on 4-stroke twin single cylinder diesel engine.
4. Load test on 2-stroke single cylinder petrol engine.
5. Morse test on 4-stroke multi cylinder petrol engine.
6. Motoring and retardation test on 4-stroke single cylinder diesel engine.
7. Heat balance on 4 - stroke single cylinder diesel engine.
8. Performance test on reciprocating air compressor.
9. Performance test on refrigeration test rig.
10. Performance on air conditioning and heat pump test rig.
11. Performance test on centrifugal blower.
12. Performance test on axial flow compressor.

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NUMERICAL AND STATISTICAL METHODS LAB

II Year – II Semester

Practical	: 2	Internal Marks	: 15
Credits	: 1	External Marks	: 35

Course Objectives

- To impart hands on training in numerical and statistical methods using MATLab and R-Programming respectively.

Course Outcomes

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

- develop MAT lab code for numerical methods.
- analyze the statistical data using R programming.

List of Experiments

1. To implement Bisection method to solve algebraic and transcendental equations .
2. To implement Regula-falsi method to solve algebraic and transcendental equations .
3. To implement Newton-Raphson method to solve algebraic and transcendental equations .
4. To implement Newton's forward and backward interpolation .
5. To implement Taylor Series method to solve first order ODE.
6. To implement Euler's method and modified Euler method to solve first order ODE.
7. To implement Runge Kutta 4^{th} order method to solve first order ODE.
8. Probability distributions using R programming.
9. Evaluation of correlation coefficient and regression lines using R programming.
10. Hypothesis testing using R programming.

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MANUFACTURING PROCESSES LAB AND MACHINE DYNAMICS LAB

II Year – II Semester

Practical	: 2	Internal Marks	: 15
Credits	: 1	External Marks	: 35

Course Objectives

- To impart hands on training in the areas of casting, welding, press working and processing of plastics.
- To demonstrate experimentally about the dynamic response of machine elements.

Course Outcomes

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

- design a pattern.
- test the properties of sand and prepare a casting.
- perform arc welding, spot welding, TIG welding and plasma welding operations..
- perform blanking and piercing operations.
- operate injection moulding machine to manufacture plastic components.
- determine gyroscopic effect on a rotating body.
- determine the characteristics of governors
- perform dynamic balancing of rotating and reciprocating masses.
- determine natural vibrations of vibrating systems
- determine the whirling speed of shaft.

List of Experiments (Any 10 of the following experiments, 5 experiments from each lab are to be performed)

Manufacturing Processes Lab:

1. Pattern making for the given specifications.
2. Testing of molding sand properties.
3. Manufacturing of the given component using casting.
4. Preparation of lap and butt joints using arc welding.
5. a) Preparation of lap and single strap butt joints using spot welding.
   b) Preparation of lap joint using brazing.
6. Preparation of butt joint using Plasma welding and TIG welding.
7. a) Blanking and piercing operations using hydraulic press.
   b) Preparation of a component using injection moulding.

Machine Dynamics Lab:

1. To determine the gyroscopic couple using motorized gyroscope.
2. To study the performance characteristics of Porter and Proell governors
3. To study the effect of rotating unbalance and balancing of rotating masses
4. To study the reciprocating unbalance and balancing of reciprocating masses.
5. To determine the natural frequency of undamped and damped torsional vibrations
6. To determine the whirling speed of shaft

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PROGRAMMING FOR CORPORATE
(Common to CE, EEE & ME)

II Year – II Semester

Practical	: 2	Internal Marks	: 15
Credits	: 1	External Marks	: 35

Using Python

- Introduction to Object Oriented Programming and Principles.
- Programming Constructs
- Data Structures
- Arrays, Class, Struct,
- Trees, Searching and Sorting Algorithms
- Pointers, Exception Handling,
- Utility API, Collection
- Database Connectivity
- Reflections and Serialization
- File Handling
- Database/SQL
- Web UI

Honors Degree

ADVANCED MECHANICS OF SOLIDS

II Year – II Semester

Lecture	: 4	Internal Marks	: 30
Credits	: 4	External Marks	: 70

Course Objectives

- To familiarize with the concepts of stresses and strains in un-symmetric bending and torsion using classical methods.

Course Outcomes

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

- apply the theory of elasticity including strain/displacement and Hooke's Law relationships.
- solve torsion problems in bars and thin walled sections.
- solve for stresses and deflections of beam under unsymmetrical loading
- assess various failure criteria in engineering problems.

Course Content

UNIT - I: Theories of Stress and Strain

Definition of stress at a point, stress notation, principal stresses, differential equations of motion of a deformable body, deformation of a deformable body, strain theory, principal strains. Elastic and inelastic response of a solid, Hooke's law, anisotropic elasticity, Isotropic elasticity, initiation of yield, yield criteria.

UNIT - II: Shear Center & Unsymmetrical Bending

Shear Center: Bending axis and shear center-shear center for axi-symmetric and unsymmetrical sections.

Unsymmetrical Bending: Bending stresses in Beams subjected to unsymmetrical bending; deflection of straight beams due to unsymmetrical bending.

UNIT - III: Curved Beam Theory

Winkler Bach formula for circumferential stress –limitations – correction factors – radial stress in curved beams – closed ring subjected to concentrated and uniform loads-stresses in chain links.

UNIT - IV: Axi-Symmetric Problems & Torsion

Axi-Symmetric Problems: Rotating Discs- flat discs, discs of uniform thickness, discs of uniform strength, rotating cylinders

Torsion: Linear elastic solution, Prandtl elastic membrane (Soap-Film) analogy, narrow rectangular cross section, hollow thin wall torsion members, multiple connected cross sections.

UNIT - V: Introduction to Theory of Elasticity

Equilibrium and Compatibility conditions for elastic solids, 2D elasticity equations for plane stress, plane strain, Airy's stress function, bending of cantilever loaded at the end.

Text Books

1. Boresi & Sidebottom, "Advanced Mechanics of materials" Wiely International, 6th edition
2. Dr Sadhu singh , "Strength of materials" , Khanna Publication, 1st edition.

Reference Books

1. Timoschenko S.P. and Goodier J.N., "Theory of elasticity", McGraw- Hill Publishers, 3rd Edition.
2. L.S Srinath, "Advanced Mechanics of Solids", McGraw Hill Education (India) Pvt. Ltd. 3rd edition.

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METAL CUTTING AND MACHINE TOOLS

III Year – I Semester

Lecture	: 2	Tutorial	: 1	Internal Marks	: 30
Credits	: 3			External Marks	: 70

Course Objectives

- To expose the students to the mechanics of metal cutting, so as to equip them with adequate knowledge about elements of metal cutting process.
- To emphasize upon the prominent theories, concepts and constructional features of machine tools related to turning, shaping, planning, drilling, milling and grinding operations.

Course Outcomes

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

- apply principles of metal cutting in machining operations.
- assess cutting forces and power requirement in various machining operations.
- illustrate the construction and operation of basic machine tools.
- analyze the effect of process parameters on machining characteristics.
- outline the principles of abrasive finishing processes.

Course Content

UNIT - I: Theory of Metal Cutting

Importance of material removal , elements of metal machining, tool, work, chip, fluid-types of cutting tools & tool materials , systems of tool nomenclature, nomenclature of single point and multi point tools, orthogonal & oblique cutting, chip formation, velocity relationships, types of chips, chip breakers.

UNIT - II: Mechanics of Orthogonal Cutting

Modern theories in mechanics of cutting , review of Merchant and Lee Shaffer theories, stress, strain, work done and power required in cutting , cutting force measurement techniques , dynamometers, machining parameters, tool life, effect of parameters on tool life, tool failure.

UNIT - III: Machine Tools & Centre Lathe

Machine Tools: Introduction, classification of machine tools, generating and forming, methods of generating surfaces, basic elements of machine tools.

Centre Lathe : Constructional features, specifications, operations, taper turning methods , thread cutting methods , tool and work holding devices , speed, feed, depth of cut , material removal rate , machining time calculations, capstan and turret lathes, difference between turret lathes and centre lathe.

UNIT - IV: Shaping, Slotting, Planning Machines and Milling Machine

Shaping, Slotting, and Planning machines: Principle of working, principal parts, specifications, types, operations performed, machining time calculations.

Milling Machine: Principle of working, specifications, types, operations performed, types of cutters, methods of indexing.

UNIT - V: Drilling & Boring Machines, Grinding and Lapping & Honing

Drilling & Boring Machines: Principle of working, specifications, types, operations performed, machining time calculations.

Grinding: Theory of grinding, classification of grinding machines, grinding wheel, characteristics, specification and selection of a grinding wheel, methods of grinding, cutting speed, feed, depth of cut and machining time calculations.

Lapping and Honing: Working principle , comparison of lapping, honing and grinding.

Text Books

1. P.N.Rao, "Manufacturing Technology: Metal Cutting and Machine Tools", Volume 2,Tata McGraw-Hill Education., 4th Edition, 2017.
2. B.S.Raghuwanshi, " A course in Workshop Technology", Vol II(Machine Tools), Dhanapat Rai publications,2nd edition, 2017.

Reference Books

1. M.C.Shaw, "Metal cutting Principles", Oxford University Press, 2nd Edition, 2012.
2. Winston A.Knight, Geoffrey Boothroyd, "Fundamentals of Metal cutting and Machine Tools", CRC Press.3rd Edition, 2005.
3. G.C.Sen and A.Bhattacharya, "Principles of Machine tools", New Central Book Agency,2nd Edition, 2009.
4. K.C Jain & A.K Chitaley, "Production Engineering", PHI Publisher,2nd Edition, 2014.

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INDUSTRIAL ENGINEERING

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize the learner with the concepts of Industrial Engineering and its tools to enhance productivity of the systems.
- To introduce the principles and techniques for effective project managementand personal management.

Course Outcomes

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

- calculate the productivity of a system and use industrial engineering tools for enhancing productivity.
- choose a suitable location for a plant and a plant layout for a given production system.
- apply appropriate work study techniques to increase productivity.
- analyze production costs and evaluate profitability of the product.
- apply principles and techniques of project management for calculating optimum duration and optimum cost of the project.

Course Content

UNIT - I: Concepts of Industrial Engineering

Production, productivity, measures of productivity, definition of I.E, Contributions to Industrial Engineering, Significance of I.E, Techniques of I.E, human resource management, functions, wage administration, job evaluation, merit rating.

UNIT - II: Materials Management and Plant Layout & Location

Materials Management and Plant Layout: Introduction, objectives of materials management- inventory- types of inventory, inventory control-objectives, functions, techniques of inventory Control, EOQ and ABC analysis.

Plant Location: Introduction, significance, influencing factors, evaluation of location alternatives, quantitative methods for plant location.

Plant Layout: Plant layout- principles of scientific layout, flow patterns, types of plant layout, features, applications and techniques for optimal design of layout.

UNIT - III: Work Study

Concept – importance – genesis and growth of work study, role of work study, work measurement techniques time study, work sampling,– standard time and its computation, concept of method study and motion study – objective, procedure

– recording techniques and tools, micromotion study — principles of motion economy – Therblings - SIMO Chart Ergonomics- Objectives, Types.

UNIT - IV: Production Cost and Breakeven Analysis

Costs of production, classification of costs, analysis of production costs, breakeven analysis, methods to lower breakeven point, cost-volume-profit analysis, numerical problems.

UNIT - V: Project Management

Importance of project management – applications-bar charts & milestone charts – limitations – terminology – network rules-various network techniques-PERT and CPM, differences between CPM and PERT, critical path, determination of floats, standarddeviation, variance and probability of completion of project-project crashing andnumerical examples.

Text Books

1. Marthand T Teslang, "Industrial Engineering &Production Management ", S.Chand, 3rd Edition,2018
2. Russell & Taylor, "Operations Management", John Wiley & sons Inc.,7th Edition, 2019.

Reference Books

1. O.P.Kanna, "Industrial Engineering & Management", Dhanpat Rai Publications, 2018.
2. L.S. Srinath, "PERT And CPM Principles And Applications" Affiliated EastWest Press (Pvt.) Ltd.

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STEAM AND GAS TURBINES

III Year – I Semester

Lecture	: 2	Tutorial	: 1	Internal Marks	: 30
Credits	: 3			External Marks	: 70

Course Objectives

- To introduce and analyze the Rankine steam power cycle and basic components of steam power plant such as boilers, nozzles, condensers and turbines.
- To familiarize with the analysis of gas turbine cycles and introduce the principle of operation of jet and rocket engines.

Course Outcomes

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

- analyze the Rankine steam power cycle and study the effect of reheating and regeneration on plant efficiency.
- illustrate the working principle of various steam boilers and design a chimney for a given draught.
- design the steam nozzle for the given pressure drop and illustrate the principle of working of various steam condensers.
- evaluate the performance of impulse and reaction steam turbines.
- analyze the gas turbine cycles and study the effect of regeneration, inter cooling and reheating on cycle efficiency.

Course Content

UNIT - I:

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

UNIT - II:

Steam Boilers: Boilers Classification, working principles of fire tube, water tube and high pressure boilers, Functions of mountings and accessories, equivalent evaporation, factor of evaporation and boiler efficiency. Draught, classification, height of chimney for given draught and discharge, condition for maximum discharge, efficiency.

UNIT - III:

Steam Nozzles: Working principle, functions of a nozzle, applications, types of nozzles, flow through nozzles, thermodynamic analysis, velocity of fluid at nozzle exit, ideal and actual expansion in a nozzle, velocity coefficient, condition for

maximum discharge, critical pressure ratio, general relationship between area velocity and pressure in a nozzle flow, super saturated flow.

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 - IV:

Steam Turbines: Principle of operation of steam turbine, classification of steam turbines.

Impulse Turbines: Mechanical details, velocity diagrams, combined velocity diagram, effect of friction, power developed, axial thrust, blade efficiency, condition for maximum efficiency. Methods to reduce rotor speed - compounding of turbines.

Reaction Turbines: Mechanical details, principle of operation, velocity diagram for impuse reaction turbine, degree of reaction, Parson's reaction turbine – combined velocity diagram, blade height, condition for maximum efficiency.

UNIT - V:

Gas Turbines: Simple gas turbine plant ideal cycle - open & closed cycles, effect of operating variables on thermal efficiency, actual cycle, methods of improving efficiency – regeneration, inter cooling and reheating.

Jet propulsion: Principle of jet propulsion, classification of jet propulsive engines, working principle of turbo-jet, turbo-propeller, turbo fan, ram-jet, pulse-jet engines, and rocket engines.

Text Books

1. V.P Vasandani and D.S Kumar, "Treatise on Heat Engineering", Metropolitan Book Co. Pvt Ltd.,4th Edition.
2. R. Yadav, "Thermodynamics and Heat Engines Vol-II", Central Publishing House.

Reference Books

1. P. K. Nag, "Basics & Applied Thermodynamics", Mc Graw Hill Education Pvt Ltd ,4th edition.
2. Mahesh Rathore, "Thermal Engineering", Mc Graw Hill Education Pvt. Ltd .
3. R Yadav, "Steam & Gas Turbines and Power Plant Engineering", Central publishing house, 7th Edition.

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Professional Elective - I

AUTOMOBILE ENGINEERING

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce various automobile systems such as transmission, steering, suspension, braking and safety systems.
- To familiarize with combustion in SI and CI engines, emission control techniques, electric and hybrid vehicles.

Course Outcomes

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

- illustrate the working of various automobile and engine components .
- illustrate the working of transmission and suspension systems of an automobile.
- describe the working of steering, braking and safety systems of an automobile.
- analyze the combustion phenomenon in S.I and C.I engines.
- list out various emission norms and emission control methods and illustrate different electric and hybrid vehicles.

Course Content

UNIT - I:

Automobile Components: Chassis, body, power unit, power transmission- front wheel drive, rear wheel drive, four-wheel drive.

Engine Components: Simple and modern carburetors, fuel injection system, ignition, cooling and lubrication systems.

UNIT - II:

Transmission System: Functions and types of clutches- single plate, multi plate, centrifugal and semi centrifugal clutch, types of gear boxes- sliding mesh, constant mesh, synchromesh, propeller shaft, universal joint and differential.

Suspension System: Objectives of suspension system, front suspension system-rigid axle suspension system, independent suspension system, rear axle suspension, torsion bar, shock absorber.

UNIT - III:

Steering System: Steering geometry, steering gears, power steering.

Braking System: Mechanical brakes, hydraulic brakes-master cylinder, wheel cylinder, tandem master cylinder, brake fluid, air brakes and vacuum brakes.

Safety Systems: Seat belt, air bags, bumper, antilock brake system (ABS), central locking, Suspension sensor.

UNIT - IV:

Combustion in S.I. Engines: Stages of combustion, abnormal combustion- pre-Ignition and knocking, effect of engine variables on knocking, Octane rating.

Combustion in C.I. Engines: Stages of combustion, delay period and its importance, effect of engine variables, diesel knock, cetane rating, comparison of knocking in SI and CI engines.

UNIT - V:

Emissions from Automobile: Emission norms - Bharat stage and Euro norms. engine emissions - exhaust and non-exhaust. emission control methods.

Electric and Hybrid vehicles: Introduction, types of electric and hybrid vehicles, concepts of hybrid electric drive train, series and parallel hybrid electric drive train, merits and demerits.

Text Books

1. Kirpal Singh, "Automobile Engineering Vol-1 & Vol-2", Standard Publishers Distributors, 11th edition.
2. R B Gupta, "Automobile Engineering" ,Satya Prakashan publishers.
3. William B. Ribbens, "Understanding Automotive Electronics", SAMS/Elsevier Publishing,6th Edition.
4. V Ganesan, "Internal Combustion Engines", Mc Graw Hill Publications, 4th edition.

Reference Books

1. G.B.S. Narang, "Automotive Engineering", Khanna Publishers, 5th edition.
2. William H Crouse & Donald Langlin, Automotive Mechanics, Tata Mc Graw Hill Publications, 10th edition.
3. Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, New York, 2011.

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Professional Elective - I

NON DESTRUCTIVE TESTING

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the concepts of various NDT techniques to identify the defect in a mechanical component.

Course Outcomes

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

- describe choose a suitable non-destructive method to find the defect in the given mechanical components using radiography test, ultrasonic test, liquid penetrant test, magnetic particle test and eddy current test

Course Content

UNIT - I: Introduction to NDT and Radiography Test

Introduction: Overview of non-destructive testing, types of materials testing, Preliminary NDT methods, NDT methods

Radiography test: Sources of X rays and Gamma Rays, their properties and interaction with matter, radiographic test**,** film characteristics, radiographic equipment, Radiographic techniques, safety aspects, advantages, limitations, industrial applications of radiography test

UNIT - II: Ultrasonic Test

Principle of wave propagation, piezo-electric effect, ultrasonic transducers - characteristics, ultrasonic equipment, testing procedure, interpretation, evaluation, advantages, limitations, industrial applications of ultrasonic testing.

UNIT - III: Liquid Penetrant Test

Basic concepts, liquid penetrant system, surface preparation, test procedure, examination, interpretation, evaluation, advantages, limitations, industrial applications of liquid penetrant testing.

UNIT - IV: Magnetic Particle Test

Magnetic materials, principle of magnetic particle test, magnetic particle test equipment, test procedure, interpretation and evaluation, advantages, limitations, Industrial applications of the magnetic particle test.

UNIT - V: Eddy Current Test

Principle of eddy current, factors affecting eddy currents, impedance diagram, eddy current test system, test coils, advantages, limitations and industrial applications of eddy current test.

Text Books

1. J Prasad and GCK Nair, “Non-Destructive Test and Evaluation of Materials”, Tata McGraw-Hill Education, 2nd edition, 2011.
2. B Raj, T Jayakumar and M Thavasimuthu, “Practical Non Destructive Testing”, Alpha Science International Limited, 3rd edition, 2017.

Reference Books

1. V Jayakumar and K Elangovan, “Non-Destructive Testing of Materials”, Lakshmi Publications, 2nd edition, 2018.
2. George V. Crowe, “An Introduction to Nondestructive Testing”, American Society for Nondestructive Testing, 3rd edition, 2009.
3. Ravi Prakash, “Non-Destructive Testing Techniques”, New age international publishers, 1st edition, 2021.

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Professional Elective - I

MECHANICAL VIBRATIONS

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the concepts of mathematical model and solution methods for vibrations of the mechanical systems.

Course Outcomes

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

- determine the frequencies of transverse and torsional vibrating systems
- analyze the forced vibrating systems for response due to exciting force
- analyze undamped two degree of freedom systems
- determine the natural frequencies and mode shapes of continuous systems
- measure various vibration parameters using vibration measuring instruments

Course Content

UNIT - I:

Transverse Vibrations: Determination of natural frequency, shaft carrying single concentrated loaded, uniformly distributed load , shaft carrying several loads , whirling of shafts , critical speed

Torsional Vibrations: Single rotor system, inertia effect of mass of shaft, two rotor and three rotor systems, torsionally equivalent shaft

UNIT - II:

Forced Vibration Analysis of Single Degree of Freedom System: Forced vibration due to harmonic excitation, steady stage response, magnification factor, forced vibration due to excitation of support motion, vibration isolation, transmissibility.

UNIT - III:

Two Degree of Freedom Systems: Undamped two degree of freedom systems, natural frequencies, normal modes and mode shapes for Spring mass systems, systems with pulleys, systems with pendulums, coordinate coupling, semi definite systems, combined rectilinear and angular modes, vibrations of geared system

UNIT - IV:

Vibrations of Continuous Systems: Lateral vibrations of string, torsional vibrations of uniform shaft, longitudinal vibrations of bars, transverse vibrations of beams

UNIT - V:

Vibration Measuring Instruments: Transducers - Variable resistance transducers, piezoelectric transducers, electro dynamic transducers, linear variable differential transformer, vibration pickups - vibrometer accelerometer, velometer, frequency measuring instruments

Text Books

1. S. S. Rao , "Mechanical Vibrations" , Pearson Education , 6th Edition, 2017.
2. V.P.Singh , "Mechanical vibration", Dhanpat Rai & Co , 5th Edition, 2016.

Reference Books

1. G.S. Grover &S.P.Nigam , "Mechanical Vibrations" , Nem Chand & Bros, 8th edition, 2015.
2. William T. Thomson and Marie Dillon Dahleh , "Theory of Vibration with Application", Pearson New International Edition, 5th Edition, 2013.

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Professional Elective - I

OPERATIONS RESEARCH

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To impart the concepts of operations research

Course Outcomes

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

- formulate and solve LPP for a given situation.
- determine optimal distribution & optimal cost for transportation / assignment problem.
- determine optimal sequence for a given sequencing problem and calculate total elapsed time.
- evaluate operating characteristics in queuing models.
- choose optimal strategies for players.

Course Content

UNIT - I: Linear Programming

Introduction to OR, definition, characteristics, modelling in OR - classification by structure, linear programming problem, formulation, solution by graphical method. standard form of LPP, simplex method, artificial variable technique, big-M method.

UNIT - II: Transportation-Assignment Problems (Allocation Methods)

Transportation problem – balanced and unbalanced, finding IBFS(North West Corner Rule, Matrix minima Method, VAM) optimal solution (MODI Method) degeneracy.

Assignment problems-optimal solution by hungarian method, special cases - unbalanced and maximal assignment problems.

UNIT - III: Job Sequencing

Introduction – types of sequencing problems-processing n jobs through two machines, processing n jobs through three machines and processing n jobs through m machines.

UNIT - IV: Queuing Theory

Introduction - elements of queuing system- operating characteristics- classification of queuing models: single channel-Poisson arrivals-exponential service times-with infinite and finite population capacity.

UNIT - V: Game Theory

Introduction to game theory, two person zero sum games, maximin - minimax principle, solution of games with and without saddle points, dominance property and graphical solution of 2Xn and mX2 games.

Text Books

1. Kanthi Swarup, P.K.Gupta and Man Mohan, "Operations Research", S. Chand & Sons,14th edition, 2008.
2. S.D. Sharma, "Operations Research", Kedarnath Publishers, 8th edition, 2007.

Reference Books

1. Hamdy A. Taha, "Operations Research", PHI Publications, 8th edition, 2008.
2. Billy E. Gillett, "Introduction to Operations Research : A Computer-oriented Algorithmic Approach", Tata McGraw-Hill.

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MACHINE TOOLS LAB

III Year – I Semester

Practical	: 2	Internal Marks	: 15
Credits	: 1	External Marks	: 35

Course Objectives

- To impart hands on training in the operation of basic machine tools.
- To impart hands on training in measuring methods.

Course Outcomes

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

- operate basic machine tools to perform various machining operations.

List of Experiments

Any 10 of the below experiments may performed

1. Step turning on lathe machine.
2. Taper turning on lathe machine.
3. Thread cutting and knurling on lathe machine.
4. Drilling and boring on lathe.
5. Drilling using radial drilling machine and tapping.
6. Shaping.
7. Planing.
8. Slotting.
9. Spur Gear cutting on milling machine.
10. Helical Gear cutting on milling machine.
11. Cylindrical grinding.
12. Grinding of tool angles.

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FLUID MECHANCIS AND HYDRAULIC MACHINES LAB

III Year – I Semester

Practical	: 2	Internal Marks	: 15
Credits	: 1	External Marks	: 35

Course Objectives

- To determine experimentally the co-efficient of discharge of various flow measuring devices and study the performance of various hydraulic machines.

Course Outcomes

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

- measure the fluid flow using different flow measuring devices
- conduct a performance test on hydraulic machines at different operating conditions.

List of Experiments

Any 10 of the below experiments may performed

1. Determine coefficient of discharge of Venturimeter /orifice meter.
2. Determination of friction factor for a given pipe line.
3. Determine the type of flow through a pipe line using Reynolds Apparatus.
4. Verification of Bernoulli's theorem.
5. Determine the efficiency of jet.
6. Performance test on Pelton Wheel.
7. Performance test on Francis Turbine.
8. Performance test on Kaplan Turbine.
9. Performance test on single stage centrifugal pump.
10. Performance test on reciprocating pump.

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SOLID MODELING LAB

III Year – I Semester

Practical	: 4	Internal Marks	: 15
Credits	: 2	External Marks	: 35

Course Objectives

- To impart hands on training for drafting , modeling and assembly of machine parts using modeling package.

Course Outcomes

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

- draft different views of machine elements and parts
- model individual parts and assemble them.

List of Experiments

1. Drafting of cotter joint
2. Drafting of coupling
3. Drafting of bearing
4. Drafting of riveted joint
5. Modeling and assembly of stuffing box parts.
6. Modeling and assembly of steam engine cross head parts.
7. Modeling and assembly of lathe single way tool post parts.
8. Modeling and assembly of knuckle joint parts.
9. Modeling and assembly of plummer block parts
10. Modeling and assembly of screw jack parts
11. Modeling and assembly of IC engine piston parts
12. Modeling of parts of Eccentric and generation of orthographic views.

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PROBLEMS SOLVING ENHANCEMENT
(Common to CE, EEE & ME)

III Year – I Semester

Practical	: 2	Internal Marks	: 15
Credits	: 1	External Marks	: 35

Number System

- Divisibility
- Numbers and Decimal Fractions
- Number System and HCF & LCM

Mensuration

- Geometry
- Shapes, Area & Perimeter

Arithmetic Ability

- Ages
- Averages
- Equations
- Probability
- Percentages
- Profit & Loss
- Work and Time
- Clocks and Calendar
- Ratios and Proportion
- Series and Progressions
- Allegations and Mixtures
- Distance , Speed and Time
- Permutations and Combinations

Honors Degree

ANALYSIS AND SYNTHESIS OF MECHANISMS

III Year – I Semester

Lecture : 3	Practical : 2	Internal Marks	: 30
Credits : 4		External Marks	: 70

Course Objectives

- To impart the concepts of force analysis of mechanisms.
- To familiarize with the concepts of synthesis of mechanisms.
- To impart hands on training on analysis and synthesis of mechanisms using software packages

Course Outcomes

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

- determine the displacement , velocity and accelerations of links of mechanism.
- evaluate the forces and torque acting by performing force analysis.
- apply path curvature characteristics in analysis of mechanisms.
- apply synthesis techniques in design of mechanisms.
- analyze and synthesize mechanisms using software packages.

Course Content

UNIT - I:

Analysis of Complex mechanisms: Goodman indirect method and Hall Ault auxiliary point method

Dynamic Force Analysis: D Alembert principle , dynamic analysis of four bar mechanism and single slider crank mechanism – dynamically equivalent system – inertia of Connecting Rod – inertia force and torque in reciprocating Engine.

UNIT - II:

Path Curvature Theory: Introduction, fixed and moving centrodes, inflection points and inflection circle, Euler Savary Equation, Bobilliers Construction, Collineation axis, Bobillier theorem, Hartmann construction

UNIT - III:

Kinematic Synthesis: Introduction, type, dimensional and number Synthesis , synthesis for function generation, path and motion generation, Chebyschev Spacing of accuracy points

Motion Generation: Motion generation for two prescribed positions and three prescribed positions – path generation for three prescribed positions without and with prescribed timing – function generation for three prescribed positions, Poles and relative poles, relative poles of 4-bar mechanism, relative poles of slider crank mechanism.

UNIT - IV:

Coupler Curves: Equation of coupler curves, synthesis for path generation, graphical synthesis for path generation, Robert-Chebyshev theorem (cognate linkages), coupler curves from 5-bar mechanisms.

Analytical Synthesis Techniques: Four bar and slider crank function generator with three accuracy points , Freudenstein equation.

UNIT - V:

Manipulator Kinematics: Manipulator kinematics, position representation, forward and inverse transformations, homogeneous transformations, manipulator path control, robot arm dynamics, configuration of a robot controller, robot joint control design.

List of Experiments:

1. Position analysis of the slider crank mechanism using MATLAB.
2. Four bar velocity analysis using MATLAB.
3. Force analysis of three bar door closing mechanism using MATLAB.
4. Designing a linkage with two specified positions of the coupler using Solid Works.
5. Designing a linkage with three specified positions of the coupler using Solid Works.
6. Analytical Synthesis of linkage using MATLAB.

Text Books

1. Erdman and Sandor , "Advanced Mechanism Design ",Prentice Hall International, 2nd Edition
2. S.S. Rattan, "Theory of Machines",Tata Mc Graw Hill, 3rd Edition
3. JJ Craig, "Introduction to Robotic Mechanisms and Control" , Pearson, 3rd Edition.
4. Eric Constans and Karl B. Dyer, "Introduction to Mechanism Design With Computer Applications", CRC Press,1st Edition , 2019

Reference Books

1. Uicker, Pennock and Shigley, "Theory of machines and Mechanisms", Oxford Univ Press.
2. Amitabha Ghosh and Ashok Kumar Mallik, "Theory of Mechanism and machines", East West Press pvt Ltd, 2nd edition.
3. Robert L.Norton," Design of Machinery", Tata McGraw Hill, 3rd edition.

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

III Year – II Semester

Lecture : 2	Tutorial : 1	Internal Marks	: 30
Credits : 3		External Marks	: 70

Course Objectives

- To familiarize with the concepts of Artificial Intelligence and Machine Learning.

Course Outcomes

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

- discuss basic concepts of artificial intelligence
- apply the principles of knowledge representation and reasoning.
- learn about basics of machine learning and bayesian computational learning .
- utilize various machine learning techniques.
- express the concepts of neural networks.

Course Content

UNIT - I: Introduction

Definition of Artificial Intelligence, Evolution, Need, Applications in real world - Intelligent Agents-Agents and environments, Good Behavior, The nature of environments, Structure of agents, Heuristic search techniques.

UNIT - II: Knowledge–Representation and Reasoning

Knowledge Representation: Logical Agents, Patterns in Propositional Logic, Inference in First-Order Logic.

Reasoning: Probability, conditional probability, Bayes Theorem, Bayes Classifier.

UNIT - III: Introduction to Machine Learning

Towards Intelligent Machines, Well posed Problems, Example of Applications in diverse fields, Data Representation, Domain Knowledge for Productive use of Machine Learning, Diversity of Data: Structured / Unstructured, Forms of Learning, Machine Learning and Data Mining.

UNIT - IV: Supervised and Unsupervised Learning

Supervised Learning: Decision Tree - Introduction, Example of a Classification Decision Tree, Measures of Impurity for Evaluating Splits in Decision Trees, ID3 Decision Tree.

Unsupervised Learning: Clustering-introduction, K-means, Hierarchical clustering.

UNIT - V: Learning With Neural Networks

Neuron Models- Biological Neuron, Artificial Neuron, Mathmatical Model, Feedforward Networks, **Perceptrons**- Limitations of Perceptron Algorithm for Linear Classification Tasks, Multi-Layer Perceptron (MLP) Networks and the Error-Backpropagation Algorithm.

Text Books

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2/e, Pearson Education, 2010.
2. M.Gopal, Applied Machine Learning, McGraw Hill Education.

Reference Books

1. Elaine Rich, Kevin Knight and Shivashankar B. Nair, Artificial Intelligence, 3/e, McGraw Hill Education, 2008.
2. Tom M. Mitchell, Machine Learning, McGraw Hill, 2013.
3. Bishop, C. M., Pattern Recognition and Machine Learning, Springer, 2006.

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MEASUREMENTS AND MECHATRONICS

III Year – II Semester

Lecture : 2	Tutorial : 1	Internal Marks	: 30
Credits : 3		External Marks	: 70

Course Objectives

- To instruct the principles of interchangeable manufacture.
- To introduce basic principles of mechanical measurements.
- To impart knowledge on mechatronics systems.

Course Outcomes

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

- design the limit gauges for interchangeable manufacture.
- apply the basic principles of mechanical measurements for engineering practice.
- illustrate the role of mechatronics systems in manufacturing.
- explain principles of mechanical, hydraulic, pneumatic and electrical actuating systems.

Course Content

UNIT - I:

Limtis & Fits: Introduction, terminology pertaining to limits and fits – unilateral and bilateral tolerance system, hole and shaft basis systems – Interchangeability, deterministic & statistical tolerance, selective assembly. International Standard system of limits and fits.

Limit Gauges: Taylor's principle – Classification and design of limit gauges.

UNIT - II:

Linear and Angular Measurements: Line and end standards, slip gauges and length bars.

bevel protractor – angle slip gauges – spirit levels and auto collimator.

Interferometry Applied to Measurement: NPL flatness interferometer and NPL gauge interferometer.

Surface Roughness Measurement: Differences between surface roughness and surface waviness-Numerical assessment of surface finish – CLA, R.M.S, Rz values, Methods of measurement of surface finish – Profilograph, Talysurf

UNIT - III:

Mechanical Measurements: Introduction to measurement: Elements of generalized measurement system

Displacement Measurement- Linear Variable Differential Transformer (LVDT), encoders, potentiometers.

Temperature Measurement - Pyrometers, Resistance Temperature Detector (RTD)

Strain Measurement-Electrical strain gauge – gauge factor – method of usage of resistance strain gauge

UNIT - IV:

Mechatronics Systems: Mechatronics systems- Elements of mechatronics system, mechatronics design process, system - measurement systems, control systems, programmable logic controllers, case studies of mechatronic systems.

UNIT - V:

Actuating Systems: Hydraulic and pneumatic actuating systems - fluid systems, hydraulic systems, and pneumatic systems, components, control valves. mechanical actuating systems and electrical actuating systems – basic principles and elements.

Text Books

1. R.K. Jain, "Engineering Metrology", Khanna Publishers.
2. BeckWith, Marangoni, Linehard, " Mechanical Measurements", 6th edition, PHI / PE.
3. W. Bolton , "Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg.", 4th Edition, Pearson, 2012.

Reference Books

1. IC Guptha,"Engineering Metrology ",Danpath Rai Publications.
2. Doeblin Earnest. O. Adaptation by Manik and Dhanesh,"Measurement Systems: Application and Design", Tata Mc Graw Hill Publications.

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HEAT TRANSFER

III Year – II Semester

Lecture : 2	Tutorial : 1	Internal Marks	: 30
Credits : 3		External Marks	: 70

Course Objectives

- To introduce modes of heat transfer and their significance in the design of heat transfer equipment.

Course Outcomes

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

- determine the rate of heat transfer through simple geometries in steady state with and without internal heat sources and find the critical radius of insulation.
- estimate the rate of heat transfer from a finned surface and find the time of cooling or heating in transient heat conduction.
- apply the techniques of dimensional analysis for forced and natural convection heat transfer phenomena and compute convective heat transfer coefficients.
- find the convective heat transfer coefficient for phase change processes and design a heat exchanger using LMTD and effectiveness-NTU method
- estimate the radiation heat exchange between the surfaces and interpret the significance of radiation shields.

Course Content

UNIT - I:

Introduction: Modes of heat transfer, basic laws of heat transfer.

Conduction Heat Transfer: Fourier Law of heat conduction, general heat conduction equation in cartesian, cylindrical and spherical coordinates. simplification and forms of the field equation, initial and boundary conditions.

One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres, electrical analogy, composite slabs, cylinders and spheres, critical radius of insulation, systems with heat generation.

UNIT - II:

Extended surface (Fin) Heat Transfer: Long Fin, fin with insulated tip and short fin, efficiency and effectiveness of fins.

One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance, significance of Biot and Fourier Numbers, Problems on infinite and semi-infinite solids using Heisler Charts.

UNIT - III:

Convective Heat Transfer: Classification of convective heat transfer, dimensional analysis- Buckingham Pi Theorem for forced and natural convection. Non-dimensional numbers.

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

Free Convection: Development of hydrodynamic and thermal boundary layer along a vertical plate, use of empirical relations for vertical plates and vertical cylinders.

UNIT - IV:

Heat Transfer with Phase Change:

Boiling: Pool boiling, Regimes - Nucleate boiling and film boiling, critical heat flux.

Condensation: Film wise and drop wise condensation, film condensation on vertical cylinder using empirical correlations.

Heat Exchangers: Classification, overall heat transfer coefficient, fouling factor, design of heat exchangers - LMTD and NTU methods.

UNIT - V:

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

Text Books

1. RC Sachdeva, "Fundamentals of Engineering Heat and Mass transfer", New age International, 2017.
2. J.P.Holman, "Heat transfer", Mc Graw Hill, 10th edition, 2010.
3. P.K.Nag, "Heat and Mass Transfer", Tata Mc Graw Hill Publications, 3rd edition, 2011.

Reference Books

1. Incropera & Dewitt, "Fundamentals of Heat Transfer & Mass Transfer", John Wiley Publications, 2020.
2. YunusCengel, Afshin Ghajar, "Heat and Mass Transfer", Tata McGraw Hill, 6th Edition.

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DESIGN OF MACHINE ELEMENTS

III Year – II Semester

Lecture	: 2	Tutorial	: 1	Internal Marks	: 30
Credits	: 3			External Marks	: 70

Course Objectives

- To impart the knowledge of the basic engineering design against static and fluctuating loads by considering strength and rigidity.

Course Outcomes

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

- perform stress analysis and design the members under the action of static and fluctuating loads.
- design structural members with cotter, riveted, bolted and welded joints.
- design various mechanical elements like bearings and springs.

Course Content

UNIT - I:

Introduction: General considerations in the design, design procedure, BIS codes of steels, simple stresses, factor of safety, stresses due to bending moment, torsion equation, strength and rigidity criteria, principal stresses, theories of failures.

Cotter joints- Spigot and socket joint, sleeve and cotter joint, knuckle joint.

UNIT - II:

Design For Fatigue Strength: Cyclic loading, fatigue failure, S-N curve - endurance limit–estimation of endurance strength, stress concentration– theoretical stress concentration factor , fatigue stress concentration factor, notch sensitivity, design for finite and infinite life- Goodman's line, Soderberg's line.

UNIT - III:

Riveted Joint: Types, efficiency of a riveted joint, eccentrically loaded riveted joints.

Welded Joint: Types, strength of parallel and transverse fillet weld, eccentrically loaded welded joints.

Bolted Joint: Terminology, types of bolted joints, design of joints under eccentric loading.

UNIT - IV:

Journal Bearings: Classification of bearings, journal bearing materials and applications, bearing characteristic number, heat generation and dissipation of bearings, design of hydro dynamic journal bearing.

Ball and Roller Bearings: Classification, rolling element bearings material and applications, static and dynamic load rating, bearing life- reliability, load-life relations, selection of ball and roller bearings.

UNIT - V:

Design Of Springs: Classification, spring material and applications, Stresses and deflections of helical springs, design of helical spring, design of helical springs subjected to fatigue loading, design co-axial springs, design of leaf springs.

Text Books

1. V.B.Bandari, Design of Machine Elements, TMH Publishers, 5th Edition, 2020.
2. Joseph Edward Shigley, Charles R.Mischke , Mechanical Engineering Design, TMH Publishers, 11th Edition, 2020.

Reference Books

1. Robert L.Norton, Machine Design – An Integrated Approach, Pearson education India, 2nd edition, 2009.
2. N.C. Pandya and C. S. Shah, Machine Design, Charotar Publishing House Pvt. Limited, 21st Edition 2022.
3. R.S.Khurmi & J.K Gupta, Machine Design, S. Chand Publishers, 1st Edition, 2020.

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Professional Elective - II

NON CONVENTIONAL SOURCES OF ENERGY

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To impart knowledge on non-conventional sources of energy and techniques used in exploiting solar, wind, tidal and geothermal sources of energy and biomass.
- To introduce direct energy conversion systems such as thermo electric, MHD and Fuel Cells.

Course Outcomes

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

- Classify various types of renewable sources of energy and illustrate the principles of solar radiation.
- evaluate solar flat plate collector efficiency and illustrate various solar energy storage methods and applications.
- describe the techniques of exploiting wind, biomass and geothermal energies in power generation.
- illustrate the methods of tapping ocean thermal, tidal and wave energies in power generation.
- describe the working of various direct energy conversion systems and their applications.

Course Content

UNIT - I:

Energy Sources and Their Availability: Conventional and non-conventional energy sources. Need of Renewable Energy Sources (RES), classification of RES, role and potential of RES in India.

Solar Radiation: Structure of the sun, solar constant, environmental impact of solar radiation, radiation at the earth surfaces, solar radiation measuring instruments, solar radiation Geometry, extraterrestrial and terrestrial solar radiation, spectral distribution of extraterrestrial radiation, solar radiation on tilted surfaces and empirical equations for estimating solar radiation.

UNIT - II:

Solar Collectors: Principles of the conversion of solar radiation into heat, classifications of solar collectors- flat plate collectors and concentrating collectors, collector materials, performance analysis of a flat plate collector.

Solar Energy Storage and applications: Different storage methods-sensible and latent heat, solar ponds, solar water heating , space heating /cooling, solar

electric conversion, solar distillation, solar pumping, solar furnace, solar cooking and solar green house.

UNIT - III:

Wind Energy: Principles of wind energy conversion, site selection consideration, basic components, types of wind machines – horizontal axis and vertical axis, applications, Betz coefficient.

Biomass Energy Conversion Systems: Biomass conversion technologies, photosynthesis, biogas generation, factors affecting bio-digestion, classification of biogas plants, advantages and disadvantages, bio mass gasification

Geothermal Thermal Energy: Resources, types of wells, methods of harnessing the energy.

UNIT - IV:

Ocean Thermal Energy: Methods of Ocean thermal electric power generation open cycle systems, closed cycle systems

Tidal Power System: Working principle, components of tidal power plant, single basin and double basin tidal energy system advantages and limitations.

Wave Energy: Wave energy conversion Devices-wave energy conversion by floats, high level reservoir wave machine and dolphin type wave power machine. advantages and disadvantages.

UNIT - V:

Direct Energy Conversion: Need for DEC, limitations, principles of DEC. thermoelectric Power – See-beck, Peltier, Joule -Thomson effects, Thermo-electric Power generators

MHD Power Generation: Principles, dissociation and ionization, Hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, electron gas dynamic conversion.

Fuel Cell: Working principle, classification – efficiency – VI characteristics

Text Books

1. SP Sukhatme, “Solar Energy: Principles of thermal collection and storage” Tata McGraw Hill
2. Tiwari and Ghosal, “Renewable Energy Resources: Basic Principles and Applications”, Narosa
3. G.D. Rai, “Non-Conventional Energy Sources”, Dhanpat Rai and Sons

Reference Books

1. B.H.Khan, “Non – conventional Energy Resources”, Tata McGraw Hill education Pvt. Ltd.
2. Twidell & Weir, “Renewable Energy Sources “. Routledge (Taylor &Francis Group)

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Professional Elective - II

AUTOMATION IN MANUFACTURING

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce various strategies of automation in manufacturing.

Course Outcomes

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

- explain automation strategies and transport mechanisms in automated flow lines.
- analyze the automated flow lines with and without buffer storage and also multi-stage automated flow line.
- choose appropriate material handling system for a given application.
- analyze the principles of AS/RS and carousel storage systems.
- illustrate the ACO and ACC strategies to reduce the machine time
- demonstrate the automated inspection methods.

Course Content

UNIT - I:

Introduction: Production system – automation in production system – elements of automated system – levels of automation - types of automation – automation principles and strategies.

Automated Flow Lines: Configurations of AFL - methods of part transport - transfer mechanism - buffer storage – system design considerations

UNIT - II:

Analysis of Automated Flow Lines: General terminology and analysis of transfer lines without buffer storage – upper bound approach and lower bound approach - analysis of automated flow lines with buffer storage – analysis of two stage transfer line – analysis of more than two stages - partial automation – analysis – cost calculations.

Assembly system and Line Balancing: Assembly process and systems, assembly line, line balancing methods, ways of improving line balance.

UNIT - III:

Automated Material Handling: Introduction – Design considerations in material handling - Types of equipment - material transport equipment – AGVS – conveyors – hoists and cranes - analysis of material transport systems – vehicle based systems – conveyor analysis.

UNIT - IV:

Automated Storage Systems: Automated storage and retrieval systems – reasons for automating storage operations – types of AS/RS – applications of AS/RS – carousel storage systems – analysis of storage systems.

UNIT - V:

Adaptive Control Systems and Automated Inspection: Introduction - adaptive control with optimization, adaptive control with constraints, application of AC. in machining operations.

Text Books

1. Groover.M.P, "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Publications.

Reference Books

1. Yoram Coren, "Computer Control of Manufacturing Systems", Tata McGraw Hill.
2. P. Radha Krishnan & S. Subrahamanyarn and Raju, "CAD/CAM/CIM", New Age International Publishers, 2008.
3. W. Buekinsham, "Automation", PHI Publications, 3rd edition.
4. Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang, "Computer Aided Manufacturing" , Pearson Publications, 2009.

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Professional Elective - II

FINITE ELEMENT METHOD

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the concepts of finite element method for structural , thermal and dynamic analysis.

Course Outcomes

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

- apply variational and weighted residual methods to solve differential equations.
- determine the stresses and strains in one dimensional bar problems.
- analyze trusses and beams to determine the stresses induced .
- determine the displacements and stresses in 2D problems.
- develop iso parametric formulations for finite elements and solve them using numerical techniques.
- analyze 1-D heat transfer problems to determine rate of heat transfer and temperature distribution.
- determine natural frequencies of vibrating systems using finite element method.

Course Content

UNIT - I:

Introduction: stress and equilibrium, strain – displacement relations, stress – strain relations, variational and weighted residual methods.

Finite Element Method: Introduction to finite element methods, steps in finite element method ,applications , advantages and disadvantages of finite element method.

One Dimensional Bar Problems: 1-D bar element - shape functions – stiffness matrix and load vector– assembly of matrices – treatment of boundary conditions- One dimensional quadratic element.

UNIT - II:

Analysis of Trusses: Local and global coordinate systems, transformation matrix , element stiffness matrix , determination of displacements and stresses

Analysis of Beams: Beam element - shape functions and element stiffness matrix, load vector , determination of deflections , support reactions

UNIT - III:

Two Dimensional Problems: Plane stress and plane strain problems , constant strain triangle(CST) element – shape functions , Jacobian of tranformation, strain displacement matrix , element stiffness matrix , determination of deflections and stresses

Isoparametric Formulations: Coordinate transformation, sub,iso and super parametric elements, iso parametric formulations of bar element, quadrilateral element, numerical integration – Gaussian quadrature approach.

UNIT - IV:

Steady State Heat Transfer Analysis: 1- D steady state thermal analysis of plane and composite walls, analysis of a fin.

UNIT - V:

Dynamic Analysis: Free longitudinal and transverse vibrations, eigen values and eigen vectors , natural frequencies for bars and beams.

Text Books

1. Chandraputla, Ashok and Belegundu , "Introduction to Finite Elements in Engineering ", Prentice – Hall,2011
2. Daryl L Logan, "A first course in finite element method", Cengage Learning. 2011.

Reference Books

1. Robert D Cook, "Finite element modeling for stress analysis ", John wily & Sons.
2. SS Rao , "The Finite Element Methods in Engineering", Elsevier Science,5th Edition, 2011.
3. JN Reddy, "An introduction to Finite Element Method", McGraw Hill Education, 2006.
4. S.S. Bhavikatti ," Finite Element Analysis", New Age International Pvt Ltd , 2015.

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Professional Elective - II

QUALITY GOVERNANCE

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the concepts of quality management and total quality Management.

Course Outcomes

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

- explain the dimensions of the quality and the relation between cost and quality.
- apply SQC techniques for quality control.
- analyse various quality standards prescribed.
- explain concepts of TQM and choose an appropriate TQM tool for a given situation.
- apply Taguchi and Six Sigma principles for analysing quality and interpret house of quality.

Course Content

UNIT - I: Concepts of Quality

Introduction - Definition of quality- significance - evolution of quality - dimensions of quality**-** quality assurance, cost of quality, link between quality and productivity-quality control-inspection– types of inspection.

UNIT - II: Statistical Quality Control

Significance, techniques of SQC – control charts – importance – features of control charts – control charts for variables and attributes with numerical problems, sampling inspection –advantages – types of acceptance sampling plans – OC curve-process capability.

UNIT - III: Quality Assurance

Quality Standards –Need of standardization- bodies of standardization, ISO 9000-series - ISO 14000 series, requirements and benefits.

Concepts of TQM: Definition of TQM – TQM Frame work ,philosophy of TQM: Contributions of Deming, Juran and Crosby to TQM- PDSA cycle.

UNIT - IV: TQM Tools and Techniques I

The seven traditional tools of quality, new management tools-quality Circles, bench Marking, KAIZEN, 5S, JIT.

UNIT - V: TQM Tools and Techniques II

Taguchi analysis- loss function- Six Sigma approach-Application of six sigma approach – Quality Function Deployment (QFD)- elements of QFD-House of Quality.

Text Books

1. Besterfield Dale H. "Total Quality Management", Pearson Education Asia, Third Edition, Indian Reprint, 2018
2. N. V. S. Raju, "Industrical Engineering & Management", Cengage Learning Publications, 2013.

Reference Books

1. O.P.Khanna, "Industrial Engineering & Management ", Dhanpat Rai Publications. 2012.
2. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall(India) Pvt. Ltd., 2016.
3. O. N. Pandey, Bhupesh Aneja, "Quality Management", S. K. Kataria & Sons, 2017.
4. R. Ramakrishnan, "Total Quality Management", Eswar Press, 2015.

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ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LAB

III Year – II Semester

Practical	: 4	Internal Marks	: 15
Credits	: 2	External Marks	: 35

Course Objectives

- To familiarize with different search algorithms used in problem solving.
- To disseminate knowledge on different machine learning algorithms.

Course Outcomes

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

- develop programs on game search
- build a decision tree
- classify the data using Bayesian methods
- classify various clustering methods and algorithms on data sets to create appropriate clusters.

List of Experiments

Any 10 of the below experiments may performed

1. Implement A* Search algorithm.
2. Implement Solutions to Water Jug Problem.
3. Write a program to implement Naive Bayes Classifier
4. Build a decision tree for Boolean functions.
5. Implement a program to generate decision tree on play tennis dataset.
6. Implement a program to calculate the distance between the data points using Euclidean distance method.
7. Implement a program to calculate the distance between the data points using Manhattan distance method.
8. Implement a program to calculate the distance between the data points using Minkowski distance method.
9. Demonstrate a program to perform cluster using k-means clustering algorithm.
10. Write a program to implement hierarchical clustering.
11. Build ANN for Boolean functions.
12. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

Reference Books:

1. Elaine Rich, Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill edition, 2nd edition.
2. Stuart J. Russell, “Artificial Intelligence: A Modern Approach”, 2nd edition.
3. Tom M. Mitchell, “Machine Learning”, MGH.

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HEAT TRANSFER LAB

III Year – II Semester

Practical	: 2	Internal Marks	: 15
Credits	: 1	External Marks	: 35

Course Objectives

- To determine experimentally the conductive and radiating properties of materials and heat transfer coefficients in single and two phase flows.

Course Outcomes

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

- able to determine conductive and radiating properties of materials and heat transfer coefficients in single and two phase flows.

List of Experiments

Any 10 of the below experiments may performed

1. Determination of thermal conductivity of a given insulating powder
2. Determination of thermal conductivity of a given liquid
3. Determination of thermal conductivity of a lagged pipe
4. Determination of efficiency of a pin-fin
5. Determination of heat transfer coefficient in transient heat conduction
6. Determination of heat transfer coefficient in forced convection
7. Determination of heat transfer coefficient in natural convection
8. Determination of emissivity of a test plate
9. Determination of Stefan Boltzmann constant
10. Determination of heat transfer coefficient in drop and film wise condensation
11. Determination of critical heat flux during pool boiling
12. Determination of overall heat transfer coefficient in a double pipe heat exchanger

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LINGUISTIC COMPETENCY BUILDING
(Common to All Branches)

III Year – II Semester

Practical	: 2	Internal Marks	: 15
Credits	: 1	External Marks	: 35

- Analytical skills
- Innovative and creative thinking
- A lateral mindset
- Adaptability and flexibility
- Level-headedness
- Initiative
- Teamwork
- Influencing skills
- Preparing professional resume
- Preparing for ivrs — Communication Skills evaluation tools like = VERSANT (pearson), SWAR(Aspiring Minds) Etc.

Elementary Statistics

- Mean, Median, Mode, Standard Deviation and Variance

Data Interpretation

- Tabular Data Interpretation
- Graphical Data Interpretation
- Pie Charts Data Interpretation

Simplifications & Approximations

- Simple Arithmetic Calculations

Usage of Language - Corporate Context

- Body Language and Professional Phrases
- Corporate etiquette
- protocol to be followed in Virtual Interview
- Online Meetings and Telephonic Interviews

Honors Degree

FRACTURE MECHANICS

III Year – II Semester

Lecture : 3	Tutorial : 1	Internal Marks	: 30
Credits : 4		External Marks	: 70

Course Objectives

- To familiarize with the basic concepts of fracture mechanics and its applications.

Course Outcomes

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

- elaborate different mechanisms of fracture failure.
- determine stress intensity factors by applying Linear Elastic and Elastic Plastic fracture mechanics.
- evaluate stresses induced at crack tip and different fracture parameters.
- apply different approaches to determine the plastic zone at the crack tip.
- select suitable nondestructive test to identify the cracks.

Course Content

UNIT - I:

Introduction: History and over view, fracture mechanics approach to design, effect of material properties on fracture.

Fracture Mechanisms: Ductile fracture, cleavage, ductile-brittle transition, inter granular fracture, environment assisted cracking.

Linear Elastic Fracture Mechanics: Griffith energy balance, energy release rate, crack resistance, R curve, stable and unstable crack growth.

UNIT - II:

Stress Analysis of Cracks: Modes of fracture - opening , sliding and shearing mode , Airy stress function , crack tip stress field using Westergaurd approach, effect of finite size , relation between stress intensity factor and energy release rate.

UNIT - III:

Crack Tip Plastic Zone: Plastic zone shape, Irwin plastic zone correction, Dugdale approach, shape of the plastic zone, plastic constraint factor, thickness effect.

UNIT - IV:

Elastic-Plastic Fracture Mechanics: Crack-tip-opening displacement, *J* contour integral, relationships between *J* and CTOD, crack-growth resistance curves, *J*-controlled fracture.

UNIT - V:

Test Methods: Introduction, K_{Ic}-test technique, test methods to determine J_{Ic}, test methods to determine G_{Ic} AND G_{IIc}, determination of critical CTOD.

Crack Detection Through Non-Destructive Testing: Introduction, examination through human senses, liquid penetration inspection, ultrasonic testing, radiographic imaging, magnetic particle inspection.

Text Books

1. T. L. Anderson, Fracture Mechanics: Fundamentals and Applications, CRC Press, 3rd edition
2. Prashant Kumar, Elements Of "Fracture Mechanics, Mcgraw Hill Education, First edition.

Reference Books

1. David Broek, Elementary engineering fracture mechanics, Kluwer Academic Publishers, 4th edition
2. J.F. Knott, P Withey, Worked examples in Fracture Mechanics, Institute of Materials, 2nd Edition

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CAD / CAM

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To present the role of computers and technology that drives the modern industry.

Course Outcomes

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

- apply principles of computer graphics for product design.
- appraise the role of computers in manufacturing.
- propose trends in manufacturing to improve productivity.

Course Content

UNIT - I: Introduction

Brief review of conventional design process. computers in design and manufacturing, product cycle in light of CAD / CAM

Computer Graphics: Raster scan graphics coordinate system, transformation of geometry, 3D transformations, mathematics of projections, line clipping, hidden surface removal, database requirements for CAD/CAM systems.

UNIT - II: Geometric Modeling

Requirements of geometric modeling, types of geometric models, entities of wireframe model-mathematical representation of line and circle, significance of efficient algorithm to generate a curve, synthetic curves-cubic spline and Bezier curves, continuity of curves. types of surfaces-brief treatment. solid modeling-sweep representation, constructive solid geometry and boundary representation.

UNIT - III: Numerical Control of Machines

NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of machining center, turning center, CNC part programming - manual part programming, and computer aided part programming.

UNIT - IV: Group Technology

Part family, coding and classification, production flow analysis, advantages and limitations.

Computer Aided Processes Planning: Definition, retrieval type and generative type, advantages of CAPP over conventional method.

Flexible manufacturing systems: Definition, components and, FMS benefits.

UNIT - V: Computer Aided Quality Control

Role of Computer in QC, difference between the inspection and testing, advantages of CAQC, contact inspection method – coordinate measuring machine, noncontact inspection method – machine vision, scanning laser beam technique

Driving Technologies of Industry 4.0: Industrial Internet of Things (IIoT), Cobotics, 3D printing and big data analytics.

Text Books

1. Ibrahim Zeid, "CAD / CAM Theory and Practice" Tata McGraw Hill Publication, 2nd Edition, 2009.
2. Groover, "Automation, Production systems & Computer integrated Manufacturing", Pearson Education Publications, 4th edition, 2016.

Reference Books

1. Zimmers & P.Groover, "CAD/CAM", Pearson Education, 1st Edition, 2003..
2. Industry 4.0 Industry Internet of things-Gilchrist, Alasdair, A Press, 1st Edition, 2017
3. Lihui Wang Xi, Vincent Wang, "Cloud Based Cyber Physical Systems in Manufacturing", Springer Publications, 1st Edition, 2018.
4. Chua C.K., Leong K.F. and Lim C.S. "Rapid Prototyping: Principles and Applications", World Scientific Publications, 3rd Edition, 2010.

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DESIGN OF TRANSMISSION ELEMENTS

IV Year – I Semester

Lecture : 2	Practical : 2	Internal Marks	: 30
Credits : 3		External Marks	: 70

Course Objectives

- To familiarize with the design of various machine elements for effective power transmission.

Course Outcomes

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

- design the power transmission elements like belts, ropes and chain drives.
- design the power transmission elements like gears, keys & couplings, and power screws .
- design of I.C engine parts like piston, cylinder, connecting rod, and crank.

Course Content

UNIT - I:

Flat belt Drive and Pulley: Introduction to belt drives, types and application, materials, power transmitted by flat belt, design of pulley, design and selection of flat belt drive.

V-belt Drive and Pulley: Introduction, types and application, materials, power transmitted by V- belt, design of pulley, design and selection of V-belt drive.

UNIT - II:

Chain Drive: Introduction, types, roller chains, geometric relationship, polygonal effect, power rating, sprocket wheels, design of Chain drives.

Rope Drive : Introduction, types, ratio of driving tensions for rope. designation of wire ropes, wire rope sheaves and drums, stresses in wire ropes. design of wire rope.

UNIT - III:

Keys & Couplings: Types of keys, stresses in keys, Muff, split muff, flange.

Design of power screws: Design of screw - square, ACME, Buttress screws, design of nut, compound screw, differential screw.

UNIT - IV:

Spur Gear Drives: Terminology, materials, force analysis, gear tooth failure, Lewis beam strength Equation, dynamic tooth load, design for wear.

Helical Gear Drives: Terminology, materials, force analysis, gear tooth failure, Lewis beam strength Equation, dynamic tooth load, design for wear.

UNIT - V:

Engine Parts: Principal Parts of an I. C. engine

Cylinder: Cylinder and cylinder liner, design of a cylinder,

Piston: Material for pistons, design considerations for a piston, design of piston

Connecting Rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends, design of connecting rod, cranks, strength and proportions of over hung crank shaft.

Text Books

1. N.C. Pandya and C. S. Shah, "Machine design" ,Charotar Publishing House Pvt. Limited, 21st Edition, 2022.
2. V.B.Bandari, "Design of Machine Elements", TMH Publishers, 5th Edition, 2020.

Reference Books

1. Joseph Edward Shigley, Charles R.Mischke , "Mechanical engineering design", TMH Publishers, 11th Edition, 2020.
2. Robert L.Norton, "Machine Design – An integrated approach", Pearson education India, 2nd edition, 2009.
3. R.S.Khurmi & J.K Gupta, "Machine Design", S. Chand Publishers, 1st Edition, 2020.

Note: *Design data book is permitted in examination.*

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Professional Elective - III

DESIGN OF HEAT TRANSFER EQUIPMENT

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce basic methods of design of heat exchangers.
- To familiarize with the design procedures of various heat transfer equipment

Course Outcomes

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

- apply LMTD and NTU methods for the design of heat exchangers.
- design shell and tube heat exchangers used in process industries.
- design hair-pin heat exchangers used in process industries.
- design plate heat exchangers used in milk industries.
- design boilers, condensers and cooling towers used in steam power plants.

Course Content

UNIT - I:

Introduction: Methods of design of Heat Exchangers

Concept of Logarithmic Mean Temperature Difference: Expression for single-pass parallel-flow and single-pass counter flow heat exchangers – Derivation from first principles, Special Cases, LMTD for a single-pass cross-flow heat exchanger , Numerical Problems, Arithmetic Mean Temperature Difference [AMTD], Relation between AMTD and LMTD, Logical Contrast between AMTD and LMTD, LMTD of a single-pass heat exchanger with linearly varying overall heat transfer coefficient [U] along the length of the heat exchanger, Numerical problems.

Concept of Effectiveness: Effectiveness-Number of Transfer Units Approach, Effectiveness of single-pass parallel-flow and counter-flow heat exchangers, Physical significance of NTU, Heat capacity ratio, Different special cases of the above approach, Chart solutions pertaining to Effectiveness-NTU approach, Numerical problems.

UNIT - II:

Design of Shell and Tube Heat Exchangers: Single-Pass, One shell-Two tube [1S-2T] and other heat exchangers, Industrial versions of the same, Classification and Nomenclature, Baffle arrangement, Types of Baffles, Tube arrangement, Types of tube pitch lay-outs, Shell and Tube side film coefficients, Pressure drop calculations, Numerical problems on Design of Shell and Tube Heat Exchangers.

UNIT - III:

Design of Hair-Pin Heat Exchangers: Introduction to Counter-flow Double-pipe or Hair-Pin heat exchangers, Industrial versions of the same, Film coefficients in tubes and annuli, Pressure drop, Augmentation of performance of hair-pin heat exchangers, Series and Series-Parallel arrangements of hair-pin heat exchangers, Comprehensive Design Algorithm for hair-pin heat exchangers, Industrial standards, Numerical problems on Design of Hair-Pin Heat Exchangers.

UNIT - IV:

Design of Plate Heat Exchangers: Introduction, Mechanical Features - Plate pack and the frame, Plate types, Advantages and performance limits, Passes and flow arrangements, Heat transfer and pressure drop calculations, Numerical problems on Design of Plate Heat Exchangers.

UNIT - V:

Design of Boilers, Condensers and Cooling Towers:

Boiling: types of boiling, various empirical relations pertaining to boiling, Numerical problems.

Condensation –Types of condensers, Nusselt's theory on laminar film-wise condensation, Empirical Refinements, Several empirical formulae, Numerical problems.

Cooling Towers: basic principle of evaporative cooling, classification of cooling towers, empirical relations pertaining evaporative cooling.

Numerical problems on Design of Boilers, Condensers and Cooling Towers.

Text Books

1. Compact Heat Exchangers, Kays, W. M. and London, A. L., McGraw – Hill, New York, 2nd Edition, 1998.
2. Fundamentals of Heat Exchanger Design, Shah, R. K. and Sekulic, D. P., John Wiley and Sons, New Jersey, 2003.

Reference Books

1. Fundamentals of Heat and Mass Transfer, Incropera, F. P. and Dewitt, D. P., 7th Edition, John Wiley and Sons, New York, 2013.
2. Kern, Donald Q. Process heat transfer. No. 04; QC320, K4. 1950.

Online Resources

1. Heat Exchangers: Fundamentals and Design Analysis by Prof. Indranil Ghosh, IIT Kharagpur, NPTEL Course (Link: https://nptel.ac.in/courses/112/105/112105248/)

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Professional Elective - III

ROBOTICS

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with anatomy, kinematics, sensors and dynamics of a programmable machine, robot.

Course Outcomes

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

- explain the functionality of various components of robot.
- choose appropriate actuator and feedback component for given application
- analyze kinematics and dynamics of a robot.
- design trajectory for the execution of a given work cycle.

Course Content

UNIT - I:

Introduction: Automation and robotics, components of robot – mechanical manipulator-control system and end effectors-types of end effectors —– requirements and challenges of end effectors classification of robots by coordinate system and control system. control resolution, accuracy, repeatability and work volume of robot.

UNIT - II:

Robot Actuators and Feedback Components: Actuators: pneumatic, hydraulic and electrical actuators.

Feedback Components: Position sensors – potentiometers, resolvers, encoders – velocity sensors.

Applications of Robots: Material handling applications, welding applications and assembly and inspection operations.

UNIT - III:

Motion Analysis: Homogeneous transformations as applicable to rotation and translation – problems.

Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

UNIT - IV:

Differential transformations and manipulator Jacobian – problems,

Dynamics: significance of dynamic modelling of a robot, Lagrange – Euler formulation- LE formulation for inverted pendulum and two degree of freedom RR manipulator.

UNIT - V:

Trajectory Planning: Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint integrated motion straight line motion.

Robot Programming: Lead through programming and textual language programming.

Autonomous Robots: Wheeled robots, aerial robots.

Text Books

1. M. P. Groover, "Industrial Robotics -Technology ,Programming and Applications", Tata McGraw Hill Publications, 2nd Edition, 2017.
2. Mittal R K &Nagrath I J, "Robotics and Control", TataMcGraw Hill Publications, 2014.

Reference Books

1. Richard D. Klafterk, "Robotic Engineering: An Integrated Approach", Prentice HallIndia Learning Private Limited, 1993.
2. John J Craig "Introduction to Robotics: Mechanics and Control", Pearson Edu, 3rd Edition, 2004.
3. Roland Siegwar, Illah R. Nourbakhsh, and Davide Scaramuzza, "Introduction to Autonomous Mobile Robots", The MIT Press, Cambridge, London, 2nd Edition, 2011.

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Professional Elective - III

TRIBOLOGY

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the selection of lubricating system for different machine components.
- To impart knowledge on design of bearings for a given application.

Course Outcomes

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

- select the appropriate lubricant and material for specific application
- design and analyze the hydrostatic and hydrodynamic lubrication systems used in bearings.
- analyze and explain the hydrostatic squeeze-film lubrication, aerostatic lubrication systems used in bearings and dry rubbing bearing.
- illustrate different types of seals and gaskets used in mechanical systems and describe the behavior of tribological components subjected to different working conditions.

Course Content

UNIT - I:

Basic Concepts: Oil Viscosity and temperature and pressure effect on viscosity of lubricants, viscosity index, determination of viscosity, viscosity measurements, friction and wear mechanisms- methods of fluid film formation.

Lubrication: classification of lubricant oils, characteristics of liquid, grease and solid, lubricants- additives.

Bearing Materials: Classification of bearing materials-desirable properties, advantages and applications.

UNIT - II:

Hydrostatic Bearings: Introduction to hydrostatic lubrication-Viscous Flow through Rectangular Slot, Hydrostatic Bearing Analysis -Flat Circular pad, Flat square pad and Conical thrust Bearing - Energy losses and Optimum design and Temperature rise.

UNIT - III:

Hydrodynamic bearings: Principles of hydrodynamic lubrication–mechanism of pressure development in the oil-film, petroffs equation-Reynolds's equation for two-dimensional flow; hydrodynamic journal bearings-Analysis of infinitely long

and infinitely short bearings- Effects of side leakage, Friction in sliding bearing-heat generated and heat dissipated. Hydrodynamic thrust bearings- Analysis of plane slider bearing with fixed Pad.

UNIT - IV:

Analysis of Hydrostatic Squeeze-film Lubrication: Circular plate approaching a plane -rectangular plate approaching a plane and applications of squeeze-film Lubrication

Aerostatic Bearing lubrication: Introduction, merits and demerits, applications to hydrodynamic and hydrostatic thrust bearings , externally pressurized gas bearings.

Dry rubbing Bearings: porous metal bearings and oscillatory journal bearings – qualitative approach only.

UNIT - V:

Oil Seals &Gaskets: Different type of mechanical seals-static and dynamic, essential properties of the seals- oil flinger rings and oil grooves.

Failure of Tribological Components: Failure analysis of plain bearings, rolling bearings, gears, seals-characteristics and causes.

Text Books

1. Gwidon Stachowiak and Andrew W Batchelor, Engineering Tribology, Butterworth-Heinemann, 4th Edition,2013
2. V. B. Bhandari, Design of Machine Elements,McGraw-Hill Education 4th Edition, 2013.

Reference Books

1. H.G. Phakatkar& R.R. Ghorpade, Tribology, Nirali Prakashan.,4th Edition, 2012
2. Er. Sushil Kumar Srivastava, Tribology in Industries, S.Chand& Company Ltd, 2nd Edition, 2011
3. M.J. Neale, Tribology Handbook, Butterworth, 2nd Edition, 2001.

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Professional Elective - III

COMPUTATIONAL FLUID DYNAMICS

IV Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To solve fluid flow/ heat transfer problems by the application of finite difference and finite volume methods.

Course Outcomes

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

- develop governing equations for fluid flow and heat transfer and classify the partial differential equations.
- adapt basic space and time finite difference discretisation techniques and solve algebraic equations using direct and iterative techniques.
- apply finite difference approach to solve one dimensional steady and unsteady diffusion problems.
- apply finite volume method for solving one dimensional steady and unsteady diffusion problems.
- solve one dimensional convection and diffusion problems using finite volume method.

Course Content

UNIT - I:

Governing equations of fluid dynamics and Heat Transfer: Models of the flow, substantial derivative, continuity equation, the momentum equation, the energy equation, initial and boundary conditions.

Classification of partial Differential Equations: Introduction, Classfication of partical differential equations - Cramer's rule, Eigen value method.

UNIT - II:

Basic Aspects of Discretization: Introduction to Finite Differnece approach, Difference Equations. Finite difference in non uniform grid, Types of errors, consistency, stability, convergence.

Solution Techniques for System of Algebraic Equations: Direct Methods, Cramer's rule, matrix inversion, Gaussian elimination, Tri-diagonal matrix algorithm (TDMA). Iterative method: Gauss-Jacobi, Gauss -Seidel.

UNIT - III:

Finite Difference Method for Diffusion Problems: Formulation for one dimensional steady and unsteady diffusion equation - Explicit Scheme, Crank-Nicolson Sceheme, Fully Implicit Scheme.

UNIT - IV:

Finite Volume Method for Diffusion Problems: Finite volume formulations for one dimensional steady state diffusion, one dimensional unsteady diffusion: Explicit scheme, Crank-Nicolson scheme, fully implicit scheme.

UNIT - V:

Finite Volume Method for Convection and Diffusion Problems: Finite volume formulation for steady one dimensional convection and diffusion, the central differencing scheme, properties of discretisation schemes, upwind differencing scheme.

Text Books

1. John D. Anderson, J R "Computational fluid dynamics The basic with applications", Mc Graw Hill international, 2012.
2. H. Versteeg, W Malalasekra , "An Introduction to Computational Fluid Dynamics The finite volume method", Pearson Publishers, 2nd Edition, 2018.

Reference Books

1. T. J. Chung - "Computational fluid dynamics", Cambridge university press, 2003
2. Suhas V. Patankar, "Numerical heat transfer and fluid flow" Butter-worth Publishers
3. T. K Sengupta, "Fundamentals of Computational Fluid Dynamics", University Press, 2013.

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Professional Elective - IV

REFRIGERATION AND AIR CONDITIONING

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the basic cycles of various refrigeration systems, their performance evaluation along with details of system components and refrigerantsused.
- To impart knowledge on psychrometric properties and processes and design of air-conditioning systems.

Course Outcomes

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

- analyze different kinds of aircrafts refrigeration systems and illustrate the working of thermoelectric refrigerator.
- analyze single stage vapour compression refrigeration systems and select a suitable refrigerantfor a given application.
- classify VCR system components and illustrate the working of various types of vapour absorption refrigeration systems.
- estimate the psychrometric properties and analyze various psychrometric processes.
- estimate the cooling/heating loads on the air-conditioning equipmentfor a given application.

Course Content

UNIT - I:

Introduction: Need and Applications of refrigeration, Unit of refrigeration and C.O.P, Methods of refrigeration.

Aircraft Refrigeration: Refrigeration needs of Aircrafts - Air craft refrigeration systems - working and their analysis.

Thermoelectric Refrigeration: Working principle and applications.

UNIT - II:

Vapor Compression Refrigeration: Working principle and essential components of the plant, actual cycle, effect of sub-cooling, super-heating, evaporator and condenser pressures on system performance – use of p-h charts.

Refrigerants: Desirable properties, classification, Nomenclature, application, Ozone Depletion, Global Warming.

UNIT - III:

VCR System Components: Classification and working of Compressors, Condensers, Evaporators and Expansion devices.

Vapor Absorption System: Description and working of NH_3 – water system, Calculation of maximum COP and Description and working of Li Br –water (Two shell) System, Requirements of refrigerant and absorbent.

UNIT - IV:

Psychrometry & Psychrometric Processes: Review of Psychrometric Properties, Psychometric Processes: Sensible heating, sensible cooling, humidification and de-humidification, cooling and de-humidification, cooling with adiabatic humidification, heating and humidification, adiabatic mixing of two air streams.

UNIT - V:

Design of Air-Conditioning Systems: Characterization of Sensible and latent heat loads, Need for Ventilation, Consideration of Infiltration, Load concepts of RSHF, GSHF- Problems, Concept of ESHF and ADP. Comfort Air conditioning - summer air conditioning, winter air conditioning, Air conditioning Load Calculations.

Text Books

1. C P Arora, "Refrigeration and Air Conditioning", Tata McGraw-Hill Education, 3rd edition.
2. S C Arora & Domkundwar, "A Course in Refrigeration and Air conditioning", Dhanpat Rai publications, 5th edition.
3. Manohar Prasad, "Refrigeration and Air Conditioning", New Age publications, Revised 2nd edition.

Reference Books

1. Dossat, "Principles of Refrigeration", Pearson Education.
2. Anantha Narayanan, "Basic Refrigeration and Air-Conditioning", Tata McGraw-Hill Education, 4th edition.

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Professional Elective - IV

UNCONVENTIONAL MACHINING PROCESSES

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To impart the principles of non-traditional machining methods.

Course Outcomes

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

- justify the need of non-traditional machining methods.
- elaborate the principle and mechanism of metal removal of various unconventional machining processes.
- interpret the various process parameters and their effect on MRR of various unconventional machining processes.
- select appropriate unconventional machining process based on mechanism of metal removal.
- summarize the applications of different UCM processes.

Course Content

UNIT - I:

Introduction: Need for non-traditional machining methods, classification of modern machining processes – considerations in process selection, applications.

Ultrasonic machining – Elements of the process, mechanics of material removal, MRR process parameters, economic considerations, applications and limitations.

UNIT - II:

Abrasive Jet Machining: Working principle, machine set-up, process parameters, MRR, effect of process parameters, advantages, limitations and applications.

Water Jet Machining: Working principle, machine set-up, process parameters and process performance, advantages, limitations and applications.

Abrasive Water Jet Machining: working principle, machining set up, nozzle designs, parametric analysis, advantages, limitations and applications.

UNIT - III:

Electro–Chemical Machining: Principle, Electrochemistry of the process, ECM Set-up, elements of the process, modelling of MRR, Process parameters, effect of process parameters on machining accuracy,

Electro-Chemical Grinding: Principle, set-up, process characteristic**s,**

Electro-Chemical Honing – Electro-Chemical Deburring

Chemical Machining- Steps- methods**,** advantages, limitations and applications.,of above processes.

UNIT - IV:

Electric Discharge Machining: Principle, set-up, elements, EDM circuits, Metal removal rate, surface finish, effect of process parameters, machining accuracy, characteristics, advantages, limitations and applications.

Electric Discharge Grinding:Working principle, elements of the process, difference between EDM and EDG

Wire-Electric Discharge Machining: working principle, set-up, elements, process variables and characteristics, advantages, limitations and applications.

UNIT - V:

Electron Beam Machining: working principle, mechanism of metal removal, machining set-up, MRR, process parameters, characteristics, advantages, limitations and applications.

Laser Beam Machining: Lasing process, operation of LBM, mechanics of LBM, process characteristics, thermal features, advantages, limitations, and applications.

Plasma Arc Machining: Generation of plasma, principle of operation, elements, plasma torch design, modes of operation of plasma torch, process parameters, advantages and applications.

Text Books

1. VK Jain , “Advanced machining processes”, 1st Edition, 2009, Allied publishers.
2. Gary F. Benedict, “Non-traditional machining methods”, 1st edition, 1987, CRC Press.

Reference Books

1. Pandey P.C. and Shah H.S,”Modern Machining Process”, Mc Graw Hill India. 2nd edition, 2012
2. Bhattacharya A, “New Technology” , 1983, The Institution of Engineers, India.

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Professional Elective - IV

DESIGN FOR MANUFACTURING AND ASSEMBLY

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the design factors used in manufacturing and assembly.

Course Outcomes

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

- incorporate the process constraints & other influencing factors for design.
- design a metal casting product considering trouble shooting elements.
- design a defect free weldment.
- select appropriate material and manufacturing process for product development.
- suggest an assembly for ease of manufacture and automation.

Course Content

UNIT - I:

Design for Manufacturing: Reducing the cost of manufacturing process, understanding the process and constraints, standard components and process, impact of DFM on industry with case studies.

UNIT - II:

Design Consideration in Metal Casting: Overview of various casting**s,** Mold and gating system design of a sand casting with design considerations, directional solidification, and troubleshooting.

UNIT - III:

Design Considerations for Welding, Forging, Sheet Metal and Powder Metal Process: Overview of joining and forming operations, Design guidelines for joining and forming operations, Keeler Goodman forming limit diagram, defects, concept of residual stresses.

UNIT - IV:

Design Considerations in Machining: Overview of various machining processes, design rules and recommendations for various machining and machined parts.

UNIT - V:

Design for Assembly and Automation: Application of design for manufacture and assembly with selection of materials and ranking of processes like casting, injection molding, sheet metal working, die casting, powder metal process, investment casting and hot forging, Design for assembly guidelines and automation.

Design for Additive Manufacturing: Prototype and model testing throughout the design process, Building Prototypes, Rapid Prototyping, RP Processes-Stereolithography, Selective laser sintering, Laminated object modeling, Fused-deposition modeling, Testing of prototypes.

Text Books

1. George E. Dieter, "Engineering Design – A Material Processing Approach", McGraw Hill International ,3rd Edition, 2021.

Reference Books

1. Geofrey Boothroyd, Peter Dewhurst, "Product Design for Manufacture and Assembly", CRC Press, 3rd Edition, 2011.
2. O. Molloy, "Design for Manufacturing and Assembly: Concepts, Architectures and Implementation", Chapman and Hall, 1st Edition, 2012.

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Professional Elective - IV

ENTREPRENEURSHIP

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize the learner with the concepts of Entrepreneurship.

Course Outcomes

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

- explain the significance of entrepreneurship for economic development.
- distinguish among micro, small, and medium enterprises.
- discuss the role of various agencies to raise the capital.
- apply marketing strategies for a given situation.
- analyse contemporary issues in entrepreneurship

Course Content

UNIT - I:

Entrepreneurship and Entrepreneur: Introduction; characteristics of an entrepreneur, types of entrepreneurs, entrepreneurship in india, women entrepreneurship, rural entrepreneurship.

UNIT - II:

Small Scale Industries in India: Concept and definition of micro, small, and medium enterprises, scope and trends of small enterprises in india, role of government in promoting ssi in india, problems of entrepreneurs, planning for setting up an industry, agencies for supporting the process, the businesses planning processes.

UNIT - III:

Institutional Finance to Entrepreneur: Small Industries Development Bank of India (SIDBI), Export-import Bank, Andhra Pradesh State Trading Corporation (APSTC), Integrated Rural Development Programme (IRDP), Export Credit Guarantee Corporation (ECGC).

UNIT - IV:

Entrepreneurial Strategies: Management of small industries- small entreprises and marketing strategies-product life cycle-marketing activities, channels of distribution- market research-marketing problems of small scale industries.

UNIT - V:

Contemporary Issues in Entrepreneurship: Introduction- ecological entrepreurship, legal issues, international business opportunities-risk management strategies, diversification strategies , and bankruptcy, social and ethical responsibility of entrepreneurs.

Text Books

1. Robert D.Hisrich, Mathew J. Manimala, Michael P.Peters, Dean A.Shepherd, Entrepreneurship , McGraw Hill Education, 2016 .
2. P.Narayana Reddy, Entrepreneurship - Text and Cases, Cengage Learning, 2011.

Reference Books

1. David H.Holt, Entrepreneurship New venture Creation, PHI Learning Limited.
2. Madhuri Lall, ShikhaSahai, Entrepreneurship, Excel Books, Second Edition.

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Professional Elective - V

POWER PLANT ENGINEERING

IV Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To introduce the working of various power plants.
- To familiarize with power plant effluents and power plant economics.

Course Outcomes

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

- illustrate working of different circuits, and coal handling systems of steam power plant.
- describe the methods of coal firing, ash handling systems and cooling towers in steam power plant.
- understand the working of hydralic and combined oprations of power plants .
- explain the working of nuclear power plant.
- familiarize with the power plant effluents, economics and their control.

Course Content

UNIT - I:

Introduction to the Sources of Energy – Resources and Development of Power in India.

Steam Power Plant: Plant Layout, Components, Working of different Circuits.

Coal Handling Systems: Types of fuels, Coal handling, Choice of coal handling equipment.

UNIT - II:

Combustion Process: Methods of Coal firing, Overfeed and Underfeed stoker firing - Principles and types of stoker firing systems, Pulverized fuel firing - Principle, Types of burners and Mills, Fluidized Bed Combustion, Cyclone Burner.

Ash and Dust handling: Types of Ash handling systems, Working principles of various Dust collectors.

Cooling towers: Types of Cooling towers and their working.

UNIT - III:

Cogeneration - Working principles, Combined stem and gas turbine platn, Combined gas and diesel power plants, limitations.

Hydroelectric Power Plant: Water power, Hydrological cycle, Hydrographs, Flow duration curve, Mass curve.

Hydroelectric Power plant layout with auxiliaries, classification of dams, spill ways and surge tanks.

UNIT - IV:

Nuclear Power Plant: Nuclear fusion and fission, working of nuclear plant, Components of Nuclear Reactor, Classification of reactors, Pressurized water reactor, Boiling water reactor, Gas cooled reactor, CANDU reactor, Fast breeder reactor, Nuclear waste and its disposal.

UNIT - V:

Environmental Aspects of Power Generation: Effluents from power plants and their impact on environment, Pollutants and Pollution standards, Methods of Pollution control.

Load Caliculations: Load curves, load duration curve, definitions of connected load, maximum demand, demand factor, average load, load factor, diversity factor – related exercises.

Text Books

1. G.D. Rai, "An Introduction to Power Plant Technology", Khanna Publishers, 2006, 5th Edition.
2. P.K.Nag, "Power Plant Engineering", Tata McGraw-Hill Education, 2008, 3rd Edition.

Reference Books

1. S.C. Arora and S. Domkundwar "A Course in Power Plant Engineering", Dhanpat Rai & Co. (P) Limited, 2004, 5th edition.
2. R. K. Rajput, "A Text Book of Power Plant Engineering", Laxmi Publications(p) Ltd. 2009, 4th Edition.
3. M.M.El-Wakil, "Power Plant Technology", Tata McGraw-Hill Education, Revised 2nd edition.
4. R.K Hedge " Power plant Engineering " Pearson India Education service Limited, 2016, 2nd edition.

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Professional Elective - V

ADDITIVE MANUFACTURING

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To present the various 3D printing technologies for manufacturing.

Course Outcomes

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

- explain the fundamental principles of Rapid prototyping
- explain the design procedure for 3D printing
- explain the RP processes and analyze their process parameters
- select appropriate 3D printing technique for a given application.

Course Content

UNIT - I:

Introduction: Prototyping fundamentals, fundamentals of rapid prototyping, difference between 3D Printer and CNC, advantages and limitations of rapid prototyping, commonly used terms, classification of RP process.

Rapid Prototyping Data Formats: STL Format, STL File Problems, consequence of building valid and invalid tessellated models, STL file repairs: generic solutions, other translators, newly proposed formats –AMF File Formats.

UNIT - II:

Design for 3D Printing: Part Orientation, Removal of Supports, Hollowing out parts, Inclusion of Undercuts and other Manufacturing Constraining features, Interlocking features, Reduction of Part Count in an Assembly, Identification of Marking/Numbers.

Liquid-Based Rapid Prototyping Systems: Stereo lithography Apparatus (SLA): models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies.

Solid Ground Curing (SGC): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT - III:

Solid-Based Rapid Prototyping Systems: Laminated object manufacturing (LOM) – models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Fused deposition modeling (FDM) – models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT - IV:

Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Three dimensional printing (3DP): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT - V:

RP Applications: Application in engineering, analysis and planning, aerospace industry, automotive industry, jewelry industry, coin industry, arts and architecture. RP medical and bioengineering applications: planning and simulation of complex surgery, customized implants & prosthesis.

Text Books

1. Ian Gibson, et.al., "Additive Manufacturing Technologies – 3D Printing, Rapid Prototyping and Direct Digital Manufacturing", Springer Publications, 2nd Edition, 2015.
2. Chua C.K., Leong K.F. and LIM C.S, "Rapid prototyping: Principles and Applications", World Scientific publications, 2nd Edition, 2003.

Reference Books

1. D.T. Pham and S.S. Dimov, "Rapid Manufacturing – The Technologies and Applications of Rapid Prototyping and Rapid Tooling", Springer Publications, 2001.
2. Andreas Gebhardt, Jan – Steffen Hotter, "Additive Manufacturing – 3D Printing for Prototyping and Manufacturing", Hanser Publishers, Munich, 2016.

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Professional Elective - V

CONDITION MONITORING

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the importance of types of maintenance with their limitations and the methods of condition monitoring in different industrial sectors.

Course Outcomes

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

- describe the types of vibrations and their characteristics.
- analyze the machine condition with the aid of measuring instruments.
- apply different maintenance strategies for the need of plant maintenance to reduce the maintenance cost.
- carry out lubrication oil analysis and temperature analysis for given applications
- analyze the case study including the fault identification and root causes of malfunction.

Course Content

UNIT - I:

Fundamentals of Vibrating Systems: Introduction, Elements of vibrating system, types of vibrations, methods of vibration analysis, undamped free vibrations: governing differential equation, torsional system – equation of motion, damped vibrations: governing differential equation, Forced vibrations: sources of excitation, equations of motion, frequency response of damped system under harmonic excitation, frequency response under harmonic excitation of the base, vibration isolation, transmissibility, force transmission to foundations.

UNIT - II:

Vibration Monitoring: Vibration signature analysis, Vibration transducers – displacement, velocity and acceleration transducers. vibrometer- introduction, laser vibrometer. accelerometers – piezo resistive, capacitive and inductive type.

UNIT - III:

Maintenance strategies: Introduction, maintenance strategies, introduction to condition monitoring. rotating machinery - machine faults and root causes, Types and benefits of vibration analysis, ISO Standards for vibration analysis.

UNIT - IV:

Wear Debris Analysis: Wear mechanisms, wear particles, wear process monitoring techniques – Ferrography - Applications, advantages and limitations, spectrometric oil analysis program (SOAP)

Temperature Monitoring: Need for temperature monitoring, thermography, IR thermography, applications, advantages and limitations.

UNIT - V:

Case Studies: Roller Bearing, Gear box, Induction motor, Wind mill.

Future Trend in VCM – Vibration condition monitoring(VCM), Centralized vibration condition monitoring(CVCM), Approach suitable for old plants, approach suitable for new plants.

Text Books

1. Jyoti K. Sinha "Industrial Approaches in Vibration-Based Condition Monitoring", CRC Press, 1st Edition, 2020.
2. C Scheffer, P Girdhar, "Practical Machinery Vibration Analysis and Predictive Maintenance", Newnes publisher, 1st Edition, 2004.

Reference Books

1. Robert Bond Randall "Vibration based condition monitoring", Wiley publications, 2nd Edition, 2021.
2. Rao, J S., "Vibration Condition Monitoring", Narosa Publishing House, 2nd Edition, 2000.

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Professional Elective - V

OPERATIONS MANAGEMENT

IV Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To emphasize the students on the objectives and functions of PPC department for effective running of a Production system.
- To impart the knowledge on various planning tools used in PPC department.

Course Outcomes

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

- outline the concepts of operations management systems.
- determine the forecast of demand of product using different methods.
- apply the principles of inventory control for the determination of |EOQ and total cost.
- use the principles of MRP and ERP processors.
- identify optimum sequence for a given problem and illustrate the principles of JIT and SCM.

Course Content

UNIT - I:

Production and Operations Management - definition - Criteria of performance for the POM - decisions of POM - classification of decision areas - types of production systems - Organization of manufacturing firm - internal organization of PPC - objectives and functions of PPC.

UNIT - II:

Forecasting for operations **-** Requirements of forecasting **-** Elements of forecasting - Categories - Qualitative methods - Delphi method - Market survey - Time series methods - Moving average method - Exponential smoothing method - Causal method - Simple regression analysis - Reliability of forecasts - Forecast error monitoring.

UNIT - III:

Inventory management - Basic function - Symptoms of mismanaged inventories - Stock points in a production distribution system - Relevant costs - Behaviour of costs in relation to level of inventory - Optimal Order Quantity- Basic inventory model - Economic manufacturing batch size - Economic batch quantity- Inventory control systems - ABC classification of inventory items.

UNIT - IV:

Material Requirements planning - Bill of materials - Demand dependence - Product structures - MRP calculations - Lot size decision policies - Evolution of MRP into MRP-II - Further evolution to ERP - Benefits of ERP- Implementation of ERP - Steps in ERP implementation - Aggregate planning - strategies - costs.

UNIT - V:

Operations scheduling - Job shop scheduling - Sequencing - Objectives - Single machine problem - Evaluation of sequencing rules - Two machines problem - Johnson's rule. Just-In-Time production - philosophy - Supply chain management - objectives - Building a supply chain - orientation and implementation of supply chain principles - Drivers of supply chain.

Text Books

1. Elwood S.Buffa, "Modern Production/Operations Management" Johm wiley & Sons, 8th edition.
2. S N Chary, "Production and Operations Management", McGraw-Hill, 3rd edition.

Reference Books

1. R Panneerselvam, "Production and Operations Management", PHI, 3rd edition.
2. Joseph G. Monks, "Operations Management", McGraw-Hill, 2nd edition.
3. Shailendra Kale, " Production and Operations Management", McGraw-Hill, 2nd edition.
4. Sunil Chopra and Peter Meindl, "Supply Chain Management", Pearson, 5th edition.

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MEASUREMENTS AND MECHATRONICS LAB

IV Year – I Semester

Practical	: 2	Internal Marks	: 15
Credits	: 1	External Marks	: 35

Course Objectives

- To impart hands on training on measuring methods and metrology instruments and calibration of various measuring instruments.
- To train the students in PLC programming.

Course Outcomes

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

- use various metrology instruments in carrying out measurement of dimensional parameters.
- calibrate the measuring instruments.
- operate PLC for a given application.

List of Experiments

Any 10 of the below experiments may performed

1. Study of Linear Measuring Instruments
2. Measurement of taper angle by using rollers ,slip gauges, sine bar and Bevel protractor
3. Measurement of chordal addendum and chordal tooth thickness by using Gear tooth vernier calipers
4. Linear and angular measurement by using Tool Maker's Microscope
5. Calibration of LVDT transducer for displacement measurement.
6. Calibration of strain gauge.
7. Calibration of thermocouple.
8. Calibration of tachometer using photo pickup and magnetic pickup.
9. Design and execute a pneumatic circuit for actuating single acting cylinder using 3/2 way valve.
10. Ladder programming on Logic gates , Timers counters using PLC.
11. Ladder programming on lift control using PLC.
12. Ladder programming on traffic light control using PLC.

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COMPUTER AIDED ENGINEERING ANALYSIS AND MANUFACTURING LAB

IV Year – I Semester

Practical	: 4	Internal Marks	: 15
Credits	: 2	External Marks	: 35

Course Objectives

- To impart hands on training for analysis of using analysis package.
- To demonstrate the working principle and operation of CNC Machines.

Course Outcomes

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

- analyze structural , vibration , fluid flow and heat transfer problems using analysis package.
- simulate manufacturing processes and produce simple components using CNC Machines.

List of Experiments

1. Static analysis of Beam.
2. Static analysis of 3-D structure
3. Free vibration analysis of a beam
4. Analysis of axisymmetric problem.
5. Analysis and validation of laminar flow / turbulent flow through a pipe
6. Boundary layer phenomenon over a flat plate.
7. Heat transfer through composite wall
8. One-dimensional heat transfer through pin fin.
9. Machining of components using CNC Lathe.
10. Machining of components using CNC Mill.
11. Palletization of objects using pick and place robot.
12. Manufacturing of simple components using 3D Printer.

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Honors Degree

MECHANICS OF COMPOSITE MATERIALS

IV Year – I Semester

Lecture	: 3	Tutorial	: 2	Internal Marks	: 30
Credits	: 4			External Marks	: 70

Course Objectives

- To familiarize with the composite materials and their mechanical behaviour.

Course Outcomes

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

- outline the concepts of operations management systems.
- explain the concepts of composite materials.
- select a best technique for fabrication of composite material.
- analyze macro and micro mechanical behaviour of a lamina.
- develop governing equations for bending, buckling and vibrations in laminated plates.

Course Content

UNIT - I:

Introduction to Composite Materials: Introduction, What is a composite material, Current and potential advantages of fibre reinforced composites, Applications of composite materials, Military, civil, space, automotive and commercial applications

Fabrication of Composites : Fabrication of Metal Matrix Composites, Fabrication of Polymer Matrix Composites , Fabrication of ceramic matrix composites, Fabrication of nano-composites.

UNIT - II:

Hooke s Law for a Two-Dimensional Angle Lamina, Engineering Constants of an Angle Lamina, Invariant Form of Stiffness and Compliance Matrices for an Angle Lamina Strength Failure Theories of an Angle Lamina : Maximum Stress Failure Theory Strength Ratio, Failure Envelopes, Maximum Strain Failure Theory ,Tsai–Hill Failure Theory, Tsai–Wu Failure Theory, Comparison of Experimental Results with Failure Theories. Hygrothermal Stresses and Strains in a Lamina: Hygrothermal Stress–Strain Relationships for a Unidirectional Lamina, Hygrothermal Stress–Strain Relationships for an Angle Lamina.

UNIT - III:

Macro mechanical Analysis of a Lamina : Introduction ,Definitions: Stress, Strain ,Elastic Moduli, Strain Energy. Hooke s Law for Different Types of Materials, Hooke s Law for a Two- Dimensional Unidirectional Lamina, Plane Stress

Assumption, Reduction of Hooke s Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

UNIT - IV:

Micromechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi- Empirical Models ,Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion.

UNIT - V:

Bending, Buckling and Vibration of laminated plates: Governing equations for bending buckling and vibration of laminated plates, Deflection of simply supported laminated plates, Vibration of simply supported laminated plates.

Design of Composite Structures: Introduction, design philosophy, Anisotropic analysis, Bending extension coupling, Micromechanics, Non linear behaviour, Interlaminar stresses, transverse shearing, Laminate optimization.

Text Books

1. Ronald F. Gibson, Principles of composite material mechanics, CRC Press, 2011.
2. Robert M Jones, Mechanics of Composite Materials, Taylor & Francis, 2000.

Reference Books

1. Lawrence E. Nielsen, Nielson, Paul Nielsen, Mechanical Properties of Polymers and Composites, Second Edition, CRC press, 2000.

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Open Elective - I

ELEMENTS OF CIVIL ENGINEERING

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce basics of Civil Engineering concepts in the fields of surveying, building materials, water resources, Water Supply, Sanitary, Electrical Works in Building and Highway Engineering.

Course Outcomes

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

- familiarize with basics of civil engineering.
- carryout various civil engineering survey works.
- identify the various properties of building materials and various types of buildings.
- get acquainted with fundamentals of Water Resources, Water Supply, Sanitary and Electrical Works in Building.
- enumerate the fundamental concepts highway engineering.

Course Content

UNIT - I: Introduction

Introduction of Civil Engineering, Scope of Civil Engineering, Role of Civil Engineer in Society. Impact of infrastructural development on economy of country.

UNIT - II: Surveying and Leveling

Introduction: Definition of Surveying, Fundamental principles of surveying, Classification of surveying.

Linear Measurement: Methods, Instruments used in chain surveying, Selection of stations, Chaining and Ranging

Angular Measurement: Instruments used, Types of compass, Types of meridians and bearings, Measurement of bearings, computation of angles. Compass traversing local attraction.

Leveling: Objectives and applications-terminology-Instruments,component parts of dumpy level, Types of leveling, levelling staff.

UNIT - III: Building Materials and Construction

Materials: Introduction to construction materials - Stones, Bricks, Lime, Cement, Timber, Sand, Aggregates, Mortar, Concrete and bitumen.

Construction: Classification of buildings, Building components and their functions.

UNIT - IV: Water Resources, Water Supply, Sanitary and Electrical Works in Building

Hydrologic cycle, water use and its conservation, Introduction to dams, barrages and check dams.

Introduction, water supply system, water supply layout of a building, housedrainage, traps, electrical works in building.

UNIT - V: Transportation Engineering

classification of roads, Introduction of flexible and rigid pavements, Introduction to road traffic and traffic control mechanism.

Text Books

1. Elements of Civil Engineering, Mimi Das Saikia, Bhargab Mohan Dasand Madan Mohan Das Publisher: PHI Learning Private Limited New Delhi.
2. Basic Civil Engineering, Dr. B.C Punmia,Ashok.K. Jain and Arun K. Jain: Laxmi Publications,Delhi.
3. Surveying Vol. I, Dr. B. C. Punmia, Ashokkumar Jain, ArunkumarJain, 17th Edition Publisher: Laxmi Publications ,Delhi.

Reference Books

1. Surveying and Leveling, R. Subramanian, Publisher: Oxford University.
2. Building drawing, M.G.Shah, C.M.Kale and S.Y.Patki Publisher: TataMcGraw Hill.

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Open Elective - I

ENVIRONMENTAL LAWS AND POLICIES

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To equip the students to have a basic awareness on environmental and socioeconomic Factors.
- To impart the knowledge of environmental pollution problem.
- To elucidate the rules and regulations of patents and trade laws.

Course Outcomes

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

- comprehend different moral perspectives and one's own Ethical standards.
- understand the concept of safety and risk.
- explain different initiatives to protect nature.
- identify the role of Environmental Engineering.
- understand different types of infringement of Intellectual Property Rights.

Course Content

UNIT - I: Introduction

Introduction to trade and environment - International environmental laws, Right to Environment as Human Right, International Humanitarian Law and Environment, Environment and conflicts management, Famous international protocols like Kyoto.

UNIT - II: Environmental Laws

Overview of environment, Nature and eco system, Concept of laws and policies, Origin of environmental law, Introduction to environmental laws and policies, Environment and Governance, Sustainable development and environment, Understanding climate change, Carbon crediting, Carbon foot print etc.

UNIT - III: Air and Noise Pollution Control Laws

Air pollutants, Sources, classification, Combustion, Processes and pollutant emission, Effects on Health, vegetation, materials and atmosphere, Reactions of pollutants in the atmosphere and their effects-Smoke, Smog and ozone layer disturbance, Greenhouse effect. Air sampling and pollution measurement methods, Principles and instruments, Overview of air pollution control laws and their mitigation measures. Sound power, Sound intensity and sound pressure levels; Plane, Point and line sources, Multiple sources; Outdoor and indoor noise propagation;

Psychoacoustics and noise criteria, Effects of noise on health; Special noise environments: Infrasound, Ultrasound, Impulsive sound and sonic boom; Noise standards and limit values; Noise instrumentation and monitoring procedure, Noise control methods.

UNIT - IV: Water Quality Laws

Introduction to water quality laws development, calibration and verification cost: benefit analysis using models, Laws for estuary and lakes, Waste water treatment legislation; Introduction to water quality management systems and procedures, Consequence Analysis; Socioeconomic aspects, Measures of effectiveness of pollution control activities.

UNIT - V: Environmental Impact Assessment and Life Cycle Analyses

Evolution of EIA: Concepts of EIA methodologies, Screening and scoping; Rapid EIA and comprehensive EIA; General framework for environmental impact assessment, Characterization and site assessment. Environmental Risk Analysis, Definition of risk, Matrix method - Checklist method, Fault tree analysis, Environmental Audit: Cost Benefit Analysis; Life Cycle Assessment; Resource balance, Energy balance & management review; Operational control; Case studies on EIA.

Text Books

1. Kuehn, T.H., Ramsey, J.W. and Threlkeld, J.L., Thermal Environmental Engineering, 3rd Edition, Prentice Hall, 1998.
2. A Textbook of Environmental Chemistry, by O. D. Tyagi and M. Mehra
3. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, economical and Working Environment, 120th ASEE Annual Conference and Exposition.

Reference Books

1. Larry W. Canter, “Environmental Impact Assessment”, 1st edition, McGraw-Hill (international edition).
2. David P. Lawrence, “Environmental Impact Assessment - Practical Solutions to Recurrent Problems”, 1st Edition, Wiley-Interscience.
3. Advanced Air and Noise Pollution Control, Lawrence K. Wang, Norman C. Pereira, Yung-Tss Hung, 2005 Edition, Humana Press.
4. Municipal Solid Waste Management, P. Jayarami Reddy, 1st Edition, B.S. Publications.

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Open Elective - I

ELECTRICAL MATERIALS

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the concepts of dielectric and ferro-magnetic materials.
- To impart knowledge on semiconductor materials, materials used in batteries and solar cells.
- To familiarize the materials required for specific electrical applications.

Course Outcomes

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

- describe the properties of liquid, gaseous and solid dielectric materials used in electrical applications.
- analyze the properties of Ferro electric, Peizo electric and Pyro electric materials.
- classify different magnetic materials and examine the effects of aging and impurities on magnets.
- elucidate various semiconductor materials and their applications in integrated circuit.
- choose appropriate material for a given electical and special purpose application.

Course Content

UNIT - I: Dielectic Materials

Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics.

UNIT - II: Ferromagnetic Materials

Properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials, applications of Ferro-electric materials.

UNIT - III: Magnetic Materials

Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, Magnetostriction, magnetically soft and hard materials, ageing of magnets, Superconductivity and its origin, Zero resistance and Meissner Effect.

UNIT - IV: Semiconductor Materials

Properties of semiconductors, Classification of Semiconductors, Silicon wafers - Wafer manufacturing process, Resistor, Fabrication processes of MOSFET on IC.

UNIT - V: Materials for Electrical Applications

Materials used for Resistors, rheostats, heaters, stranded conductors, fuses, electric contact materials, Solid Liquid and Gaseous insulating materials. Effect of moisture on insulation, Testing of Transformer oil as per ISI standards - Galvanization methods, Materials for battery and solar cells.

Text Books

1. R K Rajput: A course in Electrical Engineering Materials, Laxmi Publications. 2009.
2. David Linden, Thomas B. Reddy "The Handbook of Batteries" McGraw-Hill Hand Books 2010.
3. T K BasaK: A course in Electrical Engineering Materials:, New Age Science Publications 2009.

Reference Books

1. TTTI Madras: Electrical Engineering Materials
2. Adrianus J.Dekker: Electrical Engineering Materials , THM Publication

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Open Elective - I

CONTROL SYSTEMS ENGINEERING

II Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To equip the students with the basic concepts of control systems by developing mathematical models for physical systems.
- To familiarize with the time domain behavior of linear control systems.
- To impart knowledge on analytical methods to quantify stability of linear control systems.
- To introduce the state space analysis to continues time systems.

Course Outcomes

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

- apply the basic concepts and properties of feedback control systems for mathematical modeling of physical systems.
- explore the transfer function analysis using singal flow graph representation of control systems.
- employ the time domain analysis to quantify the performance of linear control systems and specify suitable controllers.
- perform frequency domain analysis of control systems required for stability analysis.
- use the concept of state variable theory to determine the dynamic behavior of linear control systems.

Course Content

UNIT - I: Introduction

Concepts of Control Systems- Open loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer function for physical systems.

UNIT - II: Control Systems Components

Transfer Function of DC Servo motor - AC Servo motor -, Block diagram representation of systems considering -Block diagram algebra – Representation by signal flow graphs - Reduction is using Mason's gain formula.

UNIT - III: Time Response Analysis

Standard test signals - Time response of first order systems – Characteristic equation of feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants.

UNIT - IV: Stability Analysis in S-Domain

The Concept of Stability – Routh's Stability Criterion – Qualitative Stability and Conditional Stability –Limitations of Routh's Stability.

Root Locus Technique: The root locus concept - construction of root loci – simple problems.

UNIT - V: State Space Analysis of Continuous Systems

Concept of state, state variables and state model, derivation of state models from physical systems, solving the Time invariant state equations- State Transition Matrix and its Properties, concept of controllability and observability.

Text Books

1. Control Systems Engineering – by I. J. Nagrath and M. Gopal, New Age International Limited Publishers, 6th edition, 2017.
2. Automatic control system – B.C.Kuo , john wiley and son's 8th edition, 2003.

Reference Books

1. Modern control engineering – K.Ogata , prentice Hall of India Pvt. Ltd., 5th Edition, 2015.
2. Control system – N.K.Sinha, New Age International (p) Limited Publishers, 3rd Edition, 1998.
3. Control system engineering – Norman S-Nice, Willey Studio Edition, 4th Edition. Feed back and control system – Joseph J Distefa.
4. Modern control systems - Richard C. Dorf and Robert H. Bishop, Pearson Prentice Hall Publications, 12th Edition, 2010.

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Open Elective - I

AUTOMOTIVE ENGINEERING

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce various components and sub systems of an automobile.
- To impart knowledge on various safety systems of an automobile and emission norms.

Course Outcomes

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

- outline the various components and sub systems of an automobile.
- specify different safety norms for the operation of an automobile.

Course Content

UNIT - I:

Introduction: classification of automobiles, components of four wheeler automobile-chassis, body, power unit, power transmission- front wheel drive, rear wheel drive, four-wheel drive.

Fuel supply systems: Simple fuel supply system in petrol and diesel engines. working of simple carburettor, direct fuel injection system in diesel engine.

UNIT - II:

Lubricating System: Functions & properties of lubricants, methods of lubrication splash, pressure, dry sump and wet sump lubrication.

Cooling System: Necessity, methods of cooling - air cooling & water cooling, components of water cooling, radiator, thermostat.

UNIT - III:

Ignition System: Functions, requirements, types of an ignition system, battery ignition system - components, Magneto ignition system, electronic ignition system.

Transmission system: Types and functions of the clutches- single plate clutch, multi plate clutch, centrifugal and semi centrifugal clutch, types of gear boxes- Sliding mesh, Constant mesh, Synchromesh, propeller shaft, universal joint and differential.

UNIT - IV:

Suspension System: Objectives of suspension system, front suspension systemrigid axle suspension system, independent suspension system, rear axle suspension, torsion bar, shock absorber.

Braking System: Mechanical brakes, hydraulic brakes-master cylinder, wheel cylinder, tandem master cylinder, brake fluid, air brakes and vacuum brakes.

UNIT - V:

Emissions from Automobile: Emission norms - Bharat stage and Euro norms. engine emissions - exhaust and non-exhaust.

Safety Systems: seat belt, air bags, bumper, antilock brake system (ABS), wind shield, suspension sensor, traction control, central locking, electric windows, speed control.

Text Books

1. Kirpal Singh, "Automobile Engineering Vol-1 & vol-2", Standard Publishers Distributors, 14 th edition, 2017 .
2. William H Crouse & Donald LAnglin, Automotive Mechanics, Tata Mc Graw Hill Publications, 10th edition, 2017.

Reference Books

1. R.B Gupta , Automobile Engineering, Satya Prakashan Publications, 6th edition,2016.
2. Newton steeds & Garrett, "The Motor vehicle", Society of Automotive Engineers, 13th edition,2001.
3. G.B.S. Narang, "Automobile Engineering", Khanna Publishers, 5th edition, 1995.

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Open Elective - I

ELEMENTS OF MECHANICAL TRANSMISSION

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the principles of mechanical power transmission elements.

Course Outcomes

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

- choose suitable shaft couplings for a given application.
- propose suitable transmission element for a given application.
- identify suitable power screw for motion transmission.

Course Content

UNIT - I: Shaft Couplings

Shaft couplings: Rigid couplings – muff, split muff and flange couplings, flexible coupling-modified flange coupling.

UNIT - II: Belt Drives

Flat Belts: Introduction, selection of a belt drive, types of belt drives, length of belts, materials, belt joints, types of flat belt drives, power transmitted.

UNIT - III: V-Belt, Rope Drives & Chain Drives

V-belts: Introduction, Types of V-belts, ratio of driving tensions for V-belt, power transmitted.

Rope Drives: Introduction, classification of rope drives, power transmitted.

Chain drives: Introduction, chain drives, polygonal effect, selection of roller chains, length of chain.

UNIT - IV: Power Screws

Forms of threads, multi-start threads, right hand and left hand threads, nut, compound screw, differential screw.

UNIT - V: Gears and Gear Trains

Types, terminology, materials, law of gearing, velocity of sliding, forms of teeth, path of contact, arc of contact, interference, gear Trains - types, differential of an automobile.

Text Books

1. Bhandari, “Design of Machine Elements”, Tata McGraw Hill book Co.,5th Edition, 2020.
2. P.C. Sharma & D.K. Agarwal, “Machine Design”, S.K.Kataria & Sons ,13th Edition, 2018.

Reference Books

1. Sharma & Purohit, “Design of Machine Elements”, PHI, 10th Edition,2011.
2. Kannaiah, “Design of Machine Elements”, Scitech Publications, 2nd Edition, 2015.

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Open Elective - I

INTRODUCTION TO EMBEDDED SYSTEMS

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the classification, characteristics, applications of embedded systems.
- To provide clear understanding about the role of firmware in correlation with hardware systems.
- To familiarize with the architecture of 8051 microcontroller.

Course Outcomes

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

- compare embedded and general computing systems.
- select the processors for an embedded system application.
- understand the architecture and instruction set of 8051 microcontroller.
- program the timers/counters and serial communication components of 8051 microcontroller.

Course Content

UNIT - I: Introduction to Embedded Systems

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT - II: Typical Embedded System: Core of the Embedded System

Elements of Embedded Systems, General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT - III: Embedded Firmware

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT - IV: Introduction to 8051 Microcontroller

Overview of 8051 microcontroller, Architecture, I/O Ports, Memory organization, Addressing modes and Instruction set of 8051, Simple programs.

UNIT - V: 8051 Real Time control

Interrupts- 8051 Interrupts, Interrupt Vector table of 8051, IE Register, IP register;Timers and Counters-Timer 0, Timer 1, TMOD Registers, TCON Register,Mode1 Programming; Serial Port- SBUF, SCON Registers, Doubling baud rate using PCON register, program for serial data transmission.

Text Books

1. K.V Shibu, "Introduction to Embedded System", TMH Education private limited, 2009.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, "The 8051 Microcontrollers and Embedded Systems", 2nd Edition, Pearson Education.

Reference Books

1. Kenneth. J. Ayala, Dhananjay V. Gadre, "The 8051 Microcontroller & Embedded Systems Using Assembly and C", 1st edition, Cengage learning, 2010.
2. Rajkamal," Embedded Systems" 2nd Edition, TMH, 2008.
3. Frank Vahid, Tony Givargis, "Embedded System Design", 2nd Edition, John Wiley Publishers.

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Open Elective - I

FUNDAMENTALS OF COMMUNICATION SYSTEMS

II Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To introduce various analog and digital modulation and demodulation techniques
- To familiarize with various multiplexing schemes and cellular telephone systems

Course Outcomes

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

- understand the concepts of basic communication system
- compare different multiplexing techniques.
- differentiate DSB-SC, SSB and frequency modulation schemes.
- distinguish ASK, PSK and FSK modulations.
- know the concepts of the cellular telephone systems

Course Content

UNIT - I: Introduction to Communication Systems

Introduction, Communication Process: Elements of communication system, Concept of Bandwidth and frequency spectrum, Sources of information: Classification of signals, Baseband and Band pass signals, Communication channels, Classification of communication systems.

UNIT - II: Basic Models of Communication

Need of modulation, Different types of modulation systems, Multiplexing, Basic Models of Communication. Primary Communication Resources, Survey of communication applications, Analog and digital signals, Conversion of analog signals to digital signals, electromagnetic spectrum (EM) Spectrum.

UNIT - III: Linear Modulation

Basics of Amplitude Modulation: Definition and Physical Appearance, Single tone an AM wave, Frequency Spectrum and Bandwidth of an AM wave, Modulation Index, Power distribution in an AM wave; Forms of an AM signal (theoretical concepts): Double Side Band-suppressed Carrier (DSB-SC), Single Side Band (SSB).

UNIT - IV: Angle Modulation

Basics of Frequency Modulation: Definition and Physical Appearance, Frequency Deviation Curve, Equation of FM wave, Frequency Deviation, Modulation Index, Deviation Ratio; Comparison of FM and AM Signals.

Phase Modulation: Definition and Physical Appearance, Equation of PM wave.

UNIT - V: Digital Transmission

Digital communication system model, advantages and disadvantages of digital communication, pulse code modulation (PCM), ASK, FSK, PSK, Basics of cellular telephone systems.

Text Books

1. Wayne Tomasi, “Electronics Communication systems”, Pearson Education, 5th edition, 2004.
2. Dr. Sanjay Sharma, "Communication Systems: Analog and Digital", Katson Books, 7th Reprint Edition, 2018.

Reference Books

1. Simon Haykin, John Wiley, “Principles of Communication Systems”, 2nd Edition, John Wiley & Sons.
2. V. Chandra Sekar, "Analog Communication", Oxford University Press, 2010.
3. Dr. Sanjay Sharma, "Digital Communications", Katson Books.
4. B.P.Lathi, “Modern Analog and Digital Communication”, 3rd Edition, Oxford reprint, 2004.

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Open Elective - I

INFORMATION RETRIEVAL SYSTEMS

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce basic concepts in information retrieval.
- To familiarize with applications of information retrieval techniques in the Internet or Web environment.

Course Outcomes

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

- identify the basic theories in information retrieval systems.
- use inverted file as an index data structure to retrieve the documents from the database.
- create signature files for fast retrieval of text data.
- build PAT treesand PAT arrays for the given text document.
- use stemming algorithms to improve the performance of IR systems.

Course Content

UNIT - I: Introduction to Information Storage and Retrieval System

Introduction, Domain Analysis of IR systems and other types of Information Systems, IR System Evaluation. Introduction to Data Structures and Algorithms related to Information Retrieval: Basic Concepts, Data structures, Algorithms.

UNIT - II: Inverted files

Introduction, Structures used in Inverted Files, Building Inverted file using a sorted array, Modifications to Basic Techniques.

UNIT - III: Signature Files

Introduction, Concepts of Signature Files, Compression, Vertical Partitioning, Horizontal Partitioning.

UNIT - IV: New Indices for Text

PAT Trees and PAT Arrays: Introduction, PAT Tree structure, algorithms on the PAT Trees, Building PAT trees as PATRICA Trees, PAT representation as arrays.

UNIT - V: Stemming Algorithms

Introduction, Types of Stemming Algorithms, Experimental Evaluations of Stemming to Compress Inverted Files.

Text Books

1. Frakes W.B., Ricardo Baeza-Yates, “Information Retrieval Data Structures and Algorithms”, Prentice Hall, 1992.
2. Ricardo Baeza-Yates, Bertheir Ribeiro-Neto, “Modern Information Retrieval”, Pearson Education.
3. Robert Korfhage, “Information Storage & Retrieval”, John Wiley & Sons.

Reference Books

1. Kowalski, Gerald, Mark T Maybury, “Information Retrieval Systems-Theory and Implementation”, Kluwer Academic Press, 1997.
2. Information retrieval Algorithms and Heuristics, 2nd edition, Springer.

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Open Elective - I

COMPUTER GRAPHICS

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To emphasize on functionalities of various graphic systems and geometric transformations
- To familiarize on visible surface detection methods and computer animations.

Course Outcomes

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

- outline different graphical display devices and drawing algorithms.
- illustrate different 2-D geometrical transformations on graphical objects
- interpret different line and polygon clipping algorithms
- infer different 3- D transformations and viewing functions on objects.
- summarize different surface detection methods and computer animations

Course Content

UNIT - I: Introduction

Introduction: Application of computer graphics, raster scan and random scanDisplays.

Filled Area Primitives: Points and lines, inside and outside tests, line drawing algorithms, Scan line polygon fill algorithm.

UNIT - II: 2-D Geometrical Transforms

Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transformations.

UNIT - III: 2D Viewing

The viewing pipeline, window to view-port coordinate transformation, Cohen-Sutherland line clipping algorithm, Sutherland – Hodgeman polygon clipping algorithm.

UNIT - IV: 3D Geometric Transformations

Translation, rotation, scaling, reflection and shear transformations, composite transformations, types of projections.

UNIT - V: Visible Surface Detection Methods and Animation

Classification – types, back-face detection, depth-buffer, BSP tree, area sub-division method.

Animations: General computer animation, raster animation, key frame systems, Graphics programming using Open GL .

Text Books

1. Donald Hearn, M. Pauline Baker, "Computer Graphics *C* version", 2nd e edition, Pearson Education.
2. Francis S.Hill, Stephen M. Kelley, "Computer Graphics using Open GL", 3rd edition, Pearson Education.

Reference Books

1. Foley, VanDam, Feiner, Hughes, "Computer Graphics Principles and Practice", 2nd edition, Pearson Education.
2. Rajesh K Maurya, "Computer Graphics with Virtual Reality Systems", Wiley.

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Open Elective - I

SYSTEM SOFTWARE

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the implementation details of assemblers, loaders, linkers, and macro processors.

Course Outcomes

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

- outline the relationship between system software and machine architecture.
- analyze working of assembler for a simplified Instructional computer.
- describe the important features of linkage Editors and Dynamic Linking .
- identify the mostly used macro processors algorithms and data structures.
- compare the functions of Absolute Loader , Bootstrap Loaders.

Course Content

UNIT - I: Introduction

System software and machine architecture, The Simplified Instructional Computer (SIC), Machine architecture, Data and instruction formats, addressing modes, instruction sets, I/O and programming System.

UNIT - II: Assemblers

Basic assembler functions, SIC assembler, assembler algorithm and data structures, machine dependent assembler features.

UNIT - III: Implementation of Assemblers

Instruction formats and addressing modes, program relocation, machine independent assembler features, literals, symbol, defining statements, expressions, one pass assemblers, multi pass assemblers, implementation example, MASM assemble.

UNIT - IV: Loaders & Linkers

Basic loader functions, design of an absolute loader, simple bootstrap loader, machine dependent loader features, relocation, loader options, program linking, algorithm and data structures for linking loader, linkage editors, dynamic linking, implementation example.

UNIT - V: Macro Processors

Basic macro processor functions, macro definition and expansion, macro processor algorithm and data structures, machine independent macro processor features, concatenation of macro parameters, generation of unique labels, conditional macro expansion.

Text Books

1. Leland L. Beck, "System Software – An Introduction to Systems Programming", 3rd edition, Pearson Education Asia, 2000.

Reference Books

1 D. M. Dhamdhere, "Systems Programming and Operating Systems", 2nd Revised edition, Tata McGraw-Hill, 1999.

2. John J. Donovan "Systems Programming", Tata McGraw-Hill Edition, 1972.

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Open Elective - I

FREE & OPEN SOURCE SOFTWARE

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To impart the opportunities for open source software in the global market.
- To familiarize with different steps in implementing the open source.

Course Outcomes

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

- state the need and applications of open source software.
- compare and Contrast between Open source and commercial software
- demonstrate LINUX operating systems concepts.
- create database in MYSQL and perform operations on it.
- design and develop a web application using PHP.

Course Content

UNIT - I: Introduction

Introduction to Open sources, Need of Open Sources, Advantages of Open Sources and Application of Open Sources.

UNIT - II: LINUX

LINUX Introduction, General Overview, Kernel Mode and user mode, Process, Advanced Concepts-Personalities, Cloning, Signals.

UNIT - III: PHP

PHP- Introduction, Programming in web environment, variables, constants, data types, operators Statements, Arrays.

UNIT - IV: MySQL

MySQL: Introduction, Setting up account, Starting, terminating and writing your own SQL programs, Record selection Technology, Working with strings, Date and Time, Generating Summary, Working with metadata.

UNIT - V: Advanced PHP

OOP–String Manipulation, PHP and SQL database, PHP Connectivity, Debugging and error handling.

Text Books

1. M.N.Rao, “Fundamentals of Open Source Software”, PHI Learning.
2. Steve Suchring,”MySQLBible”, John Wiley, 2002

Reference Books

1. Remy Card, Eric Dumas and Frank Mevel, “The Linux Kernel Book”, Wiley Publications, 2003.

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Open Elective - I

FUZZY MATHEMATICS

II Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To impart the knowledge of fuzzy set theory and its applications in Engineering.

Course Outcomes

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

- state the need and applications of open source software.
- distinguish between crisp set and fuzzy set.
- know different operations on fuzzy relations.
- use defuzzification methods to crisp sets.
- draw inferences using fuzzy logic.
- develop membership value assignments.

Course Content

UNIT - I: Classical Sets And Fuzzy Sets

Classical sets – Operations – Properties. Fuzzy sets – Operations – Properties – membership functions - Features of the membership function.

UNIT - II: Fuzzy Relations

Fuzzy Cartesian product and composition - Fuzzy relations - Operations - Properties of fuzzy relations - Fuzzy tolerance and equivalence relations.

UNIT - III: Fuzzification And Defuzzification

Fuzzification - defuzzification to crisp set - Defuzzification to scalars (centroid method, centre of sums method, mean of maxima method).

UNIT - IV: Fuzzy Logic

Classical logic – Fuzz logic – Approximate reasoning ["if ... then" approach and "if ... then ....else" approach] – Other forms of the implication operation.

UNIT - V: Development Of Membership Functions

Membership value assignments – Inference – Rank ordering – Neural networks – Genetic algorithms – Inductive reasoning.

Text Books

1. Timothy J.Ross., Fuzzy Logic with Engineering Applications - Second Edition, Wiley Publications, 2015, New Delhi.

2. S.Rajasekaran, G.A.Vijayalakshmi Pai, Neural networks, Fuzzy logic, and genetic algorithms synthesis and applications- – Prentice-Hall of India private limited, 2008, New Delhi.

Reference Books

1. H.J. Zimmarman, Fuzzy set theory and its applications, 4th edition — Springer, 2013. New Delhi.
2. S.Nanda and N.R.Das "Fuzzy Mathematical concepts, Narosa Publishing House, New Delhi.

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Open Elective - II

REMOTE SENSING AND GIS

III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To introduce the basic concepts and principles of Remote Sensing.
- To familiarize with structure and function of Geographic Information Systems.
- To illustrate the multidisciplinary nature of Geospatial applications.

Course Outcomes

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

- relate the scientific theories to the behaviour of electromagnetic spectrum
- distinguish between different types of satellites and identify appropriate remote sensing data products for mapping, monitoring and management applications
- interpret Satellite images and processed outputs for extracting relevant information
- structure the concept of a spatial decision support system in its analog and digital forms
- list and elaborate applications of Remote Sensing and GIS in various fields

Course Content

UNIT - I: Electro-Magnetic Radiation (EMR), Its Interaction with Atmosphere & Earth

Definition of remote sensing and its components – Electromagnetic spectrum, wavelength regions important to remote sensing, wave theory, particle theory, Stefan-Boltzmann and Wien's Displacement Law – Atmospheric scattering, absorption, atmospheric windows, spectral signature concepts, typical spectral reflective characteristics of water, vegetation and soil.

UNIT - II: Platforms and Sensors

Types of platforms, orbit types, Sun-synchronous and Geosynchronous – Passive and Active sensors, resolution concept, payload description of important Earth Resources and Meteorological satellites – Airborne and Space-borne TIR (Thermal Infrared Radiation) and microwave sensors.

UNIT - III: Image Interpretation and Analysis

Types of Data Products – types of image interpretation, basic elements of image interpretation, visual interpretation keys – Digital Image Processing, pre-processing, image enhancement techniques – multispectral image classification, supervised and unsupervised.

UNIT - IV: Geographic Information System

Introduction to Maps, definitions, map projections, types of map projections, map analysis – GIS definition, basic components of GIS, standard GIS software's – Data types, spatial and non-spatial (attribute) data - Data models – Data input - measurement scales – Data Base Management Systems (DBMS).

UNIT - V: RS and GIS Applications

Land cover and land use classification, crop productivity and crop monitoring, Smart city applications, Forest fire detection using image analysis.

Text Books

1. Remote Sensing and Image Interpretation by Thomas. M. Lillesand and Ralph. W. Kiefer,7th Edition, John Wiley and Sons, 2015.
2. Remote Sensing and Geographical Information Systems by M. Anji Reddy, 4th Edition, B.S. Publications.

Reference Books

1. Remote Sensing and GIS by Basudeb Bhatta, 2nd Edition, Oxford University Press.
2. Principles of Geographical Information Systems by Burrough P.A. and Rachel A. Mc Donell,3rd Edition, Oxford Publication, 2016.

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Open Elective - II

GREEN BUILDING TECHNOLOGY

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the different concepts of sustainable design and green building techniques.
- To explore the techniques available of best fit for the specific construction project.

Course Outcomes

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

- describe the concepts of sustainable design and green building techniques
- understand the energy efficiency and indoor environmental quality management
- explain the energy efficiency techniques and concepts of embodied energy
- apprise the drawings and models of their own personal green building project
- select the Indoor Environmental Quality and comfort

Course Content

UNIT - I: Introduction to Green Buildings

Definition of green buildings and sustainable development, typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating systems.

UNIT - II: Site Selection and Planning

Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, etc. Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems.

UNIT - III: Energy Efficiency

Environmental impact of building constructions, Concepts of embodied energy, operational energy and life cycle energy. Methods to reduce operational energy: Energy efficient building envelopes, efficient lighting technologies, energy efficient appliances for heating and air-conditioning systems in buildings, zero ozone

depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of net zero buildings.

UNIT - IV: Green Building Materials

Methods to reduce embodied energy in building materials: (a) Use of local building materials (b) Use of natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks, (c) use of materials with recycled content such as blended cements, pozzolana cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste. (d) reuse of waste and salvaged materials Waste Management: Handling of construction waste materials, separation of household waste, on-site and off-site organic waste management.

UNIT - V: Occupant Comfort and Wellbeing

Daylighting, air ventilation,exhaust systems, low VOC paints, materials & adhesives, building acoustics. Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc. Suggested.

Text Books

1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
3. Alternative building materials and technologies by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao, New Age International, New Delhi.

Reference Books

1. Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers.
2. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004.
3. Green Building Fundamentals by Mike Montoya, Pearson, USA, 2010.
4. Sustainable Construction – Green Building Design and delivery by Charles J. Kibert, John Wiley &Sons, New York, 2008.
5. Sustainable Construction and Design by Regina Leffers, Pearson/ Prentice Hall, USA, 2009.

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Open Elective - II

MODELING AND SIMULATION OF ENGINEERING SYSTEMS

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with programming skills using basic MATLAB and its associated tool boxes.
- To impart knowledge on building SIMULINK and Graphical user interface

Course Outcomes

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

- create, modify and work with variables and its related operations
- develop MATLAB program to solve real time engineering problems.
- solve and visualize the dynamic performance of engineering systems through MATLAB plotting features.
- compute and analyze the numerical data of a physical system using advanced features in MATLAB.
- analyze the performance of physical system using toolboxes and GUI.

Course Content

UNIT - I: Introduction to MATLAB

Getting Started, MATLAB as language, MATLAB windows-Direct and Indirect windows, and Functions of Windows, MATLAB Environment, File Types, Inputting and Outputting methods.

UNIT - II: Variables, Scripts and Functions

Making Variables, Manipulating Variables, Vectorization, Scripts, , creating and working with scripts, Basic Functions, creating and working with function files, Flow Control-if, for, while and switch cases, Signal routing-break, continue and return, examples with engineering applications.

UNIT - III: Plotting

Basic Plotting, 2D Plotting – line, bar, area; 3D plotting-mesh and surface; plotting types - Multiple plotting, Sub plotting; Line styles, examples with engineering applications.

UNIT - IV: Solving Equations and Curve Fitting

Linear Algebra, Polynomials, Optimization, Differentiation / Integration, Differential Equations, Probability and Statistics, Data Structures, Images and Animation, Debugging, examples with engineering applications.

UNIT - V: Toolboxes and GUIs

Introduction to Neural networks, Fuzzy logic, Control systems, Symbolic Math, Simulink, File I/O, Graphical User Interfaces, examples with engineering applications.

Text Books

1. Getting started with MATLAB-A quick introduction for scientists and engineers, Rudra Pratap, Oxford University Press, January, 2010.
2. MATLAB and SIMULINK for Engineers, Agam Kumar Tyagi, Oxford University Press, 2012.

Reference Books

1. Introduction to MATLAB, Spencer, R.L. and Ware, M, Brigham Young University, available online accessed, May, 2008.
2. An introduction to MATLAB, David F. Griffiths, The University of Dundee, available online, accessed, October 2012.
3. MATLAB an introduction with applications, Amos Gilat, Wiley publications, January 2012.

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Open Elective - II

POWER SYSTEMS ENGINEERING

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the working of various types of power plants and layout of substations.
- To familiarize the concepts of corona, insulators and various tariff methods.

Course Outcomes

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

- describe the operation of thermal power station.
- illustrate the operation of hydro power plants.
- identify various components and their role in the operation of nuclear power plant
- distinguish various bus bar arrangements and insulators used in substation
- analyze the phenomenon of corona and describe various tariff methods.

Course Content

UNIT - I: Thermal Power Stations

Single line diagram of Thermal Power Station showing paths of coal, steam, water, air, ash and flue gasses-Brief description of TPS components: Economizers, Boilers, super heaters, Turbines ,condensers, chimney and cooling towers.

UNIT - II: Hydro Power stations

Selection of site, block diagram approach of hydro electric power plant and classification of pumped storage power plants.

UNIT - III: Nuclear Power Stations

Working principle, Nuclear fuels. Nuclear reactor Components: Moderators, Control roads, Reflectors and Coolants. Types of Nuclear reactors and brief description of PWR, BWR and FBR.

UNIT - IV: Air insulated substations

Equipments used in substations, Types of Insulators, Classification of substations: - Indoor & Outdoor substations: Single line diagram of substation. Bus bar arrangements and their classification.

UNIT - V: Corona and Tariff Methods

Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss.

Tariff Methods: Simple rate, Flat Rate, Block-Rate, two-part, three –part, and power factor tariff methods.

Text Books

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakrabarti, Dhanpat Rai & Co. Pvt. Ltd., 1999.
2. A Textbook of Power System Engineering by Er.R k Rajput, Laxmi Publications ,2nd Edition, 2015.

Reference Books

1. Principles of Power Systems by V.K Mehta and Rohit Mehta S.Chand& Company Ltd.New Delhi 2004.
2. Generation Distribution and Utilization of Electrical Energy by C.L.Wadhawa New age International (P) Limited, Publishers 3rd Edition 2011.
3. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2008.

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Open Elective - II

RENEWABLE ENERGY SOURCES

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To impart knowledge on renewable sources of energy and techniques used in exploiting solar, wind, biomass, geothermal and ocean sources of energy.
- To introduce direct energy conversion systems such as thermo electric, MHD and Fuel Cells.

Course Outcomes

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

- classify various types of renewable sources of energy and illustrate the principles of solar radiation.
- illustrate various solar energy storage methods and applications.
- describe the techniques of exploiting wind, biomass and geothermal energies in power generation.
- illustrate the methods of tapping ocean thermal in power generation
- describe the working of various direct energy conversion systems and their applications.

Course Content

UNIT - I:

Introduction: Energy Sources and their availability, role and potential of renewable source.

Solar Radiation: Structure of the sun, the solar constant, sun-earth relationships, extraterrestrial and terrestrial solar radiation, instruments for measuring solar radiation, solar radiation geometry, Numerical problems on solar radiation.

UNIT - II:

Solar Energy Storage and Collectors: Different methods - sensible, latent heat and stratified storage, solar ponds. solar collectors- flat plate, concentric collectors.

Applications of Solar Energy: Solar heating/cooling technique, solar distillation, drying, photovoltaic energy conversion, solar central power tower concept and solar chimney.

UNIT - III:

Wind Energy: Sources and potentials, horizontal and vertical axis wind turbines, Betz criteria.

Bio-Mass Energy: Biomass energy Sources, methods for obtaining energy from biomass, Biomass gasification.

UNIT - IV:

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

Ocean Energy: Requirements of OTEC, classifications of OTEC, Environmental impacts of OTEC.

UNIT - V:

Direct Energy Conversion: Need for DEC, limitations, principles of DEC. Thermo electric Power – See-beck, Peltier, joule, Thomson effects, Thermo-electric Power generators, applications.

MHD power Generation: Principles, dissociation and ionization, Hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, advantages and disadvantages of MHD power generator, applications.

Fuel cells: Principles, types of fuel cells.

Text Books

1. Tiwari and Ghosal, "Renewable Energy Resources: Basic Principles and Applications", Narosa.
2. B.H.Khan "Non – conventional Energy Resources", Tata McGraw Hill education Pvt. Ltd.
3. G.D. Rai, "Non-Conventional Energy Sources", Dhanpat Rai and Sons.

Reference Books

1. Twidell & Weir, "Renewable Energy Sources ", Routledge (Taylor &Francis Group).
2. SP Sukhatme, "Solar Energy: Principles of thermal collection and storage". Tata McGraw Hill.

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Open Elective - II

VENTURE DEVELOPMENT

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize the learner with the concepts of venture development

Course Outcomes

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

- explain the significance of entrepreneurship for economic development.
- distinguish among micro, small, and medium enterprises.
- discuss the role of various agencies to raise the capital.
- apply marketing strategies for a given situation.
- analyse contemporary issues in entrepreneurship.

Course Content

UNIT - I: Entrepreneurship and Entrepreneur

Introduction; characteristics of an entrepreneur, types of entrepreneurs, entrepreneurship in India, women entrepreneurship, rural entrepreneurship.

UNIT - II: Small Scale Industries in India

Concept and definition of micro, small, and medium enterprises, scope and trends of small enterprises in India, role of government in promoting ssi in india, problems of entrepreneurs, planning for setting up an industry, agencies for supporting the process, the businesses planning processes.

UNIT - III: Institutional Finance to Entrepreneur

Small Industries Development Bank of India (SIDBI), export-import Bank, Andhra Pradesh State Trading Corporation (APSTC), Integrated Rural Development Programme (IRDP), Export Credit Guarantee Corporation (ECGC).

UNIT - IV: Entrepreneurial Strategies

Management of small industries- small entreprises and marketing strategies- product life cycle-marketing activities, channels of distribution- market research-marketing problems of small scale industries.

UNIT - V: Contemporary Issues in Entrepreneurship

Introduction- ecological entrepreurship, legal issues, international business opportunities- risk management strategies, diversification strategies , and bankruptcy, social and ethical responsibility of entrepreneurs.

Text Books

1. Robert D.Hisrich, Mathew J. Manimala, Michael P.Peters, A.Shepherd, "Entrepreneurship" , McGraw Hill Education, 2016 .
2. P.Narayana Reddy, "Entrepreneurship - Text and Cases", Cengage Learning, 2011.

Reference Books

1. G.G. Meredith, R.E.Nelson and P.A. Neek, "The Practice of Entrepreneurship", ILO, 1982.
2. David H.Holt, "Entrepreneurship New venture Creation", PHI Learning Limited.
3. MadhuriLall, ShikhaSahai, "Entrepreneurship", Excel Books, Second Edition.

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Open Elective - II

AUTOMOTIVE ELECTRONICS

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the electronic systems inside an automotive vehicle.
- To introduce the concepts of advanced safety systems.

Course Outcomes

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

- describe the fundamentals of automotive technology.
- differentiatedigital andanalog systems.
- classify various automotive sensors and control systems.
- develop communications & navigation/routing in automotive vehicles.

Course Content

UNIT - I: Automotive Fundamentals

Use of electronics in the automobile, evolution of automotive electronics, theautomobile physical configuration, evolution of electronics in the automobile, surveyof major automotive systems.

UNIT - II: Automotive Micro-Computer System

Microcomputer fundamentals-digital versusanalog computers, basic computer block diagram, microcomputer operations,CPU registers, accumulator registers, condition code register-branching;microprocessor architecture, memory-ROM, RAM; I/O parallel interface, digitalto analog converter and analog to digital converters with block diagram.

UNIT - III: Basics of Electronics Engine Control

Motivation for electronic engine control, exhaust emissions, fuel economy, conceptof an electronic engine control system, engine functions and control, electronicfuel control configuration, electronic ignition with sensors.

UNIT - IV: Sensors and Actuators

Basic sensor arrangement; types of sensors such as oxygen sensors,crank angle position sensors, fuel metering/vehicle speed sensors and detonation sensors, flow sensors, throttle position sensors, solenoids,actuators – fuel metering actuator, fuel injector, and ignitionactuator.

UNIT - V: Electronic Vehicle Management System

Cruise control system, antilock braking system, electronic suspension system,electronic steering control, safety: air bags, collisionavoidance radar warning system with block diagram, low tire pressure warningsystem.

Sensor multiplexing, control signal multiplexing with blockdiagram, automotive internal navigation system, GPS navigation system, Distributed Control Area Network example - a network of embedded systems in automobile.

Text Books

1. William B. Ribbens, "Understanding Automotive Electronics", 6th Edition SAMS/ElsevierPublishing.
2. Raj Kamal, "Embedded Systems - Architecture, Programming and Design", 3rd Edition, McGraw-Hill Education.
3. Robert Bosch Gambh, "Automotive Electrics Automotive Electronics Systems and Components", 5th edition, John Wiley& Sons Ltd., 2007.

Reference Books

1. Ronald K Jurgen, "Automotive Electronics Handbook", 2nd Edition, McGraw-Hill, 1999.
2. G. Meyer, J. Valldorf, W. Gessner, "Advanced Microsystems for AutomotiveApplications", Springer, 2009.
3. Robert Bosch, "Automotive Hand Book", 5th Edition, SAE, 2000.

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Open Elective - II

INTRODUCTION TO SIGNAL PROCESSING

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with the basic concepts and operation on signals.
- To introduce various transform techniques on signals.

Course Outcomes

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

- classify the signals and various operations on signals.
- compute Fourier analysis on the signals.
- applyvarious sampling techniques on continuous time signals.
- analyzecontinuous time signals using Fourier and Laplace transforms.

Course Content

UNIT - I: Signal Analysis

Classification of signals, basic operations on signals-amplitude and time scaling, time shifting, addition and multiplication, introduction to elementary signals-unit step, impulse, ramp, parabolic, rectangular, triangular, sinusoidal, exponential, signum, sinc and gaussian functions.

UNIT - II: Fourier Series

Trigonometric and exponential Fourier series, relationship between trigonometric and exponential Fourier series, convergence of Fourier series, symmetry conditions-even and odd, complex Fourier spectrum.

UNIT - III: Fourier Transform

Representation of an arbitrary function over the entire interval: Fourier transform, ourier transform of some useful functions and periodic function, properties of Fourier transform, Parseval's theorem.

UNIT - IV: Sampling

Sampling theorem for band limited signals- explanation, reconstruction of signal from samples, aliasing, sampling techniques- impulse, natural and flat top sampling.

UNIT - V: Laplace Transform

Laplace transform of signals, properties of Region of Convergence (ROC), unilateral Laplace transform, properties of unilateral Laplace transform, inversion of Laplace transform, relationship between Laplace and Fourier Transforms.

Text Books

1. B.P.Lathi, “Signals, Systems &Communications”, BS Publications, 2003.
2. A.V. Oppenheim, A.S. Willsky and S.H.Nawab, “Signals and Systems”, 2nd EditionPHI.

Reference Books

1. Simon Haykin and Van Veen, “Signals &Systems”, 2nd edition, Wiley Publishers.
2. Michel J. Robert , “Fundamentals of Signals and Systems”, International Edition, Tata McGraw-Hill, 2008
3. C.L.Philips, J.M. Parr and Eve A. Riskin, “Signals, Systems and Transforms”, 3rd Edition, Pearson Education, 2004.

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Open Elective - II

NETWORK PROGRAMMING

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the basics of network Technologies.
- To impart in-depth knowledge in socket creation and client-server communication in TCP and UDP.

Course Outcomes

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

- analyze the requirements of a networked programming environment and identify the issues to be solved.
- interpret the basic network technologies and protocols usage by common internet application.
- develop client-server communication using TCP for communicating processes exist in the different systems.
- apply theoretical principles and use appropriate functions for establishing client-server communication.
- develop client-server communication using UDP protocols by writing socket programming.

Course Content

UNIT - I: Introduction to Network Programming

OSI model, UNIX standards, TCP and UDP and TCP connection establishment and termination, port numbers, TCP port numbers and concurrent servers, buffer sizes and limitation, protocol usage by common internet application.

UNIT - II: Sockets

Address structures, value–result arguments, byte ordering and manipulation functions. Elementary TCP sockets–socket, connect, bind, listen, accept, fork function, concurrent servers.

UNIT - III: TCP Client-Server

Introduction, TCP echo server functions, normal startup, termination, POSIX signal handling, termination of server process, crashing and rebooting of server host, shutdown of server host.

UNIT - IV: I/O Multiplexing and Socket Options

I/O models, select function, poll function, TCP echo server, getsockopt and setsockopt functions.

UNIT - V: Elementary UDP Sockets

Introduction, UDP echo server function, lost datagrams, UDP example, lack of flow control with UDP.

Text Books

1. W.Richard Stevens, Bill Fenner, Andrew M. Rudoff, "UNIX Network Programming: The Sockets Networking API", Volume 1, 3rd edition, Addison-Wesley.
2. W. Richard Stevens, "UNIX Network Programming", 1st edition, PHI.

Reference Books

1. Graham Glass, King Ables, "UNIX for Programmers and Users", 3rd edition, Pearson Education.
2. Marc. J. Rochkind, "Advanced UNIX Programming", 2nd edition, Pearson Education.

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Open Elective - II

SOCIAL NETWORK ANALYSIS

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To provide students with essential knowledge of network analysis applicable to real world data, with examples from today's most popular social networks.

Course Outcomes

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

- demonstrate social network analysis and measures.
- analyze random graph models and navigate social networks data
- apply the network topology and Visualization tools.
- analyze the experiment with small world models and clustering models.
- compare the application driven virtual communities from social network Structure.

Course Content

UNIT - I: Graphs

Graphs as models of Networks, Paths and Connectivity, Distance and Breadth-First Search, The Strength of Weak Ties, Structual Holes, Betweenness measure, Homophily, Affiliation, Structural Balance.

UNIT - II: Link Analysis and Web Search

Web as Directed Graph, Searching the Web, Link Analysis Using Hubs and Authorities, Page Rank, Applying Link Analysis in Modern Web Search.

UNIT - III: Cascading Behavior in Networks

Power Laws, Rich-Get-Richer Phenomenon, Diffusion, Cascading Behavior, Cascades and Clusters, Role of Weak Ties.

UNIT - IV: Small World Phenomenon

Six Degrees of Separation, Structure and Randomness, Decentralized search, Empirical Analysis and Generalized Models.

UNIT - V: Basics of Game Theory

Games, Reasoning about behavior in games, Best Responses and Dominant Strategies, Nash Equilibrium, Multiple Equilibria, Mixed Strategies.

Text Books

1. D. Easley and J. Kleinberg, Networks, Crowds and Markets: Reasoning about a highly connected world-2010.
2. Tanmoy Chakraborthy, Social Network Analysis, Wiley.

Reference Books

1. Social Network Analysis: Methods and Applications (Structural Analysis in the Social Sciences) by Stanley Wasserman, Katherine Faust, 1994.

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Open Elective - II

CYBER SECURITY

III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To expose the multiple cyber security technologies, processes, and procedures.
- To analyze the threats, vulnerabilities and risks present in these environments.
- To develop appropriate strategies to mitigate potential cyber security problems.

Course Outcomes

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

- demonstrate the fundamentals of cyber crimes and information security systems.
- analyze and resolve security vulnerabilities in networks and computer systems to secure an it infrastructure.
- develop a security architecture for an organization which can handle mobile, wireless devices and related security issues.
- use the cybercrime tools and methods in solving real world problems
- analyze web and internet security threats and find the solutions

Course Content

UNIT - I:

Introduction to Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT - II:

Cyber offenses: Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

UNIT - III:

Cybercrime-Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Authentication Service Security, Attacks on Mobile/Cell Phones,

Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT - IV:

Tools and Methods Used in Cybercrime: Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Attacks on Wireless Networks, Phishing and Identity Theft: Introduction, Phishing, Identity Theft (IDTheft).

UNIT - V:

Web and Network Security: Introduction, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Overview of Vulnerability Scanning, Scanning for Web vulnerabilities, Firewalls, Packet Filters, How a firewall protects a network.

Text Books

1. Nina Godbole and SunitBelpure ¯ Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives , 1st Edition Publication Wiley, 2011.
2. Mike Shema, ¯Anti-Hacker Tool Kit (Indian Edition) ,1st Edition Publication Mc Graw Hill.

Reference Books

1. Mark Rhodes, Ousley, Information Security, 1st Edition ,MGH, 2013.

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Open Elective - II

E-COMMERCE

III Year – I Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To introduce the basic concepts of E-Commerce.
- To gain the knowledge on various Mercantile Process models.
- To identify the concepts of E-Payment Systems and Web Marketing Strategies.

Course Outcomes

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

- outline the fundamentals in E-Commerce Frame work and Concepts.
- describe various Mercantile Process models for Consumers and Merchants.
- analyze Electronic Data Interchange (EDI) problems to perform e-transactions.
- categorize and classify various E-Payment systems used in online transaction procesing.
- distinguish various web marketing Strategies to improve customer relationship and marketing.

Course Content

UNIT - I: Electronic Commerce Framework

Introduction, Electronic Commerce Framework, Anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications.

UNIT - II: Consumer Oriented Electronic Commerce

Consumer Oriented Applications, Mercantile process models, Mercantile models from the consumer's perspective, Mercantile models from the merchant's perspective.

UNIT - III: Inter and Intra Organizational Commerce

Inter Organizational Commerce-EDI, EDI implementation, Value Added Networks, Intra Organizational Commerce -Work flow automation and coordination, Supply chain management.

UNIT - IV: Payment Systems for Electronic Commerce

Online Payment basics, payment cards, Electronic Cash, Electronic Wallets, Stored-Value Cards, Internet Technologies and the Banking Industry.

UNIT - V: Marketing on the Web

Web Marketing Strategies, Communicating with Different Market Segments, Advertising on The Web, E-Mail Marketing, Technology enabled Customer Relationship Management. Search engine Positioning and Domain Names.

Text Books

1. Kalakota, Winston , Frontiers of electronic commerce , Pearson, 2nd Edition, 2012.
2. Gary P.Schneider Thomson , Electronic Commerce, 7th Edition, 2012

Reference Books

1. S.Jaiswal ,E-Commerce, Galgotia publications.
2. Efrain Turbon, Jae Lee, David King ,E-Commerce, H.Michael Chang.

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Open Elective - II

INTELLIGENT SYSTEMS

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To understand the fine structure or deeper origin of knowledge
- To generate intelligent behavior on the basis of statistical evidence.

Course Outcomes

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

- demonstrate Data representation and Logical operations.
- analyze backward reasoning and solving problems by reduction.
- learning of Verification and Validation of Rule Bases .
- explain the architecture of real time expert systems.
- define Quantitative simulation.

Course Content

UNIT - I: Knowledge Representation

Data and knowledge: Data representation and data items in traditional databases, Data representation and data items in relational databases. Rules: Logical operations, Syntax and semantics of rules, Data log rule sets, the dependence graph of data log rule sets, objects.

UNIT - II: Rule Based Systems

Solving problems by reasoning: The structure of the knowledge base, the reasoning algorithm, Conflict resolution, Explanation of the reasoning.

Forward reasoning: The method of forward reasoning, a simple case study of forward reasoning, backward reasoning: Solving problems by reduction, the method of backward reasoning, a simple case study of backward reasoning, Bidirectional reasoning.

UNIT - III: Verification and Validation of Rule Bases

Contradiction freeness: The notion of contradiction freeness, Testing contradiction freeness, The search problem of contradiction freeness .Completeness: The notion of completeness, Testing Completeness, The search problem of completeness. Decomposition of knowledge bases: Strict decomposition, Heuristic decomposition.

UNIT - IV: Real-Time Expert Systems

The architecture of real-time expert systems: The real-time subsystem, The intelligent subsystem Synchronization and communication between real-time and in-

telligent subsystems: Synchronization and communication primitives, Priority handling and time-out. Data exchange between the real-time and the intelligent subsystems: Loose data exchange, the blackboard architecture. Software engineering of real- time expert systems: The software lifecycle of real time expert systems, Special steps and tool, An Example of A Real-Time expert System.

UNIT - V: Qualitative Reasoning

Sign and interval calculus, Qualitative simulation: Constraint type qualitative differential equations, The solution of QDEs: the qualitative simulation algorithm: Initial data for the simulation, Steps of the simulation algorithm, Simulation results. Qualitative physics, Signed directed graph (SDG) models.

Text Books

1. Intelligent Control Systems-An Introduction with Examples by Katalin M. Hangos, RozáliaLakner ,MiklósGerzson, Kluwer Academic Publishers.
2. Intelligent Systems and Control: Principles and Applications Paperback – 12 Nov 2009 by Laxmidhar Behera, Indrani Kar by OXFORD.

Reference Books

1. Intelligent Systems and Technologies Methods and Applications by Springer publications.
2. Intelligent Systems - Modeling, Optimization and Control, by Yung C. Shin and Chengying Xu, CRC Press, Taylor & Francis Group, 2009.

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Open Elective - II

RECOMMENDER SYSTEMS

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To learn basic techniques for building recommender Systems.
- To automate a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations.

Course Outcomes

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

- identify the importance of Recommender Systems.
- model Recommender System by using Content-based Filtering technique.
- build Recommender System by Collaborative Filtering technique.
- design Recommender System by Hybrid approaches.
- evaluate Recommender Systems.

Course Content

UNIT - I: Introduction

Introduction, Recommender Systems Function, Data and Knowledge Sources, Recommendation Techniques, Application and Evaluation, Challenges.

UNIT - II: Content-based Filtering

High level architecture of content-based systems, Content representation and content similarity, Similarity-based retrieval, Other text classification methods, Comparative evaluation, Limitations.

UNIT - III: Collaborative Filtering

User-based nearest neighbor recommendation, Item-based nearest neighbor recommendation, About ratings, Further model-based and preprocessing-based approaches, Recent practical approaches and systems.

UNIT - IV: Hybrid Approaches

Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade, Meta-level.

UNIT - V: Evaluating Recommender System

Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets.

Text Books

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press (2011), 1st edition.
2. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, Springer(2011), 1st edition.

Reference Books

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer (2016), 1st edition.
2. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st edition.

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Open Elective - II

INTRODUCTION TO IoT ARCHITECTURE

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To impart the basic characteristics and different technologies with the IoT.
- To familiarize with architectures, enabling technologies and design methodologies of IoT.

Course Outcomes

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

- demonstrate the concepts of IoT and its characteristics.
- make use of the design methodologies of IoT.
- compare IoT and M2M.
- outline different technologies used in IoT.
- explain the case studies on IoT.

Course Content

UNIT - I: Internet of Things Concepts

Introduction to Internet of Things, Block diagram of IoT, characteristics of IoT, architectural view of IoT, Physical Design of IoT, Logical Design of IoT.

UNIT - II: IoT Design Templates & Design Methodology

IoT Enabling Technologies, IoT levels, Development Templates, Developing Internet of Things: Introduction, IoT Design Methodology.

UNIT - III: IoT and M2M

M2M, Differences between IoT and M2M, SDN and NFV for IoT, Software defined Networking, Network Function Virtualization.

UNIT - IV: IoT Technologies

Basic building blocks of IoT, Introduction to cloud storage models, Role of Machine learning, Artificial Intelligence and Data Science in IoT, Categories of ML, Applications of ML, Tools in ML, Requirement of Data analytics in IoT.

UNIT - V: Case Studies

Case studies on Domain specific IoT's, Home Automation, cities, environment, Agriculture and health monitoring and energy, Health and fitness monitoring.

Text Books

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On-Approach”, Arshdeep & Vijay Madisetti Publishers, 2014.
2. V.K.Jain, “Data science and Analytics”, Khanna Publishing, 2018.
3. Rajkamal, Internet of Things Architecture & Design Principles”, Mc.Grawhill

Reference Books

1. Vlasios Tsiatsis Stamatis Karnouskos Jan Holler David Boyle Catherine Mulligan, “InternetofThings”, Academic Press, 2018.
2. Daniel Kellmereit, “The Silent Intelligence: The Internet of Things”, Lightning Source Inc., 2014.

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Open Elective - II

INTRODUCTION TO SMART SENSORS

III Year – I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the fundamentals of smart sensors and provides interfacing with embedded hardware.
- To gain knowledge of the latest developments in measurement and sensors expose with the various types of smart sensors.

Course Outcomes

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

- classify different types of smart sensor for iot applications
- apply signal conditioning circuit for sensor interface to digital computer.
- gain the knowledge required for interfacing the smart sensor
- demonstrate the various packaging types of smart sensor

Course Content

UNIT - I: Sensor Devices

Piezoresistive pressure sensor, Piezoresistive Accelerometer, Capacitive Sensing-Accelerometer and Microphone, Resonant Sensor and Vibratory Gyroscope Nano Sensors.

UNIT - II: Interfacing Sensor Information and MCU

Amplification and Signal Conditioning- Integrated Signal Conditioning- Digital conversion- MCU Control MCUs for Sensor Interface- Techniques and System Considerations- Sensor Integration.

UNIT - III: Control Techniques and Standards

Control of Sensors using - State Machines, Fuzzy Logic, Neural Networks, adaptive Control.

UNIT - IV: Communication for Smart Sensor

Wireless Data Communications- RF Sensing- Telemetry- Automotive Protocols-Industrial Networks, Home Automation- MCU Protocols.

UNIT - V: Packaging, Testing and Reliability Implications of Smart Sensors

Semiconductor Packaging- Hybrid Packaging- Packaging for Monolithic Sensors-Reliability Implications Testing Smart Sensors- HVAC Sensor Chip.

Text Books

1. Randy Frank, “Understanding Smart Sensors”, Artech House, Second Edition, 2011Boston.
2. Minhang Bao, “Analysis and design principles of MEMS devices”, Elsevier Publications, 2005,USA.

Reference Books

1. Nadim Maluf and Kirt Williams, “An Introduction to Micro Electro Mechanical Systems Engineering”, Second Edition, Artech House Publishers, June 2004, USA.
2. Gabriel M. Rebeiz, “RF MEMS: Theory, Design, and Technology”, Wiley-Inter science; 1st edition, 2002,UK

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Open Elective - III

BASICS OF ENVIRONMENTAL ENGINEERING

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To understand the basic of water borne diseases,drinking water standards and treatment of wastewater and disposal
- To expose the students to understand to treatment of wastewater and disposal
- To learn the basics of air pollution and effects, noise pollution and solid waste disposal

Course Outcomes

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

- demonstrate water sources, water borne diseases, water treatment and potable water standards
- understand basicsof wastewater treatment and disposal methods
- identity air pollution sources and understand air pollution effects
- identity noise pollution sources and understand noise pollution effects
- understand sources and basic principles of solid waste

Course Content

UNIT - I: Water

Sources of water; Availability of fresh water; Water borne diseases; Brief explanation on ground and surface water treatment; Potable water standards as per IS and WHO standards; Water conservation; Role of public health engineering department in the prevention of the water borne diseases.

UNIT - II: Wastewater

Wastewater sources; Sewage characteristics; Brief explanation on treatment of sewage; Disposal of treated wastewater; Practise on reuse of treated wastewater; Effects of wastewater without treatment disposal in streams, on land

UNIT - III: Air Pollution Sources and Effects

Layers of atmosphere; Sources and classification of air pollutants – Man made, Natural sources; Type of air pollutants; Pollution due to automobiles; Effect of air pollution on health, vegetation and materials; Global warming; Worst environmental disasters caused by humans.

UNIT - IV: Noise Pollution

Sources of noise pollution - plane, point and line sources, multiple sources; Effect of noise pollution on humans; Control of noise pollution; Outdoor and indoor noise propagation; Intensity of noise pollution; Noise pollution permissible limits as per CPCB and WHO

UNIT - V: Solid Waste

Sources of solid waste – classification solid waste - Basic principles of Solid Waste storage, collection, transportation, processing and Disposal.

Text Books

1. Water supply Engineering – Environmental Engineering (Vol. I) by S.K. Garg (2019)– Khanna Publishers.
2. Sewage Disposal and Air Pollution Engineering – Environmental Engineering (Vol. II)S.K. Garg (2019) – Khanna Publishers.
3. Water Supply Engineering by Punmia B.C., Ashok Jain & Arun Jain (2014), Laxmi Publication Pvt., Ltd., New Delhi
4. Wastewater Engineering by Punmia B.C., Ashok Jain & Arun Jain (2014), Laxmi Publication Pvt., Ltd., New Delhi

Reference Books

1. Environmental Engineering by Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, McGraw Hill Inc., New York, 2017.
2. Handbook of Solid Waste Management by Frank Kreith and George Tchobanoglous, McGraw-Hill, 1994.

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Open Elective - III

DISASTER PREPAREDNESS, PLANNING AND MANAGEMENT

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To provide an exposure to disasters, their significance and types.
- To impart the knowledge on different approaches of disaster preparedness.

Course Outcomes

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

- analyse the concepts, terminologies and developments in thefield of disaster and disaster management.
- differentiate the types of disasters, causes and their impact on environment and society.
- explain the process of risk and vulnerability.
- assess different types of disaster preparedness.
- explain the role of technology in disaster management.

Course Content

UNIT - I: Disaster and Disaster Management

Introduction, Disaster, Hazard – Classification of hazard, Magnitude of disasters, Vulnerability – Categorization of vulnerabilities, Coping Capacity, Risk – Disaster risk management, Risk formula, Disaster Management – Monitoring and evaluation, Disaster management cycle.

UNIT - II: Disasters Classification

Introduction, Types of disasters, Natural disasters - Earthquakes, Cyclones, Flood, Drought, Landslides, Avalanches, Manmade disasters – Chemical disaster, Industrial wastes, Hazardous wastes, Radioactivity, Traffic disasters.

UNIT - III: Risk and Vulnerability

Building codes and land use planning, social vulnerability, Macroeconomic management and sustainable development, environmental vulnerability, climate change risk rendition, financial management of disasterrelated losses.

UNIT - IV: Disaster Preparedness

Introduction, Components of preparedness, Formulation of preparedness plan, Types of disaster preparedness, Principles of preparedness, Problems associated with preparedness.

UNIT - V: Role of Technology in Disaster Management

Disaster management for infra structures, Mitigation program for earthquakes, Geospatial information in agricultural drought assessment, Multimedia technology in disaster risk management training, Transformable indigenous knowledge in disaster reduction.

Text Books

1. Disaster Management – Global Challenges and Local Solutions, by Rajib shah & R R Krishnamurthy, Universities press, 2009.
2. Disaster management,M.M. Sulphey, PHI Learning Pvt. Ltd, 2016.

Reference Books

1. Disaster Science & Management by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
2. An Introduction of Disaster Management- Natural Disasters & Vulnerable Hazard by S. Vaidyanathan, CBS Publishers& Distributors Pvt. Ltd.
3. Disaster Management - Future Challenges and Opportunities by Jagbir Singh I K International Publishing House Pvt. Ltd, 2007.

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Open Elective - III

PRINCIPLES OF SPECIAL ELECTRIC MACHINES

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To familiarize the students with the constructional details, operating principles, theory of torque production, and characteristics of various special electrical machines.
- To expose the students to different control practices associated with various special electrical machines and applications of special electrical machines.

Course Outcomes

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

- describe the constructional and operating principles, control schemes and applications of various types of Stepper Motors.
- explain the constructional details, working principles, control practices and applications of Switched Reluctance Motors.
- analyze the speed-torque characteristics, construction and principle of operation, control techniques and applications of Permanent Magnet Brushless D.C. Motors.
- acquire the knowledge of operating principles, constructional details and applications of Servomotors and Tachometers.
- compare the constructional details, principle of operation and applications of various single phase special electrical machines.

Course Content

UNIT - I: Stepper Motors

Constructional features – Types – Variable Reluctance and Permanent Magnet motors – Principle of operation – Dynamic Characteristics –Closed loop control of Stepper Motor – Applications.

UNIT - II: Switched Reluctance Motors

Constructional features – Principle of operation – Torque Equation – Torque Speed characteristics –Closed loop control of SRM – Applications.

UNIT - III: Permanent Magnet Brushless D.C. Motors

Constructional features – Principle of operation – EMF equations – Torque and Speed characteristics – control of PMBLDC motor –Applications.

UNIT - IV: Servomotors and Tachometers

Servomotor – Types – Constructional features – Principle of Operation – Characteristics – Applications of Servomotors – AC Tachometers – Schematic diagram – Operating Principle.

UNIT - V: Single Phase Special Electrical Machines

AC series Motor – Repulsion Motor – Reluctance Motor - Hysteresis Motor – Constructional features, Principle of Operation, Characteristics and Applications of the above motors.

Text Books

1. Special Electrical Machines by E.G.Janardanan, PHI Learning Pvt Ltd, Delhi, 2014.
2. Principles of Special Electrical Machines by J.Gnanavadivel, Dr.S.Muralidharan and J.Karthikeyan, Anuradha Publications, Chennai, 2013.

Reference Books

1. Stepping Motors and their Microprocessor Controls by Takashi Kenjo, Clarendon Press, 1984.
2. Special Electrical Machines by K.Venkata Ratnam, University press, New Delhi, 2009.
3. Basic Electrical Engineering by C.L.Wadhwa, New Age
4. International (P) Limited Publishers, New Delhi, 2007.
5. Principles of Electrical Machines by V.K.Mehta andRohit
5. Mehta, S.Chand Publishing,New Delhi, 2014.
6. Stepping Motors: A Guide to Modern theory and practice by P.P.Acarnley, Peter Peregrines, London, 2002.
7. Brushless Permanent Magnet & Reluctance Motor Drives by T.J.E. Miller, Clarenden press, Oxford, 1989.

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Open Elective - III

ELECTRICAL INSTRUMENTATION

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To familiarize various types of signals, their representation and measurements using CRO.
- To impart knowledge on construction, operation and working principles of digital measuring instruments and Transducers.

Course Outcomes

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

- analyze various types of signals, and errors in digital instruments.
- measure various parameters like amplitude, phase and frequency of a signal using CRO.
- select a suitable transducer working on electrical principles to measure non electrical quantities.
- select a suitable transducer working on non-electrical principles to measure physical parameters.
- analyse the operation of various digital meters.

Course Content

UNIT - I: Signals and their Representation

Measuring Systems, Performance Characteristics, – Static characteristics – Dynamic Characteristics – Errors in Measurement – Gross Errors – Systematic Errors – Statistical analysis of random errors. Signal and their representation – Standard test, periodic, aperiodic, modulated signal – Sampled data pulse modulation and pulse code modulation.

UNIT - II: Cathode Ray Oscilloscope

Basic operation of Oscilloscope Cathode ray oscilloscope – Cathode ray tube – Time base generator – Horizantal and vertical amplifiers – Measurement of phase and frequency – Lissajous patterns.

UNIT - III: Transducers

Classification of transducers – Characteristics and choice of transducers – Principle operation of resistor, inductor, and capacitor transducers – LVDT – Strain gauge and its principle of operation – Gauge factor– Thermistors – Thermocouples– Piezo electric transducers -– Pyro transducer – Hall sensor.

UNIT - IV: Measurement of Non–Electrical Quantities

Velocity – Angular Velocity – Acceleration – Force – Torque – Measurement of Temperature, Pressure, Vacuum, Flow, Liquid level.

UNIT - V: Digital Voltmeters

Digital voltmeters – Successive approximation, ramp, dual–Slope integration continuous balance type – Micro-processor-based ramp type – DVM digital frequency meter – Digital phase angle meter – Q Meter.

Text Books

1. Electronic Instrumentation–by H.S.Kalsi Tata MCGraw–Hill Higher Education 4thEdition, 2018.
2. Electrical & Electronic Measurement & Instruments,A.K.Sawhney and Puneet Sawhney, Dhanpat Rai & Co., Pvt. Ltd., 18th edition, 2010.

Reference Books

1. Measurement and Instrumentation: Theory and Application, Alan S.Morris and Reza Langari, S. Netherlands: Elsevier Science, 2nd edition,2015.
2. Measurement Systems: Application and Design. Doebelin, E., Japan: McGraw – Hill Higher Education, 4th edition, 2003.
3. Modern Electronic Instrumentation and Measurement Techniques. Cooper,W. D., Helfrick, A. D.India: Pearson Education. 1st edition, 2005.
4. Transducers and Instrumentation. by D. V. S.MURTY, India, PHI Learning 2nd edition, 2010.

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Open Elective - III

GREEN ENGINEERING

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To impart the knowledge needed to minimize impacts of products, processes on environment for sustainable development.

Course Outcomes

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

- evaluate the impact of technology on environment.
- compare biological ecology to industrial ecology.
- create sustainable products, facilities, processes and infrastructure.
- assess the life cycle of a product to evaluate its impact on energy and materials use.
- analyze technological systems.

Course Content

UNIT - I: Introduction

Humanity and technology, the concept of sustainability, quantifying sustainability.

UNIT - II: Frame Work for Green Engineering

Industrial ecology, relevance of biological ecology to industrial ecology, metabolic analysis, technology and risk, the social dimensions of industrial ecology.

UNIT - III: Implementation

Technological product development, design for environment and sustainability-customer products- buildings and infrastructure.

UNIT - IV: Life Cycle Assessment

An introduction to life cycle assessment, the LCA impact and interpretation stages, streamlining the LCA process.

UNIT - V: Analysis of Technological Systems

Systems analysis, industrial ecosystems, material flow analysis, energy and industrial ecology, air quality impacts, carbon cycles and energy balance, water quality impacts.

Text Books

1. T E Graedel, Braden R Allenby, “Industrial Ecology and Sustainable Engineering”, Prentice Hall, 2010.

2. David T. Allen, David R Shonnard, “Sustainable Engineering Concepts, Design and Case Studies”, Prentice Hall, 2012.

Reference Books

1. Bradley A. Striebig, Adebayo A. Ogundipe, Maria Papadakis, “Engineering Applications in Sustainable Design and Development”, Cengage Learning, 2016.
2. Anastas, Paul T, Zimmerman, Julie B, “Innovations in Green Chemistry and Green Engineering”, Springer, First Edition, 2013.
3. Daniel A. Vallero, Chris Brasier, “Sustainable Design: The Science of Sustainability and Green Engineering”, Wiley, First Edition, 2008.

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Open Elective - III

3D PRINTING TECHNOLOGIES

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To present the various 3D printing technologies for manufacturing.

Course Outcomes

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

- explain the fundamental principles of Rapid prototyping.
- explain the RP processes and analyze their process parameters.
- select appropriate 3D printing technique for a given application.

Course Content

UNIT - I:

Introduction: Brief description on design process**,** Prototyping fundamentals, fundamentals of rapid prototyping, advantages and limitations of rapid prototyping, commonly used terms, classification of RP process.

Rapid Prototyping Data Formats: STL Format, STL File Problems, consequence of building valid and invalid tessellated models, STL file repairs: generic solutions, other translators, newly proposed formats- AMF Files Format.

UNIT - II:

Liquid-Based Rapid Prototyping Systems: Stereo lithography Apparatus (SLA): models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies.

Solid Ground Curing (SGC): models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT - III:

Solid-Based Rapid Prototyping Systems: Laminated object manufacturing (LOM) – models and specifications, process, working principle, applications, advantages and disadvantages, case studies. Fused deposition modeling (FDM) – models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT - IV:

Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): models and specifications, process, working principle, applications, advantages and disadvantages, case studies. three dimensional printing (3DP): models and

specifications, process, working principle, applications, advantages and disadvantages, case studies.

UNIT - V:

RP Applications: Application in engineering, analysis and planning, aerospace industry, automotive industry, jewelry industry, coin industry, arts and architecture. RP medical and bioengineering applications: planning and simulation of complex surgery, customized implants & prosthesis.

Text Books

1. Ian Gibson, et.al., "Additive Manufacturing Technologies – 3D Printing, Rapid Prototyping and Direct Digital Manufacturing", Springer Publications, 2nd Edition, 2015.
2. Chua C.K., Leong K.F. and LIM C.S, "Rapid prototyping: Principles and Applications", World Scientific publications, 2010.

Reference Books

1. D.T. Pham and S.S. Dimov, "Rapid Manufacturing – The Technologies and Applications of Rapid Prototyping and Rapid Tooling", Springer Publications, 2001.
2. Andreas Gebhardt, Jan – Steffen Hotter, "Additive Manufacturing – 3D Printing for Prototyping and Manufacturing", Hanser Publishers, Munich, 2016.
3. Zimmers&P.Groover, "CAD/CAM", Pearson Education, 1st Edition, 2003.

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Open Elective - III

ASSISTIVE TECHNOLOGIES

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce different assistive technology devices.
- To familiarize with the concepts of enhancing speech communication and Independent Living.

Course Outcomes

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

- identify the adaptation framework connected with assistive technologies.
- demonstrate various types of assessments for assistive technologies.
- explore the processes to enhance speech communication.
- describe the process to enhance mobility and information access.
- analyze the technology aspects needed for independent living.

Course Content

UNIT - I: Introduction to Assistive Technology and Adaptation Framework

Definition and historical overview of assistive technology, multidisciplinary nature of service provision, introduction to adaptations framework, selecting specific characteristics, evaluation of effectiveness of adaptations.

UNIT - II: Assistive Technology Assessments

Overview of assessment issues, overview of general assessments, assistive technology assessments, assessment components.

UNIT - III: Enhance Speech Communication

Nature of spoken language, introduction to augmentative and alternative communication systems, selection techniques for aided communication systems, overview of non-electronic systems and electronic devices.

UNIT - IV: Mobility and Access to Information

Introduction to mobility adaptations, basic design considerations, seating and positioning issues, introduction to information access, computer access, telecommunication, listening and print access.

UNIT - V: Enhance Independent Living

Introduction to independent living, devices for daily life, switches and scanning, environmental control units, access to management devices.

Text Books

1. Diane P edrotty Bryant, Brian R. Bryant, Allyn, Bacon, “Assistive Technology for People with Disabilities”, 2nd Edition, Psycho Educational Services.

Reference Books

1. Marion A. Herash, Michael A. Johnson, “Assistive Technology for the Hearing Impaired, Deaf and Deafblind”, Springer Publications, 2003.
2. Meeko Mitsuko K. Oishi, Ian M. Mitchell, H.F. MachielVanderloss, “Design and use of Assistive Technology”, Springer Publications, 2010.
3. Eckehard Fozzy Moritz, “Assistive Technologies for the Interaction of the Elderly”, Springer Publications, 2014.

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Open Elective - III

INTRODUCTION TO BIO-MEDICAL ENGINEERING

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the basics of biological concepts and relate it to engineering.
- To familiarize with physiology of cardio-vascular system, respiratory system and the elements of Patient Care Monitoring.
- To impart the knowledge on the diagnostic techniques and shocking hazards.

Course Outcomes

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

- demonstrate the novel theory related to human body and various components in cardio vascular system.
- relate the concept of electrode theory and transduction principles to bio-medical instrumentation.
- analyze the operation of measuring the cardio-vascular and respiratory systems by knowing its inner organization.
- outline the patient care monitoring.
- apply the fundamental principles & techniques of diagnosis and demonstrate shocking hazards related to biomedical instrumentation.

Course Content

UNIT - I: Introduction to Bio-Medical Instrumentation and Electro-Cardiography

Man instrumentation system-introduction & components, physiological system of the body, sources of bio-electric potentials, resting & action potentials,The heart & cardiovascular system, Electro-Cardiography, Electro-Cardiogram(ECG),Electro-Encephalogram(EEG).

UNIT - II: Electrodes& Transducers

Bio-potential electrodes, basic transducers-transduction principles, biochemical transducers, active & passive transducers, transducers of bio-medical applications.

UNIT - III: Measurements of Cardio-Vascular & Respiratory Systems

Blood pressure measurement, pulse sensors, the physiology of the respiratory system, tests & instrumentation for the mechanics of breathing, respiration sensors, respiratory therapy equipment.

UNIT - IV: Patient Care & Monitoring

Elements of intensive care monitoring, patient monitoring displays, diagnosis,organization of the hospital for patient care monitoring, pace-makers, defibrillators.

UNIT - V: Diagnostic Techniques &Shocking Hazards

Principles of ultrasonic measurement, Ultrasonic Imaging, Ultrasonic Diagnosis, X-Ray &CT Scan, MRI,shock hazards & prevention, physiological effects & electrical equipment, methods of accident prevention

Text Books

1. Onkar N. Pandey, Rakeshkumar, "Bio-Medical Electronics and Instrumentation", S. K. Kataria& Sons, 2007.
2. Cromewell, Wiebell, P.feiffer, "Biomedical instrumentation and measurements",Prentice-Hall, 1973.

Reference Books

1. Joseph J.Carr, John M.Brown, "Introduction to Bio-Medical EquipmentTechnology", 4th Edition, Pearson Publications.
2. Khandapur, "Handbook of Bio-Medical Instrumentation", 2nd Edition, Tata McGrawHill.

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Open Elective - III

DEVOPS

III Year – II Semester

Lecture : 3	Internal Marks : 30
Credits : 3	External Marks : 70

Course Objectives

- To familiarize with precise knowledge of tools to architect effective pipelines by selecting tools suitable for specific scenarios.

Course Outcomes

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

- explain fundamentals and advance concepts of Agile and DevOps.
- describe Usage of multiple tools for unit functions in a DevOps pipeline.
- illustrate various types of version control systems, continuous integration tools.
- elaborate on various tools to orchestrate, deployment, infrastructure management.
- outline Devops and Cloud work together.

Course Content

UNIT - I: The World without DevOps and Agile Methodology and DevOps

Introduction- Problem Case Definition, Benefits of fixing Application Development Challenges, DevOps Adoption Approach through Assessment.

Agile Methodology and DevOps - Before Agile-Waterfall, Agile Development, What is DevOps, DevOps Importance and Benefits, Devops Principles and Practices, 7 C's of DevOps Lifecycle for Business Agility, DevOps and Continuous Testing.

UNIT - II: Tool Suits

Introduction, Atlassian Tools - Key Features, where can Atlassian be Best Utilized, Pros and cons of Atlassian, Phabricator - Key Features, where can Phabricator be Best Utilized, Pros and cons of Phabricator.

UNIT - III: Orchestration

Introduction, Jenkins- Features, Example of Reference Architecture. Ansible - Key Features, Pros and Cons, Example of Reference Architecture, Bamboo- Key Features, Pros and Cons, Example of Reference Architecture.

UNIT - IV: Application Lifecycle Management and Deployment and Infrastructure Management

Introduction, JIRA - Key Features, Pros and Cons, Example of Reference Architecture, Chef - Key Features, Pros and Cons, Example of Reference Architecture.

UNIT - V: DevOps with Cloud

Introduction, DevOps and Cloud Adoption- Benefits of using DevOps along with Cloud, Few best practices for DevOps in the Cloud. AWS- Reasons for selecting AWS for DevOps. Features of AWS, AWS tools and services for Orchestrating DevOps Capability, Pros and Cons.

Text Books

1. Deepak Gaikwad, Viral Thakkar, DevOps Tools, from Practitioner's viewpoint, 1st edition, Wiley.
2. Jez Humble and David Farley, Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation, 1st edition, 2010.

Reference Books

1. Jenkins and Kubernetes, Pierluigi Rit, Pro DevOps with Google Cloud Platform With Docker, Apress.

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Open Elective - III

OBJECT ORIENTED ANALYSIS AND DESIGN

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To get familiar with the Object Oriented Analysis and Design in software development, develop UML structural and behavioral models of an application.
- To describe and choose an appropriate Design Pattern to refine the model.

Course Outcomes

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

- apply the object oriented analysis and designs in software development and familiar with the UML concepts.
- develop static conceptual models of the system.
- create dynamic behavioral models of the system to meet user needs.
- design object oriented architecture models.

Course Content

UNIT - I: Introduction to UML

Importance of modeling, principles of modeling, object oriented modeling, Conceptual model of the UML, Architecture of UML.

UNIT - II: Structural Modelling

Structural Modeling:Classes, Relationships: Dependency, Generalization, Realization and Association- advanced features of association, Class diagrams, Interfaces and Packages, Object Diagrams.

UNIT - III: Behavioral Modelling

Behavioral Modeling: Use case, Use case Diagrams, Interactions, Interaction Diagrams- Sequence diagram, Collaboration diagrams.

UNIT - IV: Advanced Behavioral Modelling

Activity diagrams, Common modeling techniques of Activity diagram.
Advanced Behavioral Modeling: Events and signals, state machines, state chart diagrams.

UNIT - V: Architectural Modelling

Architectural Modeling: Components, Component diagrams, Deployment, Deployment diagrams.

Text Books

1. "The Unified Modeling Language User Guide", Booch, James Rumbaugh, Ivar Jacobson, Pearson Education 13th Edition,2004.
2. "Fundamentals of Object Oriented Design in UML", Meilir Page-Jones, Pearson Education.

Reference Books

1. "Object Oriented Analysis and Design with Applications", Grady Booch, Pearson Education Asia, 2nd Edition.
2. "Object-Oriented Systems Ananlysis And Design Using UML", Simon Bennett, Steve McRobb and Ray Farmer , TATA McGrawHill, 2nd Edition.

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Open Elective - III

SCRIPTING LANGUAGES

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To familiarize with JQuery, JSON, PERL, Ruby, AJAX to develop client-side and server-side web applications.

Course Outcomes

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

- make use of jQuery with DOM to manipulate HTML elements, attributes and CSS.
- develop script to exchange data between server and browser using JSON.
- develop PERL scripts using arrays, hashes, control structures and subroutines.
- create Ruby scripts using data types, arrays, hashes, control structures and classes.
- develop script to retrieve data from a database using PHP and AJAX.

Course Content

UNIT - I: jQuery

Introduction, Selectors, Events, Effects, Manipulating HTML and CSS using jQuery.

UNIT - II: JSON

Introduction, Syntax rules, JSON vs XML, Data types, Objects, Arrays, Parsing JSON and using stringify() function.

UNIT - III: PERL

Basic Syntax, Perl Language Elements: Variables, Operators, Control Flow Statements, Arrays, Hashes, Subroutines, Packages and Modules, File Handling and Operations on Files, Retrieving Documents from the Web using Perl LWP.

UNIT - IV: Ruby

Introduction to Ruby, Variables, types, simple I/O, Control, Arrays, Hashes, Methods, classes, Iterators.

UNIT - V: AJAX A New Approach

Introduction, Creating XMLHttp Request object, Integrating AJAX with PHP, Retrieving data from a database using PHP and AJAX, Handling XML data using PHP and AJAX.

Text Books

1. Kogent , HTML 5 Black Book, 2nd Edition, Dreamtech Press
2. Dave Thomas, Programming Ruby 1.9 & 2.0: The Pragmatic Programmers' Guide, 4th Edition, Pragmatic Bookshelf.

Reference Books

1. Randal L. Schwartz Brian D. Foy, Tom Phoenix, Learning Perl, 6th edition, O'REILLY Publications.

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Open Elective - III

FUNDAMENTALS OF SOFTWARE PROJECT MANAGEMENT

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To plan and manage projects at each stage of software development life cycle (SDLC).
- To develop effective software projects that support organization's strategic goals.

Course Outcomes

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

- interpret various necessary rudiments of software project management.
- apply improvement strategies to see the inline growth in economic concerns of the project.
- develop project plans that address real time management challenges.
- design efficient work break down structures that meet real time deadlines of a project.
- use software metrics to measure the quality of software projects and to gain insights of management issues related to the project.

Course Content

UNIT - I: Introduction to Software Project Management

Introduction, project definition, software project vs other types of project, activities covered by software project management, ways to categorize software projects, project as a system, management definition, problems with software projects , management control, stakeholders, requirement specification.

UNIT - II: Conventional Software Management

The waterfall model, conventional software Management performance, Evolution of Software Economics: Software Economics, pragmatic software cost estimation, Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness

UNIT - III: The Old Way and The New

The Old Way and The New: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

Life Cycle Phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

UNIT - IV: Checkpoints of the Process

Checkpoints of the Process: Major mile stones, Minor Milestones, Periodic status assessments.

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

UNIT - V: Project Organizations and Responsibilities

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of Organizations.

Project Control and Process Instrumentation: The seven core Metrics, Management indicators, quality indicators, life cycle expectations.

Text Books

1. Bob Hughes , Software Project Management, 4th edition, Mike Cotterell, TMH.
2. Walker Royce, Software Project Management, Pearson Education, 2005.

Reference Books

1. Joel Henry , Software Project Management, Pearson Education.
2. Pankaj Jalote , Software Project Management in practice, Pearson Education, 2005.

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Open Elective - III

WEB MINING

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To impart machine learning techniques to mine the web and other information networks like social networks and social media.
- To introduce search, retrieval, classification and recommendation methods.

Course Outcomes

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

- describe classic and recent developments in information retrieval, web search and web mining.
- apply Page Rank and HITS algorithm for social network data analysis.
- differentiate Universal, Focused and Topical crawlers in internet.
- analyze complex information and social networks using Information Integration techniques.
- discover sentiment from social media data using opinion mining and web usage mining.

Course Content

UNIT - I: Information Retrieval and Web Search

Basic concepts of information retrieval, IR models, text and web page preprocessing, inverted index and its compression, web search, meta-search.

UNIT - II: Link Analysis

Social network analysis, page rank algorithm, HITS algorithm, community discovery.

UNIT - III: Web Crawling

Crawler algorithm, implementation issues, universal crawlers, focused crawlers, topical crawlers.

UNIT - IV: Information Integration

Schema matching, pre-processing, schema level match, domain and instance level match, 1: m match, integration of web query interfaces.

UNIT - V: Opining and Web Usage Mining

Opining Mining - Sentiment classification, feature based opinion mining, comparative sentence and relation mining, opinion search.

Web Usage Mining - Data collection, data modelling for web usage mining, discovery and analysis.

Text Books

1. Bing Liu, “Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data”, Springer Science & Business Media.
2. Charu C. Aggarwal, “Social Network Data Analytics”, Springer Science & Business Media.

Reference Books

1. GuandongXu ,Yanchun Zhang and Lin Li, “Web Mining and Social Networking Techniques and applications”, Springer Science & Business Media.

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Open Elective - III

AI CHATBOTS

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To learn how artificial intelligence powers chatbots, get an overview of the bot ecosystem and bot anatomy, and study different types of bots and use cases.
- To identify best practices for defining a chatbot use case and use a rapid prototyping framework to develop a use case for a personalized chatbot.

Course Outcomes

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

- develop an in-depth understanding of conversation design, including onboarding, flows, utterances, entities, and personality.
- design, build, test, and iterate a fully-functional, interactive chatbot using acommercial platform.
- deploy the finished chatbot for public use and interaction.

Course Content

UNIT - I: Introduction

Benefits from Chatbots for a Business,A Customer-Centric Approach in Financial Services, Chatbots in the Insurance Industry, Conversational Chatbot Landscape, Identifying the Sources of Data: Chatbot Conversations, Training Chatbots for Conversations, Personal Data in Chatbots, Introduction to the General Data Protection Regulation (GDPR).

UNIT - II: Chatbot Development Essentials

Customer Service-Centric Chatbots, Chatbot Development Approaches, Rules-Based Approach, AI-Based Approach, Conversational Flow, Key Terms in Chatbots, Utterance, Intent, Entity, Channel, Human Takeover, Use Case: 24x7 Insurance Agent

UNIT - III: Building a Chatbot Solution

Business Considerations, Chatbots Vs Apps, Growth of Messenger Applications, Direct Contact Vs Chat, Business Benefits of Chatbots, Success Metrics, Customer Satisfaction Index, Completion Rate, Bounce Rate, Managing Risks in Chatbots Service, Generic Solution Architecture for Private Chatbots.

UNIT - IV: Natural Language Processing, Understanding, and Generation

Chatbot Architecture, Popular Open Source NLP and NLU Tools, Natural Language Processing, Natural Language Understanding, Natural Language Generation, Applications.

UNIT - V: Introduction to Microsoft Bot, RASA, and GoogleDialogflow

Microsoft Bot Framework, Introduction to QnA Maker, Introduction to LUIS, Introduction to RASA, RASA Core, RASA NLU, Introduction to Dialogflow.

Chatbot Integration Mechanism: Integration with Third-Party APIs, Connecting to an Enterprise Data Store, Integration Module.

Text Books

1. Abhishek Singh, Karthik Ramasubramanian, ShreyShivam, "Building an Enterprise Chatbot: Work with Protected Enterprise Data Using Open Source Frameworks",ISBN 978-1-4842-5034-1, Apress,2019.

Reference Books

1. Janarthanam and Srini, Hands-on chatbots and conversational UI development: Build chatbots and voice user interfaces with C (1 ed.), Packt Publishing Ltd, 2017. ISBN 978-1788294669.
2. Galitsky, Boris., Developing Enterprise Chatbots (1 ed.), Springer International Publishing, 2019. ISBN 978-303004298
3. Kelly III, John E. and Steve Hamm, Smart machines: IBM's Watson and the era of cognitive computing (1 ed.), Columbia University Press, 2013. ISBN 978- 0231168564.
4. Abhishek Singh, Karthik Ramasubramanian and ShreyShivam, Building an Enterprise Chatbot (1 ed.), Springer, 2019. ISBN 978-1484250334.

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Open Elective - III

TRENDS IN IoT

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To introduce the advanced concepts in IoT
- To familiarize the digital transformation in various fields with the advent of IoT

Course Outcomes

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

- demonstrate the advantages of edge computing.
- describe the concepts of various technologies in IoT.
- analyze the digital transformation in IoT and future marketing.
- summarize the trust issues in IoT.

Course Content

UNIT - I: Edge Computing

Introduction, Edge Computing Architecture, Background Essentials: IoT Devices, Networking Architecture, Network Management and Control.

UNIT - II: IoT Ecosystems and Technologies

Introduction, support for IoT Ecosystem creation, spurring innovation in lead markets, outlook IoT vision, IoT strategic Research and Innovation Directions, IoT smart environments and applications, IoT and related future technologies.

UNIT - III: IoT and Digital Transformation

IoT Standardization, IoT security, IoT enabling the Digital Transformation of Industry, Case study - Farming Food and IoT: where we are going and challenges.

UNIT - IV: IoT in Future Marketing

Introduction, EU Initiatives and IoT Platforms for Digital Manufacturing, Digital Factory Automation, IoT Applications for Manufacturing.

UNIT - V: Trust in IoT

The need for evaluating trust in IoT, Trust management in IoT, Trust for devices, Trust for IoT services, consent and trust in personal data sharing, using trust in authorization

Text Books

1. Edge computing: Fundamentals, Advances and Applications, K.Anitha Kumari, G.Sudha Sada sivam, D.Dharani, M.Niranjamurthy, CRC Press,Taylor Francis Group,2022
2. Digitising the Industry Internet of Things Connecting the Physical, Digital and Virtual Worlds, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publisher series.

Reference Books

1. Alasdair Gilchrist, “Industry 4.0: The Industrial Internet of Things”,Apress 2016.
2. Vijay Madisetti, Arshdeep Bahga,” Internet of Things A Hands-On- Approach”, 2014.

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Open Elective - III

ACADEMIC COMMUNICATION

III Year – II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To acquaint the students with the process and elements of academic writing.
- To help them gain accuracy in the academic writing tasks they will be called upon to perform as part of their graduate and postgraduate studies.
- To empower them to carry out academic writing tasks such as project report writing with success.

Learning Outcomes

Upon successful completion of the course, the student will be able to produce successful academic writing tasks (such as designing and reporting a survey/project, writing discussion essays, and composing formal letters) with attention to:

- the writing process involving a good understanding of the purpose and the register as well as organizational strategies such as introduction, main body, conclusion, paragraphing;
- the elements of academic writing such as argument, cause and effect, cohesion and coherence, generalizations, references, style, and visual information; and
- the kind of accuracy, technical as well as grammatical, that writing in academic contexts demands

Course Content

I. The Writing Process

a. Background to writing

i. The purpose of academic writing
ii. Common types of academic writing
iii. The features of academic writing
iv. Writing in paragraphs

b. From understanding to planning

i. The planning process
ii. Analyzing essay titles
iii. Brainstorming

c. Organizing paragraphs

i. Paragraph structure
ii. Development of ideas
iii. Linking paragraphs together

d. Introductions and conclusions

i. Introduction contents ii. Introduction structure

iii. Opening sentences iv. Conclusions

e. Re-writing and proof-reading

i. Re-writing ii. Proof-reading

II. Elements of Writing

a. Cohesion

i. Reference words ii. Preventing confusion

b. Comparisons

i. Comparison structures ii. Forms of comparison

iii. Using superlatives

c. Style

i. Components of academic style ii. Guidelines

d. Visual information

i. The language of change ii. Types of visuals

iii. Describing visuals iv. Labelling

III. Accuracy in Writing

a. Academic vocabulary b. Remedial grammar

c. Punctuation

IV. Writing Models

a. Formal/Professional emails b. CVs

c. Reports d. Scholarly essays

Suggesting Reading

1. Bailey, Stephen. (2011). *Academic Writing A Handbook for International Students*. Routledge: London.

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