# ACADEMIC REGULATIONS
# COURSE STRUCTURE
# AND
# DETAILED SYLLABUS

## MECHANICAL ENGINEERING

## B.Tech Four Year Degree Course

(Applicable for the batches admitted from 2014-15)


## 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)

- Apply knowledge of Mathematics, Science and Engineering to solve complex Mechanical Engineering problems.
- Identify, formulate and analyze problems related to Mechanical Engineering.
- Design Mechanical engineering systems, to meet the desired needs with the economic, environmental, social, ethical, health and safety constraints.
- Investigate the technological challenges through the use of research based knowledge to design experiments, critical analysis and interpretation of data, synthesis of the data to arrive at valid conclusions.
- Model and simulate Mechanical engineering systems, to conduct experiments and analyze the performance using modern software tools.
- Assesess issues pertaining to societal, health, safety .legal, cultural and accordingly engage in professional engineering practices.
- Demonstrate knowledge for sustainable development with an understanding on the impact of professional engineering on society and environment.
- Follow professional ethics, norms and standards of engineering practices.
- Work as an effective member of the team and also as an individual in diverse and multi disciplinary streams.
- Prepare reports and present effectively and also orally communicate fluently with the society and engineering community.
- Apply knowledge of Management and Finance for effective project management.
- Engage in life-long learning independently to stay with the changes in technology.

## V. ACADEMIC REGULATIONS

Applicable for the students of B.Tech from the Academic Year 2014-15.

### 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)

### 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. Program Credits

i) Each discipline of the B.Tech program is designed to have a total of 180 credits and the student shall have to complete the four year course work and earn all the **180** credits for the award of B.Tech Degree.

ii) Students joining the B.Tech program into the third semester directly through Lateral Entry (LE) Scheme shall have to complete the three year course work and earn **132** credits for the award of B.Tech degree.

### 5. Attendance Regulations

5.1 A student shall be eligible to appear for End Semester Examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects.

5.2 Condoning of shortage of attendance in aggregate upto 10% (65% and above and below 75%) in each semester will be considered for genuine reasons such as medical grounds and participation in co-curricular and extra-curricular activities and shall be granted only after approval by a committee duly appointed by the college. The student should submit application for medical leave along with medical certificate from a registered medical practitioner within three days from reporting to the class work after the expiry of the Medical Leave. In case of participation in co-curricular and extra-curricular activities, either in the college or

other colleges, students must take prior written permission from HoD concerned and should also submit the certificate of participation from the organizer of the event within three days after the completion of the event. Only such cases will be considered for condoning attendance shortage.

5.3 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 regular B.Tech / three year (six semesters) course work of B.Tech, Lateral Entry.

5.4 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 next.

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

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

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

5.8 A student is required to put up a minimum of 75% of attendance in the mandatory non-credit courses such as NSS and Games & Sports / Creative Arts.

5.9 A student whose shortage of attendance is condoned in the case of credit courses in that semester shall also be eligible for condoning shortage of attendance up to 10% in the case of mandatory non-credit courses also.

## 6. Examinations and Scheme of Evaluation

### 6.1 Theory Courses (3 Credits):

Each theory course shall be evaluated for a total of 100 marks, consisting of 40 marks for internal assessment and 60 marks for semester end examination.

***Internal Assessment:***

i) Out of 40 marks for internal assessment, 20 marks are for continuous assessment in the form of class tests and 20 marks are based on two mid-term examinations. The first mid-term examination shall be from the first three units of syllabus and second mid-term from the last three units of syllabus, conducted during the semester.

ii) Four class tests, two tests before first mid-term examination and the other two before second mid-term examination, each for 10 marks, with 45 minutes duration, are conducted in a semester and the average marks of the three best scored tests are scaled up for 20 marks and taken as marks for the continuous evaluation process.

iii) Each mid-term examination is conducted for 40 marks with two hours duration. Each mid-term examination consists of four questions, each for 10 marks. All the questions need to be answered. First question shall have 5 short questions, each of two marks or 10 objective questions each of one mark and the remaining three questions are of descriptive type, one from each unit of syllabus.

iv) Sum of the 75% marks of best scored mid-term examination and 25% marks of least scored mid-term examination are scaled down for 20 marks.

v) For the subjects such as Engineering Graphics, Engineering Drawing, Machine Drawing, Design & Drawing of R.C. structures, Steel structures, Irrigation structures, Estimation Cost and Valuation, Building Planning and Drawing etc., the distribution of 40 marks for internal evaluation shall be 20 marks for day-to-day work and 20 marks for internal tests (average of 2 tests) and 60 marks for semester end examination.

***External Assessment:***

i) Semester End Examination will have questions under Part-A and Part-B with three hours duration. **Part-A** is compulsory and consists of six 2 marks questions. **Part-B** consists of six questions, one question from each unit, out of which four questions are to be answered. All questions carry equal marks of 12 each.

ii) For subjects like Engineering Drawing / Engineering Graphics, Machine Drawing, Building Planning & Drawing, etc., the pattern of semester end examination is given along with the syllabus of respective subject.

**6.2 Theory Courses (2 Credits):**

Each theory course shall be evaluated for a total of 75 marks, consisting of 25 marks for internal assessment and 50 marks for semester end examination.

***Internal Assessment:***

i) Out of 25 marks for internal, 5 marks for assignments and 20 marks are based on two mid-term examinations.

ii) Two assignments, each for 10 marks, are evaluated in a semester and the average marks of two assignments are scaled down for 5 marks.

iii) Each mid-term examination is conducted for 40 marks with two hours duration. Each mid-term examination consists of four questions, each for 10 marks. All the questions need to be answered.

iv) Sum of the 75% marks of the best scored mid-term examination and 25% marks of the least scored mid-term examination are scaled down for 20 marks.

***External Assessment:***

i) Semester End Examination will have questions under Part-A and Part-B with three hours duration. **Part-A** is compulsory and consists of five 2 marks questions. **Part-B** consists of six questions, covering uniformly the entire syllabus, out of which four questions are to be answered. All questions carry equal marks of 10 each.

***Employability Skills:***

The distribution of marks shall be 25 marks for Internal Evaluation and 50 marks for the semester end examination. There shall be continuous evaluation by the internal subject teacher during the semester for 25 internal marks, of which 15 marks shall be for day-to-day performance and 10 marks shall be evaluated by conducting an internal test towards the end of semester.

Semester end examination shall be conducted by the teacher concerned and external examiner for 50 marks. The distribution of marks in the semester end examination will be:

| | |
|---|---|
| Questionnaire / data collection | : 10 marks, |
| Project Report | : 10 marks, |
| Presentation of the Project | : 15 marks and |
| Viva-voce | : 15 marks |

***MOOCs (Massive Open Online Courses):***

The evaluation procedures and award of grades in different MOOCs and equivalent letter grading of the college shall be prescribed for each MOOCs along with the notification of MOOCs.

**6.3 Laboratory Courses:**

i) For practical subjects the distribution shall be 25 marks for Internal Evaluation and 50 marks for the semester end examinations. There shall be continuous evaluation by the internal subject teacher during the semester for 25 internal marks of which 15 marks shall be for day-to-day performance (10 marks for day-to-day evaluation and 5 marks for Record) and 10 marks shall be evaluated by conducting an internal laboratory test towards the end of semester.

ii) Semester end examination shall be conducted by the teacher concerned and external examiner for 50 marks.

**6.4 Mandatory Non-Credit Courses:**

A student is required to take up two Non-Credit courses, viz. NSS and Sports & Games / Creative Arts, one in II year and the other in III year, either in the first semester or second semester. Marks are awarded based on the day-to-day participation and performance in the activities organized under each event. A student is required to score 40 marks out of 100 marks despite putting up a minimum of 75% attendance to be

declared satisfactory in each mandatory non-credit course. The B.Tech degree shall only be awarded if a student gets satisfactory grade in each of the two mandatory non-credit courses and besides acquiring 180 credits of the B.Tech degree course.

A student has to repeat the course if he does not get satisfactory grade in each non-credit course for getting the degree awarded.

**NSS**

There shall be internal valuation for 100 Marks, out of which 60 marks are for participation and involvement in day-to-day activities and 40 marks for participation and involvement in a three days NSS camp arranged during the semester.

**Sports and Games / Creative Arts**

There shall be two internal valuations, each for 50 marks, in the chosen activity, one in the middle of semester and the other towards the end of semester. Sum of the two valuations shall be taken as the final marks for 100.

**6.5 Industrial / Practical Training:**

Industrial / Practical training shall be evaluated for a total of 100 marks, consisting of 40 marks for internal assessment of day-to-day work and 60 marks for the assessment of the training report and viva-voce examination, conducted by a panel of examiners appointed by the college.

**6.6 Mini Project:**

Industrial / Practical training shall be evaluated for a total of 75 marks, consisting of 25 marks for internal assessment of day-to-day work and 50 marks for the assessment of the project report and viva-voce examination, conducted by a panel of examiners appointed by the college.

**6.7 Project Work:**

i) The final project work shall be carried out during the 8th semester and will be evaluated for 200 marks.

ii) Out of 200 marks, 80 marks shall be for Internal Evaluation and 120 marks for the assessment of project thesis and viva-voce examination.

iii) Each student needs to give two seminars on the topic of his project, and each seminar is evaluated for 40 marks by a committee consisting of the supervisor and a senior faculty of the department. The sum of the marks of two seminars is taken as internal marks for 80.

iv) The assessment of Project Thesis and Viva–Voce shall be conducted by the committee consisting of an External Examiner, Head of the Department and Supervisor of the Project. The evaluation of project work shall be conducted at the end of the fourth year second semester.

## 7. Criteria for Passing a Course and Award of Grades:

### 7.1 Criteria for Passing a Course:

i) A candidate shall be declared to have passed in individual theory/ drawing/ design course if he secures a minimum of 40% aggregate marks (internal & semester end examination marks put together), subject to securing a minimum of 35% marks in the semester end examination.

ii) A candidate shall be declared to have passed in individual laboratory/ project course if he secures a minimum of 50% aggregate marks (internal & semester end examination marks put together), subject to securing a minimum of 40% marks in the semester end examination.

iii) The candidate shall be declared to have passed in Employability Skills / Industrial / Practical Training / Mini Project / Porject Work if he secures 50% marks.

iv) On passing a course of a program, the student shall earn the credits as asigned to that course.

### 7.2 Method of Awarding Letter Grade and Grade Points for a Course:

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

| Theory / Drawing Course (%) | Laboratory / Employability Skills / Industrial / Practical Training/ Mini Project/ Project Work (%) | Grade Points | Letter Grade |
|---|---|---|---|
| ≥ 90 | ≥ 90 | 10 | O (Outstanding |
| ≥ 80 & < 90 | ≥ 80 & < 90 | 9 | A+ (Excellent) |
| ≥ 70 & < 80 | ≥ 70 & < 80 | 8 | A (Very Good) |
| ≥ 60 & < 70 | ≥ 60 & < 70 | 7 | B+ (Good) |
| ≥ 50 & < 60 | ≥ 50 & < 60 | 6 | B (Above Average) |
| ≥ 45 & < 50 | – | 5 | C (Average) |
| ≥ 40 & < 45 | – | 4 | P (Pass) |
| < 40 | < 50 | 0 | F (Fail) |

### 7.3 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:

$$\textbf{SGPA} = \frac{\sum (CR \, X \, GP)}{\sum CR}$$

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.

### 7.4 Eligibility for Award of B.Tech Degree:

A student will be declared eligible for the award of the B.Tech. Degree if he fulfills the following academic regulations.

**i) 4 Year B.Tech Course:**

(a) Pursued a course of study for not less than four academic years and not more than eight academic years.

(b) Registered for **180** credits and secured **180** credits.

(c) Students, who fail to complete their Four years Course of study within Eight years or fail to acquire the **180** Credits for the award of the degree within eight academic years from the year of their admission shall forfeit their seat in B.Tech course and their admission shall stand cancelled.

**ii) 3 Year B.Tech Course under Lateral Entry:**

(a) Pursued a course of study for not less than three academic years and not more than six academic years.

(b) Registered for **132** credits and secured **132** credits.

(c) Students, who fail to complete their Three years Course of study within Six years or fail to acquire the **132** Credits for the award of the degree within six academic years from the year of their admission shall forfeit their seat in B.Tech course and their admission shall stand cancelled.

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

The CGPA is calculated as given below:

$$\textbf{CGPA} = \frac{\sum (CR \, X \, GP)}{\sum CR}$$

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

### 7.6 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:

| CGPA | Class |
|---|---|
| ≥ 7.5 | First Class with Distinction |
| ≥ 6.5 & < 7.5 | First Class |
| ≥ 5.5 & < 6.5 | Second Class |
| < 5.5 | Pass Class |

### 7.7 Consolidated Grade Card

A consolidated grade card containing credits & grades obtained by the candidate will be issued after completion of the four year B.Tech program.

**8. Supplementary Examinations**

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

ii) Semester end supplementary examinations shall be conducted till next regulation comes into force for that semester, after the conduct of the last set of regular examinations under the present regulation.

iii) Thereafter, supplementary examinations will be conducted in the equivalent courses as decided by the Board of Studies concerned.

iv) **Advanced Supplementary Examinations:** Candidate(s), who failed in theory / project work courses in 4th B.Tech 2nd Semester can appear for advanced supplementary examination conducted within one month after declaration of the revaluation results. However, those candidates who fail in these advanced supplementary examinations shall appear for subsequent examination along with regular candidates in the examinations conducted at the end of the respective semester.

**9. 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 5.

ii) The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in Regulation 5 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 50% 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 50% of 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 50% 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.

**10. Revaluation**

i) Students can submit the applications for revaluation, along with the prescribed fee receipt for revaluation of his 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 external 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.

**11. Re-admission Criteria**

i) A candidate, who is detained in a semester due to 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 9 by paying the required tuition fee and special fee in addition to paying an administrative fee of Rs. 1,000/-.

**12. 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 and special fees should be paid by the candidate to condone his break in study.

**13. Transitory Regulations**

A candidate, who is detained or discontinued in a semester, on readmission shall be required to do all the courses in the curriculum prescribed for the batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed such courses in the earlier semester(s) he was originally admitted into and substitute subjects are offered in place of them as decided by the Board of Studies. However, the decision of the Board of Studies will be final.

**a) Four Year B.Tech Regular course:**

**13.1** A student who is following JNTUK curriculum and detained due to shortage of attendance at the end of the first semester of first year shall join the autonomous batch of first year first semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with regular candidates of Autonomous stream and will be governed by the autonomous regulations.

**13.2** A student who is following JNTUK curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester of first year or at the 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 will be offered in place of them as decided by the Board of Studies. The student has to clear all his backlog subjects up to previous semester by appearing for the supplementary examinations conducted by JNTUK for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUK regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

**b) Three Year B.Tech program under Lateral Entry Scheme:**

**13.3** A student who is following JNTUK curriculum and detained due to

shortage of attendance at the end of the first semester of second year shall join the autonomous batch of second year first semester. Such students shall study all the courses prescribed for the batch in which the student joins and considered on par with Lateral Entry regular candidates of Autonomous stream and will be governed by the autonomous regulations.

**13.4** A student who is following JNTUK curriculum, detained due to lack of credits or shortage of attendance at the end of the second semester of second year or at the 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 place of them as decided by the Board of Studies. The student has to clear all his backlog subjects up to previous semester by appearing for the supplementary examinations conducted by JNTUK for the award of degree. The total number of credits to be secured for the award of the degree will be sum of the credits up to previous semester under JNTUK regulations and the credits prescribed for the semester in which a candidate seeks readmission and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

**c) Transfer candidates (from non-autonomous college affiliated to JNTUK):**

**13.5** A student who is following JNTUK curriculum, transferred from other college 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 student has to clear all his backlog subjects up to previous semester by appearing for the supplementary examinations conducted by JNTUK for the award of degree. The total number of credits to be secured for the award of the degree will be the sum of the credits upto

previous semester under JNTUK regulations and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

**d) Transfer candidates (from an autonomous college affiliated to JNTUK):**

**13.6** A student who has secured the required credits upto previous semesters as per the regulations of other autonomous institutions shall also 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 will be the sum of the credits upto previous semester as per the regulations of the college from which he is transferred and the credits prescribed for the semester in which a candidate joined after transfer and subsequent semesters under the autonomous stream. The class will be awarded based on the academic performance of a student in the autonomous pattern.

**14. 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 the student will be withheld. His degree will be withheld in such cases.

**15. Malpractices**

i) 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.

ii) 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.<br>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.<br>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. | |

iii) 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.

**16. 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.

**17. 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.

## VI. CURRICULAR COMPONENTS

| Sl.No. | Course Work - Subject Areas | Credits % |
|---|---|---|
| 1. | Humanities and Social Sciences (HSS) | 11 |
| 2. | Baisc Sciences (BS) | 11 |
| 3. | Engineering Sciences (ES) | 17 |
| 4. | Professional Subjects Core (PSC) | 39 |
| 5. | Professional Subjects Electives (PSE) | 08 |
| 6. | Open Subjects Electives (OSE) | 06 |
| 7. | Project / Industrial / Practical Training | 08 |
| 8. | Non-Credit Courses | 03 |

# COURSE STRUCTURE

# &

# SYLLABUS

# COURSE STRUCTURE

**I Year - I Semester**

| Sl. No. | Name of the Course / Laboratory | No.of Periods per week | | No.of Credits |
|---|---|---|---|---|
| | | L | P | |
| 1 | Professional Communication – I | 3+1* | - | 3 |
| 2 | Mathematics – I | 3+1* | - | 3 |
| 3 | Engineering Physics | 3+1* | - | 3 |
| 4 | Environmental Studies | 3+1* | - | 3 |
| 5 | Engineering Mechanics | 3+1* | - | 3 |
| 6 | Engineering Graphics - I | 1 | 3 | 3 |
| 7 | Professional Communication Lab – I | - | 3 | 2 |
| 8 | Engineering Physics Lab | - | 3 | 2 |
| 9 | Engineering Workshop | - | 3 | 2 |
| | **Total** | **21** | **12** | **24** |

**I Year - II Semester**

| Sl. No. | Name of the Course / Laboratory | No.of Periods per week | | No.of Credits |
|---|---|---|---|---|
| | | L | P | |
| 1 | Professional Communication – II | 3+1* | - | 3 |
| 2 | Mathematics – II | 3+1* | - | 3 |
| 3 | Mathematical Methods | 3+1* | - | 3 |
| 4 | Engineering Chemistry | 3+1* | - | 3 |
| 5 | Problem Solving Using C | 3+1* | - | 3 |
| 6 | Engineering Graphics - II | 3+1* | - | 3 |
| 7 | Professional Communication Lab – II | - | 3 | 2 |
| 8 | Engineering Chemistry Lab | - | 3 | 2 |
| 9 | Programming Lab | - | 3 | 2 |
| | **Total** | **24** | **9** | **24** |

* **Tutorial**

## II Year - I Semester

| Sl. No. | Name of the Course / Laboratory | No.of Periods per week | | No.of Credits |
|---|---|---|---|---|
| | | L | P | |
| 1 | Managerial Economics and Financial Analysis | 3+1* | - | 3 |
| 2 | Electrical & Electronics Engineering | 3+1* | - | 3 |
| 3 | Kinematics of Machines | 3+1* | - | 3 |
| 4 | Mechanics of Solids | 3+1* | - | 3 |
| 5 | Engineering Thermodynamics | 3+1* | - | 3 |
| 6 | Material Science & Metallurgy | 3+1* | - | 3 |
| 7 | Employability Skills | 1 | 2 | 3 |
| 8 | Electrical & Electronics Engineering Lab | - | 3 | 2 |
| 9 | Mechanics of Solids Lab & Metallurgy Lab | - | 3 | 2 |
| | **Total** | **25** | **8** | **24** |
| 10 | NSS (Mandatory Non-Credit Course) | - | 2 | - |

## II Year - II Semester

| Sl. No. | Name of the Course / Laboratory | No.of Periods per week | | No.of Credits |
|---|---|---|---|---|
| | | L | P | |
| 1 | Industrial Engineering & Management | 3+1* | - | 3 |
| 2 | Dynamics of Machines | 3+1* | - | 3 |
| 3 | Fluid Mechanics | 3+1* | - | 3 |
| 4 | Manufacturing Processes | 3+1* | - | 3 |
| 5 | Thermal Engineering - I | 3+1* | - | 3 |
| 6 | Machine Drawing | 1 | 4 | 3 |
| 7 | Professional Ethics and Patents | 2 | - | 2 |
| 8 | Machine Dynamics Lab and Fuels & Lubricants Lab | - | 3 | 2 |
| 9 | Manufacturing Processes Lab | - | 3 | 2 |
| | **Total** | **23** | **10** | **24** |

* **Tutorial**

**III Year - I Semester**

| Sl. No. | Name of the Course / Laboratory | No.of Periods per week | | No.of Credits |
|---|---|---|---|---|
| | | L | P | |
| 1 | Hydraulic Machines and Systems | 3+1* | - | 3 |
| 2 | Principles of Machine Design | 3+1* | - | 3 |
| 3 | Metal Cutting & Machine Tools | 3+1* | - | 3 |
| 4 | Thermal Engineering - II | 3+1* | - | 3 |
| 5 | Open Elective – I (see the list of Open Electives) | 3+1* | - | 3 |
| 6 | Machine Tools Lab | - | 3 | 2 |
| 7 | Thermal Engineering Lab | - | 3 | 2 |
| 8 | Computer Aided Modeling Lab | - | 3 | 2 |
| | **Total** | **20** | **9** | **21** |
| 9 | Sports & Games / Creative Arts (Mandatory Non-Credit Course) | - | 2 | - |

**III Year - II Semester**

| Sl. No. | Name of the Course / Laboratory | No.of Periods per week | | No.of Credits |
|---|---|---|---|---|
| | | L | P | |
| 1 | Operation Research | 3+1* | - | 3 |
| 2 | Design of Mechanical Components | 3+1* | - | 3 |
| 3 | Metrology and Instrumentation | 3+1* | - | 3 |
| 4 | Elective – I<br>i) Automobile Engineering<br>ii) Finite Element Methods<br>iii) Unconventional Machining Processes<br>iv) Control Systems | 3+1* | - | 3 |
| 5 | Open Elective – II (see the list of Open Electives) | 3+1* | - | 3 |
| 6 | Metrology and Instrumentation Lab | - | 3 | 2 |
| 7 | Fluid Mechanics and Hydraulic Machines Lab | - | 3 | 2 |
| 8 | Mini Project | - | 3 | 2 |
| | **Total** | **20** | **9** | **21** |

* **Tutorial**

**IV Year - I Semester**

| Sl. No. | Name of the Course / Laboratory | No.of Periods per week | | No.of Credits |
|---|---|---|---|---|
| | | L | P | |
| 1 | CAD / CAM | 3+1* | - | 3 |
| 2 | Heat Transfer | 3+1* | - | 3 |
| 3 | Elective – II<br>i) Computational Fluid Dynamics<br>ii) Robotics<br>iii) Interactive Computer Graphics<br>iv) Mechanical Vibrations | 3+1* | - | 3 |
| 4 | Elective – III<br>i) Production Planning and Control<br>ii) Tribology<br>iii) Refrigeration & Air Conditioning<br>iv) Fracture Mechanics | 3+1* | - | 3 |
| 5 | Open Elective – III (see the list of Open Electives) | 3+1* | - | 3 |
| 6 | CAD / CAM Lab | - | 3 | 2 |
| 7 | Heat Transfer Lab | - | 3 | 2 |
| 8 | Computational Methods for Engineers Lab | - | 3 | 2 |
| | **Total** | **20** | **9** | **21** |

**IV Year - II Semester**

| Sl. No. | Name of the Course / Laboratory | No.of Periods per week | | No.of Credits |
|---|---|---|---|---|
| | | L | P | |
| 1 | Elective – IV<br>i) Condition Monitoring<br>ii) Rapid Prototyping<br>iii) Power Plant Engineering<br>iv) Design for Manufacturing & Assembly | 3+1* | - | 3 |
| 2 | Elective – V<br>i) Nanotechnology<br>ii) Gas Dynamics & Jet Propulsion<br>iii) Automation in Manufacturing<br>iv) Supply Chain Management | 3+1* | - | 3 |
| 3 | Self Study Course (see the list of Self Study Courses) | - | - | 2 |
| 4 | Industrial / Practical Training | - | - | 4 |
| 5 | Project Work | - | 9 | 9 |
| | **Total** | **8** | **9** | **21** |

* **Tutorial**

## Open Elective - I

| Sl. No. | Title of the Subject | Department Offering the Subject | No.of Periods per week | | No.of Credits |
|---|---|---|---|---|---|
| | | | L | P | |
| 1 | Remote Sensing and GIS Techniques | CE | 3+1* | - | 3 |
| 2 | Elements of Civil Engineering (other than CE) | CE | 3+1* | - | 3 |
| 3 | Modeling and Simulation of Engineering Systems | EEE | 3+1* | - | 3 |
| 4 | Renewable Energy Sources | ME | 3+1* | - | 3 |
| 5 | Elements of Mechanical Engineering(other than ME) | ME | 3+1* | - | 3 |
| 6 | Computer Networks (other than CSE & IT) | CSE | 3+1* | - | 3 |
| 7 | Object Oriented Programming (other than CSE & IT) | CSE | 3+1* | - | 3 |
| 8 | Data Structures Using C (other than EEE,ECE,CSE&IT) | CSE | 3+1* | - | 3 |
| 9 | Cyber Laws | CSE | 3+1* | - | 3 |
| 10 | Open Source Software | IT | 3+1* | - | 3 |
| 11 | Fundamentals of Data Base Management Systems (other than CSE & IT) | IT | 3+1* | - | 3 |
| 12 | Fuzzy Mathematics | Maths | 3+1* | - | 3 |

* **Tutorial**

## Open Elective - II

| Sl. No. | Title of the Subject | Department Offering the Subject | No.of Periods per week | | No.of Credits |
|---|---|---|---|---|---|
| | | | L | P | |
| 1 | Disaster Management | CE | 3+1* | - | 3 |
| 2 | Solid Waste Management (other than CE) | CE | 3+1* | - | 3 |
| 3 | Energy Audit, Conservation and Management | EEE | 3+1* | - | 3 |
| 4 | Material Science (other than ME) | ME | 3+1* | - | 3 |
| 5 | Automotive Electronics | ECE | 3+1* | - | 3 |
| 6 | Introduction to MP&MC (other than EEE, ECE, CSE & IT) | ECE | 3+1* | - | 3 |
| 7 | Cloud Computing (other than CSE & IT) | CSE | 3+1* | - | 3 |
| 8 | Web Technologies(other than CSE & IT) | CSE | 3+1* | - | 3 |
| 9 | Virtual Reality | CSE | 3+1* | - | 3 |
| 10 | Scripting Languages | IT | 3+1* | - | 3 |
| 11 | Big Data (other than CSE & IT) | IT | 3+1* | - | 3 |
| 12 | Multi-variate analysis and Special Functions | Maths | 3+1* | - | 3 |

* **Tutorial**

## Open Elective - III

| Sl. No. | Title of the Subject | Department Offering the Subject | No.of Periods per week | | No.of Credits |
|---|---|---|---|---|---|
| | | | L | P | |
| 1 | Building Services | CE | 3+1* | - | 3 |
| 2 | Modern Optimization Techniques | EEE | 3+1* | - | 3 |
| 3 | Electrical Power Utilization (other than EEE) | EEE | 3+1* | - | 3 |
| 4 | Robotics (other than ME) | ME | 3+1* | - | 3 |
| 5 | Assistive Technologies | ECE | 3+1* | - | 3 |
| 6 | Introduction to Embedded Systems (other than ECE, CSE & IT) | ECE | 3+1* | - | 3 |
| 7 | Social Networks | CSE | 3+1* | - | 3 |
| 8 | Mobile Application Development (other than CSE & IT) | CSE | 3+1* | - | 3 |
| 9 | Real-Time Systems | CSE | 3+1* | - | 3 |
| 10 | Network Management Systems | IT | 3+1* | - | 3 |
| 11 | Fundamentals of E-Commerce (other than CSE & IT) | IT | 3+1* | - | 3 |
| 12 | Statistical Methods using R Software | Maths | 3+1* | - | 3 |

* **Tutorial**

## Self Study Courses

| Sl. No. | Title of the Subject | Department Offering the Subject | No.of Credits |
|---|---|---|---|
| 1 | Global Positioning Systems | CE | 2 |
| 2 | Interior Design | CE | 2 |
| 3 | Electrical Safety Management | EEE | 2 |
| 4 | Green Engineering | ME | 2 |
| 5 | Managing Innovation & Entrepreneurship | ME | 2 |
| 6 | Internet of Things | ECE | 2 |
| 7 | Consumer Electronics | ECE | 2 |
| 8 | e-Waste Management | CSE | 2 |
| 9 | Management Information Systems | CSE | 2 |
| 10 | Information & Communication Technology | IT | 2 |
| 11 | Organizational Behaviour | MBA | 2 |
| 12 | MOOCs | -- | 2 |

# SYLLABUS

## PROFESSIONAL COMMUNICATIONICS – I
## (Common to All Branches)

I Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To equip students for their present and future academic pursuits: to understand classroom lectures, read textbooks, do reference reading, participate in classroom discussions, and write assignments and examination answers.
- To develop in them the communication skills and social graces necessary for functioning effectively in the social and other situations in which they may be called upon to use English.

**Learning Outcomes:**

Students will be able to

- Produce and process language for academic, professional and social life.
- Produce coherent spoken and written discourse of various kinds with attention to appropriate strategies and conventions of speaking and writing.

**Speaking, Listening, Intensive Reading and Grammar Practice**

**UNIT – I:**

- To transfer textual information to a table
- To introduce yourself
- To make polite conversations
- To comprehend subject-verb agreement

**UNIT – II:**

- To communicate well with your peers
- To express your views on a topic
- The present simple and present continuous tenses
- To write a text that has unity

**UNIT – III:**

**Extensive Reading**

**Simplified Classics from the series Great Stories in Easy English:**

- A Tale of Two Cities by Charles Dickens
- Treasure Island by R.L.Stevenson

**Vocabulary Builder: English in Contexts for students of Engineering and Technology'**

- GRE words 75 words
- Idioms 25
- Words often confused 15
- Collocations 15
- One word substitutes 25
- Phrasal verbs 25

**Speaking, Listening, Intensive Reading and Grammar Practice**

**UNIT – IV:**

- To interact with your faculty members
- To express futurity
- To write a text that has cohesion
- To make your writing clutter-free

**UNIT – V:**

- To represent information in a diagram
- To make notes
- To offer your advice/suggestions
- To understand and use auxiliary verbs
- To write a letter to a company

**UNIT – VI:**

**Extensive Reading**

**Simplified Classics from the series *Great Stories in Easy English***

- *Tales from Shakespeare by Charles and Mary Lamb*

**Vocabulary Builder: English in Contexts for students of Engineering and Technology'**

- GRE words 75 words
- Idioms 25
- Words often confused 15
- Collocations 15
- One word substitutes 25
- Phrasal verbs 25

**Text Books:**

1. Samson, T. (2010). Innovate with English. Hyderabad : Foundation **Great Stories in Easy English Published by S.Chand & Company Limited:**
2. Treasure Island by R.L. Stevenson
3. Tales From Shakespeare by Charles and Mary Lamb.
4. A Tale of Two Cities by Charles Dickens.
5. Vocabulary Builder: English in Contexts for students of Engineering and Technology

**Reference Books:**


1. Comfort, J. and others (2012). *Speaking Effectively.* U.K: Cambridge University Press.
2. Murphy, Raymond. *Intermediate English Grammar.* Cambridge University Press.
3. Lewis, N.(2005 ).*Word Power Made Easy.U.K: Bloomsbury.*
4. McCarthy and O'Dell. F (2008).*Test Your English Vocabulary in Use:* Upper – Intermediate U.K: Cambridge University Press
5. O'Dell. F and McCarthy (2010).*English Collocations in Advanced Use.* New Delhi :Cambridge University Press.
6. Cambridge IELTS Examination Papers. New Delhi :Cambridge University Press.
7. TOEFL Examination Papers.
8. BEC Examination Papers.

Hornby.A.S. (2010). *Oxford Advanced Learner's Dictionary*. New Delhi: Oxford University Press.


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# MATHEMATICS – I
## (Common to All Branches)
I Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To find the solutions of 1st and 2nd order Differential equations.
- To find the solutions of multiple integral problems using calculus and vector concepts.

**Learning Outcomes:**

Students will be able to

- apply 1st and 2nd order differential equations to various Engineering Problems.
- apply the techniques of partial differentiation to find maxima and minima of two variables.
- evaluate single and double integrals using various types of curves.
- apply the concepts of vector differentiation and integration to the surface and volume integrals.

**UNIT – I: Linear Differential Equations of first order**

Differential equations of first order – Exact – Equations reducible to Exact, Linear and Bernoulli.

Applications: Newton's law of cooling, law of natural growth and decay.

**UNIT – II: Linear Differential Equations of Second and higher order**

Linear differential equations of second and higher order with constant coefficients-Complete solution, Operator D, Rules for finding complementary function, Inverse operator for D, Rules for finding particular integral with Right hand side term of the type $e^{ax}$, Sin ax, cos ax, polynomials in x, $e^{ax}$ V(x), x.V(x). Applications: LCR circuits.

**UNIT – III: Partial Differentiation**

Introduction - Total derivative - Chain rule - Functional dependence – Jacobian. Application: Maxima and Minima of functions of two / three variables with or without constraints.

**UNIT – IV: Multiple Integrals**

Introduction to Curve Tracing [Cartesian and Polar Curves]. Change of order of integration, Areas by double integrals, Volumes by triple integrals.

**UNIT – V: Vector Differentiation**

Vector Differentiation: Gradient- Divergence- Curl - Laplacian operator

**UNIT – VI: Vector Integration**

Line, surface and volume integrals. Integral theorems: Greens - Stokes - Gauss Divergence Theorems (Without proof) and related problems. Applications: Work done, flux across the surface.

**Text Books:**


1. B.S.Grewal, Higher Engineering Mathematics : 42nd edition, Khanna Publishers,2012, New Delhi.
2. Dr. T.K.V.Iyengar, Dr. B.Krishna Gandhi, S.Ranganatham and Dr.M.V.S.S.N.Prasad, Engineering Mathematics, Volume-I : 11th edition, S. Chand Publishers, 2012, New Delhi.


**Reference Books:**


1. B.V.Ramana, Engineering Mathematics: 4th Edition, Tata McGraw Hill, 2009, New Delhi.
2. U.M.Swamy, A Text Book of Engineering Mathematics – I & II: 2nd Edition, Excel Books, 2011, New Delhi.
3. Erwin Kreyszig, Advanced Engineering Mathematics : 8th edition, Maitrey Printech Pvt. Ltd, 2009, Noida.


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# ENGINEERING PHYSICS
## (Common to CE, EEE & ME)
I Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To understand principles of solid state materials for use in the engineering applications.

**Learning Outcomes:**

Students will be able to

- apply the principles of light for optical communication.
- Identify the appropriate solid state materials for engineering applications.
- apply Quantum mechanics to study the behavior of a particle.

**UNIT – I: Wave Optics**

**Interference:**

Introduction – Interference in thin films by reflection –Newton's rings.

**Diffraction:**

Introduction – Fraunhofer diffraction - Fraunhofer diffraction at single slit– Diffraction grating – Resolving power of a grating

**Polarization:** Introduction – Types of Polarization – Double refraction – Quarter wave plate and Half Wave plate.

**UNIT – II: Lasers & Fiber Optics**

**Lasers:**

Introduction – coherent sources – Characteristics of lasers – Spontaneous and Stimulated emission of radiation – Einstein's coefficients– Population inversion – Helium Neon laser – $Co_2$ laser – semi conductor lasers.

**Fiber Optics :**

Introduction, Principle of Optical Fiber - Total Internal Reflection, Conditions for Light to Propagate - Numerical Aperture and Acceptance Angle, Optical Fiber Construction, Types of Optical Fibers - Step Index Fibers and Graded Index Fibers, Advantages of Optical Fibers in Communications.

**UNIT – III: Introductory Solid State Physics**

**Crystal Structure**

Introduction, Basic Terms - Lattice, Basis, Crystal Structure,CoordinationNumber, Atomic Radius, Packing Fraction, Free Volume, LatticeParameters, Unit Cell and Primitive Cell, Crystal Systems and Bravais Lattices, Structure and Packing

Fractions of Simple Cubic, Body Centered Cubic and Face Centered Cubic Crystal Structures.

**X-Ray Diffraction**

Crystal Planes, Directions and Miller Indices, Distance of Separation between successive hkl Planes - Inter Planar Spacing, Diffraction of X-Rays by Crystal Planes - Bragg's Law

**UNIT – IV: Essentials Of Materials Science**

**Magnetic Properties**: Magnetic permeability – Magnetization – Orgin or magnetic moment – Classification of Magnetic materials – Dir, para, Ferro, Hysteresis curve.

**Dielectric Properties**: Introduction – Dielectric constant – Electronic, ionic and orientational polarization – internal fields – Clausius –Mossotti equation

**Superconductivity**: General properties – Meissner effect – Type I and Type II superconductors – BCS Theory – Penetration depth – DC and AC Josephson effects (Qualitative). Applications of Super conductors.

**UNIT – V: Semiconductor**

Introduction – Intrinsic semiconductor and carrier concentration – Equation for conductivity – Extrinsic semiconductor and carrier concentration – Drift and diffusion – Einstein s equation – Hall Effect – direct & indirect band gap semiconductors

**UNIT – VI: Preliminary Quantum Mechanics & Solid State Physics**

**Preliminary Quantum Mechanics**:

Introduction to matter waves – Schrodinger Time Independent and Time Dependent wave equations – Particle in a box.

**Free Electron Theory and Band Theory (Solid State Physics):**

Classical free electron theory – electrical conductivity – Fermi energy (Qualitative) -Quantum free electron theory – Bloch theorem (qualitative) – Kronig – Penney model.

**Text Books:**


1. Engineering Physics by Mani Naidu, Pearson Publications Chennai
2. A text book of Engineering Physics by M.N. Avadhanulu & P.G.Kshirasagar (S. Chand publications).
3. Engineering Physics by Gaur and Gupta.
4. Optics – 5th Edition – Ghatak (TMH Publications)


**Reference Books:**


1. Solid state Physics by A.J. Dekker (Mc Millan India Ltd).
2. Engineering Physics b;y M.R. Srinivasan (New Age international publishers )
3. Fundamental of Physics by Resnick, Halliday and Walker.


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## ENVIRONMENTAL STUDIES
## (Common to CE , EEE & ME)

I Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To know the multidisciplinary nature of Environment.
- To understand various measures of improvement & protection of Environment.

**Learning Outcomes:**

Students will be able to

- apply various mitigation measures to minimize environmental pollution.
- know the principles of Ecosystem.
- understand the various stages of Environmental Impact Assessment (EIA).

**UNIT – I: Ecology & Environment**

**Multidisciplinary Nature of Environmental Studies:**

Definition, Scope, Importance and public awareness of Environmental Studies - Concept of an Ecosystem – Components of an Ecosystem – Food Chain, Food Web, Ecological Pyramids – Energy flow – Bio-Geochemical Cycles – Ecological Succession – Major Types of Ecosystems – Forest, Grassland, Desert Land & aquatic Ecosystem.

**UNIT – II: Natural Resource**: **Classification and status**

**Water Resources**: Used and over utilization of surface & ground water – Conflicts over water – Big dams, Benefits and problems.

**Land Resource**: Land as a resource, Soil Erosion, Sources of Land degradation, Soil conservation practices – case studies.

**Forest Resources**:Use and over – Exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people – Case Studies related to deforestation.

**Food & Fodder Resources**: World food problems, changes caused by agriculture and overgrazing – effects of modern agriculture – fertilizer, pesticide related problems, water logging, Eutrophication, super pest, salinity, organic farming – Case studies.

**Mineral Resources**: Use and exploitation problems, environmental effects of extracting and using mineral resources – Case studies.

**Energy Resources**

**UNIT – III: Biodiversity and its conservation**

Introduction, Definition – genetic and ecosystem diversity – Biogeographical classification of India – value of biodiversity: consumptive use, productive use,

social, ethical, Aesthetic, option values and ecosystem service values – India as a mega diversity nation – Threats to biodiversity: habitat loss, poaching of wild life – man, wild life conflicts – Endangered and endemic species of India – conservation of biodiversity: In – situ and Ex-situ conservation of biodiversity.

**UNIT – IV: Environmental pollution**

Definition, cause, effects and control measures of

a) Air pollution b) Water pollution
c) Noise pollution d) Soil pollution
e) Environmental Impact Assessment (EIA) – Definition, Significance & Classification.

**UNIT – V: Waste Management**

Industrial solid waste – Municipal solid waste – Industrial waste waters – Solid waste – Biomedical waste – hazardous waste – e-waste – Green building – Green Development Mechanism – Carbon Credits – Carbon Trading.

**UNIT – VI: Social Issues and Environment**

Climate change: Global warming, Acid rains, Ozone layer depletion – case studies. Sustainable development and unsustainability–Rain water harvesting, watershed management, water conservation–Environmental Ethics–environmental Law (Air, Water, Wild life, forest, Environmental protection act)

**Text Books:**


1. Environmental studies: Anubha Kaushik,C.P.Kaushik:New Age International Publishers.
2. Society and Environment: Dr.Suresh K.Dhameja:S.K.Kataria and Sons
3. Environmental Studies: Benny Joseph:Tata Mc Graw-Hill Publishing Company Limited.


**Reference Books:**


1. A text of Environmental Studies: Shashi chawala:Tata Mc graw Hill Education Private Limited.
2. Environmental Science & Engineering: P.Anandan, R.Kumaravelan, Scitech Publications (India) Pvt. Ltd.
3. Environmental Studies by R. Rajagopalan 2nd Edition 2011, Oxford University Press.
4. Environmental Studies by Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.


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

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To impart the basic concepts of Engineering Mechanics and the principles of various force systems under static and dynamic conditions.

**Learning Outcomes:**

Students will be able to

- determine the resultant of the given force systems.
- analyze force systems using equations of equilibrium.
- determine centroid, center of gravity and moment of inertia of areas and bodies.
- apply virtual work principle to simple beams and trusses.
- distinguish between kinematics and kinetics.
- apply the work energy and impulse momentum methods of various engineering problems.

**UNIT – I: Introduction to Engineering Mechanics**

Basic Concepts.

**Systems of Forces:**

Coplanar, Concurrent and parallel forces – Resultant – Composition and resolution of forces, method of projections – Moment of Force systems in plane and its Application – Couples.

**Equilibrium of Systems of Forces:**

Free Body Diagrams, Equations of Equilibrium of Coplanar Systems. Lami's Theorem - Equilibrium of Coplanar forces in plane and space – condition of equilibrium.

**UNIT – II: Friction**

Introduction, limiting friction and impending motion - Coefficient of friction, cone of static friction, applications of friction- Impending motion of connected bodies, ladder friction and wedges - Principle of screw jack & Belt friction.

**UNIT – III: Centroid**

Centroids of simple figures (from basic principles) – Centroids of Composite Figures

**Centre of Gravity:**

Centre of gravity of simple bodies (from basic principles), centre of gravity of composite bodies, pappu's theorems.

**Area moments of Inertia:**

Definition, Moment of Inertia of standard figures – Polar Moment of Inertia, Transfer Theorem, Moment of Inertia of composite figures.

**UNIT – IV: Mass Moment of Inertia**

Transfer Formula for Mass moment of Inertia, Mass moment of Inertia of standard bodies.

**Virtual work:**

Principle – Equilibrium of ideal systems – Virtual displacement – Applications to connected systems, simple beams, ladders and trusses.

**UNIT – V: Kinematics**

Rectilinear and Curve linear motions – Time, Displacement, Velocity and Acceleration & their relations – Linear & Angular.

**Kinetics:**

Analysis as a Particle, Newton's Laws of motion, D' Alembert's Principle– Simple applications - Analysis as a Rigid Body in Translation – Fixed Axis Rotation – Simple Applications.

**UNIT – VI: Work – Energy & Impulse - Momentum Method**

Equations for Translation, Work-Energy Applications to Particle Motion and Connected Systems - Impulse momentum method – Simple applications.

**Text Books:**


1. Engineering Mechanics, Timoshenko & Young, Tata Mc Graw – Hill education (India) Pvt. Ltd.
2. Engineering Mechanics, R.K.Bansal, Laxmi publications Pvt. Ltd.


**Reference Books:**


1. Singer's Engineering Mechanics Statics and Dynamics, K.Vijay Kumar Reddy and J.Suresh Kumar, B.S publications, Hyderabad.
2. Engineering Mechanics statics and dynamics, Nelson e.w, Tata Mc Graw–Hill publishing company limited, New Delhi.
3. Engineering. Mechanics, S.S.Bhavikatti and K.G.Rajashekarappa, New age International Pvt. Ltd., Publishers.
4. Engineering Mechanics A.K.Tayal, Umesh Publications.


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# ENGINEERING GRAPHICS - I

I Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To highlight the significance of universal language of engineers.
- To impart basic knowledge and skills required to prepare engineering drawings.

**Learning Outcomes:**

Students will be able to

- apply principles of drawing to represent dimensions of an object.
- construct polygons, scales and curves.
- draw projections of points, lines and planes.
- draw projections on auxiliary reference planes.

**UNIT – I: Introduction**

Principle of Dimensioning, Geometrical Construction- Polygons.

**Scales** : Plain, Vernier and Diagonal Scales.

**UNIT – II: Conic Sections**

Ellipse, Parabola, Hyperbola –General Method. Curves – Epi Cycloid, Hypocycloid; Involute

**UNIT – III: Orthographic Projections**

Introduction to Orthographic Projections; Projections of Points; Projections of Straight Lines parallel to both planes; Projections of Straight Lines-Parallel to one and inclined to other plane.

**UNIT – IV: Projections of Straight Lines**

Projections of Straight Lines inclined to both planes, determination of true lengths, angle of inclinations and traces.

**UNIT – V: Projections of Planes**

Regular Planes Perpendicular / Parallel to one Reference Plane and inclined to other Reference Plane; inclined to both the Reference Planes.

**UNIT – VI: Projections on Auziliary Reference Planes**

Projections on Auxiliary Reference Planes : Auxiliary Plane Method - Projection of Point on Auxiliary vertical Plane and Inclined Plane - Auxiliary front view - Auxiliary top view.

**Semester End Examination Pattern:**

Semester end examination paper consists of eight questions out of which five questions are to be answered. All questions carry equal marks.

**Text Books:**

1. Engineering Drawing by N.D. Bhatt, Chariot Publications.
2. Engineering Drawing by K. Venugopal, V. Prabhu Raja, G. Sreekanjana, New Age International Publishers.

**Reference Books:**

1. Engineering Drawing by M.B. Shah and B.C. Rana, Pearson Publishers.
2. Engineering Drawing by Dhananjay A. Jolhe, Tata McGraw Hill Publishers.
3. Engineering Graphics for Degree by K.C. John, PHI Publishers.

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## PROFESSIONAL COMMUNICATION LAB - I
## (Common to All Branches)

I Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To strengthen the oral communication skills of the learners for communicative functions;
- To hone their pronunciation;
- To build confidence in them to communicate effectively in English.

**Learning Outcomes:**

Students will be able to

- enhance their basic communication skills to interact with people around them;
- shed their inhibition and take part in different speaking activities;
- respond in several contexts using the expressions they will have learned;
- speak English with reasonably good pronunciation.

**UNIT – I:**

- Greeting others
- Taking leave
- Introducing
- Identifying and pronouncing vowel sounds

**UNIT – II:**

- Asking for information
- Giving information
- Identifying and pronouncing diphthongs

**UNIT – III:**

- Inviting
- Accepting and declining invitations
- Identifying and pronouncing consonants

**UNIT – IV:**

- Giving commands or instructions
- Requesting
- Using accent on the appropriate syllable
- Speak rhythmically

**UNIT – V:**

- Giving suggestions
- Expressing opinions
- Using different tones in connected speech

**Text Books:**

1. Strengthen your communications skills by Maruthi Publications

**Reference Books:**

1. Strengthen your steps by Maruthi Publications
2. Speak well by Orient Blackswan.
3. Jones, D. English Pronunciation Dictionary.

# ENGINEERING PHYSICS LAB
## (Common to CE , EEE & ME)

I Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To understand Active and Passive Electronic Components.
- To measure magnetic field along the axis of circular coil.
- To learn waves and oscillations.
- To explore the nature of light.

**Learning Outcomes:**

Students will be able to

- calculate the time constant of RC circuit & Predict resonance frequency of LCR circuit.
- verify magnetic field along the axis of a circular coil.
- observe the regulatory nature of Zener diode & Identify energy gap of semiconductor.
- estimate rigidity modulus of a given wire.
- determine radius of curvature of a given Plano convex lens.

| S.N. | Name of the experiment- Aim |
|---|---|
| | **Electromagnetism and Electronics** |
| 1 | Study the variation of Magnetic field along the axis of a Solenoid coil using Stewart-Gee's Apparatus. |
| 2 | Draw the frequency response curves of LCR Series and Parallel circuits |
| 3 | Determine the time constant for a CR Circuit |
| 4 | Determine the Band Gap of a semiconductor using a PN junction diode. |
| 5 | Study of characteristic curves (I/V) of a Zener diode to determine its breakdown voltage. |
| 6 | Determine the rigidity modulus of given wire |
| 7 | Determine the radius of curvature of given planoconvex lens |
| 8 | Determine the thickness of thin objects by optical wedge method |
| 9 | Determine the velocity of sound in air by using volume resonator |
| 10 | Determine the wave length of Y1 and Y2 lines by diffraction grating normal incidence |

**Reference Books:**

(lab manuals, equipment user manuals, text books, data books, code books, etc.)


1. College lab manuals
2. Practical Physics for engineering students by Vijay Kumar & T. Radha Krishna.
3. Lab manual of Engineering Physics by Dr. Y.Aparna and Dr. K.Venkateswara Rao (VGS Books links, Vijayawada)


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# ENGINEERING WORKSHOP

I Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

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

**Learning Outcomes:**

Student 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.
- fabricate simple components using tin smithy.

**List of Trades**:

**Carpentry :**

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

**Fitting :**

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

**Black Smithy :**

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

**House Wiring :**

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

**Tin Smithy:**

1. Taper Tray
2. Square Box without lid
3. L - Pipe
4. Funnel

**Note:** Practice any two experiments from each trade

**Reference Books:**


1. Engineering Drawing by M.B. Shah and B.C. Rana, PearsonPublishers.
2. Engineering Drawing by Dhananjay A. Jolhe, Tata McGraw Hill Publishers.
3. Engineering Graphics for Degree by K.C. John, PHI Publishers.

## PROFESSIONAL COMMUNICATION - II
## (Common to All Branches)

I Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To equip students for their present and future academic pursuits: to understand classroom lectures, read textbooks, do reference reading, participate in classroom discussions, and write assignments and examination answers.
- To develop in them the communication skills and social graces necessary for functioning effectively in the social and other situations in which they may be called upon to use English.
- To prepare them to secure employment and to function successfully in their career.

**Learning Outcomes:**

Students will be able to

- Produce and process language for academic, professional and social life.
- Produce coherent spoken and written discourse of various kinds with attention to appropriate strategies and conventions of writing.
- To take part in job interviews with confidence and competence.

**Speaking, Listening, Intensive Reading and Grammar Practice**

**UNIT – I:**

- To make effective telephone conversations
- To use the modal auxiliaries *can* and *could*
- To write persuasive letters
- To write a winning resume

**UNIT – II:**

- To effectively participate in an informal meeting
- To use articles and other determiners
- To get some practice in composing professional emails
- To plan a professional presentation

**UNIT – III:**

**Extensive Reading**

**Simplified Classics from the series Great Stories in Easy English:**

- *Oliver Twist by Charles Dickens*
- *Robinson Crusoe by Daniel Defoe*

**Vocabulary**

***'Vocabulary Builder: English in Contexts for students of Engineering and Technology'***

- GRE words 75 words
- Idioms 25
- Words often confused 15
- Collocations 15
- One word substitutes 25
- Phrasal verbs 25

**Speaking, Listening, Intensive Reading and Grammar Practice**

**UNIT – IV:**

- To effectively participate in an informal meeting
- To use passive voice
- To identify the structure of reader-oriented technical reports

**UNIT – V:**

- To use prepositions
- To use visual aids in a presentation

**UNIT – VI:**

**Extensive Reading**

***Simplified Classics from the series Great Stories in Easy English:***

- *Round the World in Eighty Days by Jules Verne*

**Vocabulary**

***'Vocabulary Builder: English in Contexts for students of Engineering and Technology'***

- GRE words 75 words
- Idioms 25
- Words often confused 15
- Collocations 15
- One word substitutes 25
- Phrasal verbs 25

**Text Books:**

1. Samson, T. (2010). *Innovate with English*. Hyderabad : Foundation **Great Stories in Easy English Published by S.Chand & Company Limited:**
   1. *Oliver Twist* by Charles Dickens
   2. *Robinson Crusoe* by Daniel Defoe
   3. *Round the World in Eighty Days* by Jules Verne
   4. *Vocabulary Builder : English in Contexts for Students of Engineering and Technology*

**Reference Books:**


1. Comfort, J. and others (2012). *Speaking Effectively.* U.K: Cambridge University Press.
2. Murphy, Raymond. *Intermediate English Grammar.* Cambridge University Press.
3. Lewis, N.(2005 ).*Word Power Made Easy.U.K: Bloomsbury.*
4. McCarthy and O'Dell. F (2008).*Test Your English Vocabulary in Use: Advanced* U.K: Cambridge University Press.
5. O'Dell. F and McCarthy (2010).*English Collocations in Advanced Use.* New Delhi: Cambridge University Press
6. Cambridge IELTS Examination Papers. New Delhi :Cambridge University Press.
7. TOEFL Examination Papers.
8. BEC Examination Papers.
9. Hornby.A.S. (2010). *Oxford Advanced Learner's Dictionary*. New Delhi: Oxford University Press.


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## MATHEMATICS - II
## (Common to All Branches)
I Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To determine the eigenvalues and eigenvectors.
- To understand the concepts of Fourier Series and Fourier Transforms.
- To solve partial differential equations of 1st and 2nd order.

**Learning Outcomes:**

Students will be able to

- use the concepts of eigenvalues and eigenvectors in Engineering problems.
- apply to transform a function into Fourier Series and Fourier Integral form.
- apply 1st and 2nd order partial differential equations to Engineering Problems.

**UNIT – I: Matrices**

Rank of Matrix- Echelon form, Normal form – System of Linear equations – Consistency-Gauss elimination Method. Applications to electrical circuits [Finding the current in an electric circuit].

**UNIT – II: Eigenvalues & Eigenvectors**

Eigenvalues - Eigenvectors – Properties – Cayley Hamilton Theorem (without proof) - Inverse and powers of a matrix using Cayley Hamilton theorem, Quadratic forms- Reduction of quadratic form to canonical form by Orthogonal Transformation– Rank - index – signature.

Applications: Free vibration of a two mass system.

**UNIT – III: Fourier Series**

Fourier series: Determination of Fourier coefficients (without proof) – Fourier series – even and odd functions – Fourier series in an arbitrary interval– Half-range sine and cosine series.

**UNIT – IV: Fourier Transforms**

Fourier integral theorem (only statement) – Fourier transform – sine and cosine transforms – properties – inverse Fourier transforms – Finite Fourier transforms.

**UNIT – V: 1st order Partial Differential equations**

Formation of partial differential equations by eliminating arbitrary functions – solutions of quasi linear equations using Lagrange's method, solutions of non-linear equations by 4 strandard forms and Charpit's method.

**UNIT – VI: 2nd order Partial Differential equations**

Method of Separation of Variables. One dimensional Heat, Wave and Laplace equations.

**Text Books:**

1. B.S.Grewal, Higher Engineering Mathematics : 42nd edition, Khanna Publishers,2012 , New Delhi.
2. Dr. T.K.V.Iyengar, Dr. B.Krishna Gandhi, S.Ranganatham and Dr.M.V.S.S.N.Prasad, Engineering Mathematics – II : 6th edition, S.Chand Publications, 2012, New Delhi.

**Reference Books:**

1. B.V.Ramana, Mathematical Methods: 4th Edition, Tata McGraw Hill, 2009,New Delhi.
2. Ravindranath, V. and Vijayalaxmi, A. : 2nd edition, A Text Book on Mathematical Methods, Himalaya Publishing House,2012, Bombay.
3. Dean G. Duffy, Advanced engineering mathematics with MatLab, CRC Press
4. Erwin Kreyszig, Advanced Engineering Mathematics:8th edition,Maitrey Printech Pvt. Ltd, 2009, Noida.

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# MATHEMATICAL METHODS
## (Common to CE, EEE & ME)

I Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To understand the various numerical techniques .
- To gain the knowledge of Laplace, z-transforms and their inverse transforms.

**Learning Outcomes:**

Students will be able to

- apply numerical techniques for solutions of Algebraic, transcendental and ordinary differential equations.
- transform ordinary function into Analytical function using Milne-Thompson Method.
- apply Laplace transforms to find the solutions of ordinary differential equations.
- apply Z–transforms to find solutions of difference equations.

**UNIT – I: Algebraic and Transcendental Equations**

Solution of Algebraic and Transcendental Equations- Introduction – Bisection Method – Method of False Position – Newton-Raphson Method.

**UNIT – II: Interpolation**

Interpolation- Introduction – Finite differences- Forward Differences –Back ward differences –Central differences – Symbolic relations – Newton formulae for interpolation – Lagranges interpolation.

**UNIT – III: Numerical Solutions Of Ordinary Differential Equations**

Solution by Taylors series – Euler and Modified Euler method – Picard method - $4^{th}$ order Runge-Kutta methods - Predictor and corrector method.

**UNIT- IV: Introduction To Complex Variables**

Continuity – Differentiability – Analyticity – Properties- Cauchy Riemann Equations in Cartesian and Polar coordinates. Harmonic functions and conjugates : Milne Thomson method.

**UNIT – V: Laplace Transforms and Inverse Laplace Transforms**

Laplace transforms of standard functions – Shifting Theorems, Transforms of derivatives and integrals – Unit step function –Dirac Delta function.

Applications : Evaluation of Improper Integrals.

Inverse Laplace transforms – Convolution theorem.

Application: Solution of ordinary differential equations.

**UNIT – VI: Z- Transforms**

Z-transform – properties – Damping rule – Shifting rule – Initial and final

value theorems -Inverse z- transform using Partial fractions, Convolution theorem.

Application: Solution of Difference equations by Z-transforms.

**Text Books:**


1. B.S.Grewal, Higher Engineering Mathematics : 42nd edition, Khanna Publishers,2012 , New Delhi.
2. Ravindranath. V, and Vijayalaxmi. A. : 2nd edition, A Text Book on Mathematical Methods, Himalaya Publishing House, Bombay.


**Reference Books:**


1. Dr. T.K.V.Iyengar, Dr. B.Krishna Gandhi, S.Ranganatham and Dr.M.V.S.S.N.Prasad, Mathematical Methods :6th edition, S. Chand Publications, 2011, New Delhi.
2. B.V.Ramana, Engineering Mathematics : 4th Edition, Tata McGraw Hill, 2009, New Delhi.
3. Erwin Kreyszig, Advanced Engineering Mathematics : 8th edition, Maitrey Printech Pvt. Ltd, 2009, Noida.


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## ENGINEERING CHEMISTRY
## (Common to CE, EEE & ME)

I Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To impart the knowledge of chemical and solar energy.
- To familiarize with various types of polymers, fuels and lubricants and their applications in engineering.

**Learning Outcomes:**

Students will be able to

- apply various methods of water treatment.
- understand the applications of chemical and solar energy in various engineering aspects.
- apply various chemical methods to prevent corrosion of metals.
- understand the process to prepare synthetic polymers used for various applications.
- know the characteristic features of lubricants and their applications.
- understand the need of green synthesis.

**UNIT – I: Water and Its Treatment**

Introduction, Hardness of water, types of hardness, Degree of hardness, Determination of hardness by EDTA Method, Numerical Problems on hardness of water by EDTA method. Softening of hard water by Permutit and Ion Exchange Processes, Treatment of brackish water by reverse osmosis, Potable Water, General Outline of municipal water treatment (Sedimentation, Filtration and chlorination).

**UNIT – II: Energy Sources**

**Chemical Sources of Energy:** Galvanic Cell - Single electrode potential – Electro chemical series-Problems on electrode potential using Nernst equation - Hydrogen and Calomel reference electrodes and measurement of pH by glass electrode – Leclanche cell, Lead **-** Acid accumulator, Hydrogen-Oxygen fuel cell and Methanol Fuel cell.

**Solar Energy:** Introduction–Harnessing of solar energy – Applications of solar energy - Photovoltaic cells-Solar reflectors (Parabolic trough, Solar dish and Solar tower) and Solar water heater.

**UNIT – III: Corrosion and Its Prevention**

Dry & wet corrosion – Mechanism – Pilling and Bedworth Rule - Factors influencing the rate of corrosion (Temperature, pH, Humidity of environment and position of metal in Galvanic series) - Types of Corrosion (galvanic corrosion, concentration

cell corrosion, pitting corrosion and stress corrosion) - Sacrificial Anodic method, Impressed voltage method – Metallic coatings (galvanization and tinning methods).

**UNIT – IV: Polymers**

Definitions of Polymer and Polymerization, Degree of polymerization and Functionality - Classification of polymers, Types of Polymerisation– Addition, Condensation and Co-polymerizations –Plastics – Thermoplastics – Thermosetting plastics, - Biodegradable polymers (PHBV & PHA). Preparation, properties and uses of poly styrene, PVC, PTFE, Bakelite, Buna-S rubber, Buna-N rubber, Thiokol rubber.

**UNIT – V: Fuels & Lubricants**

**Fuels:** Classification of fuels, calorific value, LCV & HCV and determination of calorific value of a solid fuel using Bomb calorimeter, Problems based on calorific values, Fischer-Tropsch Method and Bergius Method for preparation of Synthetic Petrol.

**Lubricants:** Definition and explanation of Lubrication-Types of Lubricants-Definition and significance of Viscosity, Flash and Fire Point, Pour and Cloud Point, Aniline point of a lubricant. - Engineering applications of lubricants.

**UNIT – VI: Green Chemistry**

Introduction- Principles of Green Chemistry, Methods of Green synthesis (aqueous phase, supercritical fluid extraction, green solvents and microwave induced methods), IWM (Integrated Waste Management), ZWT (Zero Waste Technology) Engineering Applications.

**Text Books:**


1. Text book of Engineering Chemistry by Jain & Jain. Dhanpat Rai Publishing Company.
2. Text book of Engineering Chemistry-II by Srinivasulu Doddaga, Ashima Srivastava, Roliverma. Parshva Publication.
3. 3. Engineering Chemistry by Dr. Bharathi Kumari Yalamanchili,VGS Publication.


**Reference Books:**


1. A Text book of Engineering Chemistry by S.S.Dara. S.Chand&Company Ltd.
2. Engineering Chemistry by J.C.Kurisascose and J.Rajaram.Tata Mc Graw-Hill Publishing.
3. A Text book of Engineering Chemistry by Balaram Pani.Galgotia Publications.
4. A Text book of Engineering Chemistry by Shashi Chawla. Dhanpat Rai Publications.
5. Industrial Chemistry by O.P.Veeramani and A.K.Narula. Galgotia Publications.
6. Text book of Engineering Chemistry by Jain & Jain. Dhanpat Rai Publishing Company.


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## PROBLEM SOLVING USING C
## (Common to EEE, ECE, CSE & IT)

I Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To introduce the steps of problem solving.
- To emphasize the role of logical flow charts and pseudo code in problem solving on computers.
- To impart skills for solving problems using C.

**Learning Outcomes:**

Students will be able to

- develop logical flow charts for solving problems.
- develop pseudo code for solving problems.
- solve simple to moderate problems on computer using C.
- self-learn advanced features of C.
- self-learn for solving complex problems on computers.

**UNIT – I: Problem Solving Steps**

Understanding problem, Formulating a mathematical model, Solving the mathematical model, Developing algorithm, Representingalgorithm as pseudo code or logical flow chart, Coding, Testing and Debugging.

General form of a C program, C Tokens – Constants, Identifiers, Operators, Punctuation and Keywords.

Basic data types, Data modifiers, Variable declaration statement, Console I/O statements, Assignment statement and Order of evaluation. Simple problems such as evaluating formulae.

**UNIT – II: Control Statements**

Selection Statements –if-else, nested if, switch, nested switch and ? Operator; Control Statements – For loop, while loop and do while loop; Jump Statements – return, goto, break, exit() and continue.

Problem Solving – Exchanging the values of two variables, Summation of a set of numbers, Factorial Computation, Sine function computation, Generation of Fibonacci sequence, reversing digits of an integer, Base conversion and Character to number conversion, LCM and GCD computation, Generating prime numbers, Computing prime factors of an integer, Raising a number to a large power, Computing the $n^{th}$ Fibonacci number.

**UNIT – III: Arrays**

Declaring, initializing and accessing of one dimensional and two dimensional arrays and strings; and multidimensional arrays.

Problem Solving – Computing mean, range and variance of a set of numbers, Array order reversal, Histogramming, Removal of duplicates from an ordered array, Partitioning an array, Finding $k^{th}$ smallest element and Longest monotone subsequence.

**UNIT – IV: Pointers and functions**

Pointers – Variables, Operators, Expressions and Multiple indirection.

Functions – General form of functions, Passing parameters by value and Passing parameters by address, Dynamic memory allocation functions, Pointers and arrays, Pointers and functions, recursive functions and String handling functions, Problem solving using functions.

**UNIT – V: Structures and Unions**

Structures -Definition, declaration, initialization of structures, accessing structure members, nested structures, arrays of structures, array within structures, structures and functions.

Unions - Bit-Fields and enumerations; Problem solving using structures, unions, Bit-fields and enumerations.

**UNIT – VI: Files**

File Handling- Text and binary files, commonly used C file system functions, File Processing Operations – inserting, deleting, searching and updating a record and displaying file contents. Random access files.

Problem solving – Billing at Checkout counter of a supermarket, Preparing consolidated attendance / marks statements, and Performing banking operations.

**Text Books:**


1. R G Dromey, How to Solve it by Computer, Prentice-Hall of India, 1999.
2. Jeri R Hanly and Elliot B Koffman, Problem Solving and Program Design in C, Seventh Edition, Pearson, 2014.
3. Herbert Schildt, C: The Complete Reference, Tata McGraw-Hill, 2008.


**Reference Books:**


1. C Programming, E Balaguruswamy, 3rd edition, TMH.
2. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE.
3. Programming in C, Second Edition Pradip Dey and Manas Ghosh, OXFORD Higher Education.


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## ENGINEERING GRAPHICS - II

I Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To impart knowledge and skills required to draw projections of solids in different contexts.
- To visualize and represent the pictorial views with proper dimensioning and scaling.

**Learning Outcomes**:

Students will be able to

- represent sectional views of solids.
- develop the surfaces of regular solids.
- obtain a definite curve at the intersection of solids.
- convert isometric views into orthographic projections and vice-versa.

**UNIT – I: Projections of Solids**

Prisms, Cylinders, Pyramids and Cones with the axis inclined to one Plane and for both the reference planes.

**UNIT – II: Sections of Solids**

Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid,Cone .

**UNIT – III: Development of Surfaces**

Development of Surfaces of Right Regular Solids – Prisms, Cylinder, Pyramid, Cone.

**UNIT – IV: Interpenetration of Solids**

Interpenetration of Right Regular Solids – Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone.

**UNIT – V: Isometric Projections**

Principles– Isometric Scale –Isometric Views of Lines, Plane Figures, simple solids. Conversion of Orthographic Views to Isometric Views

**UNIT – VI: Transformation of Projections**

Conversion of Isometric Views to Orthographic Views

**Semester End Examination Pattern:**

Semester end examination paper consists of eight questions out of which five questions are to be answered. All questions carry equal marks.

**Text Books:**

1. Engineering Drawing by N.D. Bhatt, Chariot Publications.
2. Engineering Drawing by K. Venugopal, V. Prabhu Raja, G. Sreekanjana, New Age International Publishiers.

**Reference Books:**

1. Engineering Drawing by M.B. Shah and B.C. Rana, Pearson Publishers.
2. Engineering Drawing by Dhananjay A. Jolhe, Tata McGraw Hill Publishers.
3. Engineering Graphics for Degree by K.C. John, PHI Publishers Engineering Graphics by P. Kannaiah / K.L.Narayana / K. Venkata Reddy

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## PROFESSIONAL COMMUNICATION LAB – II
## (Common to All Branches)

I Year – II Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To strengthen the oral communication skills of the learners for communicative functions at an advanced level;
- To train them in handling complex communication situation;
- To give them adequate practice for communication in professional situations like group discussions, presentations and interviews.

**Learning Outcomes:**

Student will be able to:

- enhance their oral communication skills to perform communicative functions;
- speak confidently in public and handle complex communication situation;
- face job interviews with confidence and competence.

**UNIT – I:**

- Body Language
- Know how body language is used in communication
- Interpret non-verbal symbols

**UNIT – II:**

- Dialogues
- Starting a conversation
- Useful functions
- Telephone Etiquette
- Making a small talk

**UNIT – III:**

- Presentation Skills
- Present information with confidence, clarity and conviction
- Use the language of presentations
- Evaluate presentations

**UNIT – IV:**

- Group Discussion
- Participate in a group discussion
- Expressing ideas logically
- Using appropriate language in group discussions

**UNIT – V:**

- Become aware of various types of interviews
- Be able to participate in interviews confidently

**UNIT – VI:**

- Debates
- Able to argue for or against something
- Able to participate in debates

**Text Books:**

1. Strengthen your communications skills by Maruthi Publications

**Reference Books**:

1. Strengthen your steps by Maruthi Publications
2. Speak well by Orient Blackswan.
3. Patnaik., Group Discussion and Interview Skills. by Foundation.

# ENGINEERING CHEMISTRY LAB
## (Common to CE, EEE & ME)

I Year – II Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To practice the titrations of chemical analysis for determining the quality of water.
- To know the preparation of Bakelite.

**Learning Outcomes:**

Students will be able to

- apply various titrations required for water quality analysis.
- understand the preparation of resin.

**List of Experiments:**

Introduction to Chemistry Lab (the teachers are expected to teach fundamentals like Primary, Secondary Standard Solutions , Normality, Molarity, Molality etc and laboratory ware used, error ,accuracy, precision, Theory of indicators, use of volumetric titrations.

1. Practice experiment-Determination of the amount of HCl using standard $Na_2CO_3$.
2. Determination of alkalinity of water sample.
3. Determination of acidity of water sample.
4. Determination of Ferrous iron by permanganometric method.
5. Determination of Ferric Iron using standard $K_2Cr_2O_7$ solution.
6. Determination of Total hardness of the water sample by EDTA method.
7. pH metric titrations - Determination of concentration of HCl using glass electrode.
8. Determination of pH of the water sample by using pH meter.
9. Determination of conductivity of the water sample by using conductivity meter.
10. Conductometric titrations between strong acid and strong base
11. Determination of turbidity of the water sample by using turbidity meter.
12. Estimation of total dissolved salts in water sample.
13. Preparation of Phenol - Formaldehyde resin.

**Lab Manual:**


1. Engineering chemistry laboratory manual &record By Srinivasulu. D Parshva publications.
2. Engineering Chemistry Lab Manual by Dr. K.Anji Reddy. Tulip publication.
3. Engineering Chemistry Lab Manual by Dr. Jyotsna Cherukuri. V.G.S publication.
4. K.Mukkanti (2009) Practical Engineering Chemistry, B.S. Publication.


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## PROGRAMMING LAB
## (Common to EEE, ECE, CSE & IT)

I Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To familiarize with the discrete components of computers and networking components.
- To familiarize with usage of MS Office Tools.
- To provide the practice of solving problems on computer using C.

**Learning Outcomes:**

Students will be able to

- identify discrete components of computers and networking components and describe their functions.
- employ MS Office Tools for documentation and presentations and making computations.
- use computer for solving problems.

**Part- A**

**Exercise - 1: IT Workshop**

a) Identifying the discrete components of a computer and networking components
b) Demonstration of assembling a computer
c) Demonstrating installation of OS and applications

**Exercise - 2: IT Workshop**

a) Creating a document using MS Word
b) Creating a document using LaTeX

**Exercise - 3: IT Workshop**

a) Familiarizing with the usage and applications of MS Excel Using Excel.
b) Creating a presentation using MS Power point.

**Exercise - 4: IT Workshop**

Familiarizing with the Integrated Development Environment (IDE) for eveloping C programs

**Part – B**

**Exercise - 5: Write a C program for the following**

a) Calculate the area of triangle using the formula area = $(s\,(s-a)\,(s-b)(s-c))^{1/2}$ where $s= (a+b+c)/2$
b) Find the largest of three numbers using ternary operator.
c) Find the roots of a quadratic equation.

**Exercise - 6: Develop a C program for the following**

a) 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)
b) Check whether given number is Prime (or) not
c) Display first N natural numbers.
d) Calculate electricity bill for the consumed units – assume suitable constraints.
e) Find the sum of individual digits of a positive integer and find the reverse of the given number.

**Exercise - 7: Design a C program for the following**

a) Find the largest and smallest numbers in the array.
b) Search whether the given element is in the array.
c) Perform Addition, subtraction and multiplication of Matrices
d) Delete n Characters from a given position in a given string.
e) Illustrate at least five string handling functions.

**Exercise - 8: Implement a C program for the following**

a) Calculate mean, standard deviation and variance for a given set of values using functions
b) Sort a given set of numbers in ascending order using functions
c) Both recursive and non-recursive functions for the following
   i) To find the factorial of a given integer.
   ii) To find the GCD (greatest common divisor) of two given integers.
   iii) To generate Fibonacci sequence.

**Exercise - 9: Prepare a C program for the following**

a) To implement a structure to read and display the Name, date of Birth and salary of ten Employees.
b) To display the Name, Marks in five subjects and total marks of given number of students. (Using array of structures).
c) Functions to perform the following operations using Structure:
   i) Reading a complex number
   ii) Writing a complex number
   iii) Addition of two complex numbers
   iv) Multiplication of two complex numbers

**Exercise - 10: Develop C program for the following**

a) Function to exchange (Swap) values of two integers using call by reference.
b) Illustrate the usage of dynamic memory management functions.
c) Develop a program to operations on a file.
d) To copy contents of one file to another.
e) To count the number of characters, words and lines in a file.

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# MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

II Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To learn about various types of business organizations.
- To access the demand for a particular product.
- To study the various types of cost concepts.
- To have an idea about the types of markets.
- To make the students expertise in account principles and concepts.

**Learning Outcomes:**

Students will be able to

- know the various factors that influence demand of particular product.
- forecast the future demand using various tools & techniques.
- take the further decisions based on the demand.
- aware of costs incurred in the production.
- alter the combination of inputs to attain the desired results.
- Access the minimum level of production that a firm should carry by using BEP.
- understand which market is suitable to introduce the product.
- ability to know various methods to determine the pricing.

**UNIT – I: Introduction to Managerial Economics**

Definition, Nature and Scope of Managerial Economics– Relation of Managerial Economics with other disciplines.

**Demand Analysis**: Demand Determinants, Law of Demand and its exceptions, Significance & Types of Elasticity of Demand. Factors governing demand forecasting- Methods of Demand forecasting.

**UNIT – II: Theory of Production and Cost Analysis**

**Production Function** – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas production function. Production function, Laws of Returns, Internal and External Economies of Scale.**Cost Analysis**: Cost concepts & BEP Analysis Break-Even Point (simple problems)

**UNIT – III: Introduction to Markets & Pricing strategies**

**Market structures:** Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Price & output determination under Perfect Competition

**Pricing strategies:** Methods of Pricing: Cost Plus Pricing, Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing, Block Pricing, Bundling Pricing, Peak Load Pricing, Cross Subsidization.

**UNIT – IV: Introduction to Business Organizations**

Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, Changing Business Environment in Post-liberalization scenario & Phases of Business Cycle.

**UNIT – V: Introduction to accountancy**

Introduction to Accountancy, Types of Accounts, Ledgers, Maintenance of Ledgers & Trial Balance, Introduction to Final Accounts, Problems on Trading , Profit & Loss Account and Balance sheet, Problems with simple adjustments

**UNIT – VI: Ratio Analysis & Capital Budgeting**

**Ratio Analysis:** Introduction to financial Analysis; analysis& Interpretation of financial statements through Liquidity ratios, Profitability & Solvency ratios, turnover ratios

**Capital budgeting:** capital & its significance, estimation of fixed & working capital requirements, methods of raising capital, introduction to capital budgeting, traditional methods of capital budgeting & discounted cash flow methods(simple problems)

**Text Books:**


1. Aryasri: Managerial Economics and Financial Analysis, 2/e, TMH, 2005.
2. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2003.


**References:**


1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, PHI, 4th Ed.
3. Suma Damodaran, Managerial Economics, Oxford University Press.
4. Lipsey & Chrystel, Economics, Oxford University Press.
5. S. A. Siddiqui & A. S. Siddiqui, Managerial Economics & Financial Analysis, New age International Space Publications.
6. Domnick Salvatore: Managerial Economics in a Global Economy, 4th Edition, Thomson.
7. Narayanaswamy: Financial Accounting—A Managerial Perspective, PHI.


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## ELECTRICAL AND ELECTRONICS ENGINEERING

II Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

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

**Learning Outcomes:**

Students will be able to

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

**UNIT - I:**

**Electrical Circuits:** Basic definitions, Types of elements, Ohm's Law, Resistive networks, Kirchhoff's Laws, Inductive networks, capacitive networks, Series, Parallel circuits and Star-delta and delta-star transformations.

**UNIT - II:**

**DC Machines:** Principle of operation of DC Generator – emf equation - types – DC motor types –torque equation – applications – three point starter.

**UNIT - III:**

**Transformers:** Principle of operation of single phase transformers – emf equation – losses – efficiency and regulation.

**UNIT - IV:**

**AC Machines:** Principle of operation of alternators, Principle of operation of induction motor – slip – torque characteristics – applications. Single phase induction motor - Constructional features, Principle of operation.

**UNIT - V:**

**Special Purpose Motors:** Construction, working principle, characteristic and applications of stepper motors, A.C. and D.C servomotors, universal motors, Industrial applications.

**UNIT - VI:**

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

**Text Books:**


1. Essentials of Electrical and Computer Engineering by David V. Kerns, JR. J. David Irwin/Pearson.
2. Principles of Electrical and Electronics Engineering by V.K.Mehta, S.Chand & Co.


**Reference Books:**


1. Introduction to Electrical Engineering – M.S Naidu and S. Kamakshaiah, TMH Publ.
2. Basic Electrical Engineering by Kothari and Nagarath, TMH Publications, 2nd Edition.
3. Fundamentals of Electrical Engineering by Rajendra Prasad, PHI publications, 2nd edition.
4. Ashfaq Husain, Fundamentals of Electrical Engineering' Dhanpat Rai & Co.


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# KINEMATICS OF MACHINES

II Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To introduce the concepts of study of relative motion between the links of mechanisms.
- To familiarize with the kinematic analysis of mechanical elements like Hooke's Joint, cams, belts and gears.

**Learning Outcomes:**

Students will be able to

- distinguish different mechanisms with their applications.
- determine the velocities and accelerations of links in mechanisms.
- perform kinematic analysis of Hooke's joint, gears and gear trains.
- construct cam profiles for different types of follower motions.

**UNIT - I: Mechanisms**

Links , kinematic pairs, constrained motion, kinematic chain, Degrees of freedom, Kutzbach criterion for planar mechanism, Grashoff's law, mechanism, inversion of mechanism – four bar, single slider and double slider.

**UNIT - II: Straight Line Motion Mechanisms**

Introduction, condition of straight line, exact straight line – Peaucellier, Hart, Scott -Russel mechanisms, approximate straight line-modified Scott Russel, Grasshopper, Watt, Tchebicheff and Robert Mechanisms, Pantograph.

**Steering Mechanisms:** Conditions for correct steering, Davi's steering gear, Ackermann steering gear.

**Hooke's Joint:** Single and double Hooke's joint – Velocity ratio, polar diagram, applications.

**UNIT - III: Velocity Analysis of Mechanisms**

Instantaneous center, Kennedy theorem, Determination of velocities using Instantaneous centre method, relative velocity method and Klien's construction.

**Acceleration Analysis of Mechanisms:** Introduction to acceleration, acceleration analysis of slider crank and four bar mechanism using relative velocity method and Klien's construction.

**Synthesis of mechanisms:** Introduction, function generation for four bar mechanism, Frudensten equation for four bar mechanism, Chebychev spacing.

**UNIT - IV: Cams**

Cam and followers – Types, Terminology, Types of follower motion- Uniform velocity, SHM, uniform acceleration and retardation and cycloidal, Construction of cam profiles.

**UNIT - V: Gears**

Types, terminology, materials, law of gearing, Velocity of sliding, Forms of teeth, path of contact, arc of contact, phenomena of interference, Introduction to Helical and bevel gears.

**UNIT - VI: Gear Trains**

Types- Simple, Compound, reverted and Epicyclic gear Train, kinematic analysis of gear trains -Differential of an automobile.

**Text Books:**


1. Dr. R. K. Bansal, "Theory of machines", Fire wall Media Publishers.
2. S. S. Rattan, "Theory of Machines", Tata McGraw Hill Publishers 3rd Edition.


**Reference Books:**


1. Amitabha Ghosh, "Theory of Mechanisms and Machines", Affiliated East west press.
2. Sadhu Singh, "Theory of Machines", Pearsons Education.
3. J. E. Shigley, "Theory of Machines & Mechanisms", Oxford University Press, (USA) 4th edition.
4. Thomas Bevan, "The Theory of Machines" Pearsons Education.


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# MECHANICS OF SOLIDS

II Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

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

**Learning Outcomes:**

Students will be able to

- determine stresses and strains in bars subjected to loads and temperatures.
- draw shear force and bending moment diagrams for beams.
- evaluate the bending and shear stresses in beams.
- calculate the deflections in beams subjected to transverse loads.
- determine the stresses induced in thick and thin cylinders subjected to pressures.
- estimate the strain energy in members subjected to different types of loads.
- evaluate the crippling load for columns with different end conditions.

**UNIT - I:**

**Simple Stresses & Strains:** Elasticity and plasticity – Types of stresses & strains– Hooke's law – stress – strain diagram for ductile and brittle materials, Working stress, Factor of safety, Lateral strain, Poisson's ratio & volumetric strain, Elastic moduli & the relationship between them, Bars of varying section – composite bars, Thermal stresses.

**UNIT - II:**

**Shear Force and Bending Moment:** Introduction, Types of beams, Shear force diagrams and Bending Moment diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed load, uniformly varying loads, relation between Shear force and bending moment.

**UNIT - III:**

**Flexural Stresses:** Theory of simple bending, Derivation of bending equation, Neutral axis, determination bending stresses, section modulus of rectangular and circular sections, I , T , Angle and Channel sections.

**Shear Stresses:** Shear stress equation, Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T and angle sections.

**UNIT - IV:**

**Deflection of Beams:** Bending into a circular arc – slope, deflection and radius of curvature, Differential equation for the elastic line of a beam, Double integration

and Macaulay's methods, Mohr's theorems, Moment area method, Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, uniformly distributed load and uniformly varying load.

**UNIT - V:**

**Strain Energy**: Introduction to Strain energy, Resilience, Gradual, sudden and impact loadings.

**Columns & Struts**: Crippling load, derivation of Euler's equation, Rankine's Formulae.

**UNIT - VI:**

**Thin Cylinders:** Thin seamless cylindrical shells, Derivation of formula for longitudinal and circumferential stresses, Volumetric strain in thin cylinders, Thin spherical shells.

**Thick cylinders:** Lame's equation, cylinders subjected to inside & outside pressures, compound cylinders.

**Text Books:**


1. S.S. Rattan, "Strength of materials", Tata Mc Graw-Hill Publications, 2nd edition.
2. S.Ramamrutam, R.Narayanan," Strength of materials", Dhanpat rai Publications, 14th edition.


**Reference Books:**


1. James M. Gere And Barry Goodno,"Mechanics of materials", CENGAGE Learning Custom Publishing, 8th edition.
2. Popov and Egor P., "engineering mechanics of soilds", Prentice Hall India.
3. Beer and Johnston, "mechanics of materials", Tata Mc GrawHill publications, 5th edition.
4. Dr. R K Bansal, "A text book of strength of materials", Lakshmi Publications,3rd edition.


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# ENGIENERING THERMODYNAMICS

II Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To introduce to the laws of thermodynamics and their relevance in studying the principles of conversion of energy.
- To analyze various thermodynamics cycles used in power generation and refrigeration.

**Learning Outcomes:**

Students will be able to

- distinguish between closed, open and isolated systems and different types of energy interactions.
- evaluate the internal energy, enthalpy, work and heat energy interactions for various thermodynamic processes and cycles.
- evaluate the performance of a heat engine and refrigerator/heat pump and apply the principle of increase of entropy to various processes occurring in nature.
- derive various thermodynamic relations by combining first and second laws of thermodynamics.
- evaluate the properties of a pure substance and determine the work and heat energy interactions for various steam processes.
- understand the deviation of real gas behavior from perfect gas and make gravimetric and volumetric analysis of mixture of gases.
- analyze the various gas & steam power cycles and refrigeration cycles and evaluate their performance parameters.

**UNIT - I:**

**Introduction: Basic Concepts:** System, Control Volume, Surroundings, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Quasi–static Process, cycle, Irreversible Process, Causes of Irreversibility. Energy in State and in Transition, Work and Heat, Point and Path functions, Various forms of Work.

**UNIT - II:**

Zeroth Law of Thermodynamics, Concept of Temperature, Principles of Thermometry, Reference Points, Const. Volume gas Thermometer, Scales of Temperature - Ideal Gas Temperature.

Joule's Experiment – First law of Thermodynamics- Applied to a closed system undergoing a cycle and a change of state, PMM1, Steady Flow Energy Equation and its applications, Limitations of the First Law of Thermodynamics.

**UNIT - III:**

Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics - Kelvin-Planck and Clausius Statements and their Equivalence, Corollaries of Second Law, PMM2, Carnot's theorem, Carnot cycle - Heat Engine & Heat Pump Cycles, Thermodynamic scale of Temperature.

Clausisus Theorem, Clausius Inequality, Entropy, Principle of the Increase of Entropy, Available and unavailable energies, Availability and Irreversibility – Thermodynamic Potentials - Gibbs and Helmholtz Functions, Maxwell Relations, Elementary treatment of Third Law of Thermodynamics.

**UNIT - IV:**

Pure Substance, Phase, Phase Transformation, P-V, P-T, T-S, and h-s diagrams of a Pure substance (water), Triple point, Critical point, P-V-T surfaces, Dryness Fraction, Steam Tables, Mollier chart, Determination of steam Properties using steam tables and Mollier Chart, Various Thermodynamic processes and energy Transfer, Measurement of steam Quality – Steam Calorimetry, Clausius – Clapeyron Equation.

**UNIT - V:**

Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non-flow processes, Heat and Work Transfer, changes in Internal Energy Enthalpy and Entropy , Throttling and Free Expansion Processes, Joule-Thompson coefficient – work Transfer during Flow processes – Deviations from perfect Gas Model – Vander Waals Equation of State, Law of Corresponding States, Compressibility charts.

Mixtures of perfect Gases – Mole Fraction, Mass fraction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes, Equivalent Gas constant and Molar Internal Energy, Enthalpy, specific heats and Entropy of mixture of perfect Gases.

**UNIT - VI:**

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

**Vapor Power Cycles:** Simple Rankine Cycle, **Refrigeration Cycles:** Bell coleman cycle, Vapor compression Refrigeration system- Performance Evaluation.

**Text Books:**


1. PK Nag "Engineering Thermodynamics", Tata McGraw Hill publishing company ltd, 3rd Edition.
2. Richard E Sonntag, Claus Borgnakke, Gordon J. Van Wylen "Fundamentals of Thermodynamics" 6th edition.


**Reference Books:**


1. James Beverly Jones & R.E. Dugan "Engineering Thermodynamics" Prentice Hall.
2. Yunus Cengel & Micheal Boles "Thermodynamics-An Engineering Approach" Tata McGraw Hill Education.


***Note: Seam Tables and Refrigeration Tables are allowed.***

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# MATERIAL SCIENCE & METALLURGY

II Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize the students with the fundamentals of crystallography, metallurgy, heat treatment and metal properties.

**Learning Outcomes:**

Students will be able to

- illustrate crystallization of metals.
- justify the effect of alloying elements on the behavior of metals.
- construct the equilibrium diagrams to describe the different phases of metals and alloys.
- apply different heat treatment processes to get desired mechanical properties of metals.
- distinguish different types of cast irons and steels and their applications.
- illustrate the structure and properties of non ferrous metals and alloys.
- appraise unique nature of ceramics and composite materials.

**UNIT - I:**

**Structure of Metals:** Bonds in Solids – Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal/ alloys – determination of grain size.

**Constitution of Alloys:** Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

**UNIT - II:**

**Equilibrium Diagrams:** Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cu-Sn and Fe-Fe3C.

**UNIT - III:**

**Heat treatment of Alloys:** Effect of alloying elements on Fe-Fe3C system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

**UNIT - IV:**

**Cast Irons and Steels:** Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

**UNIT - V:**

**Non-ferrous Metals and Alloys:** Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

**UNIT - VI:**

**Ceramic materials:** Crystalline ceramics, glasses, cermaets, abrasive materials, nanomaterials– definition, properties and applications of the above.

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

**Text Books:**


1. Sidney H. Avener, "introduction to physical metallurgy", Tata Mc Graw Hill Publications.
2. Donald R.Askeland and Wendelin J.Wright ,"Essential of Materials science and engineering", CL Engineering publications.


**Reference Books:**


1. V.D.Kodgire, S.V Kodgire."material science and metallurgy", Everest publishing house.
2. Agarwal, "Science of engineering materials", S.Chand Publications.
3. William D.collister,David G.Rethwich," Materials science and engineering an introduction", Loose leaf publications, 8th edition.
4. W.G.Vinas & HL Mancini, "An introduction to material science".
5. C.D.Yesudian & harris Samuel,"Material science and metallurgy".
6. R. A Flinn and P K Trojan," Engineering Materials and Their Applications ", Jaico Books.


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## EMPLOYABILITY SKILLS
## (Common to EEE, ME & ECE)
II Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 1 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives**:

- To equip the learners to gain employability skills and to have successful careers.
- To enable them to use English in different socio-cultural and professional contexts.
- To assist them to communicate their ideas relevantly and coherently in globalized contexts.

**Learnaing Outcomes:**

Students will be able to

- gain employment and function successfully in their careers.
- use English successfully in different socio-cultural and professional contexts
- communicate their ideas coherently in globalized situations.

**Syllabus**:

**Listening**:

- Listening Comprehension- 4 exercises
- Active Listening

**Reading**:

- Reading Comprehension – 4 Passages
- Book Review-Any Novel among the list prescribed by the Department
- Cloze Test

**Speaking**:

- Extempore
- One Act Plays
- Public Speaking
- Group Discussions
- Interpersonal skills
- Ad Making
- Poster presentation
- Mock Interviews
- Assertiveness

**Writing**:

- Information Transfer
- Report Writing
- Team building
- Paragraph Writing
- Project Work

**Vocabulary:**

- Business Vocabulary

**Short Films:**

- Creativity
- Leadership

**Books Recommended**:


1. Effective Technical Communication, M. Ashraf Rizvi, Tata Mc. Graw-Hill Publishing Company Ltd.
2. Communication Skills by Leena Sen, Prentice-Hall of India, 2005.
3. Academic Writing- A Practical guide for students by Stephen Bailey, Rontledge Falmer, London & New York, 2004.
4. English Language Communication: A Reader cum Lab Manual Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai.
5. Body Language- Your Success Mantra by Dr. Shalini Verma, S. Chand, 2006.
6. DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice, New Age International (P) Ltd., Publishers, New Delhi.
7. Books on TOEFL/GRE/GMAT/CAT by Barron's/cup.
8. IELTS series with CDs by Cambridge University Press.
9. Technical Report Writing Today by Daniel G. Riordan & Steven E. Pauley, Biztantra Publishers, 2005.
10. Communication Skills for Engineers by Sunita Mishra & C. Muralikrishna, Pearson Education, 2007.
11. Objective English by Edgar Thorpe & Showick Thorpe, 2nd edition, Pearson Education, 2007.
12. Cambridge Preparation for the TOEFL Test by Jolene Gear & Robert Gear, 4th Edition.


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## ELECTRICAL & ELECTRONICS ENGINEERING LAB

II Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- Information to supplement to the Electrical & Electronics Engineering courses.
- The ability to conduct testing and experimental procedures on Circuits.

**Learning Outcomes:**

Students will be able to

- apply the concepts of Theorems for a given electrical circuit.
- evaluate the efficiency and regulation of a single phase transformer.
- relate physical observations and measurements involving electrical circuit so theoretical principles.
- design amplifier circuit using NPN transistor

**List of Experiments:**

Any 10 of the following experiments are to be conducted:

1. Verification Of Kirchhoff's Laws
2. Verification Of Superposition Theorem
3. Verification Of Maximum Power Transfer Theorem
4. Experimental Verification Of The venin'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

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# MECHANICS OF SOLIDS LAB AND METALLURGY LAB

II Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Any 6 experiments are to be conducted from each of the following**

## (A) MECHANICS OF SOLIDS LAB

**Course Objectives:**

- To determine experimentally the mechanical properties of materials.

**Learning Outcomes:**

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.
- determine the shear stress under single shear and double shear.

**List of Experiments:**

To determine

1. modulus of elasticity using universal Testing machine.
2. modulus of elasticity and bending stress in
   a) Simple supported and b) Cantilever beam
3. modulus of rigidity using torsion testing machine.
4. hardness number using a)Brinells hardness test b) Rockwell hardness test.
5. stiffness of springs using Spring Testing machine.
6. Shear test using Universal testing machine.
7. Impact strength using Impact Testing Machine

## (B) METALLURGY LAB

**Course Objectives:**

- To impart hands on training in preparation of metal specimens so as to observe the microstructure.

**Learning Outcomes:**

Students will be able to

- preparing the Specimen using rough grinding, finish grinding and polishing.
- using different types of etchants to expose the microstructure of metal and alloys.
- observing the microstructure and ascertaining the same.
- performing Jominy End Quench test.

**List of Experiments:**

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. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardenability of steels by Jominy End Quench Test.

* * *

# INDUSTRIAL ENGINEERING & MANAGEMENT

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To impart the principles of industrial engineering and management for efficient operation and maintenance of a production system.

**Learning Outcomes:**

Students will be able to

- outline the role of Industrial Engineer.
- list the functions of Management and describe the evolution of Management thought.
- design a suitable plant layout.
- distinguish between Time Study and Method Study.
- explain the principles of Motion economy.
- interpret control charts for assessment of process quality.
- list the functions of Human Resource management.
- implement the principles of PERT and CPM techniques.

**UNIT - I : Introduction**

Concept of Industrial Engineering (IE) – Genesis and growth – applications – Role of an Industrial Engineer – Production – Productivity – Tools of I.E.

Concept of Management, Administration and Organization – Significance – Principles of scientific and Modern Management – Functions of Management – Theories of Motivation – Organization structure – Significance – Types – Applications.

**UNIT - II : Plant Location and Plant Layout**

Importance of plant location –factors influencing the plant location.

Types of Production : features , Applications . Flow Pattern for Material movement in plant – Types. Plant Layout – Principles of Scientific layout – Types of Plant layouts – Features – Applications – Techniques for optimal design of Layouts. Plant Maintenance – Significance – Types of Plant maintenance.

**UNIT - III : Operations Management**

Concept – Importance – Genesis and growth of work study – Role of work study in productivity enhancement – Work measurement – Standard time and its computation – Rating factor and techniques – Types of Elements in Job breakdown – Techniques of work Measurement – Time study, Synthesis from Elemental data, PMTS, Analytical Estimating, Work sampling – Applications of techniques.

Concepts of Method study and Motion study – Procedure – Recording techniques and tools – Micro Motion study — Principles of Motion Economy – Therbligs.

**UNIT - IV : Quality Concepts:**

Quality – Significance – Types of Inspection – Types of Statistical Quality Control – Significance – Techniques of SQC – Control Charts – Importance – Features of control charts – Control charts for variables ($\bar{X}$ & R charts, $\bar{X}$ and S Charts) – Control charts for attributes (C charts, P charts) – Numerical examples. Sampling inspection – Advantages – Types of Acceptance sampling plans – Applications. Concepts of TQM – Implementation – ISO Systems – Quality Circles – Zero Defect concept, Bench Marking, Six sigma concept, 5s, Kaizen, Cause and Effect diagram, Parato analysis.

**UNIT - V : Human Resource Management (HRM)**

Significance of HRM and HRD, Personnel Management Vs HRM, Functions of Human Resource Management – Manpower planning, Job analysis, Recruitment, Selection, Induction, Training and Development, Placement, Wage Administration, performance appraisal, Transfer / Promotion / Dismissal, Welfare Administration, Grievance Handling and Conflict Management, Job Evaluation and Merit Rating – Objectives – Types – Applications.

**UNIT - VI : Project Management**

Importance of Project Management – Bar charts & Milestone charts – Limitations – concept of Management Techniques / Network Techniques – Various Techniques. Critical Path Method – Concept – Terminology – Network rules – Numerical examples.

Programme Evaluation and Review Technique (P.E.R.T) – Concept – Terminology –Simple Problems. Standard deviation, Variance and Probability of completion of project. Applications of CPM and PERT – Differences between CPM and PERT.

**Text Books:**


1. O.P.Kanna, “Industrial Engineering & Management “, Dhanpat Rai Publications..
2. T.R Banga, N.K Agarwal, S.C Sharma,” Industrial Engineering & Management Science” Khanna Publications.


**Reference Books:**


1. Sanjay S.Patil, Nandakumar K Hukeri , “Industrial Engineering & Production & Operation Management” , Electrotech Publication Engineering Series.
2. N.V.S. Raju,” Industrial Engineering & Management”, CENGAGE Learning.


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# DYNAMICS OF MACHINES

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To impart the knowledge on study of forces, motion, inertia in machines and performance of machines under dynamic conditions and their analysis.

**Learning Outcomes:**

Students will be able to

- evaluate the effect of friction on power transmission in devices like bearings and clutches.
- design the flywheels and synthesize the governors.
- synthesize different types of brakes and dynamometers.
- estimate the effect of gyroscopic couple on the stability of moving vehicles.
- balance the engines against unbalance forces.
- determine the forces in vibrating systems in different loaded conditions.

**UNIT - I:**

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

**Brakes:** Block brake, Band Brake, band and block brake, internally expanding shoe brake.

**Dynamometers:** Absorption Dynamometers -Prony, Rope brake, Transmission Dynamometer- Epicyclic, Bevis Gibson and belt transmission.

**UNIT - II:**

**Static and Dynamic Force Analysis:** slider crank mechanism

**Flywheel:** Turning moment diagram, fly wheel design of 2-stroke and 4-stroke engines, punching machines.

**UNIT - III:**

**Gyroscope:** Effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero plane and ship.

**Governers:** Watt, porter and proell governors, Hartnell governor, governor performance - sensitiveness, isochronism and hunting

**UNIT - IV:**

**Balancing of Rotating Masses:** Balancing of rotating masses(single and multiple) – single and different planes, use analytical and graphical methods.

**UNIT - V:**

**Balancing of Reciprocating Masses:** Balancing of single cylinder engine, multi cylinder in-line engine, radial engine and V- engine.

**UNIT - VI:**

**Vibrations:** Introduction, types of vibrations - longitudinal vibrations - transverse vibrations – damped vibrations, logarithmic decrement , forced vibrations – vibrations isolation and transmissibility, whirling of shafts – critical speed.

**Text Books:**


1. Dr. R.K. Bansal, “Theory of Machiens”, Fire wall media publishers.
2. S. S. Rattan “Theory of Machines”, Tata McGraw Hill Publishers.


**Reference Books:**


1. Thomas Bevan “The Theory of Machines” Pearsons Education.
2. Ashok G. Ambedkar “Mechanism and machine theory”, Prentice Hall of India Pvt Ltd.
3. R.S.Khurmi, J.K.Gupta “Theory of machines”, Eurasia Publishing House.


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# FLUID MECHANICS

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To introduce the principles of conservation of mass, momentum and energy and their application in the study of fluid statics and dynamics.

**Learning Outcomes:**

Students will be able to

- understand the basic concepts of fluid properties, hydrodynamic forces on submerged bodies.
- analyze the flow field phenomena and apply the basic governing equations in solving fluid flow problems.
- analyze the various losses occurring when the fluid flowing in closed conduit and measure the discharge by different apparatus.
- understand the concept of boundary layer theory and significance of lift and drag forces.

**UNIT - I:**

**Introduction**: Physical properties of fluids – Mass density, specific weight, specific gravity, viscosity, vapor pressure, Compressibility, surface tension and Capillarity.

**Fluid statics**: Fluid pressure - 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, Mechanical gauges. Hydrostatic forces on Plane and Curved surfaces, Buoyancy and Flotation.

**UNIT - II:**

**Fluid kinematics:** Flow fields and description of fluid Motion- Lagrangian Method and Eulerian Method, Types of Fluid Flow - Steady, unsteady, Uniform, Non uniform, Laminar, Turbulent, Rotational, and Irrotational 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, Potential Flow.

**UNIT - III:**

**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, momentum equation and its application on force on pipe bend., Navier stokes Equations of Motion.

**UNIT - IV:**

**Closed conduit flow:** Reynolds' experiment, Laws of Fluid friction, Darcy Weisbach equation, Minor losses in pipes, hydraulic Grade line and Total Energy Grade line, pipes in series Equivalent pipe , pipes in parallel, Siphon.

Measurement of flow: Pitot tube, Venturimeter, Orifice meter, Flow nozzle, Turbine flow meter, Notches and weirs.

**UNIT - V:**

**Laminar Flow:** Laminar Fully Developed Pipe Flow- Hagen Poiseuille flow, laminar flow through inclined pipes. Laminar flow through annulus, Flow between parallel plates – Both plates at Rest, one Plate is moving and other at rest. Introduction to turbulent flows, Moody Chart.

**UNIT - VI:**

**Boundary layer theory**: Introduction, Boundary layer development, Boundary layer thickness, Displacement thickness, Momentum thickness, Energy thickness, Development of boundary layer along a thin flat plate, Boundary layer equations, VonKarman's Integral equation, Laminar boundary layer, turbulent boundary layer, Laminar sub layer, boundary layer separation, Methods of Controlling the Boundary layer. Drag and lift forces

**Dimensional Analysis and Similarity:** Introduction, Dimensional Homogeneity, Similitude, Dimensionless Numbers.

**Text Books:**


1. Dr. P.N. Modi & Dr. S.M. Seth "Hydraulics and Fluid Mechanics Including Hydraulics Machines", Rajsons publication Pvt Ltd.
2. D.S. Kumar, S.K. Kataria & Sons "Fluid Mechanics and Fluid Power Engineering".
3. S K Som & G Biswas "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw-Hill publications.


**Reference Books:**


1. D. Rama Durgaiah "Fluid Mechanics and Machinery", New Age International publishers.
3. James W. Dally, William E. Riley, John Wiley & Kennet G. Mc Connell "Instrumentation for Engineering Measurements", Wiley India Pvt Ltd 2nd edition.
4. Dr. R.K. Bansal "Fluid Mechanics and Hydraulic Machines", Laxmi Publications, 9th edition.


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# MANUFACTURING PROCESSES

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To expose principles of manufacturing processes to create desired shape and size to the materials.

**Learning Outcomes:**

Students will be able to

- design a pattern and gating system for preparation of a casting.
- distinguish different types of furnaces.
- recommend appropriate type of welding process for fabrication of metals.
- identify welding defects and suggest remedial measures.
- distinguish between hot working and cold working processes.
- identify methods of producing standard forms of metal supply.
- select appropriate type of press for a metal forming operation.

**UNIT - I:**

**Casting:** Steps involved in making a casting – Advantage of casting and its applications. – Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Principles of Gating, Gating ratio and design of Gating systems

**UNIT - II:**

Solidification of casting – Solidification of pure metal and alloys, short & long freezing range alloys. Riser – Types, function and design, casting design considerations, special casting processes: Centrifugal, Die and Investment.
Furnaces **:** Crucible melting and cupola operation, steel making processes.

**UNIT - III:**

**A) Welding :** Classification of welding process types of welds and welded joints and their characteristics, Gas welding, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water ) welding.
**B) Cutting of Metals:** Oxy – Acetylene Gas cutting, water plasma. Cutting of ferrous, non-ferrous metals.

**UNIT - IV:**

Inert Gas welding, TIG & MIG welding, Friction welding, Induction welding, Explosive welding, Laser welding, Soldering & Brazing. Welding defects – causes and remedies – destructive and nondestructive testing of welds.

**UNIT - V:**

**Forming:** Hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts.

Rolling fundamentals – theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements.

**Other cold working processes**: Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning – Types of presses and press tools.

**UNIT - VI:**

**Extrusion of Metals:** Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion and Hydrostatic extrusion.

**Forging processes:** Principles of forging – Tools and dies – Types Forging – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects.

**Text Books:**


1. Serope Kalpakjian and Steven R.Schmid,"Manufacturing Engineering & Technolgy", Pearson Education, Inc., 5th edition.
2. P.N.Rao, "Manufacturing Technology ", Tata Mc Graw Hill Publications.


**Reference Books:**


1. R.K.Jain,"Production Technology", Khanna *Publications.*
2. Lindberg/PE , "Process and materials of manufacturing ", PHI.
3. Heine, Roper, Rosenthal, "Principles of Metal Castings ", Tata Mc Graw Hill Publications, 2nd edition.
4. R.S.Paramar, "Welding Engineering and Technology ", khanna Publications.
5. P.C.Sarma, "A text book of Production Engineering", S.Chand Publications.
6. Suresh Dalela & Ravi Shankar "Production Engineering ",Galgotia Publications Pvt. Ltd.


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# THERMAL ENGINEERING - I

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To study the working of various heat engines and compressors and their performance characteristics.

**Learning Outcomes:**

Students will be able to

- compare the air standard, fuel-air and actual cycles and ascertain the reasons for reduced efficiency.
- understand the working of 2-stroke and 4- stroke, S.I and C.I engines and the functioning of different engine components.
- understand the processes of normal and abnormal combustion in S.I and C.I engines and the influence of engine parameters and fuel characteristics.
- evaluate various engine performance parameters and plot the performance characteristic curves.
- understand the working of reciprocating and rotary compressors and their design features.
- analyze the gas turbine cycles and study the effect of regeneration, inter cooling and reheating on cycle efficiency.

**UNIT - I:**

**Heat Engines:** External and Internal combustion Engines, Engine Components, Basic Engine Nomenclature, Classification, Four Stroke and Two Stroke Engines, Valve and Port Timing Diagrams, Comparison of SI and CI Engines. Comparison of air standard, fuel - air and actual cycles.

**Engine systems:** Simple Carburetor, Fuel Injection System, Ignition, Cooling and Lubrication.

**UNIT - II:**

**Combustion:** Balancing of combustion Equation, Theoretical and Actual Combustion processes, Flue Gas analysis, Enthalpy of Formation and Enthalpy of combustion, First law analysis of Reacting Systems, Adiabatic flame temperature.

**Combustion in S.I. Engines:** Stages of combustion, Effect of engine variables on ignition lag and flame propagation, abnormal combustion- pre-ignition and knocking, effect of engine variables on Knocking.

**Combustion in C.I. Engines:** Four stages of combustion, Delay period and its importance, Effect of engine variables, Diesel Knock.

Fuel's requirements, rating, anti knock additives.

**UNIT - III:**

**Testing and Performance of I.C Engines:** Measurement of Fuel consumption, Air consumption, Brake power, Fictional Power and indicated power. Performance test, Heat balance sheet.

Emission & pollution standards in automotive applications.

**UNIT - IV:**

**Compressors:** Classification - Reciprocating and Rotary, Positive displacement and dynamic machines. Fan, Blower and Compressor

**Reciprocating:** Principle of operation, Single stage of 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.

**UNIT - V:**

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

**Axial Flow Compressors:** Mechanical details and principle of operation – velocity triangles and energy transfer per stage, degree of reaction, work done factor - isentropic efficiency- pressure rise calculations – Polytropic efficiency.

**UNIT - VI:**

**Gas Turbines:** Simple gas turbine plant ideal cycle - open & closed cycles, essential components, Effect of operating variables on thermal efficiency, actual cycle, Merits & demerits. Methods of improving efficiency – regeneration, inter cooling and reheating, Constant Volume Gas turbine.

**Text books:**


1. M. L. Mathur, R. P. Sharma " A Course in Internal Combustion Engines", Dhanpath Rai & Sons.
2. V.P. Vasandani and D.S. Kumar "Heat Engineering", Metropolitan Book Company, New Delhi.
3. V. Ganesan "Gas turbines", Tata McGraw Hill Education.


**Reference Books:**


1. V. Ganesan "Internal Combustion Engines", Tata McGraw Hill Education.
2. P.Khajuria & S.P.Dubey "Gas Turbines and Propulsive Systems", Dhanpatrai Publications.
3. H.Cohen, GFC Rogers and HIH Saravanamuttoo "Gas Turbine theory", Pearson Education India.


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# MACHINE DRAWING

II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize with the conventional representation of materials and machine elements.
- To introduce the concepts of developing the views of machine elements and assembly drawings.

**Learning Outcomes:**

Students will be able to

- represent materials , simple machine components as per conventions.
- draw the views of different machine elements and parts.
- prepare assembly drawings.

**Section - A**

**Machine Drawing Conventions:**

Need for drawing conventions – introduction to IS conventions

1. Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
2. Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
3. General rules for sizes and placement of dimensions for holes, centers, curved and tapered features.

**Drawing of Machine Elements and simple parts**

Views for the following machine elements and parts.

a) Forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws, foundation bolts.
b) Keys, cotter joints and knuckle joint.
c) Riveted joints for plates.
d) Shaft couplings.
e) Journal, pivot and collar and foot step bearings.

**Section - B**

**II. Assembly Drawings:**

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

a) Engine parts – stuffing box, cross head, Eccentric, Petrol Engine connecting rod.
b) Other machine parts - Screws jack, Machine Vice, Plummer block, Tailstock, single way tool post.

**NOTE:** First angle projection to be adopted.

**Final examination pattern:**

The question paper consists of two parts i.e. Part A and Part B. Part A for 24 Marks and Part B for 36 Marks. Part A from section A of the syllabus shall have 3 questions out of which two questions are to be answered. Each question will carry 12 Marks. Part B from Section B of the syllabus shall have 1 question and will carry 36 Marks.

**Text books:**

1. K.L.Narayana, P.Kannaiah & K. Venkata Reddy ,"Machine Drawing", New Age Publications.
2. Dhawan,"Machine Drawing", S.Chand Publications.

**Reference Books:**

1. P.S.Gill, "A text book of Machine drawing", Katson Publications.
2. Siddeswar , Kannaih & Sastry, "A text book of machine drawing",Tata Mc Graw Hill Publications.
3. Sadhu Singh and Sah," A text book of Machine Drawing ", PHI publications.
4. N D Bhatt, "machine drawing", Charotar Publishing House Pvt Ltd.

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## PROFESSIONAL ETHICS AND PATENTS
## (Common to EEE, ME & ECE)
II Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 2 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To understand the basic concepts of Ethics and Human values.
- To enable the students understand the role and importance of ethics in Engineering.
- To familiarize the rights and responsibilities of Engineers.
- To know the laws and protect author's rights.
- To understand the legal aspects present in intellectual property law.

**Learning Outcomes:**

Students will be able to

- comprehend different Moral Perspectives and enabling him to frame one's own Ethical standards.
- find solutions for issues related to growth with reference to absolute ethical tenets.
- resolve Professional/Moral Dilemmas and be able to guide productivity.
- analyze the likelihood of confusion in Trademark Claims.
- understand different forms of infringement of Intellectual Property Rights.
- recognize the relevant criteria for protecting Creativity.

**UNIT – I: Human Values**

Morals, Values and Ethics – Integrity – Work Ethics – Service Learning – Civic Virtue -Value time – Co-operation – Commitment – Empathy – Self-confidence – Character.

Ethics- Types of Inquiry – Kohlberg's Theory – Gilligan's Argument – Heinz's Dilemma.

**UNIT – II: Engineers' Responsibilities and Rights**

Safety and Risk – Types of Risks – Voluntary vs. Involuntary Risk- Short Term vs Long Term Consequences - Expected Probability - Reversible Effects - Threshold Levels for Risk - Delayed vs Immediate. Risk Collegiality – Techniques for achieving Collegiality – Group / Team – Two Senses of Loyalty, Rights – Professional Responsibilities – Confidential and Proprietary information – Conflict of Interest – Conflict resolution – Self-interest.

**UNIT – III: Patent Law, Trade Marks and Copyrights**

Introduction – Rights and Limitations – Application process – Patent requirements – Ownership – Transfer – Infringement – Litigation – International Patent Law – Double Patenting – New development in Patent Law.

Trade Mark and Copyrights: Introduction – Registration Process – Transfer – Infringement – Dilution of Ownership – Imitation – Litigations.

**UNIT – IV: Cyber Law**

Introduction to Cyber Law – Cyber Crime and E-Commerce – Online Crime – Innovations and Inventions in Trade Related Intellectual Property Rights.

**Text Books:**


1. "Principia Ethica" by Goerge Edward Moore, Cambridge University Press, 11-Nov-1993, Cambridge.
2. "Engineering Ethics includes Human Values" by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd-2009.
3. Deborah E.Bouchoux: "Intellectual Property", Cengage Learning, New Delhi


**Reference Books:**


1. "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran- Laxmi Publications.
2. R.Radha Krishnan, S.Balasubramanian: "Intellectual Property Rights",Excel Books, New Delhi.
3. Prabhuddha Ganguli: "Intellectual Property Rights" Tata Mc-Graw- Hill, New Delhi.


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## MACHINE DYNAMICS LAB AND FUEL'S & LUBRICANTS LAB

II Year – II Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Machine Dynamics Lab:**

**Course Objectives:**

- To study and determine the dynamic response of machine elements experimentally.

**Learning Outcomes:**

Students will be able to

- determine gyroscopic effect of a rotating body.
- determine the whirling speed of shaft.
- determine the natural frequency of a rotor subjected to torsional vibrations.
- perform dynamic balancing of rotating and reciprocating masses.

**List of Experiments:**

1. Motorized Gyroscopic Couple Apparatus
2. Balancing of Rotating Masses
3. Balancing of Reciprocating Masses
4. Whirling speed of shaft
5. Torsional vibrations of a shaft (a) without damping (b) with damping
6. Longitudinal Vibrations of a beam (a) without damping (b) with damping

**Fuel's &Lubricants Lab :**

**Course Objectives:**

- To determine experimentally various physical properties of fuels and lubricants.

**Learning Outcomes:**

Students will be able to

- determine the viscosity of lubricant oils.
- find the calorific value of the fuel.
- Determine the flash and fire points of the fuel.

**List of Experiments:**

1. Determination of Flash and Fire points of Liquid Fuels using Abel's apparatus.
2. Carbon Residue Test : Solid/ Liquid Fuels.
3. Determination of Viscosity of Liquid Lubricants using Redwood Viscometer-I.
4. Determination of Viscosity of Liquid Lubricants using Redwood Viscometer-II
5. Determination of Calorific Value of Liquid Fuels using Bomb Calorimeter.
6. Determination of Calorific Value of Gaseous Fuels using Junker Calorimeter.

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# MANUFACTURING PROCESSES LAB

II Year – II Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To impart hands on training in the areas of casting, welding, press working and processing of plastics.

**Learning Outcomes:**

Students will be able to

- design a pattern.
- test the properties of sand and prepare a casting.
- perform pre welding operations.
- perform Arc welding, Spot welding, TIG welding and Plasma Welding operations.
- understand the features of simple, compound and progressive dies.
- perform blanking, piercing and bending operations.
- operate injection and blow moulding machines to manufacture plastic components.

**List of Experiments:**

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. Preparation of lap and single strap butt joints using SPOT welding.
6. Preparation of butt joints using Plasma welding.
7. Preparation of butt joints using TIG welding.
8. Preparation of lap joints using brazing.
9. Blanking and piercing operations using hydraulic press.
10. Preparation of a bottle using blow moulding.
11. Preparation of a component using injection moulding.

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# HYDRAULIC MACHINES AND SYSTEMS

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To study the working of hydraulic turbines and pumps and their performance characteristics.
- To understand the basic principles of operation of hydraulic devices and controls.

**Learning Outcomes:**

Students will be able to

- understand the design and planning of Hydroelectric Power plant with the available water resources and requirement of power.
- determine hydrodynamic force developed by impact of jets on various plates, ie stationary, moving by Apply momentum principle.
- analyze the working principles of hydraulic turbines and draw the performance characteristics of hydraulic turbines.
- understand the governing methods of hydraulic turbines.
- analyze the working principles of hydraulic pumps and draw the performance characteristics of hydraulic pumps.
- understand the working principles of different hydraulic devices /systems needed for various applications.

**UNIT - I:**

**Hydroelectric power stations:** Elements of hydro electric power plants, Types, Concept of pumped storage plants, storage requirements, mass curve (explanation only), and estimation of power developed from a given catchment area, heads and efficiencies.

**UNIT - II:**

**Impact of Water Jets:** Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip - velocity diagrams, work done and efficiency, Angular momentum Principle, Flow over radial vanes.

**UNIT - III:**

**Hydraulic Turbines**: Classification of turbines, Pelton wheel, Francis turbine and Kaplan turbine- working proportions, work done, efficiencies, hydraulic design. Draft Tube - Theory function and efficiency, Governing of Turbines, Surge tanks.

**Performance of hydraulic turbines** Performance Under Unit Head-Unit Quantities, Performance Under Specific conditions, Specific Speed, Performance Characteristic Curves, Cavitation, Selection of Turbines.

**UNIT - IV:**

**Reciprocating Pumps:** Introduction, Main components and working of a Reciprocating pump, Types, Work done by Reciprocating pump-Single Acting & Double Acting Pump, Coefficient of Discharge, Slip, Percentage Slip And Negative Slip, Indicator diagram, Effect of Acceleration Of Piston On Velocity & Pressure in suction and delivery pipes , Air vessels work saved by air vessels, operating characteristic curves.

**Positive displacement pumps**: Gear pump, Screw pump, Vane pumps**,** Air Lift Pump.

**UNIT - V:**

**Centrifugal Pumps:** Introduction, Component parts and Working ,Types, Work done by the Impeller, Static head, Manometric head, Losses and Efficiencies, Minimum Starting Speed, Loss of head Due to Reduced or increased flow, Diameters of impeller and pipes, Multistage Pumps – Pumps in series and parallel,

**Performance of centrifugal pumps:** Specific Speed, Model testing of Pumps, performance characteristic curves, Limitation of suction Lift, NPSH, Cavitation, Priming devices, Troubles and Remedies.

**UNIT - VI:**

**Hydraulic Systems:** Introduction**,** Hydraulic Accumulator, Hydraulic Intensifier, Hydraulic Ram, Hydraulic Press, Hydraulic Lift, Hydraulic Crane, Hydraulic Couplings and Torque Converters, Hydraulic Brake systems.

**Control Systems:** Functions of Hydraulic Control system, **C**omponents of Hydraulic control Systems, control Valves, Types of control Systems, Applications of control systems,

**Text Books:**


1. Dr. P.N. Modi & Dr. S.M. Seth “Hydraulics and Fluid Mechanics Including Hydraulics Machines”, Standard book house.
2. S K Som & G Biswas “Introduction to Fluid Mechanics and Fluid Machines”, Tata McGraw-Hill publications.


**Reference Books:**


1. D. Rama Durgaiah “Fluid Mechanics and Machinery”, New Age International publishers.
2. T.R Banga, B.P.Makker, S.C. Sharma “Hydraulics Fluid Mechanics and Hydraulic Machines by Khanna Publishers.
3. James W. Dally, William E. Riley, John Wiley & Kennet G. Mc Connell “Instrumentation for Engineering Measurements”, Wiley India Pvt Ltd 2nd edition.
4. Dr. R.K. Bansal “Fluid Mechanics and Hydraulic Machines”, Laxmi Publications, 9th edition.
5. D.S. Kumar, S.K. Kataria & Sons “Fluid Mechanics and Fluid Power Engineering”.


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# PRINCIPLES OF MACHINE DESIGN

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To impart knowledge of the basic engineering design against static and dynamic loading by considering strength and rigidity.

**Learning Outcomes:**

Students will be able to

- apply the concepts of design to perform stress analysis on members.
- determine principal stresses and strains and design members based on failures of theories.
- design members under the action of fluctuating forces.
- design members having riveted , bolted and welded joints.
- design members having cotter and knuckle joints.
- design keys, shafts and shaft couplings.

**UNIT - I:**

**Introduction:** General considerations in the design of Engineering Materials and their properties – selection –Manufacturing consideration in design, BIS codes of steels - preferred numbers.

**Stresses in Machine Members:** Simple stresses – combined stresses – torsional and bending stresses – impact stresses.

**UNIT - II:**

**Principal Stresses and Strains:** Stress component on inclined planes, Principal Stresses – Mohr's circle – determination of principal stresses and principal planes analytically and graphically – principal strains.

Theories of failure – factor of safety – design for strength and rigidity.

**UNIT - III:**

**Design for Fatigue Strength:** Stress concentration – theoretical stress concentration factor – fatigue stress concentration factor, notch sensitivity – design for fluctuating stresses – endurance limit – estimation of endurance strength, S-N Curves, Design for finite and infinite life, goodman's line – soderberg's line – modified goodman's line.

**UNIT - IV:**

**Design of Riveted and welded joints:** design of joints– eccentric loading, primary and secondary shear effect.

**Design of Fastners** – design of bolts with pre-tension – design of joints under eccentric loading

**UNIT - V:**

**Design of Keys:** Design of keys-stresses in keys

**Design of Cotters and Knuckle Joints:** cotter joints-spigot and socket, sleeve and cotter, gib and cotter joints, knuckle joints.

**UNIT - VI:**

**Design of Shafts:** Design of solid and hollow shafts for strength and rigidity – design of shafts for combined bending and axial loads – shaft sizes – BIS code.

**Design of couplings:** Muff, split muff, flanged and bushed pin coupling, Modified Flange Coupling,Oldham Coupling, Universal coupling.

**Text Books:**


1. V. B. Bhandari "Introduction to Machine Design", TMH Publishers.
2. Dr. N.C. Pandya & Dr. C. S. Shah "Machine design" Charotar Publishing House Pvt. Limited.


**Reference Books:**


1. Joseph Edward Shigley, Charles R.Mischke , "Mechanical engineering design", TMH Publishers.
2. Robert L.Norton, "Machine Design – An integrated approach", 2nd edition, Pearson education India.
3. V.M.Faires, "Design of Machine Elements" , 4th edition, Macmillan Company N.Y., 1965.


**Note :** Design Data Book is allowed.

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# METAL CUTTING & MACHINE TOOLS

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To explain the theory of metal cutting.
- To familiarize with the working principles of basic machine tools.

**Learning Outcomes:**

Students will be able to

- apply theory of metal cutting in machining of components.
- judge the appropriate lathe machine to process axis symmetric parts.
- select appropriate machine tool to process prismatic parts.
- use principles of drilling and boring in hole making operations.
- recommend correct type of milling operation to process the parts.
- distinguish between grinding, lapping and honing and explain broaching operation.

**UNIT - I:**

Elementary treatment of metal cutting theory – element of cutting process – geometry of single point tool angles, chip formation and types of chips – built up edge and its effects, chip breakers, mechanics of orthogonal cutting –Merchant's force diagram, cutting forces, cutting speeds, feed, depth of cut, tool life, coolants, tool materials.

**UNIT - II:**

Engine lathe – principle of working - specification of lathe – types of lathe – work holders, tool holders – lathe operations. Turret and capstan lathes – collet chucks – other work holders – tool holding devices – box tools and tool layout. Principal features of automatic lathes – classification – single spindle and multi-spindle automatic lathes.

**UNIT - III:**

Shaping, Slotting and Planning Machines**:** Principles of working – principal parts – specifications, operations performed, machining time calculations.

**UNIT - IV:**

Drilling & Boring Machines**:** Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring Machines – fine Boring Machines – jig boring machine, deep hole Drilling Machine, machining time calculations.

**UNIT - V:**

Milling Machine**:** Principles of working – specifications – classification of Milling Machines – features of horizontal, vertical and universal Milling Machine, machining operations, types of cutters, geometry of milling cutters – methods of indexing, accessories to milling machines.

**UNIT - VI:**

Grinding**:** Theory of grinding – classification of grinding machines, cylindrical and surface grinding machines, tool and cutter grinding machines, different types of abrasives, bonds, specification and selection of a grinding wheel. Lapping, Honing & Broaching operations, comparison to grinding.

**Jigs & Fixtures**: Principles of design of jigs and fixtures and uses, classification of jigs & fixtures, principles of location and clamping, types of clamping & work holding devices, typical examples of jigs and fixtures.

**Text Books:**


1. R.K. Jain and S.C. Gupta, "Production Technology", Khanna Publications.
2. B.s.Raghu Vamsi, " A course in Workshop Technology", Vol II, 2nd edition, Dhanapat Rai publications.


**Reference Books:**


1. M.c.Shaw, "Metal cutting Principles", Oxford University Press.
2. Winston A.Knight, Geoffrey Boothroyd, "Fundamentals of Metal cutting and Machine Tools", 3rd edition, TMH publications.
3. K.C Jain & A.K Chitaley ," Production Engineering", PHI Publishers.


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## THERMAL ENGINEERING - II

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To study and analyze the Rankine cycle and the basic components of steam power plant such as boilers, nozzles, condensers and turbines.
- To study and analyze various refrigeration systems and introduce to various psychrometric properties and processes and the design of air conditioning systems.

**Learning Outcomes:**

Students will be able to

- analyze the Rankine cycle with and without regeneration and study the effect of operating variables on cycle performance.
- know the principle of working of steam boilers and their accessories and mountings.
- understand the principle of natural and artificial draught and design the dimensions of a chimney used in natural draught.
- design steam nozzle for the given pressure drop and understand the concept of supersaturated flow in steam nozzles.
- analyze impulse and reaction steam turbines and determine the power output and efficiency.
- know the principle of working of steam condensers and cooling towers and their analysis.
- analyze various refrigeration systems, understand the psychrometric properties and processes in the design of air conditioning systems.

**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, Cogeneration cycles, and combined cycles.

**UNIT - II:**

**Boilers:** Classification, working principles of low pressure and High pressure boilers, Mountings and Accessories – working principles, Equivalent evaporation, Efficiency and heat balance. Draught, classification, height of chimney for given draught and discharge, condition for maximum discharge, efficiency, Artificial draught - induced and forced.

**UNIT - III:**

**Steam Nozzles:** Function of a nozzle, applications, Types, flow through nozzles, thermodynamic analysis, assumptions, velocity of fluid at nozzle exit, Ideal and

actual expansion in a nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape. Super saturated flow, its effects, degree of super saturation and degree of under cooling, Wilson line.

**UNIT - IV:**

**Impulse Turbines:** Classification, Impulse turbine: Mechanical details, velocity diagram, effect of friction, power developed, axial thrust, blade or diagram efficiency, condition for maximum efficiency. Methods to reduce rotor speed - velocity compounding, pressure compounding and velocity & pressure compounding, combined velocity diagram for a velocity compounded impulse turbine, Condition for maximum efficiency

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

**UNIT - V:**

**Steam Condensers**: Requirements of steam condensing plant, classification of condensers, working principle of different types, vacuum efficiency and condenser efficiency, cooling water requirement, air leakage, sources and its affects, air extraction pump.

**UNIT - VI:**

**Refrigeration**: Air refrigeration systems- Bell coleman cycle, details and principles of operation, vapor compression refrigeration systems- calculations of COP-Effect of super heating and sub cooling, desired properties of refrigerants and common refrigerants, Vapor absorption system- Description and working of $NH_3$ – water Absorption System, Li -Br (Two shell & Four shell) System.

**Air-conditioning**: Psychrometric properties and process, Comfort Air conditioning - summer air conditioning, winter air conditioning.

**Text Books:**


1. V.P Vasandani and D.S Kumar, "Heat Engineering", Metropolitan Book Co. Pvt Ltd.,, New Delhi.
2. R.Yadav ,"Thermodynamics and Heat Engines", Central Publishing House.


**Reference Books:**


1. P.L.Bellaney, "A course in Thermal Engineering", Khanna publications.
2. R.S Khurmi & JS Gupta "Thermal Engineering",- S.Chand.publications.
3. M.L.Marthur & F. S. Mehta "Thermal Science and Engineering", Published by Jain bros.


***Note: Seam Tables and Refrigeration Tables are allowed.***

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*Open Elective - I*

## REMOTE SENSING AND GIS TECHNIQUES

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course objectives:**

- To introduce the students to the basic concepts and principles of various components of remote sensin.
- To provide an exposure to GIS and its practical applications in civil engineering.
- To demonstrate the process of remote sensing and theories related to EMR.
- To establish the interpretation of spatial data in various platforms.

**Course Outcomes:**

StudentS will be able to

- identify various satellites, which are advantage for managing the resources available on earth.
- develop thematic maps with the help of raster and vector data.
- employ the analysis and interpretation techniques in the data models.
- apply the strategies of GIS in land information highway system.

**UNIT – I: EMR and Its Interaction with Atmosphere & Earth Material**

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 – Pay load description of important Earth Resources and Meteorological satellites – Airborne and spaceborne TIR 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 – Maps – Definitions – Map projections – types of map projections – map analysis – GIS definition – basic components of GIS – standard GIS software's – Data type – Spatial and non-spatial (attribute) data – measurement scales – Data Base Management Systems(DBMS).

**UNIT – V: Data Entry, Stprage amd Analysis**

Data models – vector and raster data – data compression – data input by digitization and scanning – attribute data analysis – integrated data analysis – Modeling in GIS Highway alignment studies – Land Information System.

**UNIT VI: RS and GIS Applications**

Land cover and land use, agriculture, forestry, geology, geomorphology, urban applications, hydrology- flood zone delineation and mapping, groundwater prospects and recharge, reservoir storage estimation.

**Text Books:**


1. Remote sensing by Basudeb Bhatta, Oxford University Press.
2. Anji Reddy, M. (2001). Textbook of Remote Sensing and Geographical Information System. Second edn. BS Publications, Hyderabad.


**Reference Books:**


1. Remote sensing and its applications by LRA Narayana University Press 1999.
2. Basics of Remote Sensing & GIS by S.Kumar, Laxmi Publications.
3. Lo. C.P.and A.K.W.Yeung (2002). Concepts and Techniques of Geographic Information Systems. Prentice-Hall of India Pvt. Ltd., New Delhi. Pp:492.
4. Peter A.Burrough, Rachael A.McDonnell (2000). Principles of GIS. Oxford University Press.
5. Ian Heywood (2000). An Introduction to GIS. Pearson Education Asia


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*Open Elective - I*

## ELEMENTS OF CIVIL ENGINEERING
**(Other than CE)**

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To understand different methods of surveying for various applications.
- To familiarize with various types of building materials, structures and transport systems.

**Learning Outcomes:**

Students will be able to

- carry out simple land survey and prepare maps showing the existing details.
- find out area of irregular shaped plane areas.
- understand building plan, elevation and section.
- get acquainted with construction materials and transportation systems

**UNIT – I: Introduction**

Introduction, history of the civil engineering, sub – disciplines of civil engineering.

**UNIT – II: Surveying**

Introduction, divisions of surveying, classification of surveying, principles of surveying. Linear measurements and errors–introduction, methods of linear measurements, chaining instruments, types of error and correction. Compass surveying – introduction, angular measurement using compass, whole circle bearing and reduced bearing, fore bearing and back bearing. Traverse surveying – introduction, chain and compass traversing, closing error and adjustments. Leveling – introduction, types of leveling instruments, dumpy level, adjustment of level, leveling staff.

**UNIT – III: Building Materials and Construction**

**Materials:**Introduction to construction materials like ferrous and non ferrous metals, alloys, Stones, Bricks, Lime, Cement, Timber, Sand, Aggregates, Mortar, Concrete and bitumen.**Construction:**Types of building, different loads considered in building design, types of foundation in building, other developments and constructions of buildings.

**UNIT – IV: Fire and Earthquake Protection in Building**

Introduction, fire protection in building, structural and architectural safety requirements of resistive structures, fire resistive properties of building materials,

fire exit requirements, force and acceleration on building due to earthquake, building response characteristics, building drift.

**UNIT – V: Water Supply, Sanitary and Electrical Works in Building**

Introduction, water supply system, water supply layout of a building, house drainage, traps, electrical works in building.

**UNIT – VI: Highway Engineering**

Introduction, historical background of road or highway, classification of roads, pavements and roads, traffic control mechanism.

**Text Books:**

1. Elements of Civil Engineering Author: Mimi Das Saikia, Bhargab Mohan Das and Madan Mohan Das Publisher: PHI Learning Private Limited New Delhi.
2. Elements of Civil Engineering Author: Dr. R.K. Jain and Dr. P.P. Lodha Publisher: McGraw Hill Education, India Pvt. Ltd.
3. Surveying Vol. I Author: Dr. B. C. Punmia, Ashokkumar Jain, Arunkumar Jain16th Edition Publisher: Laxmi Publication Delhi.
4. Building drawing Author: M.G.Shah, C.M.Kale and S.Y.Patki Publisher: Tata McGraw Hill.

**Reference Books:**

1. Surveying Theory and Practice (7th Edition) Author: James M Anderson and Edward M Mikhail Publisher: McGraw Hill Education, India Pvt. Ltd.
2. Surveying and Leveling Author: R. Subramanian Publisher: Oxford University.
3. Building drawing Author: M.G.Shah, C.M.Kale and S.Y.Patki Publisher: Tata McGraw Hill.
4. Civil Engg. Drawing Author: S. C. Rangwala Publisher: Charotar Pub. House Anand.

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*Open Elective - I*

## MODELING AND SIMULATION OF ENGINEERING SYSTEMS

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To Familiarize with programming skills in Equation Solving Software.
- To build Graphic user interface.

**Learning Outcomes:**

Students will be able to

- develop a Model of a Physical System.
- develop a systematic method to simulate engineering system and asses its performance.

**UNIT – I**: **Variables, scripts, and operations**

Getting Started, Scripts, Making Variables, Manipulating Variables, Basic Plotting

**UNIT – II: Visualization and programming**

Functions, Flow Control, Line Plots, Image/Surface Plots, Vectorization

**UNIT – III: Solving equations and curve fitting**

Linear Algebra, Polynomials, Optimization, Differentiation/Integration, Differential Equations

**UNIT – IV: Advanced methods**

Probability and Statistics, Data Structures, Images and Animation, Debugging, Online Resources

**UNIT – V: Symbolics, Simulink®, file I/O, building GUIs**

Symbolic Math, Simulink, File I/O, Graphical User Interfaces

**UNIT – VI:**

Examples on statistics, optimization, plots

**Text Books:**


1. "Getting started with MATLAB" by Rudra pratap, Oxford University, 2002.
2. MATLAB and SIMULINK for Engineers by Agam Kumar Tyagi,OUP 2011


**Reference Books:**


1. Spencer, R.L. and Ware, M (2008), Introduction to MAT Lab, Brigham Young Unviersity, available online, accessed, 7, 2008.
2. David F.Griffiths, October (2012) "An introduction to MAT Lab" the Unviersity of Dundee, available online, Acessed, October 2012..


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*Open Elective - I*

## RENEWABLE ENERGY SOURCES

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To study various types of non-conventional sources of energy and techniques used in exploiting solar, wind, tidal and geothermal sources of energy and bio-fuels.

**Learning Outcomes:**

StudentS will be able to

- analyze the significance of renewable energy.
- understand the principles of solar radiation and design the solar collectors.
- know the functioning of basic components of wind energy and understand the utilization of biomass in power generation.
- understand the working principles of geothermal, ocean, tidal and wave energy techniques.
- know the functioning of direct energy conversion techniques.

**UNIT – I:**

**Introduction:** Energy Sources and their availability, Role and potential of renewable source.

**Principles of Solar Radiation:** The solar constant, Solar Radiation outside the Earth's atmosphere, Solar Radiation at the Earth's surface, instruments for measuring solar radiation and sun shine, solar radiation data, solar radiation Geometry, solar radiation on titled surfaces with numerical problems.

**UNIT – II:**

**Solar Energy Storage and Applications:** Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications-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 windmills, performance characteristics, Betz criteria

**Bio-Mass:** Bio fuels, Methods for obtaining energy from Biomass, Anaerobic/ aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects. Thermal gasification of Biomass.

**UNIT – IV:**

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

**Ocean Energy:** OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles.

**Tidal and wave energy:** Potential and conversion techniques, Mini-hydel power plants and their economics.

**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, Figure of merit, Selection of materials, applications.

**UNIT – VI:**

**MHD power Generation:** Principles, dissociation and ionization, Hall Effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects.

**Fuel cells:** Principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

**Text Books:**

1. Tiwari and Ghosal, "Renewable energy resources", Narosa.
2. G.D. Rai, "Non-Conventional Energy Sources", Dhanpat Rai and Sons

**Reference Books:**

1. Twidell & Weir, "Renewable Energy Sources "
2. Sukhatme, "Solar Energy", Tata McGraw-Hill Education.
3. B.S Magal Frank Kreith & J.F Kreith, "Solar Power Engineering "
4. Frank Krieth & John F Kreider, "Principles of Solar Energy"

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*Open Elective - I*

## ELEMENTS OF MECHANCIAL ENGINEERING
**(Other than ME)**

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objective:**

- To familiarize with the basic principles of Mechanical Engineering required in various fields of engineering.

**Learning Outcomes:**

Students will be able to

- understand the fundamentals of mechanical systems.
- understand and appreciate significance of mechanical engineering in different fields of engineering.

**UNIT – I: Simple stress and strains**

Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic Moduli & the relationship between them.

**UNIT – II: Power Transmission Devices**

Introduction to power transmission, belt, rope, chain and gear drives, couplings, clutches (Theoretical treatment only)

Power Transmission through Shafts: Introduction, Torsion of Circular Shafts, Torsion equation, Hollow Circular Shafts, Torsional Rigidity, Power Transmitted by the Shaft (simple Problems).

**UNIT – III: Basic Manufacturing Methods**

Principles of casting , green sand moulds , Advantages and applications of casting ; Principles of gas welding and arc welding, Soldering and Brazing ; Hot working – hot rolling , Cold working – cold rolling ;

**UNIT – IV: Basics of Machine Tools and Engineering Materials**

**Basics of Machine Tools:** Description of basic machine tools- Lathe – operations – turning, threading, taper turning and drilling ;

**Engineering Materials** : Classification of engineering material, Composition of cast iron and carbon steels on Iron-Carbon diagram and their mechanical properties. Alloy steels and their application

**UNIT – V: IC Engines**

Introduction , Main components of IC engines , working of 4-stroke petrol engine and diesel engine , working of 2- stroke petrol engine and diesel engine , differences between petrol and diesel engines, differences between 4- stroke and 2- stroke engines. (Theoretical treatment only)

**Steam Boilers**: Function, classification, differences between water and fire tube boilers, mountings and accessories with their functions, construction and working of cochran, vertical, Lancashire and Babcock & Wilcox boiler (Theoretical treatment only).

**UNIT – VI:**

**Power Plants**: Introduction, working principle of steam and gas turbine power plant, working of hydraulic turbines and pumps (Theoretical treatment only).

**Refrigeration & Air conditioning**: Definition – COP, Unit of Refrigeration, Applications of refrigeration system, vapour compression refrigeration system , simple layout of summer and winter air conditioning system (Theoretical treatment only).

**Text Books:**

1. Elements of Mechanical Engineering – R.K.Rajput, Lakmi Pub., Delhi.
2. Elements of Mechanical Engineering – D.S.Kumar, S.K. Kataria and Sons

**Reference Books:**

1. Elements of Mechanical Engineering – K.R.Golala Krishnan, S.Gopala Krishnana, S.C.Sharma, Subhas Stores.
2. Elements of Mechanical Engineering – S.Tryambaka Murthy, I.K. International publishing house pvt. Ltd.

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*Open Elective - I*

## COMPUTER NETWORKS
**(Other than CSE & IT)**

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize with different transmission media.
- To gain knowledge of various protocols used for efficient transmission of data over network.

**Learning Outcomes:**

Students will be able to

- understand basic network topologies.
- choose appropriate transmission media for establishing a network.
- differentiate various data link layer protocols.
- choose appropriate routing algorithm suitable for the network for an organization.
- differentiate various transport layer protocols.
- analyze the type of network used in an organization.

**UNIT – I: Introduction**

OSI, TCP/IP, Examples of Networks: Novel Networks, Arpanet, Internet, Network Topologies, Classification of networks: LAN, MAN, WAN.

**UNIT – II: Physical Layer**

Transmission media- copper, twisted pair, wireless, switching and encoding asynchronous communications, Narrow band, broad band ISDN.

**UNIT – III: Data link layer & Medium Access sub layer**

**Data link layer:** Design issues, framing, error detection and correction, CRC, Elementary Protocol-stop and wait, Sliding Window, Data link layer in HDLC, Slip, and PPP.

**Medium Access sub layer:** ALOHA, Carrier sense multiple access. IEEE 802.x Standards, wireless LANs. Bridges

**UNIT – IV: Network Layer**

Virtual circuit and Datagram subnets, Routing algorithms- shortest path routing, Flooding, Hierarchical routing, Broad cast, Multi cast, distance vector routing, congestion control algorithms.

**UNIT –V: Transport Layer**

Transport Services, TCP, SCTP and UDP protocols.

**UNIT – VI: Application Layer**

Domain name system, SNMP, Electronic Mail, WWW

**Text Books:**

1. Computer Networks — Andrew S Tanenbaum, 4th Edition. Pearson Education/ PHI
2. Data Communications and Networking – Behrouz A. Forouzan.Third Edition TMH.

**Refence Books:**

1. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education.
2. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson.

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*Open Elective - I*

## OBJECT ORIENTED PROGRAMMING
**(Other than CSE & IT)**

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To get acquainted with the concepts of object-oriented programming.
- To create GUI using AWT components

**Learning Outcomes:**

Students will be able to

- understand the programming constructs of JAVA.
- apply concepts of inheritance.
- implement interfaces and packages through JAVA.
- simulate the concept of multi threading.
- handle run time errors.
- design and implement an effective GUI for various applications.

**UNIT – I: Fundamentals of OOP and Java**

Need of OOP, Principles of OOP Languages, Procedural Languages vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features.

Java Programming constructs: variables, primitive data types, identifiers, keywords, literals, operators, arrays, type conversion and casting,

**UNIT – II: Class Fundamentals and Inheritance**

Class fundamentals, declaring objects, methods, constructors, this keyword, garbage collection, overloading methods and constructors, argument passing, recursion, access control.

**Inheritance-** Basics, types, using super keyword, method overriding, dynamic method dispatch, abstract classes, using final with inheritance, object class, string class.

**UNIT – III: Interfaces and Packages**

**Interfaces:** Defining an interface, implementing interfaces, nested interfaces, applying interfaces, variables in interfaces and extending interfaces.

**Packages:** Defining, creating and accessing a package.

**UNIT – IV: Exception Handling and Multithreading**

**Exception Handling-** exception-handling fundamentals, exception types, uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws, finally, java's built-in exceptions, user-defined exception sub classes.

**MultiThreading-** differences between multi threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups.

**UNIT – V: Applets and Event Handling**

**Applets-** Concepts of Applets, differences between applets and applications, life cycle of an applet, creating applets.

**Event Handling-** Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes.

**UNIT – VI: AWT**

The AWT class hierarchy, user interface components- label, button, checkbox, checkboxgroup, choice, list, scrollbar, menubar, layout managers –Flow, Border, Grid, Card, GridBag.

**Text Books:**


1. Herbert schildt, Java The complete reference, TMH, 7th edition.
2. Sachin Malhotra, Saurabh choudhary, Programming in JAVA, Oxford.


**Reference Books:**


1. Joyce Farrel, Ankit R.Bhavsar, JAVA for Beginners, Cengage Learning, 4th edition.
2. Y.Daniel Liang, Introduction to Java Programming, Pearson, 7th edition.
3. P.Radha Krishna, Object Oriented Programming Through Java, Universities Press.


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*Open Elective - I*

## DATA STRUCTURES USING C
### (Other than EEE, ECE, CSE & IT)

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To gain knowledge of linear and non-linear data structures.
- To familiarize with different sorting and searching techniques.

**Learning Outcomes:**

Students will be able to

- implement single, circular and double linked list.
- implement stacks and queues using arrays and linked lists.
- implement various operations on binary trees.
- apply appropriate sorting and searching techniques for the given data.
- implement various operations on Graphs.

**UNIT – I: Linked lists**

**Introduction-** Concept of data structures, overview of data structures, implementation of data structures.

**Linked Lists-** Single linked list, Circularlinked list, Double linked list, Circular double linked list.

**UNIT – II: Stacks**

Representation using Arrays and Linked List, operations on stack, factorial calculation, evaluation of arithmetic expression.

**UNIT – III: Queues**

Representation using Arrays and Linked List, operations on queue, circular queue, queue using stack.

**UNIT - IV: Trees**

**Binary Trees:** Basic tree concepts, Properties, Representation of Binary Trees using Arrays and Linked List, Binary Tree Traversals, threaded binary tree.

**Binary search trees:** Basic concepts, BST operations: Search, insertion, deletion and traversals, Creation of binary search tree from in-order and pre (post)order traversals.

**UNIT - V: Sorting and Searching**

**Searching:** Linear Search, Binary Search, Fibonacci search.

**Sorting (Internal):** Basic concepts, Sorting by: insertion (Insertion sort), selection (selection sort), exchange (Bubble sort, quick sort), distribution (radix sort) and merging (merge sort).

**UNIT - VI: Graphs**

Basic concepts, representations of graphs, operations on graphs- vertex insertion, vertex deletion, find vertex, edge addition, edge deletion, graph traversals (BFS & DFS).

**Text Books:**


1. Debasis samanta, Classic Data Structures, PHI, 2nd edition, 2011.
2. Richard F, Gilberg , Forouzan, Data Structures, 2nd edition, , Cengage.


**Reference Books:**


1. Seymour Lipschutz, Data Structure with C, TMH.
2. G. A. V. Pai, Data Structures and Algorithms, TMH, 2008.
3. Horowitz, Sahni, Anderson Freed, Fundamentals of Data Structure in C, University Press, 2nd edition.


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*Open Elective - I*

## CYBER LAWS

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To expose the need of cyber laws to prosecute cybercrimes in the society.
- To understand the IT ACT 2000 for Cyber Crime and Cyber Justice.
- To introduce the Criminal Activities based on Internet.
- To familiarize various Licensing Issues Authorities for Digital Signatures.

**Learning Outcomes:**

Student will be able to

- outline the pros and cons of Internet.
- operate on Confidential data in a precautious manner.
- demonstrate about the Criminal Justice in India and its Implications.
- define the Cyber Consumers under the consumer Protection Act.
- devise the legal framework for Confidential Information.
- outline e-commerce issue for copyright protection and Defend Personal Data from being hacked.

**UNIT – I: The IT Act, 2000- A Ccritique**

Crimes in this Millennium, Section 80 of the IT Act, 2000 – A Weapon or a Farce?, Forgetting the Line between Cognizable and Non - Cognizable Officers, Arrest for "About to Commit" an Offence Under the IT Act, A Tribute to Darco, Arrest But No Punishment.

**UNIT – II: Cyber Crime and Criminal Justice**

Penalties, Adjudication and Appeals Under the IT Act, 2000: Concept of Cyber Crime and the IT Act, 2000, Hacking, Teenage Web Vandals, Cyber fraud and Cyber Cheating, Virus on Internet Deformation, Harassment and E- mail Abuse

**UNIT – III: Cyber Pornography**

Cyber Pornography, Other IT Offences, Monetary Penalties, Adjudication and Appeals Under IT Act 2000, Network Service Providers, Jurisdiction and Cyber Crimes, Nature of Cyber Criminality Strategies to Tackle Cyber Crime and Trends, Criminal Justice in India and Implications.

**UNIT – IV: Digital Signatures, Certifying Authorities and e-Governance**

Introduction to Digital Signatures, Certifying Authorities and Liability in the Event of Digital Signature compromise, E - Governance in the India. A Warming to

Babudom, Are Cyber Consumers Covered under the Consumer Protection, Goods and Services, Consumer Complaint Defect in Goods and Deficiency in Services Restrictive and Unfair Trade Practices

**UNIT – V: Traditional Computer Crime**

Early Hacker and Theft of Components Traditional problems, Recognizing and Defining Computer Crime, Phreakers: Yesterday's Hackers, Hacking, Computers as Commodities, Theft of intellectual Property

**UNIT – VI: Web Based Criminal Activity**

Interference with Lawful Use of Computers, Malware, DoS (Denial of Service) and DDoS (Distributed Denial of Service) Attacks, Spam ,Ransomware and Kidnapping of Information, Theft of Information, Data Manipulation, and Web Encroachment Online Gambling Online Fraud, Securities Fraud and stock Manipulation, Ancillary crimes

**Text Books:**

1. Vivek Sood, " Cyber Law Simplefied", Tata McGraw Hill.
2. Marjie T. Britz, "Computer Forensics and Cyber Crime", Pearson

**Reference Book:**

1. Cyber Laws Texts and Cases, Ferrera, CENGAGE.

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*Open Elective - I*

## OPEN SOURCE SOFTWARE

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To understand the opportunities for open source software in the global market.
- To familiarize the different steps in implementing the open source.

**Learning Outcomes:**

Students will be able to

- analyze the open source software need and applications.
- explain LINUX operating systems concepts.
- work with MySQL database.
- design and develop a web application using PHP.

**UNIT – I: Introduction**

Introduction to Open sources – Need of Open Sources – Advantages of Open Sources–Application of Open Sources.

**UNIT – II: LINUX**

LINUX Introduction – General Overview – Kernel Mode and user mode , Process – Advanced Concepts – Scheduling – Personalities – Cloning – Signals – Development with Linux.

**UNIT – III: Introduction to MySQL**

MySQL: Introduction – Setting up account – Starting, terminating and writing your own SQL programs – Record selection Technology – Working with strings – Date and Time

**UNIT – IV: Working with MySQL**

Sorting Query Results – Generating Summary – Working with metadata – Using sequences – MySQL and Web.

**UNIT – V: Open Source Programming Languages**

PHP- Introduction – Programming in web environment – variables – constants – data types – operators – Statements – Functions – Arrays – OOP – String Manipulation and regular expression – File handling and data storage

**UNIT – VI: PHP and SQL**

PHP and SQL database –PHP and LDAP – PHP Connectivity – Sending and receiving E-mails –Debugging and error handling – Security – Templates.

**Text Books:**

1. Remy Card, Eric Dumas and Frank Mevel, “The Linux Kernel Book”, Wiley Publications,2003.
2. Steve Suchring, “MySQL Bible”, John Wiley, 2002

**Reference Books:**

1. Rasmus Lerdorf and Levin Tatroe, “Programming PHP”, O’Reilly, 2002.
1. Steven Holzner, “PHP: The Complete Reference”, 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2009.
3. Vikram Vaswani, “MYSQL: The Complete Reference”, 2nd Edition, Tata McGraw –Hill Publishing Company Limited, Indian Reprint 2009.

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*Open Elective - I*

## FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEMS
**(Other than CSE & IT)**

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives**

- To introduce the database management systems and applications, Database System Architectures.
- To expose E- R Modeling and Design.
- To explain Relational Data Model and Relational Algebra.
- To demonstrate Structured Query Language and apply different operations on Database.
- To explain Transaction management.

**Learning Outcomes:**

Students will be able to

- develop Conceptual(ER- modeling) and Logical models specified requirements of data base.
- describe the basics of SQL. Can construct tables and answer queries using SQL.
- perform Schema refinement.
- interpret the basic issues of transaction processing.

**UNIT – I: Introduction to DataBase**

Purpose of Database Systems Vs File System, Data Models, Schema and instances, DBMS Architecture, E- R Model- Attributes and Keys, Relationship Types, Weak Entity set, Strong Entity Set.
(Practice: Execute DDL, DML, DCL and TCL Commands. )

**UNIT – II: Enhanced E–R Modeling**

Specialization and Generalization, Database design for Banking Enterprise, Relational model concepts, constraints.
(Practice:. Execute basic SELECT operations.)

**UNIT – III:SQL**

DDL, DML, DCL, Set operations, Aggregate Functions, Null values, Nested queries. Defining different constraints on a table, apply joins on tables, Creating Views and Indices.
(Practice: Execute a single line and group functions for a table, set operations on various Relations.)

**UNIT – IV: Database Bottom Up Design**

Functional Dependencies and Normalization for Relational Databases: Informal design guidelines for relation schemes, Functional dependencies,
(Practice: Execute Orderby, Groupby clause on various Relations)

**UNIT – V: Normal forms**

First, second and third normal forms, Boyce- Cod normal form, Multi valued & Join Dependencies, 4th & 5th Normal forms.
(Practice: Implement the following Integrity Constraints
a. Primary Key b. Foreign Key c. Unique d. Not NULL and Check. )

**UNIT – VI: Transaction Management**

Transaction concept, ACID properties, Concurrent execution of transactions
(Practice: Execute Nested Queries)

**Text Books**

1. Korth & Sudarshan *Database system concept*, TMH.
2. Raghu Ramakrishnan, Johannes Gehrke *Database Management Systems,* TMH

**Reference Books**

1. Peter Rob & C Coronel *Database Systems design, Implementation, and Management*, 7th Edition.
2. Elmasri Navrate *Fundamentals of Database Systems* , Pearson Education.
3. C.J.Date *Introduction to Database Systems,* Pearson Education.

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*Open Elective - I*

## FUZZY MATHEMATICS

III Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To know the fundamentals of fuzzy algebra.
- To know the basic definitions of fuzzy theory.
- To know the applications of fuzzy Technology.

**Learning Outcomes:**

Students will be able to

- understand the fundamentals of fuzzy algebra.
- apply fuzzy logic.

**UNIT – I:**

Introduction – Fuzzy subsets – Lattices and Boolean Algebras – L fuzzy sets.

**UNIT – II:**

Operations on fuzzy - $\alpha$ levels sets – properties of fuzzy subsets of a set. Sections 1.1-1.10.

**UNIT – III:**

Algebraic product and sum of two fuzzy subsets – properties satisfied by addition and product – Cartesian product of fuzzy subsets. Sections 1.11 -1.13.

**UNIT – IV:**

Introduction – Algebra of fuzzy relations – logic – connectives. Sections 2.1-2.4.

**UNIT – V:**

Some more connectives – introduction – fuzzy subgroup – homomorphic image and Pre-image of subgroupoid. Sections 2.5,3.1-3.3.

**UNIT – VI:**

Fuzzy invariant subgroups - fuzzy subrings. Section 3.4 and 3.5.

**Text Books:**

1. Recommended Text S.Nanda and N.R.Das "Fuzzy Mathematical concepts, Narosa Publishing House, New Delhi.

**Reference Books:**

1. Fuzzy Logic with Engineering Applications, Second Edition, Wiley Publications, Timothy J.Ross.
2. Fuzzy Set Theory and Its Applications, Fourth Edition,Yes Dee Publishing Pvt. Ltd., Springer, H.-J. Zimmermann.

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# MACHINE TOOLS LAB

III Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To impart experience in operation of basic machine tools

**Learning Outcomes:**

Students will be able to

- operate lathe machine to carry out step turning, taper turning, knurling, thread cutting, drilling and boring operations.
- perform drilling operation and distinguish tap set and perform tapping operation.
- perform shaping and planing operations.
- perform indexing operation to prepare gear on milling machine.
- carry out cylindrical and surface grinding operations.
- carry out grinding operation on single point cutting tool to obtain different tool angles.

**List of Experiments:**

1. Step turning.
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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# THERMAL ENGINEERING LAB

III Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To study experimentally the performance of IC engines, compressor, refrigeration and air conditioning systems.
- To study various components of steam boilers.

**Learning Outcomes:**

Students will be able to

- analyze the performance and determine the operating characteristics of I.C engine using rope brake , hydraulic brake, electrical dynamometers.
- draw the heat balance sheet for an I.C Engine.
- analyze the performance of reciprocation air compressor.
- analyze the performance of refrigeration and air conditioning test rigs.

**List of Experiments:**

1. Valve timing diagram of 4- stroke single cylinder diesel engine.
2. Port timing diagram of 2- stroke single cylinder petrol engine.
3. Disassembly / assembly of 4- stroke single cylinder petrol engine.
4. Load test on 4-stroke single cylinder diesel engine.
5. Load test on 2-stroke single cylinder petrol engine.
6. Morse test on 4-stroke multi cylinder petrol engine.
7. Motoring and retardation test on 4-stroke single cylinder diesel engine.
8. Heat balance test on 4 - stroke single cylinder diesel engine.
9. Economical speed test on 4- stroke multi cylinder petrol engine.
10. Load test on 4 - stroke single cylinder variable compression ratio petrol engine.
11. Performance test on reciprocating air compressor.
12. Performance test on Refrigeration test rig.
13. Performance test on Air conditioning and Heat Pump test rig.
14. Study of Boilers.

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## COMPUTER AIDED MODELING LAB

III Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To develop the Skills for modeling of machine components using modeling package.

**Learning Outcomes:**

Students will be able to

- draw orthographic views of mechanical parts.
- model different mechanical components.
- create assembly and detailed drawings of components.

**List of Experiments:**

1. Drafting of cotter joint
2. Drafting of Coupling and Bearning
3. Part Drawing of Screw Jack
4. Part Drawing of stuffing box
5. Indication of Fits Tolerances on drawings
6. Modeling of components of eccentric
7. Modeling of components of Stuffing Box
8. Indication of Surface roughness, heat treatment and surface treatment symbols on drawings.
9. Assembly of Hooks Joint
10. Assembly of Pipe vice
11. Detailed drawing of Oldham coupling.
12. Detailed drawing of Eccentric

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# OPERATIONS RESEARCH

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To formulate the management problem as LPP, transportation problem and assign problems and locate solution.
- To familiarize with the concepts of replacement theory, inventory theory, queuing theory, dynamic programming and simulation.

**Learning Outcomes:**

Students will be able to

- observe the behaviour of systems through modelling .
- manage inventory through mathematical models.
- assess the life of systems using replacement theory.
- evaluate operating characteristics in queuing theory.
- apply dynamic programming to multi stage decision making problems.
- forecast the demand using queuing and inventory models.

**UNIT – I: Introduction to Operations Research and Linear Programming Problem**

Introduction to OR: Development - definition – characteristics and phases - OR models –applications - Linear Programming problem- Formulation- Graphical Solution- standard form of LPP- Simplex Method - artificial variables techniques - Big-M method – duality principle

**UNIT – II: Transportation - Assignment**

Transportation problem: Formulation- Finding IBFS and Optimal solution- Unbalanced and Degeneracy - assignment problems-formulation- optimal solution- Special Cases in Assignment Problems- Travelling Salesman Problem.

**UNIT – III: Replacement Model - Game Theory**

Introduction, Replacement of items that deteriorate with time- Individual replacement when money value is counted and not counted –replacement of items that fail completely, group replacement .

Introduction, Two Person Zero sum games, Maximin - Minimax principle, Solution of Games with and without saddle points, Dominance property and Graphical solution of 2 x n and m x2 games.

**UNIT – IV: Waiting Line Models - Job Sequencing**

Introduction - Elements of Queuing system- Operating characteristics- Classification of queuing models: single channel-poisson arrivals-exponential

service times-with infinite and finite population models-multi channel-poisson arrivals-exponential service times with infinite population

Job sequencing: Introduction - Processing n jobs through two ,three and' m' machines- two jobs through' m' machines

**UNIT – V: Inventory Control**

Introduction, - single item - Types of Inventories- Costs associated with inventory-the concept of EOQ- Deterministic inventory model with and without shortages – purchase inventory model- one price break and multiple price breaks - stochastic inventory model-instantaneous production, Instantaneous demand and continuous demand and no set up cost

**UNIT – VI: Dynamic Programming and Simulation**

Dynamic programming: introduction-Bellman's principle of optimality-application of dynamic programming-capital budget problem. Simulation; types of simulation - Monticarlo simulation – simulation of queuing and inventory models – advantages and disadvantages

**Text Books:**

1. S.D. Sharma, "Operations Research", 8th ed., Kedarnath Publishers, 2007.
2. Taha, "Introduction to Operations Research.", 8th ed., PHI Publications, 2008.

**Reference Books:**

1. Wagner," Operations Research" PHI Publications.
2. Kanthi Swarup, P.K.Gupta and Man Mohan, " Operations Research" , Sultan Chand & Sons New Delhi, Fourteenth Edition -2008.

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# DESIGN OF MECHANICAL COMPONENTS

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize with the design of various machine elements for effective power transmission based on strength and rigidity.

**Learning Outcomes:**

Students will be able to

- design different types of bearings.
- design connecting rod, crank shaft and piston.
- design members having curved beams and power screws.
- design power transmission systems like belts, ropes and chain drives, gears.
- design springs.

**UNIT - I:**

**Journal Bearings:** Classification of bearings – applications ,Types of Journal bearings – Lubrication – Bearing Modulus – Full and partial bearings –Clearance ratio – Heat dissipation of bearings, bearing materials – journal bearing design

**Ball and roller bearings** : classification and selection of ball and roller bearings, Static and dynamic load rating, Bearing life, load-life relations,.

**UNIT - II:**

**Engine Parts-Connecting Rod:** Thrust in connecting rod – stress due to whipping action on connecting rod ends – Cranks and Crank shafts, strength and proportions of over hung and center cranks – Crank pins, Crank shafts.

Pistons, Forces acting on piston – Construction, Design and proportions of piston, Cylinder, Cylinder liners

**UNIT - III:**

**Design of curved beams**: Introduction, stresses in curved beams, Expression for radius of neutral axis for rectangular, circular, trapezoidal and T-Section, Design of Levers

**Design of power screws:** Design of screw - Square, ACME, Buttress screws, design of nut, compound screw, differential screw, ball screw- possible failures.

**UNIT - IV:**

**Power Transmissions Systems, Pulleys:** Transmission of power by Belt and Rope drives , Transmission efficiencies, Selection of Belts – Flat and V types – Ropes - pulleys for belt and rope drives, Materials, Chain drives

**UNIT - V:**

**Spur & Helical Gear Drives:** Spur gears and Helical gears – Lewis Equation - Load concentration and Dynamic load factor - Bending strength– Check for plastic deformation.

**UNIT - VI:**

**Mechanical Springs:** Stresses and deflections of helical springs – extension - compression springs – Non-circular springs for fatigue loading, energy storage capacity – helical torsion springs – co-axial springs, leaf springs.

**Text Book:**

1. V.B.Bandari "Introduction to Machine Design", TMH Publishers.
2. T.V. Sundararajan murthy and N.Shanmugam, "Machine design", Anuradha publications.

**Reference Books:**

1. Robert L.Norton, "Machine Design – An integrated approach", 2nd edition, Pearson education India.
2. Joseph Edward Shigley, Charles R.Mischke , "Mechanical engineering design", TMH Publishers.
3. Dr. N.C. Pandya & Dr. C. S. Shah "Machine design" Charotar Publishing House Pvt.

**Note : Design Data Book is to be allowed**

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# METROLOGY AND INSTRUMENTATION

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize with the principles of measurement of dimensional and geometric parameters of mechanical elements.

**Learning Outcomes:**

Students will be able to

- describe the importance of tolerance and allowance in manufacturing.
- distinguish between line standards and end standards.
- design of limit gauges.
- apply the principles of interferometer and optics in measurement of flatness and straightness.
- interpret the significance of surface roughness and calculate the surface roughness parameters.
- explain the basic principles of measurement systems.
- judge the appropriate instrument to measure the physical parameters like pressure, temperature, force, torque, displacement, speed and strain.

**UNIT - I:**

**Systems of limits and fits:** Introduction, normal size, tolerance limits, deviations, allowance, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability, deterministic & statistical tolerance, selective assembly. British standard system, International Standard system, application of limits and tolerances for correct functioning.

**Limit Gauges:** Taylor's principle – Design of go and No go gauges, plug, ring, snap, gap, taper, profile and position gauges.

**UNIT - II:**

**Linear Measurement:** Length standard, line and end standard, slip gauges – calibration of the slip gauges, Dial indicator, micrometers.

**Measurement of Angles and Tapers:** Different methods – Bevel protractor – angle slip gauges – spirit levels – sine bar – Sine plate, rollers and spheres used to determine the tapers.

**Optical Measuring Instruments:** Tool maker's microscope and its uses – collimators, optical projector – optical flats and their uses. Interference of light, Michaleson's interferometer, NPL flatness interferometer and NPL gauge interferometer.

**UNIT - III:**

**Flat Surface Measurement:** Measurement of flat surfaces – instruments used – straight edges – surface plates – auto collimator.

**Surface Roughness Measurement :** Differences between surface roughness and surface waviness-Numerical assessment of surface finish – CLA,R, R.M.S

Values – Rz values, R10 value, Methods of measurement of surface finish-profilograph. Talysurf, ISI symbols for indication of surface finish.

**UNIT - IV:**

**Measurement Instruments** – Measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics – sources of error, Classification and elimination of error.

**Measurement of Displacement:** Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

**UNIT - V:**

**Measurement of Temperature:** Classification – Ranges – Various Principles of measurement – Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers – Temperature Indicators.

**Measurement of Pressure:** Units – classification – different principles used. Manometers, Piston, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge.

**Flow Measurement:** Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).

**UNIT - VI:**

**Measurement of Speed:** Mechanical Tachometers – Electrical tachometers – Stroboscope, Noncontact type of tachometer.

**Measurement of Force, Torque and Power:** Elastic force meters, load cells, Torsion meters, Dynamometers.

**Stress and Strain Measurement:** Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, Strain gauge Rosettes.

**Text Books:**


1. R.K. Jain,"Engineering Metrology", Khanna Publishers.
2. Mahajan,"Engineering Metrology ",Danpath Rai Publications.
3. D.S.Kumar, "Measurement Systems: Applications & design",Anuradha Agencies.
4. BeckWith, Marangoni,Linehard, " Mechanical Measurements", 6th edition, PHI / PE.


**Reference Books:**


1. I.C.Gupta ,"Engineering Metrology", Danpath Rai Publications.
2. Connie Dotson "Fundamentals of Dimensional Metrology 4e ",Thomson Publications.
3. Doeblin Earnest. O. Adaptation by Manik and Dhanesh,"Measurement systems: Application and design", Tata Mc Graw Hill Publications.
4. S.Bhaskar, "Instrumentation and Control systems ", Anuradha Agencies.


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*Elective - I*

## AUTOMOBILE ENGINEERING

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To study various components of an automobile and engine sub systems such as fuel supply, lubrication, cooling and ignition.
- To introduce various safety systems of an automobile and emission norms.

**Learning Outcomes:**

Students will be able to

- analyze complete details & Working of fuel supply systems in automobile vehicle and modern trends in fuel supply systems.
- understand necessity and working of cooling system, lubrication, electrical and starting systems.
- understand systems that are transmitting power from prime mover of automobile to the road wheels.
- familiarize with the systems for stability for an automobile.
- understand the safety systems used and emission standards of an automobile.

**UNIT - I:**

**Introduction:** Components of four wheeler automobile – chassis and body, power unit, power transmission – rear wheel drive, front wheel drive, Four wheel drive , Types of automobile engines, Engine construction,

**Fuel System: S.I. Engine:** Fuel supply systems - Mechanical and electrical fuel pump, carburetor – types, air filters, petrol injection.

**C.I. Engines:** Requirements of diesel injection systems, Fuel injection systems, Fuel Injection pump, Fuel Injector(Nozzle), air filters, spray formation, injection timing.

**UNIT - II:**

**Lubrication System**: Necessity, functions, Engine lubrication systems, Splash and pressure lubrication systems, oil filters, oil pumps, Engine Service, Reboring of cylinder block.

**Cooling System:** Cooling Requirements, Air Cooling, Water Cooling - Thermo siphon systems and Pump circulation System. Components of Water cooling system -Radiators, Pressure cap, Cooling Fan, water pump, thermostat. Liquid Cooling evaporating cooling, pressure sealed cooling, antifreeze solutions.

**UNIT - III:**

**Ignition System:** Function of an ignition system, battery ignition system, constructional features of Battery ignition System - Battery, Ignition Coil, contact

breaker, distributor, condenser and spark plug. Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact less triggers, ignition advance, ignition Timing

**Electrical System:** Charging Systems **-** Charging circuit, generator, -principle, construction details, current, voltage regulator, starting system, Bendix drive mechanism, staring Motor switches ,Types, lighting systems, Horn, wiper, fuel gauge, oil pressure gauge, engine temperature indicator .

**UNIT - IV:**

**Transmission System:** Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, semi -centrifugal clutch and centrifugal clutches, fluid fly wheel , gear boxes, types, sliding mesh, constant mesh gear box, synchromesh gear box, epicyclic gear box , torque converter. Propeller shaft, universal joint, differential, rear axles – Hotchkiss drive, Torque tube drive ,wheels and tyres.

**Steering System:** Steering geometry – camber, castor, king pin rake, combined angle, toe-in, correct steering angle. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages, power Steering.

**UNIT - V:**

**Suspension System:** Objectives of suspension systems, Front Suspension – rigid axle suspension system, Independent suspension system. Rear axle Suspension, torsion bar, shock absorber.

**Braking System:** Mechanical brake system, Hydraulic brake system - Master cylinder, wheel cylinder, tandem master cylinder. Requirement of brake fluid, Air Brakes,vacuum brakes.

**UNIT - VI:**

**Emissions from Automobiles** – Pollution standards National and international, Reduction of formation of Pollutants, Treatment of Exhaust gases to reduce pollutants, Use of alternative fuels for emission control, Noise pollution and control.

**Safety Systems** - Seat belt, air bags, bumper, anti lock brake system(ABS), Wind Shield . Suspension Sensor, Traction Control mirrors, Central Locking System and electric windows ,Speed Control

**Text Books:**


1. Kirpal Singh, " Automobile Engineering – Vol. 1 & Vol. 2" ,Standard publishers distributers.
2. William Crouse,"Automotive Mechanics",Tata Mc Graw Hill Publications .


**Reference Books:**


1. Newton Steeds & Garrett, "Automotive Engineering" , Society of Automotive Engineers.
2. G.B.S. Narang, "Automotive Engineering " khanna publishers.
3. Heitner, "Automobile Engineering", 2nd Edition, IPC Transport Press Ltd.,
4. S.Srinivasan, "Automotive Engines " , Tata Mc Graw Hill Publications.


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*Elective - I*

## FINITE ELEMENT METHODS

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize with the concepts of finite element method for analyzing structural and heat transfer problems

**Learning Outcomes:**

Students will be able to

- derive displacement , stress , strain relations and apply variational and weighted residual methods to solve differential equations.
- determine the elongation ,stresses and strains in one dimensional bar problems.
- determine the deflections in beams using beam element.
- compute stress and strains in two dimensional problems using constant strain triangle and iso parametric elements.
- evaluate the rate of heat transfer and temperature distribution in thin plates and fin.
- determine natural frequencies of free vibration problems.

**UNIT - I:**

**Introduction:** stress and equilibrium, strain – displacement relations, stress – strain relations, plane stress and plane strain conditions, variational and weighted residual methods

**Finite Element Method:** Discretization, Types of elements, band width, node numbering, interpolation functions, local and global coordinates, convergence requirements, Types of boundary conditions, Steps in Finite Element Method ,Applications of Finite Element Method .

**UNIT - II:**

**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 - III:**

**Analysis of Beams:** Beam Element - Shape functions and Element stiffness matrix, load vector for concentrated and Uniformly Distributed Load , simple problems on beams.

**UNIT - IV:**

**Two Dimensional Problems:** Finite element modeling of two dimensional Problems - constant strain triangle Element - treatment of boundary conditions 2-D

four noded iso parametric element, numerical integration , Gaussian Quadrature Approach.

**UNIT - V:**

**Steady state heat transfer analysis:** 1- D Thermal analysis of thin plane walls, analysis of a fin.

**UNIT - VI:**

**Dynamic Analysis:** Free Vibrations , Longitudinal Vibrations and Transverse Vibrations , Eigen Values and Eigen Vectors , Natural Frequencies for bar and beam problems.

**Text Books:**


1. Chandraputla, Ashok and Belegundu, "Introduction to Finite Elements in Engineering" Prentice – Hall.
2. Sk.Md. Jalaluddin ,"Finite Element Analysis ", Anuradha Publications.


**Reference Books:**


1. JN Reddy, "An introduction to Finite Element Method ", McGrawHill.
2. SS Rao, "The Finite Element Methods in Engineering ", Pergamon.
3. Daryl L Logan, "A first course in finite element method", Cengage Learning.
4. C. S. Krishnamoorthy , "Finite Element Analysis -Theory and Programming " ,Tata Mc Graw Hill.


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*Elective - I*

## UNCONVENTIONAL MACHINING PROCESS

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize with the principles of unconventional machining methods to manufacture the components

**Learning Outcomes:**

Students will be able to

- analyse the main limitations of Conventional Machining.
- explain the basic Mechanism of material removal in non-traditional machining methods.
- identify the influence of process parameters in non-traditional machining methods.
- Judge the appropriate non-traditional machining method for suitable application.

**UNIT - I:**

**Introduction** – Need for non-traditional machining methods - Classification of mechanical processes – considerations in process selection. Materials. Applications.

**UNIT - II:**

Ultrasonic machining – Basic Principle - Elements of the process, mechanics of material removal process parameters, economic considerations, applications and limitations, recent development, MRR.

**UNIT - III:**

Abrasive jet machining, Water jet machining and abrasive water jet machining: Basic principles, equipments, process variables, mechanics of material removal, MRR, application and limitations.

**UNIT - IV:**

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

**UNIT - V:**

**Thermal Processes:** General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes – Power circuits for EDM, Mechanics of material removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, Wire EDM, principle, applications. EBM, MRR.

**UNIT - VI:**

Application of plasma for machining, material removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. Magnetic abrasive finishing, Abrasive flow finishing, Electrostream drilling, Shaped tube electrolytic machining.

**Text Book:**

1. Benedict G.F., "Non Traditional Manufacturing Processes", CRC Press.
2. V.K.Jain, "Advanced Machining Processes", 2nd ed., Allied Publisher Bombay.

**Reference Books:**

1. Pandey P.C. &Shah H.S, "Modern Machining Processes" , TMH.
2. HMT, "Production Technology" , McGraw-Hill.
3. Ghosh & Mallik,"Manufacturing Science" , east west publications.
4. Advanced machining processes, "McGraw-Hill, Hassan Abdul, Gawad En Hohg.

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*Elective - I*

## CONTROL SYSTEMS

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To introduce the basic principles of control systems to develop mathematical models for physical systems.
- To familiarize the students on the basic concepts of feedback characteristics of control systems for standard test signals.
- To familiarize the students on finding stability of control systems using time and frequency domain techniques.

**Learning Outcomes:**

Students will be able to

- develop mathematical models for physical systems using the knowledge of fundamental principles of mathematics and control systems.
- apply the knowledge of various controlling techniques to develop suitable controller to meet specific requirements.
- describe and determine the various time and frequency domain specifications.
- select appropriate stability techniques to determine performance characteristics of physical systems.

**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 functions.

**UNIT - II: Control Systems Components**

Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver, Block diagram representation of systems considering -Block diagram algebra – Representation by Signal flow graph - 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 – Effects of proportional derivative, proportional integral, proportional integral derivative systems.

**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-effects of adding poles and zeros to G(s)H(s) on the root loci.

**UNIT - V: Frequency Response Analysis**

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots-Stability Analysis.

**UNIT - VI: State Space Analysis of Continuous Systems**

Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations-State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

**Text Books:**


1. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International Limited Publishers, 2nd edition.
2. B.C.Kuo , john weley and son's, "Automatic control system", 8th edition, 2003.


**Reference Books:**


1. K.Ogata, "Modern control engineering" , prentice Hall of India Pvt. Ltd., 3rd edition, 1998.
2. N.K.Sinha, "Control system", New Age International (p) Limited Publishers, 3rd edition, 1998.
3. Norman S-Nice, "Control system engineering" , Willey Studio edition, 4th edition.
4. Joseph J Distefano-III, Allen R. Stubberud, Ivan J. Willioms, "Feed back and control system" , Tata Mc-graw Hill, 2nd edition.


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*Open Elective - II*

## DISASTER MANAGEMENT

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To learn about disaster occurrence, strategies and remedial measures.

**Learning Outcomes:**

Students will be able to

- explain the aspects of disaster management and adopt remedial measures.
- access the impact of hazards on structures.
- explain the vulnerability conditions.
- adopt the rehabilitation procedures.

**UNIT – I: Introduction**

Concept of Disaster Management. Types of Disasters. Disaster mitigating agencies and their organizational structure at different levels.

**UNIT – II: Overview of Disaster Situations in India**

Vulnerability of profile of India and Vulnerability mapping including disaster – pone areas, communities, places. Disaster preparedness – ways and means; skills and strategies; rescue, relief reconstruction. Case Studies: Lessons and Experiences from Various Important Disasters in India

**UNIT – III: Flood and Drought Disaster**

Raising flood damage, assessing flood risk, flood hazard assessment, flood impact assessment, flood risk reduction options. Drought and development, relief management and prevention, drought mitigation and management- integrating technology and people.

**UNIT – IV: Landslide and Earthquake Disaster**

Land slide hazards zonation mapping and geo environmental problems associated with the occurrence of landslides. The use of electrical resistivity method in the study of landslide. Studies in rock mass classification and land slide management in a part of Garwal-Himalaya, India. Causes and effects of earth quakes. Secondary effects. Criteria for earthquake resistant design.

**UNIT – V: Cyclone and Fire Disaster**

Cyclone occurrence and hazards. Cyclone resistant house for coastal areas. Disaster resistant construction role of insurance sector. Types of fire. Fire safety and fire fighting method, fire detectors , fire extinguishers.

**UNIT – VI: Rehabilitation**

Rehabilitation programmes, Management of Relief Camp, information systems & decision making tools

**Text Books:**


1. Disaster Management, RB Singh (Ed), Rawat Publications, 2000.
2. Disaster Management Future Challenges and Opportunities, jagbir singh, I.K international publishing house


**Reference Books:**


1. Natural Hazards in the Urban habitat by Iyengar, CBRI, Tata McGraw Hill
2. Natural Disaster management, Jon Ingleton (Ed), Tulor Rose, 1999
3. Anthropology of Disaster management, Sachindra Narayan, Gyan Publishing house, 2000.


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*Open Elective - II*

## SOLID WASTE MANAGEMENT
**(Other than CE)**
III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To learn about Solid Waste management
- To describe the collection, treatment and disposal methods of Solid waste

**Learning Outcomes:**

Students will be able to

- identify the types and sources of solid waste, and its characteristics.
- employ the treatment and disposal methods of solid waste.
- apply the concepts of solid waste management.

**UNIT – I: Introduction**

Definition of solid waste, garbage, rubbish-Sources and Types of solid wastes-Municipal waste, industrial waste, plastic waste, electronic waste, bio-medical waste and hazardous waste - Characteristics of Solid Wastes: Physical, chemical and biological characteristics- Problems due to improper disposal of solid waste.

**UNIT – II: Functional Elements of Solid Waste Management**

Waste generation and handling at source-onsite storage-Collection of solid wastes-Collection methods and services-storage of solid waste- guidelines for collection route layout.

**UNIT – III: Transfer and Transport of Wastes**

Transfer station-types of vehicles used for transportation of solid waste-Processing and segregation of the solid waste- various methods of material segregation.

**UNIT – IV: Processing and Transformation of Solid Wastes**

Recycling and recovery principles of waste management- Composting: definition-methods of composting-advantages of composting- Incineration: definition-methods of incineration advantages and disadvantages of incineration.

**UNIT – V: Treatment and Disposal of Solid Waste**

Volume reduction, Open dumping, land filling techniques, Landfills: classification-Design and Operation of landfills, Land Farming, Deep well injection.

**UNIT – VI: Waste Minimization**

Introduction to waste minimization, waste minimization techniques-5R (refuse, reduce, reuse, recover, recycle), municipal waste minimization, industrial waste minimization.

**Text Books:**

1. Solid and hazardous waste management by M.N.Rao and Razia sultana, BS publications
2. Environmental Engineering by Howard S.Peavy, Donald R.Rowe and George Tchobanognous

**Refence Books:**

1. Integrated Solid Waste Management by Tchobanognous.
2. Environmental engineering by Y.Anjaneyulu, B.S publication.
3. Environmental Pollution Control Engineering by C.S. Rao; Wiley Eastern Ltd., New Delhi.
4. Environmental engineering by Gerad Kiley, Tata Mc Graw Hill

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*Open Elective - II*

## ENERGY AUDIT, CONSERVATION AND MANAGEMENT

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To introduce the basic concepts of Energy Auditing and Management.
- To familiarize the various Techniques of Electrical Energy Conservation.

**Learning Outcomes:**

Students will be able to

- understand the Process of Energy Audit of Industries.
- apply the concepts of Energy management for Efficient Energy Utilization and Conservation.
- identify a suitable method for Energy Conservation of various electric devices.
- analyze the benefits of energy conservation from the Economic aspects.

**UNIT - I: Basic Principles of Energy Audit**

Energy audit- definitions, concept , types of audit, energy index, cost index ,pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit.

**UNIT - II: Energy Management**

Principles of energy management, organizing energy management program, initiating, planning,controlling, promoting, monitoring, reporting- Energy manger, Qualities and functions, language, Questionnaire – check list for top management.

**UNIT - III: Energy Efficient Motors**

Energy efficient motors , factors affecting efficiency, loss distribution , constructional details, characteristics - variable speed , variable duty cycle systems, RMS hp-voltage variation-voltage unbalance- over motoring- motor energy audit.

**UNIT - IV: Power Factor Improvement**

Power factor – methods of improvement, location of capacitors, Pf with non linear loads, effect of harmonics on power factor, power factor motor controllers

**UNIT - V: Lighting and Energy Instruments**

Good lighting system design andpractice, lighting control ,lighting energy audit – Energy. Instruments- wattmeter, data loggers, thermocouples, pyrometers, lux meters, tongue testers, application of PLC's.

**UNIT - VI: Economic Aspects and Analysis**

Economics Analysis-Depreciation Methods, time value of money, rate of return , present worth method , replacement analysis, life cycle costing analysis- Energy efficient motors- calculation of simple payback method, net present worth method- Power factor correction, lighting - Applications of life cycle costing analysis, return on investment .

**Text Books:**


1. Energy management by W.R. Murphy AND G. Mckay Butter worth, Heinemann publications.
2. Energy management by Paul o' Callaghan, Mc-graw Hill Book company-1st edition, 1998


**Reference Books:**


1. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd-2nd edition,1995.
2. Energy management hand book by W.C.Turner, John wiley and sons.
3. Energy management and good lighting practice: fuel efficiency- booklet12-EEO


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*Open Elective - II*

## MATERIAL SCIENCE
**(Other than ME)**
III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**
- To familiarise with the crystallography of materials and their properties i.e. Mechanical, Electrical and Optical and their field of applications.

**Learning Outcomes:**
Students will be able to
- understand of contemporary issues relevant to Crystal Structures.
- identify the defects in crystals and understand the mechanisms of plastic deformation.
- draw Equilibrium/phase diagrams.
- understand Mechanical, Electrical, Optical properties of Materials.

**UNIT - I: Crystal Structure**
Introduction, Space lattice, Unit cell, Lattice parameters, Bravis lattices, Structure and packing fractions of simple cubic, Body centred cubic, Face centred cubic crystals. Directions and planes in crystals, miller indices, Diffraction of X-rays by crystal planes, Bragg's law.

**UNIT - II: Plastic Deformation**
Plastic deformation of single crystals. Deformation by slip, CRSS for slip, Deformation of single crystal. Deformation by twinning, Stacking faults, hot working, and cold working. Recovery, recrystallization and grain growth. Grain size, Halt-Petch equation. Dislocations, types, Burgers' Vector, Dislocation movement by climb and cross slip.

**UNIT - III: Equilibrium Diagrams and Phase Transformation**
Solid solutions, Hume-Rothery's rules, Intermediate compounds, Phase diagrams, Gibb's phase rule, Equilibrium diagram of a binary system. Applications of phase transformations, Iron –carbon equilibrium diagram.

**UNIT - IV: Mechanical properties**
Tensile stress-strain diagrams, proof stress, yield stress diagrams, modules of elasticity. Hardness Testing: -Rockwell, Brinell and Vickers. Impact , toughness, Charpy V-Notch, fracture, ductile, brittle, Griffith criteria for brittle failure, creep, creep mechanisms, fatigue-mechanism-factors to improve fatigue resistance.

**UNIT - V: Electrical Properties of Materials**

Electronic conductivity, free electron theory, Super conductivity, Magnetic properties, Dia, para, ferro, ferri magnetism. Soft and hard magnetic materials.

**UNIT - VI: Optical Properties**

Optical properties of materials. Reflection, Refraction, Absorption and transmission of electromagnetic radiation in solids Polymerization, classification of polymers. Uses of polymers.

**Text Books:**


1. Materials Science and Engineering by V.Raghavan, Prentice Hall of India, Fifth edition.
2. Mechanical Metallurgy – GE Dieter., Mechanical metallurgy, 1988, edition, McGraw-Hill.
3. Material science and Engineering an introduction William D. callister, David G. Rethwisch.


**References Books:**


1. Essentials of Material Science by A.G.Guy, McGraw-Hill(1976).
2. Material Science for Engineers – Schakleford.


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*Open Elective - II*

## AUTOMOTIVE ELECTRONICS

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize with the electronic systems inside automotive vehicle.
- To know the advanced safety systems

**Learning Outcomes**

Students will be able to

- broad understanding of automotive technology
- knowledge in operating principles and performance of various subsystems of automotive systems.
- understand the operation of microcomputer systems.
- acquire knowledge in automotive sensors and control systems.
- develop communications & navigation/routing in automotive telematics

**UNIT - I: Automotive Fundamentals**

Use of electronics in the automobile, evolution of automotive electronics, the automobile physical configuration, evolution of electronics in the automobile, survey of major automotive systems, engine control or electronic control unit, ignition system

**UNIT - II: Electronics Fundamentals**

Semiconductor devices- diodes, rectifier circuit, transistors, field effect transistors; transistor amplifiers, use of feedback in op amps, summing mode amplifier, analog computers, digital circuits- binary number system, combinational- Basic logic gates, multiplexer (IC 74151), 3 to8 decoder (IC74138) , sequential- flip flops, decade counters(IC 7490).

**UNIT - III: Automotive Micro-Computer System**

Microcomputer fundamentals-digital versus analog computers, basic computer block diagram, microcomputer operations, CPU registers, accumulator registers, condition code register-branching; microprocessor architecture, memory-ROM, RAM; I/O parallel interface, digital to analog converter and analog to digital converters with block diagram, microcomputer application in automotive systems.

**UNIT - IV: Basics of Electronics Engine Control**

Motivation for electronic engine control, exhaust emissions, fuel economy, concept of an electronic engine control system, engine functions and control, electronic fuel control configuration, electronic ignition with sensors.

**UNIT - V: Sensors and Actuators**

Introduction; Basic sensor arrangement; Types of Sensors such as oxygen sensors, Crank angle position sensors, fuel Metering/vehicle speed sensors and detonation sensors, altitude sensors, flow Sensors, throttle position sensors, solenoids, stepper motors, relays. Actuators – Fuel Metering Actuator, Fuel Injector, Ignition Actuator

**UNIT - VI: Future Automotive Electronic Systems**

Telematics, Safety: Collision Avoidance Radar warning System with block diagram, speech synthesis, sensor multiplexing, control signal multiplexing with block diagram, fiber optics inside the car, automotive internal navigation system, GPS navigation system, voice recognition cell phone dialling, advanced cruise control system.

**Text Books:**


1. William B. Ribbens, "Understanding Automotive Electronics", 6th Edition, SAMS/Elsevier Publishing (UNIT I to VI).
2. 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 and W. Gessner, "Advanced Microsystems for Automotive Applications", Springer, 2009.
3. Robert Bosch, "Automotive Hand Book" SAE, 5th Edition, 2000.


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*Open Elective - II*

## INTRODUCTION TO MICROPROCESSORS AND MICROCONTROLLERS
## (Other than EEE, ECE, CSE & IT)

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives**

- To familiarize the students with architecture of 8086 microprocessor and 8051 microcontroller.
- To introduce the assembly language programming concepts of 8086 processor.
- To expose the students to various interfacing devices with 8086 using 8255.
- To introduce the concepts of interrupt mechanism and serial communication standards.

**Course Outcomes:**

Students will be able to

- understand the architecture and instruction set of 8086 Microprocessor and 8051 micro controller.
- design and develop various interfacing circuits with 8086 using 8255.
- understand the concepts of interrupt mechanism and serial communication.
- develop 8051 based different kinds of applications.

**UNIT - I**: **8086 Microprocessor**

Introduction 8086 Processor, Architecture-Functional diagram, Register Organization, Memory Segmentation, Physical memory organization, signal descriptions of 8086- common function signals, Minimum and Maximum mode signals, Timing diagrams.

**UNIT - II**: **Instruction Set and Assembly Language Programming of 8086**

Instruction formats, addressing modes, instruction set, assembler directives, macros, simple programs involving logical, branch and call instructions, sorting, evaluating arithmetic expressions, string manipulations.

**UNIT - III**: **Basic Peripherals and Their Interfacing**

8255 PPI various modes of operation and interfacing to 8086. Interfacing keyboard, display, stepper motor interfacing, D/A and A/D converter, Keyboard/Display Controller-8279,

Memory interfacing to 8086, Interfacing DMA controller 8257 to 8086

**UNIT - IV**: **Interrupt Structure and Serial Communication**

Interrupt structure of 8086, Vector interrupt table, Interrupt service routine, Interfacing Interrupt Controller 8259, Serial communication standards, Serial data transfer schemes,8251 USART architecture and interfacing, RS- 232, IEEE-4-88, Prototyping and trouble shooting.

**UNIT - V**: **Introduction to 8051 Microcontroller**

Overview of 8051 microcontroller, Architecture, I/O Ports, Memory organization, addressing modes and instruction set of 8051, Interrupts, timer/ Counter and serial communication.

**UNIT - VI**: **Interfacing and Applications of 8051**

Interfacing 8051 to LED's, Push button, Relays and latch Connections, Keyboard Interfacing, Interfacing Seven segment display, ADC and DAC Interfacing

**Text Books**:

1. D. V. Hall' "Microprocessors and Interfacing", TMGH.2'1 edition 2006.(I to IV Units).
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, "The 8051 Microcontrollers and Embedded Systems", Pearson, 2nd Ed.(IV to VI Units)

**Reference Books:**

1. Barry B.Brey, "The Intel Microprocessors", PHI, 7th Edition 2006.
2. Liu and GA Gibson, "Micro Computer System 8086/8088 Family Architecture. Programming and Design", PHI, 2nd Ed.,
3. Kenneth. J. Ayala, "The 8051 Microcontroller", 3rd Edition, Cengage Learning, 2010.

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*Open Elective - II*

## CLOUD COMPUTING
**(Other than CSE & IT)**
III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**
- To understand Virtualization, Virtual Machine and different models of VM.
- To familiarize Cloud computing architecture and its security aspects.

**Learning Outcomes**

Students will be able to
- know about basics of cloud computing.
- cloud computing and its services available today.
- distinguish Virtualization and Virtual Machine and its need, Types of Virtualization.
- understand how to provide security for the cloud .
- understand disaster recovery and disaster management.
- design a Cloud for an Enterprise.

**UNIT – I: Cloud computing**

Introduction, what it is and what it isn't, from collaborations to cloud- a short history of cloud computing, the network is the computer- How cloud computing works, companies in the cloud- Cloud computing today.

**UNIT – II: Ready for Computing in the cloud**

The pros and cons of Cloud Computing, Developing Cloud Services- Why Develop Web-Based Applications?, The Pros and Cons of Cloud Service Development, Types of Cloud Service Development, Discovering Cloud Services Development services and Tools.

**UNIT - III: Virtulization**

Virtualization for cloud, Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization –System Vm, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - Hypervisors – Xen, KVM , VMWare, Virtual Box, Hyper-V.

**UNIT - IV: Security**

Data Security, Data Control Encrypt Everything, Regulatory and Standards compliances, Network Security, Firewall rules, Network Intrusion detection, Host Security, System Hardening, Antivirus Protection, Host Intrusion detection, Data segmentation, Credential Management.

**UNIT - V: Disaster**

What is Disaster, Disaster Recovery Planning, The Recovery Point objective, The Recovery Time Objective, Disasters in the Cloud, Backups and data retention, Geographic redundancy, Organizational redundancy, Disaster Management, Monitoring, Load Balancer Recovery, Application server recovery, Database Recovery.

**UNIT – VI: Defining Clouds for the Enterprise**

Storage-as-a-Service, Database-as-a- Service, Information-as-a-Service, Process-as-a-Service, Application-as-a- Service, Platform-as-a-Service, Integration-as-a-Service, Security-as-a-Service, Management/Governance-as-a-Service, Testing-as-a-Service Infrastructure-as- a-Service.

**Text Books:**

1. Michael Miller, Cloud Computing – Web Based Applications That change the way you work and Collaborate Online –Person Education.
2. George Reese Cloud Application Architectures, Ist Edition O'Reilly Media.

**Reference Books:**

1. David S. Linthicum, Cloud Computing and SOA Convergence in your Enterprise : A Step-by-Step Guide- Addison-Wesley Professional.
2. Kai Hwang, Geoffery C.Fox, Jack J, Dongarra, Distributed & Cloud Computing From Parallel Processing to the Internet of Things.

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*Open Elective - II*

## WEB TECHNOLOGIES
**(Other than CSE & IT)**
III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**
- To develop real time web applications.
- To get acquainted with skills for creating websites and web apps through learning various technologies like HTML, CSS, JavaScript, XML, Servlets, JSP and JDBC.

**Learning Outcomes:**
Students will be able to
- develop UI for web applications using markup languages.
- build dynamic web pages using Java Script .
- build web pages using XML.
- design and implement one or more Java servlets; test and debug the servlets; deploy the servlets.
- design and implement one or more Java Server Pages; test and debug the JSPs; deploy the JSPs.
- update and retrieve the data from the databases using JDBC-ODBC.

**UNIT - I: HTML & CSS**
**HTML-** Basic HTML Tags, Working with Lists, Tables, Forms, Frames, Images and Image maps.
**Cascading Style sheets-** CSS rules, Selectors, Types of CSS, CSS Properties for Styling Backgrounds, Text, Fonts, Links, Lists, Tables and Positioning.

**UNIT - II: Java Script**
Introduction to Java Script, Variables, Data types, Functions, Operators, Control flow statements, Objects in Java Script, Event Handling. DHTML with Java Script

**UNIT - III: XML**
Basic building blocks, Validating XML Documents using DTD and XML Schemas, XML DOM, XML Parsers- DOM and SAX, XSLT, using CSS with XML.

**UNIT - IV: Web Servers and Servlets**
Tomcat web server, Introduction to Servlets, Lifecycle of a Servlet, JSDK, The Servlet API, The javax.servlet Package, Reading Servlet parameters, Reading Initialization parameters, The javax.servlet HTTP package, Using Cookies-Session Tracking.

**UNIT - V: JSP**

The Problem with Servlet. The Anatomy of a JSP Page, Generating Dynamic Content, Using Scripting Elements, Implicit JSP Objects, Declaring Variables and Methods, Passing Control and Data between Pages, Sharing Session and Application Data.

**UNIT - VI: Database Access**

JDBC Drivers, Database Programming using JDBC, Studying Javax.sql.* package, accessing a database from a JSP Page and a Servlet page, introduction to struts.

**Text Books:**


1. Web Technologies, "Black book", Kogent Learning Solutions, Dreamtech press.
2. Chris Bates, "Web Programming: building internet applications", WILEY Dreamtech, 2nd edition.


**Reference Books:**


1. Uttam K Roy, "Web Technologies", Oxford.
2. John Duckett, "Beginning Web Programming".
3. Wang Thomson, "An Introduction to web design and Programming".
4. Robert W Sebesta, "Programming the World Wide Web", Pearson publications, Fourth edition.


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*Open Elective - II*

## VIRTUAL REALITY

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To Understand key elements of virtual Reality with the components in VR systems.
- To gain knowledge of various input and output devices required for interacting in virtual world along with rendering and modeling.

**Learning Outcomes:**

Students will be able to

- identify basic elements of virtual Reality with the components in VR systems
- describe various input and output devices required for interacting in virtual world along with rendering and modeling.
- differentiate various types of modeling,
- apply the concepts of Virtual Reality for an application.

**UNIT – I: Introduction**

The three I's of virtual reality, commercial VR technology and the five classic components of a VR system

**UNIT – II: Input Devices**

Trackers, Navigation, and Gesture Interfaces- Three-dimensional position trackers, Navigation and manipulation, interfaces and gesture interfaces.

**UNIT – III: Output Devices**

Graphics displays, sound displays & haptic feedback.

**UNIT – IV: Modeling**

Geometric modeling, kinematics modeling, physical modeling, behavior modeling, model Management.

**UNIT – V: Human Factors**

Methodology and terminology, user performance studies, VR health and safety issues.

**UNIT – VI: Applications**

Medical applications, military applications, robotics applications.

**Text Books:**

1. Virtual Reality Systems, John Vince, Pearson Education.
2. Virtual Reality Technology, Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons, Inc.,

**Reference Books:**

1. Understanding Virtual Reality, interface, Application and Design, William R.Sherman, Alan Craig, Elsevier (Morgan Kaufmann).

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*Open Elective - II*

## SCRIPTING LANGUAGES

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To gain knowledge of various scripting languages.
- To familiar with development of web application using scripting languages.

**Learning Outcomes:**

Students will be able to

- employ JavaScript as a general purpose web-based client-side scripting language.
- utilize both XML and PHP to develop interactive web applications.
- describe and apply files concepts in traditional web applications.
- utilize PERL to solve a wide range of text processing problems.

**UNIT – I: Advanced Java Script**

Java Script Events, Objects, DHTML, DOM and Forms, Introduction to AJAX

**UNIT – II: XML**

XML Introduction and Overview, XML Syntax, XML Namespaces, Document Type Definitions (DTDs), XML Schemas, Parsing XML,X Path and XML Transformation

**UNIT – III: Python**

Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples –Dictionaries – Conditionals and Loops

**UNIT – IV: Files**

Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP –Execution Environment.

**UNIT – V: Introduction to PERL**

Perl backgrounder – Perl overview – Perl parsing rules – Variables and Data – Statements and Control structures – Subroutines

**UNIT – VI: Working with PERL**

Packages and Modules- Working with Files –Data Manipulation.

**Text Books:**


1. Web Technologies , Uttam Roy, OXFORD University press.
2. Remy Card, Eric Dumas and Frank Mevel, “The Linux Kernel Book”, Wiley Publications,2003.


**Reference Books:**


1. Wesley J. Chun, “Core Phython Programming”, Prentice Hall, 2001.
2. Martin C. Brown, “Perl: The Complete Reference”, 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2009.


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*Open Elective - II*

## BIG DATA
## (Other than CSE & IT)
III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize the fundamental concepts of cloud for laying a strong foundation of Apache Hadoop (Big data framework).
- To gain knowledge of HDFS file system, MapReduce frameworks and relevant tools.

**Learning Outcomes:**

Students will be able to

- describe the fundamentals of Bigdata and cloud architectures.
- utilize HDFS file structure and MapReduce frameworks to solve complex problems.
- know how to analyze data using UNIX tools and Hadoop.
- understand how to develop environment for analyzing Bigdata.
- understand how to use mapper and reducer functions

**UNIT – I: Introduction to Big Data**

What is Big Data, Why Big Data is Important, Meet Hadoop- data, Data Storage and Analysis, Comparison with other systems, Grid Computing, a brief history of Hadoop, Apache Hadoop and the Hadoop Eco System.

**UNIT – II: MapReduce**

Analyzing data with unix tools, Analyzing data with hadoop, Java MapReduce classes (new API), Data flow, combiner functions, Running a distributed MapReduce Job.

**UNIT – III: Hadoop Distributed File System**

HDFS concepts, Command line interface to HDFS, Hadoop File systems, Interfaces, Java Interface to Hadoop, Anatomy of a file read, and write, Replica placement and Coherency Model

**UNIT – IV: Developing a MapReduce Application**

Setting up the development environment, Managing configuration, Writing a unit test with MRUnit, Running a job in local job runner, Running on a cluster, Launching a job.

**UNIT – V: MapReduce Working-I**

Classic MapReduce, Job submission, Job Initialization, Task Assignment, Task execution, Progress and status updates

**UNIT – VI: MapReduce Working-II**

Job Completion, Shuffle and sort on Map and reducer side, Configuration tuning, MapReduce Types, Input formats, Output formats .

**Text Books:**

1. Tom White, Hadoop,"The Definitive Guide", 3rd Edition, O'Reilly Publications, 2012.
1. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", 1st Edition, TMH,2012.

**Reference Book:**

1. Frank J.Ohlhorst, "Big Data Analytics: Turning Big Data Into Big Money",2nd Edition, TMH,2012.

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*Open Elective - II*

## MULTI-VARIATE ANALYSIS AND SPECIAL FUNCTIONS

III Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To understand the multivariate analysis concepts.
- To know special functions.

**Learning Outcomes:**

Students will be able to

- analyze the multivariate data using dependence techniques.
- apply interdependence techniques.

**UNIT – I: Introduction**

Nature of multivariate analysis – classifying multivariate techniques - Analysis of dependence.

**UNIT – II: Analysis**

Analysis of inter dependence - influence of measurement scales.

**UNIT – III: Analysis of Dependence**

Multiple regression analysis – Discriminant analysis – Multivariate Analysis of variance (MANOVA)

**UNIT – IV: Analysis of inter Dependence**

Factor Analysis – Cluster analysis – Multidimensional scaling.

**UNIT – V: Legendre Functions**

Legendre Polynomials. Properties, Rodrigue's formula, Recurrence Relations and orthoganality.

**UNIT – VI: Bessel Functions**

Solution of Bessel's equation, Properties, Recurrence Relations, orthoganality.

**Text Books:**


1. Richard Arnold Johnson, Dean W. Wichern, Applied Multivariate Statistical Analysis, Pearson Prentice Hall, 2007.
2. William G.Zikmund, Business Research Methods 7th Edition, Cengage Learning.
3. Tabachnick B., Fidell, L using multivariate statistics, 5th Edition, Pearson Education, Inc 2007.
4. J.N.Sharma, R.K.Gupta, Special Functions, Krishna Prakashan Media (p) Ltd., Meerut.


**Reference Books:**


1. Yang, K, Trewn, J. Multivariate Statistical Methods in Quality Management Mc Graw-Hill.
2. Larry C. Andrew, Special Functions of Mathematics for Engineers, SPIE Press, 1992.


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# METROLOGY AND INSTRUMENTATION LAB

III Year – II Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

## METROLOGY LAB

**Course Objectives:**

- To impart hands on training in measuring methods and metrology instruments

**Learning outcomes:**

Students will be able to

- operate equipment like tool maker's microscope, profile projector etc.
- use instruments like vernier calipers, bevel protractor etc.
- apply various metrology instruments in carrying out measurement of dimensional parameters

**List of Experiments:**

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth vernier calipers and checking the chordal thickness of spur gear.
4. Angle and taper measurements by Bevel protractor, sine bars etc.
5. Thread measurement by two wire/three wire methods and tool maker's microscope.
6. Linear and angular measurements using profile projector.

## INSTRUMENTATION LAB

**Course Objectives:**

- Study and calibrate the measuring instruments

**Learning outcomes:**

Students will be able to

- measure different parameters like displacement, pressure, temperature etc.,
- calibrate the given measuring instrument.

**List of Experiments:**

1. Calibration of thermester for temperature measurement.
2. Calibration of thermocouple for temperature measurement.
3. Calibration of resistance temperature detector for temperature measurement.
4. Study and calibration of LVDT transducer for displacement measurement.
5. Calibration of strain gauge
6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.

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# FLUID MECHANICS AND HYDRAULIC MACHINES LAB

III Year – II Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To determine experimentally the co-efficient of discharge of various flow measuring devices and study the performance of various hydraulic turbines and pumps.

**Learning Outcomes:**

Students will be able to

- measure the fluid flow using different flow measuring devices.
- gain knowledge on working of centrifugal pumps, reciprocating pumps, hydraulic turbines, and compare the performance at different operating conditions.

**List of experiments:**

1. Determine coefficient of discharge of Venturimeter.
2. Determine coefficient of discharge of Orifice meter.
3. Determination of friction factor for a given pipe line.
4. Determination of loss of head due to sudden contraction in a pipeline.
5. Determine coefficient of discharge Turbine flow meter.
6. Verification of Bernoulis equation.
7. Determine coefficient of discharge of V-Notch.
8. Determine coefficient of discharge of orifice.
9. Determine coefficient of discharge of Mouth Piece.
10. Determine the efficiency of jet.
11. Performance Test on Pelton Wheel.
12. Performance Test on Francis Turbine.
13. Performance Test on Kaplan Turbine.
14. Performance Test on Single Stage Centrifugal Pump.
15. Performance Test on Multi Stage Centrifugal Pump.
16. Performance Test on Reciprocating Pump.

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# CAD / CAM

IV Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To present the role of computers in design, manufacture, and quality control.

**Learning Outcomes:**

Students will be able to

- appreciate the role of computer in the design and manufacturing
- analyze the product cycle in the light of CAD/CAM
- apply various transformations to create and manipulate a geometric model
- illustrate various entities of wire frame, surface, and solid models
- distinguish between a CNC machine and a conventional machine
- prepare part programming of CNC machine
- formulate manufacturing cell based on similar manufacturing attributes of parts
- list the benefits of computer aided quality control

**UNIT - I:**

Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU,
Memory types, input devices, display devices, hard copy devices, storage devices.

**UNIT - II:**

**Computer Graphics:** Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

**UNIT - III:**

**Geometric modeling:** Requirements, types of geometric models, wire-frame, surface and solid modeling, surface representation methods, modeling facilities desired.

**Drafting and Modeling systems:** Basic geometric commands, layers, display control commands, editing, dimensioning,

**UNIT - IV:**

**Numerical control:** NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming : fundamentals, part programming methods.

**UNIT - V:**

**Group Technolgy:** Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type.

**Flexible manufacturing systems:** Types of Manufacturing systems, Machine tools and related equipment, material handling systems, computer control systems, human labor in the manufacturing systems, FMS benefits.

**UNIT - VI:**

**Computer Aided Quality Control:** Terminology in quality control, the computer in QC, contact inspection methods, noncontact inspection methods-optical, - non optical, computer aided testing, integration of CAQC with CAD/CAM.

**Text Books:**


1. Zimmers & P.Groover, "CAD/CAM", Pearson Education.
2. Ibrahim Zeid, "CAD / CAM Theory and Practice" Tata McGraw Hill Publications


**Reference Books:**


1. Groover,"Automation , Production systems & Computer integrated Manufacturing", Pearson Education Publications.
2. Radhakrishnan and Subramanian,"CAD/CAM/CIM", New Age International publications.
3. Farid Amirouche ,"Principles of Computer Aided Design and Manufacturing", Pearson Education Publications.
4. Alavala, "CAD/CAM: Concepts and Applications" , PHI.
5. Warren S Seames,"Computer Numerical Control Concepts and programming", Thomson.


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# HEAT TRANSFER

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To introduce various modes of heat transfer and their application in the design of various heat transfer equipment.

**Learning Outcomes:**

Students will be able to

- determine the rate of heat transfer through composite slabs, cylinders and spheres in steady state and find the critical radius of insulation in case of steam pipes and electrical cables.
- evaluate the rate of heat transfer from a finned surface and the time of cooling or heating in transient heat conduction problems.
- compute convective heat transfer coefficients in forced and natural convection, both for internal and external flows.
- compute the heat transfer coefficient in boiling and condensation.
- design a heat exchanger using LMTD or NTU method.
- evaluate the radiation heat exchange between the surfaces and know the significance of radiation shields.

**UNIT - I:**

**Introduction:** Modes and mechanisms of heat transfer, Basic laws of heat transfer ,General discussion about applications of heat transfer. Difference between heat transfer and thermodynamics.

**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, steady, unsteady heat transfer, Initial and boundary conditions.

**One Dimensional Steady State Conduction Heat Transfer:** Homogeneous slabs, hollow cylinders and spheres, Electrical Analogy, Thermal Contact Resistance, Thermal Shape Factor, Critical radius of insulation, Variable Thermal conductivity, systems with heat generation.

**UNIT - II:**

**Extended surface (fins) Heat Transfer:** Long Fin, Fin with insulated tip and Short Fin, Application of error calculation in temparature measurement.

**One Dimensional Transient Conduction Heat Transfer:** Systems with negligible internal resistance, Significance of Biot and Fourier Numbers, Chart solutions of transient conduction systems.

**UNIT - III:**

**Convective Heat Transfer:** Classification of Convective Heat Transfer, Dimensional analysis as a tool for experimental investigation – Buckingham Pi Theorem for forced and Natural convection, application for developing semi – empirical non-dimensional correlation for convection heat transfer, Significance of non-dimensional numbers. Concepts of Continuity, Momentum and Energy Equations.

**Forced convection: External Flows:** Concepts about hydrodynamic and thermal boundary layer, use of empirical correlations for convective heat transfer -Flat plates and Cylinders.

**Internal Flows:** Concepts about Hydrodynamic and Thermal Entry Lengths, Division of internal flow based on this, Use of empirical relations for Horizontal Pipe Flow and annulus flow.

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

**UNIT - V:**

**Heat Transfer with Phase Change:**

**Boiling:** Pool boiling, Regimes, Calculations on Nucleate boiling, Critical Heat flux and Flow boiling.

**Condensation:** Film wise and drop wise condensation, Nusselt's theory of Condensation on a vertical plate, Film condensation on vertical and horizontal cylinders using empirical correlations.

**Heat Exchangers:** Classification, overall heat transfer Coefficient, fouling factor, Concepts of LMTD and NTU methods, Problems using LMTD and NTU methods.

**UNIT - VI:**

**Radiation Heat Transfer:** Emission characteristics and laws of black-body radiation, Irradiation, total and monochromatic quantities laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann, Heat exchange between two black bodies, concepts of shape factor, Emissivity, electrical analogy for radiation networks, heat exchange between grey bodies, radiation shields.

**Text Books:**


1. Incropera&Dewitt,"Fundamentals of Heat Transfer & Mass Transfer", John Wiley Publications.
2. P.K.Nag,"Heat And Mass Transfer",Tata Mc Graw Hill Publications.
3. Dr.D.S.Kumar, "Heat and Mass Transfer", S.K.Kataria & Sons Publications.


**Reference Books:**


1. Cengal, "Heat and Mass Transfer", Tata McGraw Hill.
2. R.C.sachdeva," Fundamentals of Engg. Heat and Mass Transfer",New Age International Publications.
3. Heat Transfer – Ghoshdastidar – Oxford University Press – II Edition.
4. Heat and Mass Transfer – R.K. Rajput – S.Chand & Company Ltd.
5. Essential Heat Transfer - Christopher A Long / Pearson Education.


***Note: Heat Transfer Data Book is allowed.***

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*Elective - II*

## COMPUTATIONAL FLUID DYNAMICS

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To expose to the governing equations required for CFD and their mathematical behavior, grid generation principles and make aware of solution techniques and computer codes.

**Learning Outcomes:**

Students will be able to

- formulate Analyze and Verify fluid, thermal systems analysis problems.
- understand the structure and operation of commercial CFD software.
- determine the velocity field, pressure distribution and heat transfer rates on the boundaries of interior and exterior flows.
- apply some of the popular FD techniques in the solution of fluid flow problem.

**UNIT - I:**

**Introduction:** Computational Fluid Dynamics as a Research and Design Tool, Applications of Computational Fluid Dynamics.

**Governing Equations of Fluid Dynamics:** Introduction, Control Volume, Substantial Derivative, Divergence of Velocity, Three dimensional continuity, momentum and energy equations in differential and integral forms. Navier- stokes equations of motion.

**UNIT - II:**

**Applied Numerical Methods:** Solution of a system of simultaneous Linear Algebraic Equations, iterative schemes of Matrix Inversion, Direct Methods for Matrix inversion, Direct Methods for banded matrices.

**UNIT - III:**

**Mathematical Behavior of Partial Differential Equations:** Introduction, Classification of Quasi-Linear Partial Differential Equations - Hyperbolic, Parabolic, Elliptic Equations.

**UNIT - IV:**

**Basics Aspects of Discretization:** Introduction to Finite Differences, Difference Equations, Explicit and Implicit Approaches, Errors and Stability Analysis

**UNIT - V:**

**Grid generation and transformation:-**Generation of grid, Transformation of non-uniform grids, General transformation of equations, form of governing equations

suitable for CFD, Compressed grids, Boundary filled coordinate systems—Elliptic grid generation, Adaptive grids, Modern developments in grid generation.

**UNIT - VI:**

**CFD techniques:-**Introduction, LAX-WENDORFF technique, MACCORMICK technique, CRANK-NICHOLSON technique, Relaxation technique, ADI technique, suitability for different conditions.

**Text Books:**

1. John Anderson, "Computational fluid dynamics", Mc Graw Hill.

**Reference Books:**

1. Dale Anderson, John C Tannehill and Richard H. Pletcher, "Computational Fluid Mechanics and Heat Transfer", CRC Press, 2nd Edition.
2. Suhas V. Patankar, "Numerical heat transfer and fluid flow" Butter-worth Publishers.
3. T. K Sengupta, "Fundamentals of Computational Fluid Dynamics", University Press.

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*Elective - II*

## ROBOTICS

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize the students with anatomy, kinematics, sensors and dynamics of a programmable machine, robot.

**Learning Outcomes:**

Students will be able to

- distinguish between fixed automation and programmable automation.
- identify various components of robot.
- select appropriate type of actuator for a joint.
- illustrate robot applications in manufacturing.
- analyze kinematics of a robot.
- derive equations of motion of a manipulator for a particular application.
- write a programme to control a robot for execution of a work cycle.

**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 Feed back components:** Actuators: Pneumatic, Hydraulic actuators, electric &
stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocitysensors.

**UNIT - III:**

**Robot Application in Manufacturing:** Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.
Future applications of robots.

**UNIT - IV:**

**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 - V:**

Differential transformation and manipulators, Jacobians – problems, Dynamics: Lagrange – Euler and
Newton – Euler formations – Problems.

**UNIT - VI:**

Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint integrated motion –
straight line motion – Robot programming, languages and software packages.

**Text Books:**

1. Groover M P ,"Industrial Robotics",Pearson Education.
2. Mittal R K & Nagrath I J,"Robotics and Control", TMH.

**Reference Books:**

1. P. Coiffet and M. Chaironze,"An Introduction to Robot Technology", Kogam Page Ltd. 1983 London.
2. Richard D. Klafter,"Robotic Engineering", Prentice Hall.
3. Asada,"Robot Analysis and Intelligence", Wiley Inter-Science.
4. John J Craig ,"Introduction to Robotics",Pearson Edu.
5. Mark W. Spong and M. Vidyasagar,"Robot Dynamics & Control",John Wiley & Sons (ASIA) Pvt Ltd.

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*Elective - II*

## INTERACTIVE COMPUTER GRAPHICS

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize with the functionalities of various graphics systems.

**Learning Outcomes:**

Students will be able to

- explain the functionalities of various display devices and visible surface detection methods.
- analyze the performance of different algorithms to draw different shapes.
- perform different transformations on objects.
- design raster animations.

**UNIT - I:**

**Introduction:** Application of Computer Graphics, raster scan systems, random scan systems, raster scan display processors.

**Output primitives:** Points and lines, line drawing algorithms.

**UNIT - II:**

**Filled area primitives:** Inside and outside tests, boundary-fill and flood-fill algorithms, Scan line polygon fill algorithm.

**2-D geometrical transforms**: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transformations.

**UNIT - III:**

**2-D viewing:** The viewing pipeline, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland line clipping algorithm, Sutherland –Hodgeman polygon clipping algorithm.

**UNIT - IV:**

**3-D Geometric transformations:** Translation, rotation, scaling, reflection and shear transformations, composite transformations, 3D Viewing pipeline, clipping, projections ( Parallel and Perspective).

**UNIT - V:**

**Visible surface detection methods:** Classification, back-face detection, depth-buffer, scan-line, depth sorting, BSP tree methods, area sub-division and octree methods.

**UNIT - VI:**

**Computer animation:** Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications.

**Text Books:**

1. Computer Graphics *C* version, Donald Hearn, M.Pauline Baker, Pearson.
2. Computer Graphics Principles & practice, 2/e, Foley, VanDam, Feiner, Hughes, Pearson.

**Reference Books:**

1. Computer Graphics with Virtual Reality Systems, Rajesh K Maurya, Wiley.
2. Computer Graphics, Peter, Shirley, CENGAGE.
3. Principles of Interactive Computer Graphics, Neuman , Sproul, TMH.
4. Introduction to Computer Graphics, Using Java 2D and 3D, Frank Klawonn, Springer.

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*Elective - II*

## MECHANICAL VIBRATIONS

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- Formulate mathematical models of problems in vibrations using Newton's second law or energy principles.
- Determine a complete solution to the modeled mechanical vibration problems.
- Correlate results from the mathematical model to physical characteristics of the actual system.
- Design of a mechanical system using fundamental principles developed in the class.

**Learning Outcomes:**

Students will be able to

- understand the causes and effects of vibration in mechanical systems and their classification.
- develop schematic models for physical systems and formulate governing equations of motion.
- understand the role of damping, stiffness and inertia in mechanical systems.
- analyze rotating and reciprocating systems and design machine supporting structures, vibration isolators and absorbers.
- calculate free and forced vibration responses of multi degree freedom systems using modal analysis.
- analysis and design for the control/ to reduce vibration effects in machinery.

**UNIT - I : Fundamentals of Vibrations Analysis**

Introduction; Elements of vibration; classification of vibration; vibration analysis procedure; spring elements – equivalent stiffness; mass or inertia elements; damping elements – equivalent damping; types of damping; definitions and terminology; simple harmonic motion.

**UNIT - II:**

**Free Vibration Analysis - Single Degree Of Freedom Systems :**

Undamped Vibrations: Different methods for equation of motion – Newton's second law, D'Alembert's principle, principle of virtual displacement, principle of conservation of energy, Rayleigh's method.

Damped Vibrations: Differential equation of motion; critical damping coefficient and damping ratio; damped natural frequency; logarithmic decrement; energy dissipated in viscous damping.

**UNIT - III:**

**Forced Vibration Analysis (Single Degree Of Freedom System):** Response of damped and undamped systems to harmonic excitation; frequency response curve; magnification factor; harmonic excitation of the base, vibration isolation, transmissibility, force transmission to foundations; Response of a damped system under rotating unbalance

Vibration measuring instruments – working principle of Seismic mass, vibrometer, accelerometer

**UNIT - IV:**

**Damped and Undamped Vibrations – Two degree of freedom system:** Free and forced vibration analysis of a two degree of freedom system – different methods for the formulation of equation equations of motion, natural frequencies, principal modes - physical interpretation and orthogonality; general method, eigen value method; influence coefficients

**UNIT - V:**

**Torsional Vibrations:** Torsional vibration of one, two and three rotor system; Equivalent shafting; torsional vibration of a geared system; coordinate coupling – static and dynamic coupling; whirling of rotating shafts

**UNIT - VI:**

**Vibrations of continuous systems:** Vibrations of springs, bars and beams, formulation of equation of motion, characteristic equation, eigen values, identification of node and mode shapes.

**Text Books:**


1. G.K. Grover & Nigam , "Mechanical Vibrations", Nem Chand and Brothers, 8th edition.
2. S.S. Rao, "Mechanical vibration", pearson India, 4th edition.


**Reference Books:**


1. Thomson, " Theory of Vibration with Application", pearson India, 5th edition.
2. V.P.Singh,"Mechanical vibration" Dhanpat Rai & Co.
3. Schaum Series," Mechanical vibration" McGraw-Hill, 1st edition.
4. F.S. Tse, Morse & Hinkle,"Mechanical Vibration", CBS Publisher, 2nd edition.


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*Elective - III*

## PRODUCTION PLANNING AND CONTROL

IV Year – I Semester

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|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To understand the objectives and functions of PPC department for effective running of a Production system

**Learning Outcomes:**

Students will be able to

- explain the objectives and functions of PPC.
- appraise different forecasting techniques and estimate the future demand of the product.
- optimize the inventory parameters to minimize the total variable cost.
- apply different planning tools for better management of production system.
- determine optimum production schedule.
- illustrate the duties of dispatcher and functions of follow up.
- appreciate the role of computers in PPC.

**UNIT - I:**

Introduction: Definition – Objectives of production Planning and Control – Functions of production planning and control – Elements of production control – Types of production – Organization of production planning and control department – Internal organization of department.

**UNIT - II:**

Forecasting – Importance of forecasting – Types of forecasting, their uses – General principles of forecasting – Forecasting techniques – qualitative methods and quantitative methods.

**UNIT - III:**

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems – purchase models with and without shortages - Manufacturing model with and without shortages.

**UNIT - IV:**

Introduction to MRP & ERP, JIT inventory, and Japanese concepts. Line Balancing, Aggregate planning.

**UNIT - V:**

Routing – Definition – Routing procedure –Route sheets – Bill of material – Factors affecting routing procedure. Schedule –definition – Difference with loading - Scheduling Policies – Techniques, Standard scheduling methods.

**UNIT - VI:**

Dispatching – Activities of dispatcher – Dispatching procedure – Expediting, controlling aspects - follow up – definition – Functions and types of follow up, applications of computer in production planning and control.

**Text Books:**

1. Samuel Eilon - Elements of Production Planning and Control.
2. Baffa & Rakesh Sarin - Modern Production and operations management.

**Reference Books:**

1. S.N. Chary - Operations Management.
2. Martin K. Starr and David W. Miller - Inventory Control Theory and Practice.
3. John E. Biegel - Production Control A Quantitative Approach.
4. Joseph Monks - Operations Management.

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*Elective - III*

## TRIBOLOGY

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize with the concepts of lubrication and design of bearings.

**Learning Outcomes:**

Students will be able to

- determine the viscosity of fluids and its behavior.
- apply the Hydrodynamic theory of lubrication in power transmission.
- analyze the effect of friction in bearings.
- implement the concepts of hydrostatic, air lubricated bearings in power transmission.
- identify the type of partial bearing for an application.
- select appropriate materials for bearings in the power transmission.

**UNIT - I:**

Study of various parameters: Viscosity, flow of fluids, viscosity and its variation - absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers used.

**UNIT - II:**

Hydrodynamic theory of lubrication: Various theories of lubrication, petroffs equation, Reynold's equation in two dimensions -Effects of side leakage - Reynolds equation in- three dimensions, Friction in sliding bearing, hydro dynamic theory applied to journal bearing, minimum oil film thickness, oil whip and whirl anti - friction bearing.

**UNIT – III:**

Friction and power losses in journal bearings: Calibration of friction loss friction in concentric bearings, bearing modulus, Sommerfield number, heat balance, practical consideration of journal bearing.

**UNIT - IV:**

Air lubricated bearing: Advantages and disadvantages application to Hydrodynamic journal bearings, hydrodynamic thrust bearings. Hydrostatic thrust bearings. Hydrostatic bearing Analysis including compressibility effect.

**UNIT - V:**

Types of bearing oil pads: Hydrostatic bearing wick oiled bearings, oil rings, pressure feed bearing, partial bearings - externally pressurized bearings.

**UNIT - VI:**

**Bearing materials:** General requirements of bearing materials, types of bearing materials.

**Text Books:**

1. Fundamentals of Tribology, Basu, SenGupta and Ahuja/PHI.
2. Tribology in Industry **:** Sushil Kumar Srivatsava, S. Chand &Co.

**Reference Books:**

1. Tribology – B.C. Majumdar.

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*Elective - III*

## REFRIGERATION & AIR CONDITIONING

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To study and analyze various refrigeration systems and understand the influence of operating variables on their performance.
- To introduce to various psychrometric properties and processes and the design of air conditioning systems.

**Learning Outcomes:**

Students will be able to

- analyze air refrigeration cycles and know the various methods of air craft refrigeration.
- analyze vapor compression refrigeration cycle and study the influence of operating variables on its performance.
- know the functioning of basic components of vapor compression refrigeration system and the refrigerants used in refrigeration industry.
- understand the working of the aqua - ammonia and LiBr – water vapor absorption refrigeration systems and find the maximum C.O.P.
- determine the heat and moisture removed or added during various psychometric processes.
- design an Air-conditioning system for winter, summer air conditioning and industrial air conditioning.
- know the functioning of equipment used in air conditioning and different heat pump circuits.

**UNIT - I:**

**Introduction:** Necessity and applications, Unit of refrigeration and C.O.P .Ideal cycles of refrigeration.

**Air Refrigeration:** Bell Coleman cycle, Open and Dense air systems, Actual air refrigeration system problems, and Refrigeration needs of Aircrafts - Air craft refrigeration systems

**UNIT - II:**

**Vapor compression refrigeration:** Working principle, essential components of the plant, simple Vapor compression refrigeration cycle, Representation of cycle on T-S and p-h charts, COP, effect of sub cooling and super heating, cycle analysis, Actual cycle Influence of various parameters on system performance, Use of p-h charts, Problems.

**System Components:** Compressors – classification – Working Principles, Condensers – classification – Working Principles, Evaporators – classification – Working Principles, Expansion devices – Types – Working Principles,
**Refrigerants:** Desirable properties, classification refrigerants, Nomenclature, Ozone Depletion potential, Global Warming potential.

**UNIT - III:**

**Vapor Absorption System: D**escription and working of $NH_3$ – water Absorption System, Li -Br (Two shell & Four shell) System. Principle of operation Three Fluid absorption system, salient features. Calculation of COP,
**Steam Jet Refrigeration System:** Working Principle and Basic Components, Representation of cycle on T-S diagram
Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube

**UNIT - IV:**

**Air Conditioning:** Atmospheric air, Psychrometric Properties, Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapor pressure, Degree of saturation, Adiabatic Saturation, Carrier's Equation Psychrometric chart. Psychometric Processes

**UNIT - V:**

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, Requirements of Industrial air conditioning, Air conditioning Load Calculations.

**UNIT - VI:**

Requirements of human comfort, concept of effective temperature, Comfort chart, Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, fans and blowers. Heat Pump, heat sources, different heat pump circuits.

**Text Books:**


1. CP Arora, "Refrigeration and Air Conditioning",TMH.
2. SC Arora & Domkundwar",A Course in Refrigeration and Air conditioning", Dhanpatrai Publications


**Reference Books:**


1. Manohar Prasad," Refrigeration and Air Conditioning",New Age publications.
2. Dossat," Principles of Refrigeration",Pearson Education.
3. P.L.Bellaney,"Refrigeration and Air Conditioning",
4. Ananthanarayanan,"Basic Refrigeration and Air-Conditioning",TMH.
5. R.S. Khurmi & J.K Gupta,"Refrigeration and Air Conditioning,"S.Chand Publications.


***Note: Refrigeration Tables are allowed.***

*Elective - III*

## FRACTURE MECHANICS

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To introduce the concepts of fracture and damage tolerant design using theories of fracture

**Learning Outcomes:**

Students will be able to

- determine stress intensity factors by applying Linear Elastic and Elastic Plastic fracture mechanics.
- apply fatigue concepts in predicting the life of components.

**UNIT - I:**

**Introduction:** Prediction of mechanical failure. macroscopic failure modes; brittle and ductile behavior. fracture in brittle and ductile materials – characteristics of fracture surfaces; inter-granular and intragranular failure, cleavage and micro-ductility, growth of fatigue cracks, the ductile/brittle fracture transition temperature for notched and unnotched components.

**UNIT - II:**

**Griffith's analysis: C**oncept of energy release rate, G, and fracture energy, R. modification for ductile materials, loading conditions. concept of R curves.

**UNIT - III:**

**Linear Elastic Fracture Mechanics, (LEFM):** Three loading modes and the state of stress ahead of the crack tip, theories of fracture, stress concentration factor, stress intensity factor and the material parameter the critical stress intensity factor, crack tip plasticity, effect of thickness on fracture toughness.

**UNIT - IV:**

**Elastic-Plastic Fracture Mechanics; (EPFM):** The definition of alternative failure prediction parameters, crack tip opening displacement, and the J integral. measurement of parameters and examples of use.

**UNIT - V:**

**Fatigue:** definition of terms used to describe fatigue cycles, high cycle fatigue, low cycle Fatigue, mean stress R ratio, strain and load control. S-N curves. Goodman rule and Miners rule. fatigue crack initiation and propagation - Laws, total life and damage tolerant approaches to life prediction.

**UNIT - VI:**

**Creep deformation:** The evolution of creep damage, primary, secondary and tertiary creep. Micro-mechanisms of creep in materials and the role of diffusion. Ashby creep deformation maps. Stress dependence of creep – power law dependence. Comparison of creep performance under different conditions – extrapolation and the use of Larson-Miller parameters. creep-fatigue interactions. examples.

**Text Books:**


1. T.L. Anderson,"Fracture Mechanics Fundamentals and Applications",CRC press ,2nd Ed.
2. B. Lawn,"Fracture of Brittle Solids", Cambridge Solid State Science Series ,2nd ed.
3. J.F. Knott," Fundamentals of Fracture Mechanics", Butterworths, 1973.


**Reference Books:**


1. J.F. Knott, P Withey," Worked examples in Fracture Mechanics", Institute of Materials, 2nd Edition.
2. S. Suresh,"Fatigue of Materials", Cambridge University Press, 2nd Edition .
3. L.B. Freund and S. Suresh,"Thin Film Materials", Cambridge University Press, 2003.


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*Open Elective - III*

## BUILDING SERVICES

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To introduce the concepts of basic services and its applications.
- To equip students with the required information and technologies of building services.
- Application of this knowledge in architectural design project.
- Evolving understanding in students to choose appropriate systems and integrate the same in their design projects.

**Learning Outcomes:**

Students will be able to

- understand the measures to be taken while planning for sanitation and installation of various sanitary units.
- identify the minimizing and disposal techniques of waste and garbage.
- evaluate the illumination strategies by consuming less energy resources.
- acquaint with distribution of electricity to all units of the project.
- provide fire protection units at service points.

**UNIT - I: Water Supply**

Tapping of water, Storage and distribution of water in premises, Pipes, piping network, specials, materials, joinery, installation of network both open and concealed, all appurtenances required for installations e.g. taps, faucets, mixing units, valves, flushing cisterns, flushing valves and other fittings.

**UNIT - II: Drainage and Sanitation**

Study of sanitary fittings with reference to use, materials and functions, traps and their uses, classification of traps as per use and shape, pipes and piping systems, specials, vent and anti-siphonage systems, jointing and installations, storm water and roof drainage systems and their installations, underground drainage systems with application of ventilation, self cleansing velocity, laying of drains to required gradients and testing of drains, disposal of sewage within the premises using septic tanks, effluent treatment plants, their function and layouts.

**UNIT - III: Room Acoustics**

Key terms & Concepts, Introduction, Acoustic principles, Sound power and pressure levels, Sound pressure level, absorption of sound, Reverberation time,

Transmission of sound. Sound pressure level in a plant room, out door sound pressure level, Sound pressure level in intermediate space, noise rating, Data requirement, output data.

**UNIT - IV: Lighting and Ventilation**

Indoor lighting- natural and artificial, systems of lighting such as direct, indirect, diffused, applications of lighting systems with reference to levels of illumination for various uses and lumen method calculations, light fittings/ luminaries-All types of energy efficient lamps, optic fiber, led etc. Ventilation - Introduction, Ventilation requirements, Natural and Mechanical systems, Removal of heat gains Psychrometric cycles, Ventilation rate measurement, Material for ventilation duct work.

**UNIT - V: Electrification**

Introduction to generation and distribution of electric power in urban areas, substations for small schemes in industrial units, electrical system installations in a building from the supply mains to individual outlet points, including meter board, distribution board and layout of points with load calculations, electrical wiring systems for small and large installations including different material specification electrical control and safety devices- switches, fuse, circuit breakers, earthing, lightning conductors etc.

**UNIT - VI: Fire Protection, Plant and Service Areas**

Key terms and concepts, introduction, Fire classification, Portable existing gushers, Fixed – Fire fighting installation, fire detectors and alarus, smoke ventilation. Key terms and conditions, Introduction, Mains and services, Plant room space requirements, service ducts, pipe, duct and cable supports, plant connections, Co-ordinated service drawings boiler room ventilation.

**Text Books:**


1. S.C.Rangwala, Water supply and sanitary engineering, Charotar publishing house.
2. A. Kamala & DL Kanth Rao, Environmental Engineering, Tata McGraw – Hill publishing company Limited


**Reference Books**


1. Technical teachers Training Institute (Madras), Environmental Engineering, Tata McGraw Hill publishing Company Limited.
2. M.David Egan, Concepts in Building Fire Safety.28
3. V.K.Jain, Fire Safety in Building.
4. E.G.Butcher, Smoke control in Fire-safety Design.
5. National Building Code 2005.


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*Open Elective - III*

## MODERN OPTIMIZATION TECHNIQUES

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize the students with the concepts of evolutionary optimization
- To develop an understanding of Genetic Algorithm
- To expose students to Particle Swarm Optimization
- To introduce the principles of Differential Evolution
- To gain knowledge on Ant Colony Optimization

**Learning Outcomes:**

Students will be able to

- analyze the pros and cons of different optimization techniques.
- describe the concepts of various techniques.
- develop suitable algorithms for the implementation of above techniques.
- apply these techniques to solve various engineering optimization problems .
- compare the performance of various techniques.
- select a suitable technique to optimize a given problem.

**UNIT – I: Definition-Classification of optimization problems**

Unconstrained and Constrained optimization-Optimality conditions, Evolution in nature-Fundamentals of Evolutionary algorithms- Evolutionary Strategy and Evolutionary Programming.

**UNIT – II: Genetic Algorithm**

Basic concepts- search space- working principle -encoding-fitness function - Genetic Operators-Selection: Roulette-wheel, Boltzmann, Tournament, Rank and Steadystate-Elitism- Crossover: single-pint, two-point, multi-point, uniform, matrix and cross over rate.

**UNIT – III: Mutation**

Mutation, mutation rate. Variations of GA: Adaptive GA and Real coded GA - Issues in GA implementation-Particle Swarm Optimization: Introduction-Fundamental principles of Particle Swarm Optimization-Velocity Updating-Advanced operators-Parameter selection.

**UNIT – IV: Binary, discrete and combinatorial PSO**

Implementation issues-Convergence issues, Multi-objective PSO (Dynamic neighbourhood PSO-Vector evaluated PSO)-Variations of PSO: weighted, repulsive, stretched, comprehensive learning, combined effect PSO and clonal PSO.

**UNIT – V: Differential Evolution**

Introduction-Fundamental principles of Differential Evolution- different strategies of differential evolution-function optimization formulation-mutation and crossover operators-estimation and selection-Discrete Differential Evolution.

**UNIT – VI: Ant Colony Optimization**

Introduction-Fundamental principles of Ant colony optimization-Ant foraging behaviour-initialization-transition strategy-pheromone update rule- applications.

**Text Books:**


1. Kalyanmoy Deb, "Multi objective optimization using Evolutionary Algorithms", John Wiley and Sons, 2008.
2. E. Goldberg, Genetic Algorithms in search, Optimization and machine learning, 1989
3. Particle Swarm Optimization, An overview by Riccardo Poli, James Kennedy, Tim Blackwell, Springer
4. Differential Evolution, A Practical Approach to Global Optimization, Authors: Price, Kenneth, Storn, Rainer M., Lampinen, Jouni A. , Springer
5. Ant Colony Optimization by Marco Dorigo, Thomas Stutzle, MIT Press.


**Reference Books:**


1. Soliman Abdel Hady, Abdel Aal Hassan Mantawy, "Modern optimization techniques with applications in Electric Power Systems", Springer,2012.
2. M. Mitchell, 'Introduction to Genetic Algorithms", Indian reprint, MIT press Cambridge, 2nd edition, 2002.
3. R.C. Eberhart, Y.Sai and J. Kennedy, Swarm Intelligence , The Morgan Kaufmann Series in Artificial Intelligence, 2001.
4. K.M. Passino, Biomimicry for optimization, control and automation, Springer-Verlag, London, UK, 2005.
5. G. C. Onwubolu, & B. V. Babu, New Optimization Techniques in Engineering, Springer- Verlag Publication, Germany, 2003.


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*Open Elective - III*

## ELECTRICAL POWER UTILIZATION
**(Other than EEE)**
IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize the students with the mechanics of train movement.
- To gain knowledge on selection of appropriate heating method.
- To introduce the laws of illumination.
- To develop an understanding of refrigeration and air-conditioning.
- To expose students to the process of Electro Lysis.

**Learning Outcomes:**

Students will be able to

- analyze the appropriate type of traction system.
- select a suitable method of heating for a given application.
- design an illumination system.
- calculate the required tonnage capacity for a given air-conditioning system.
- select a suitable charging method.
- evaluate domestic wiring connection and debug any faults occured.

**UNIT – I: Electrical Traction**

Features of an Ideal Traction System, Systems of Electrical Traction, Traction Supply System, Mechanism of Train Movement, Speed- Time Curve, Traction Motors, Tractive Effort and Horse Power, Speed Control Schemes, Electric Braking, Recent Trends in Traction.

**UNIT – II: Electric Heating**

Classification, Heating Element, Losses in Oven and Efficiency, Resistance Furnace, Radiant Heating, Induction Heating, High Frequency Eddy Current Heating, Dielectric Heating, Arc Furnace, Heating of Furnace, Electric Welding, Methods and Equipments.

**UNIT – III: Illumination**

Radiant Energy, Terms and Definitions, Laws of Illumination, Polar Curves, Photometry, MSCP, Integrating Sphere, Luminous Efficacy, Electrical Lamps, Design of Interior and Exterior Lighting Systems, Illumination Levels for Various Purposes, Light Fittings, Factory Lighting, Flood Lighting, Street Lighting, Energy Conservation in Lighting.

**UNIT – IV: Air Conditioning and Refrigeration**

Control of Temperature, Protection of Motors, Simple Heat-Load and Motor Calculations, Various Types of Air Conditioning, Functioning of Complete Air Conditioning System, Type of Compressor Motor, Cool Storage, Estimation of Tonnage Capacity and Motor Power.

**UNIT – V: Electro-Chemical Processes**

Electrolysis – Electroplating – Electro deposition – Extraction of metals current, Efficiency - Batteries – types – Charging Methods.

**UNIT – VI: Basics of Domestic Electrical Wiring**

Types of Cables, Flexible Wires Sizes and Current Capacity, Use of Fuse, MCB and MCCB (Working and Construction), Idea about Megger, Earthling – Domestic and Industrial.

**Text Books:**


1. Garg and Girdhar, "Utilisation of Electric Energy" 1982, Khanna Publisher.
2. Pratab H., "Art and Science of Utilization of Electrical Energy", Second Edition, Dhanpat Rai and Sons, New Delhi.


**Reference Books:**


1. Wadhwa C.L., "Generation, Distribution and Utilization of Electrical Energy",1993, Wiley Eastern Limited,
2. S.C.Tripathy, "Electric Energy Utilization and Conservation",1993, Tata McGraw Hill.
3. R.K. Rajaput, . "Utilization of Electric Power", Laxmi Publications, 1st Edition, 2007.
4. N.V.Suryanarayana, "Utilization of Electric Power", New Age International, 2005
5. C.L.Wadhwa, "Generation, Distribution and Utilization of Electrical Energy, New Age International, 4th Edition, 2011.
6. M. Prasad, Refrigiration and Air-conditioning, Wiley Eastern Ltd., 1995 .
7. Taylor E. Openshaw, "Utilization of Electrical Energy", 1968, Orient Longman.
8. Gupta J. B., "Utilization of Electric Power and Electric Traction", 2002,S. K. Kataria and Sons.


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*Open Elective - III*

## ROBOTICS
### (Other than ME)
IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize the students with anatomy, kinematics, sensors and dynamics of a programmable machine, robot.

**Learning Outcomes:**

Students will be able to

- distinguish between fixed automation and programmable automation.
- identify various components of robot.
- select appropriate type of actuator for a joint.
- illustrate robot applications in manufacturing.
- analyze kinematics of a robot.
- derive equations of motion of a manipulator for a particular application.
- write a programme to control a robot for execution of a work cycle.

**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 Feed back components**

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors.
Feedback components: position sensors – potentiometers, resolvers, encoders – Velocitysensors.

**UNIT – III: Robot Application in Manufacturing**

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

**UNIT – IV: 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 – V:**

Differential transformation and manipulators, Jacobians – problems.Dynamics: Lagrange – Euler and
Newton – Euler formations – Problems.

**UNIT – VI:**

Trajectory planning and avoidance of obstacles, path planning, Slew motion, joint integrated motion – straight line motion – Robot programming, languages and software packages.

**Text Books:**

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Robotics and Control / Mittal R K & Nagrath I J / TMH.

**Reference Books:**

1. Robotics / Fu K S/ McGraw Hill.
2. An Introduction to Robot Technology, / P. Coiffet and M. Chaironze / Kogam Page Ltd. 1983 London.
3. Robotic Engineering / Richard D. Klafter, Prentice Hall.
4. Robot Analysis and Intelligence / Asada and Slow time / Wiley Inter-Science.
5. Introduction to Robotics / John J Craig / Pearson Edu.
6. Robot Dynamics & Control – Mark W. Spong and M. Vidyasagar / John Wiley & Sons (ASIA) Pte Ltd.

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*Open Elective - III*

## ASSISTIVE TECHNOLOGIES

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- Understand the laws that govern the use of assistive technology in higher education.
- Evaluate appropriate pieces of technology according to a student's specific disability and academic needs.

**Learning Outcomes:**

Students will be able to

- identify the legislative policies connected with assistive
- discuss Universal design principles in the context of general education environments and curriculum materials.
- explore the process for finding the right technology and the right applications, and determine how to pay for it.
- explore and discuss how to establish a technology team with an assistive technology representative, perform a school wide assessment of all student needs and develop a school and/or classroom tech plan.

**UNIT – I: Introduction to Assistive Technology (AT) Devices and Services**

Assistive Technology Defined. Historical Overview of Assistive Technology. Multidisciplinary Nature of at Service Provision.

**UNIT – II: Adaptations Framework for Considering Assistive Technology**

Introduction to the Adaptations Framework, Setting-Specific Demands, Person-Specific Characteristics, Adaptations, Evaluation of Effectiveness of Adaptations.

**UNIT – III: Assistive Technology Assessments**

Overview of Assessment Issues, Overview of General Assessments , Assistive Technology Assessments, Assessment Components.

**UNIT – IV: Enhance Speech Communication**

Nature of Spoken Language, Introduction to Augmentative and Alternative Communication Systems, Selection Techniques for Aided Communication Systems, Overview of Nonelectronic Systems and Electronic Devices.

**UNIT – V: Mobility & 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 – VI: 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 and Bacon "Assistive Technology for People with Disabilities", 2nd edition ***Psycho-Educational Services***
2. Amy G.Dell, Deborah A.Newton, Jerry G.Petroff, "Assistive Technology in the class room Enhancing the school experiences of students with disabilities", Pearson Publications


**Reference Books:**


1. Marion A.Hersh, Michael A.Johnson , " Assistive Technology for the Hearing-impaired, Deaf and Deafblind", Springer Publications
2. Meeko Mitsuko K.Oishi, lan M.Mitchell, H.F. Machiel vanderloss, "Design and use of Assistive Technology, Springer Publications.
3. Eckehard Fozzy Moritz, "Assistive Technologies for the Interaction of the Elderly", Springer Publications.


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*Open Elective - III*

## INTRODUCTION TO EMBEDDED SYSTEMS

**(Other than ECE, CSE & IT)**

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To gain knowledge on basic quantitative principles of embedded system design and performance measurements.
- To study about different embedded firmware and RTOS concepts

**Learning Outcomes:**

Students will be able to

- know the design concepts of different embedded systems.
- know the embedded system components and firmware.
- learn about the techniques of the task communication and RTOS concepts
- design principles of RTOS Based Embedded System Design

**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: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory selection for Embedded Systems, Processor selection for embedded system.

**UNIT – III: Embedded System Components and Firmware**

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware design approaches and Development languages.

**UNIT – IV: Embedded communication interface**

Communication Interface: Onboard and External Communication Interfaces, Serial/ Parallel Communication – Serial communication protocols -RS232 standard – RS485 –Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C).

**UNIT – V: RTOS Based Embedded System Design**

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

**UNIT – VI: Task Communication**

Task Synchronization, Task communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

**Text Books:**

1. Shibu K.V, "Introduction to Embedded Systems ",Mc Graw Hill. (I to VI Units)
2. Raj Kamal,"Embedded Systems", TMH. (IV Unit)

**Reference Books:**

1. Frank Vahid, Tony Givargis,"Embedded System Design", John Wiley.
2. Lyla, "Embedded Systems", Pearson, 2013
3. David E. Simon, "An Embedded Software Primer", Pearson Education.

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*Open Elective - III*

## SOCIAL NETWORKS

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To provide basic concepts of Social networks and make them learn the psychological foundations of Social networks.
- To Know about Network Influence and diffusion

**Learning Outcomes:**

Students will be able to

- describe Social network concepts.
- categorize segmentation and Characteristics.
- analyze psychological foundation of Social networks.
- evaluation of various organizations of networks.
- define Network Influence and diffusion.
- design social network systems in different areas.

**UNIT – I:**

Basic social network concepts-Distributions- Multiplexity-Roles and positions-Embedded of the informal within instituted or named networks.

**UNIT – II:**

Network segmentation-Named and Unnamed Network segments-segmenting groups on the basis of cohesion-structural similarity and structural equivalence.

**UNIT – III:**

Psychological foundations of social networks-safety-effectiveness-Status-Limits on individual networks

**UNIT – IV:**

Organizations and networks Information-Driven organizations-Bridging the gaps: Network size, diversion and social cohesion

**UNIT – V:**

Networks, Influence and diffusion – influence and decision making-epidemiology and network diffusion.

**UNIT – VI:**

Network as social capital –Individual level social capital-social capital as an attribute of social systems.

**Text Books:**

1. Understanding Social Networks: Theories, Concepts, and Findings By Charles Kadushin.

**Reference Books:**

1. Social Networks and the Semantic Web By Peter Mika.
1. **Social Network Analysis: Methods and Applications** By Stanley Wasserman, Katherine Faust

*Open Elective - III*

## MOBILE APPLICATION DEVELOPMENT

**(Other than CSE & IT)**

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course objectives:**

- To prepare students with skills and knowledge of Mobile application development using J2ME Technology.
- Understand the Android OS architecture and able to develop the applications for mobile devices

**Learning Outcomes:**

Students will be able to

- configure a J2ME environment for development.
- plan and design of J2ME applications.
- access and work with database under the J2ME.
- reproduce the installation of the Android Eclipse SKD.
- implement the user interface for android applications.
- use best design practices for mobile development, designing applications for performance and responsiveness and also implement communication between the mobile devices.

**UNIT – I: J2ME Overview**

Inside J2ME, How J2ME Is Organized, J2ME and Wireless Devices, What J2ME Isn't, Other Java Platforms for Small Computing Devices.

**J2ME Architecture and Development Environment :** J2ME Architecture ,Small Computing Device Requirements, Run-Time Environment, MIDlet Programming .Java Language for J2ME ,J2ME Software Development Kits ,Hello World J2ME Style Multiple MIDlets in a MIDlet Suite ,J2ME Wireless Toolkit.

**UNIT – II:**

**Commands, Items, and Event Processing:** J2ME User Interfaces ,Display Class ,The Palm OS Emulator ,Command Class ,Item Class ,Exception Handling .High-Level Display: Screens :Screen Class , Alert Class, Form Class ,Item Class ,List Class, Text Box Class, Ticker Class.

**Canvas**: The Canvas, User Interactions Graphics, Clipping Regions, Animation

**UNIT – III:**

**Record Management System** : Record Storage ,Writing and Reading Records, Writing and Reading Mixed Data Types ,Record Enumeration ,Sorting Records, Searching Records ,Record Listener .

**J2ME Database Concepts:** Data, Databases, Database Schema, Overview of the JDBC Process, Database Connection.

**UNIT – IV:**

Installation and configuration of android, starting an android application project: components, debugging with eclipse. Application design: the screen layout and Main.xml file, components ids, controls, creating and configuring android Emulator, communication with emulator.

**UNIT – V:**

**controls and user interface:** radio buttons, radio group ,the spinner, data picker, buttons, array adapter .

**view class:** combining graphics with a touch listener ,canvas, bitmap, paint ,motion event.

**UNIT – VI:**

working with images :display images ,using images stored on android devices ,image view, working with text files ,working with data tables, using sqlite ,using xml for data exchange, cursor, content values, XML PUL Parser, XML Resource parser.

**Client -server applications:** socket, server socket, HTTP URL connection, URL.

**Text Books:**

1. J2ME: The Complete Reference by James Keogh ,McGraw-Hill/Osborne.
2. Android Application development for java programmers by James C Sheusi, Cengage Learning

**Reference Books**


1. **Core J2ME Technology by John W. Muchow, Prentice Hall PTR; 1st edition.**
2. **Enterprise J2ME : developing mobile java applications –Michael juntao yuan,pearson Education ,2004.**
3. **Beginning java ME platform, Ray Richpater, Après, 2009.**
4. **Android apps for absolute Beginners by Wallace Jackson, Apress.**
5. **Begining android 4 application development, Wei-meng Lee, wiley** Programming android, Ziguord Mednieks, Laired Dornin, G.Blake Meike & Masumi Nakameera, Orelly


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*Open Elective - III*

## REAL - TIME SYSTEMS

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize with the concepts of Real – Time systems.

**Learning Outcomes:**

StudentS will be able to

- understand the use of multi tasking techniques in real time systems.
- evaluate the performance of soft and hard real time systems.
- analyze multi task scheduling algorithms for periodic, aperiodic and sporadic tasks.
- design real time operating systems.

**UNIT – I:**

Real-Time systems, typical real-time applications, hard versus soft real-time systems, a reference model of real-time systems.

**UNIT – II:**

Commonly used approaches to hard real-time scheduling, clock-driven scheduling,

**UNIT – III:**

Priority-driven scheduling of periodic tasks, scheduling aperiodic and sporadic jobs in priority- driven systems.

**UNIT – IV:**

Resources and resource access control, multiprocessor scheduling and resource access control.

**UNIT – V:**

Scheduling flexible computations and tasks with temporal distance constraints.

**UNIT – VI:**

Real-Time Communications, Operating Systems.

**Text Books:**

1. Jane Liu, Real-Time Systems, Prentice Hall, 2000.
2. Philip.A.Laplante, Real Time System Design and Analysis, 3rd Edition, PHI, 2001.

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*Open Elective - III*

## NETWORK MANAGEMENT SYSTEMS

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To understand key elements of Network Management.
- To understand the various Network management tools.

**Learning Outcomes:**

Students will be able to

- analyze the key elements of Network Management.
- distinguish different types of SNMPs.
- apply the remote monitoring mechanism for an application.

**UNIT – I: Data communications**

Analogy of Telephone Network Management, Communications protocols and Standards, Challenges of Information Technology Managers

**UNIT – II: Network Management**

Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Current Status and future of Network Management.

**UNIT – III: SNMPV1 Network Management**

Organization and Information and Information Models.

**Managed network**: Case Histories and Examples, The History of SNMP Management, The SNMP Model, The Organization Model, System Overview, The Information Model.

**UNIT – IV: SNMPv1 Network Management**

Communication and Functional Models, The SNMP Communication Model, Functional model

**UNIT – V: SNMP Management**

**SNMPv2:** Major Changes in SNMPv2, SNMPv2 System Architecture, SNMPv2 Structure of Management Information, the SNMPv2 Management Information Base, SNMPv2 Protocol, Compatibility with SNMPv1

**UNIT – VI: SNMP Management**

**RMON:** What is Remote Monitoring? , RMON SMI and MIB, RMON1, RMON2, ATM Remote Monitoring

**Network Management Tools and Systems:** Network Management Tools, Network Statistics Measurement Systems.

**Text Book:**

1. Network Management, Principles and Practice, Mani Subrahmanian, Pearson Education.

**Reference Books:**

1. Network management, Morris, Pearson Education.
2. Principles of Network System Administration, Mark Burges, Wiley Dreamtech.

. Distributed Network Management, Paul, John Wiley.

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*Open Elective - III*

## FUNDAMENTALS OF E-COMMERCE

**(Other than CSE & IT)**

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To introduce the basic concepts of E-Commerce.
- To gain the knowledge on various Mercantile Process models.
- To identify the fundamental concepts in E-Payment systems like smart card, credit card..etc
- To expose to electronic data interchange (EDI) problems.

**Learning Outcomes:**

Students will be able to

- outline the fundamentals in E-Commerce.
- describe various Mercantile Process models.
- discuss about various E-Payment systems.
- identify electronic data interchange (EDI) problems.
- describe various Advertising techniques on internet

**UNIT – I: Electronic Commerce-Frame work**

Electronic Commerce-Frame work, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications.

**UNIT – II: Consumer Oriented Electronic commerce**

Consumer Oriented Electronic commerce - Mercantile Process models.

**UNIT – III: Electronic payment systems**

Electronic payment systems - Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems.

**UNIT – IV: Inter Organizational Commerce**

Inter Organizational Commerce - EDI, EDI Implementation, Value added networks.

**UNIT – V: Intra Organizational Commerce**

Work Flow, Automation Customization and internal Commerce, Supply chain Management.

**UNIT – VI: Advertising and Marketing**

Information based marketing, Advertising on Internet, on-line marketing process, market research

**Text Book:**

1. Kalakota, Whinston *Frontiers of electronic commerce*, Pearson.

**Reference Books:**

1. Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang *E-Commerce fundamentals and applications*, John Wiley.
2. S.Jaiswal – Galgotia *E-Commerce.*
3. Kenneth C.Taudon, Carol Guyerico Traver *E-Commerce – Business, Technology, Society.*

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*Open Elective - III*

## STATISTICAL METHODS USING R SOFTWARE

IV Year – I Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To understand statistical concepts.
- To know R software.

**Learning Outcomes:**

Students will be able to

- examine the relationship between the variables and forecast.
- apply suitable range of statistical tests.
- use R for statistical programming, Computation, Graphics, and modeling.
- expand their knowledge of R on their own.

**UNIT – I: Correlation-Regression**

Simple correlation for ungrouped data , rank correlation and simple regression.

**UNIT – II: Testing of Hypothesis**

Introduction - population-sample-large sample and small sample. Testing of hypothesis - hypothesis - null hypothesis - alternative hypothesis - level of significance - degrees of freedom - one tailed and two tailed tests - procedure of testing of hypothesis.

**UNIT – III: One Sample Significance Tests**

One sample tests: Large sample - Test for single mean, single proportion, Small sample tests: t-test for single mean.

**UNIT – IV: Two Sample Significance Tests**

Two sample tests : Large sample - test for two means, two proportions, Small sample: t-test for two means, F-test.

**UNIT – V: Introduction to R software**

An introductory R session- R as a calculator- Getting help and loading packages- Data entry and exporting data.

**Correlation and Regression using R:** Calculating correlation coefficient-calculating rank correlation-finding regression lines- interpretations

**UNIT – VI: One Sample and Two Sample Tests using R**

Large sample: Calculating Z value for single and two means - interpretation - Calculating Z value for single proportion and two proportions-interpretations

Small sample: Calculating t for single mean and two means- interpretations Calculating F value -interpretations

**Text Books:**


1. S.C.Gupta and V.K.kapoor-Fundamentals of Mathematical Statistics-S.chand & co.
2. Probability and Statistics, Dr. T. K. V. Iyengar, Dr. B. Krishna Gandhi, S. Ranganatham and Dr. M.V. S. S. N. Prasad, S. Chand & Company Ltd.
3. Peter Dalgaard. Introductory Statistics with R (Paperback) 1st Edition Springer-Verlag New York, Inc. ISBN 0-387-95475-9
4. W. N. Venables and B. D. Ripley. 2002. Modern Applied Statistics with S. 4th Edition. Springer. ISBN 0-387-95457-0


**Reference Books:**


1. An Introduction to R. Online manual at the R website at http://cran.r-project.org/manuals.html
2. Andreas Krause, Melvin Olson. 2005. The Basics of S-PLUS. 4th edition. Springer-Verlag, New York. ISBN 0-387-26109-5.


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## CAD / CAM LAB

IV Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To provide necessary skills for analysis of structural , heat transfer and vibration problems using analysis package.
- To demonstrate the simulation of manufacturing processes using simulation package.
- To demonstrate the working principle and operation of CNC lathe, CNC Mill and Robot.

**Learning Outcomes:**

Students will be able to

- analyze structural , heat transfer and vibration problems.
- simulate manufacturing processes used for production of components.
- produce simple components using CNC lathe and CNC Mill.
- operate Robot and write code for Palletization of components.

**List of experiments:**

1. Static Analysis of truss
2. Static Analysis of beam
3. Static Analysis of 3- D structures
4. Steady State Heat Transfer Analysis
5. Modal analysis of beam
6. Analysis of Axisymmetric Problem
7. Optimization of cantilever beam
8. Analysis of plane stress problem
9. Simulation of manufacturing Processes
10. Machining of Simple Components using CNC Lathe
11. Machining of Simple Components using CNC Mill
12. Palletization of objects using pick and place Robot

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# HEAT TRANSFER LAB

IV Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To determine experimentally the conductive and radiating properties of materials and heat transfer coefficients in single and two phase flows.

**Learning Outcomes:**

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:**

1. Determination of the overall heat transfer co-efficient of composite slab
2. Determination of Thermal Conductivity of a lagged pipe
3. Determination of Thermal Conductivity of a given insulating powder
4. Determination of Thermal Conductivity of given metal rod.
5. Determination of efficiency of a pin-fin
6. Determination of heat transfer coefficient in Transient Heat Conduction
7. Determination of heat transfer coefficient in forced convection
8. Determination of heat transfer coefficient in natural convection
9. Determination of overall heat transfer coefficient in a heat exchanger
10. Determination of Emissivity of a test plates
11. Determination of Stefan Boltzmann constant
12. Determination of heat transfer coefficient in drop and film wise condensation
13. Determination of Critical Heat flux during boiling
14. Study of heat pipe and its demonstration
15. Study of Two – Phase flow

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## COMPUTATIONAL METHODS FOR ENGINEERS LAB

IV Year – I Semester

| | | | |
|---|---|---|---|
| Practical | : 3 | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To provide hands on experience in C Programming/MATLAB and to write simple codes to implement the numerical methods.

**Learning Outcomes:**

Students will be able to

- understand basic commands in C Programming/MATLAB.
- solve ordinary Partial differential equations, Integrate & Develop 2-D plots.

**List of experiments:**

1. To deduce error involved in polynomial equation.
2. To Find out the root of the Algebraic and Transcendental equations using Bisection, Regula-falsi, Newton Raphson and Iterative Methods.
3. To implement Newton's Forward and Backward Interpolation formula.
4. To implement Gauss Forward and Backward Interpolation formula.
5. To implement Newton's Divided Difference and Langranges Interpolation formula.
6. To implement Numerical Differentiations.
7. To implement Numerical Integration using Trapezoidal, Simpson 1/3 rule.
8. To implement Least Square Method for curve fitting.
9. To draw frequency chart like histogram, frequency curve and pie-chart etc.
10. To estimate regression equation from sampled data and evaluate values of standard deviation, t-statistics, regression coefficient, value of $R^2$ for at least two independent variables.

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*Elective - IV*

## CONDITION MONITORING

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To understand the maintenance scheme, their scope and limitations.

**Learning Outcomes:**

Students will be able to

- develop an appreciation for the need of modern technological approach for plant maintenance to reduce the maintenance expenditure.
- carry out lubrication oil analysis and temperature analysis in vibrating systems.
- analyze for machinery condition monitoring and explain how this compliments monitoring the condition.
- emphasizes on case studies that require gathering information using the modern testing equipment and processing it to identify the malfunction in that system.

**UNIT - I:**

Maintenance strategies, Introduction to condition monitoring, Criticality index, Various techniques for fault detection, Introduction to Non-destructive testing, role of non-destructive testing in condition monitoring.

**UNIT - II:**

**Wear debris analysis:** Wear mechanisms, wear particles, wear process monitoring techniques - Spectrometric oil analysis program (SOAP), Ferrography, Applications, Adavntages and limitations.

**UNIT - III:**

**Corrosion monitoring:** Causes and effects of corrosion, Methods of corrosion prevention – reactive coating, applied coatings and corrosion inhibitors, Cathodic protection.

**Flaw detection:** Discontinuity **–** Origin and classification, Ultrasonic testing and Magnetic particle inspection.

**UNIT - IV:**

Rotating machinery, Identification of machine faults and frequency range of symptoms, localized & distributed faults, ISO Standards for vibration monitoring and analysis, types and benefits of vibration analysis, Vibration signature analysis,

Vibration transducers – Proximity probes, velocity transducers, accelerometers, laser Vibrometer.

**UNIT - V:**

**Temperature monitoring:** Need for temperature monitoring, Thermography, Active and passive thermography, IR thermography, applications, advantages and limitations.

**UNIT - VI:**

Fault detection in Rolling Element Bearings, Orbit Analysis static & Dynamic Balancing.

**Case studies**: Induction Motors, Gear Box vibration, Reciprocating engines & Compressors.

**Text Books:**


1. R.A. Collacot "Vibration Monitoring & Diagnosis" ,George Godwin Ltd.,London,1979.
2. Isermann R, "Fault Diagnosis Applications" , Springer-Verlag, Berlin .


**Reference Books:**


1. J S Rao, "Vibration Condition Monitoring of Machines", Narosa Publishing House, 2nd Edition.
2. B.K.N. Rao "Hand book of Condition Monitoring" ,Elsevier Advanced Technology,1st Edition.
3. Allan Davies, "Handbook of Condition Monitoring: Techniques and methodology", Chapman and Hall.
4. B.J. Boeing, "Hand book of Non Destructive Application".


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*Elective - IV*

## RAPID PROTOTYPING

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To introduce Rapid Prototype tools and techniques for design and Manufacturing.

**Learning Outcomes:**

Students will be able to

- assess the need of RPT in Product development.
- use appropriate RT Software for development of Prototype model.
- judge the correct RP Process for Product/Prototype development.
- predict the technical challenges in 3D printing.
- list the applications of RPT.

**UNIT - I:**

**Introduction to Rapid Prototyping**: Introduction to prototyping, traditional prototyping Vs. rapid prototyping (RP), need for time compression in product development, usage of RP parts, generic RP process, distinction between RP and CNC, other related technologies, classification of RP.

**UNIT - II:**

**RP Software:** Need for RP software, MIMICS, magics, surgiGuide, 3D-doctor, simplant, velocity2, voxim, solidView, 3Dview, etc., software.

**Software Issues of RP:** Preparation of CAD models, problems with STI, files, STL file manipulation formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP.

**UNIT - III:**

**Photopolymerization RP Processes:** Sterolighography (SL), SL resin curing process, SL scan patterns, microstereolithography, applications of photopolymerization processes.

**Powder Bed Fusion RP Processes :** Selective laser sintering (SLS), powder fusion mechanism and powder handling, SLS metal and ceramic part creation, electron beam melting (EBM), applications of powder bed fusion processes.

**Extrusion-Based RP Systems:** Fused deposition modelling (FDM), principles, plotting and path control, applications of extrusion-based processes.

**UNIT - IV:**

**Printing RP Processes**: 3D printing (3DP), research achievements in printing deposition, technical challenges in printing, printing process modeling, applications of printing processes.

**Sheet Lamination RP Processes:** Laminated Object Manufacturing (LOM), ultrasonic consolidation (UC), gluing, thermal bonding, LOM and UC applications.
**Beam Deposition RP Processes:** Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), processing – structure - properties, relationships, benefits and drawbacks.

**UNIT - V:**

**Rapid Tooling**: Conventional Tooling Vs. Rapid Tooling, classification of rapid tooling, direct and indirect tooling methods, soft and hard tooling methods.
**Errors in RP Processes:** Pre-processing, processing, post-processing errors, part building errors in SLA, SLS, etc.,

**UNIT - VI:**

**RP Applications:** Design, engineering analysis and planning applications, rapid tooling, reverse engineering, medical applications of RP.

**Text Books:**


1. Chua Chee Kai., Leong KahFai., Chu Sing Lim, "Rapid Prototyping: Principles and Applications in Manufacturing", World Scientific publishing Co.Pte.Ltd, 3rd Edition.
2. Ian Gibsn., David W Rosen., Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2nd edition.


**Reference Books:**


1. Duc Pham, S.S.Dimoy , "Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping ", Springer, 2001.


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*Elective - IV*

## POWER PLANT ENGINEERING

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives**

- To impart knowledge on working of various power plants and to create awareness about power plant economics.

**Learning Outcomes:**

Students will be able to

- identify the various conventional energy resources.
- understand the working principles of various power plants such as steam, IC engines, gas turbine , hydal and nuclear reactors.
- identify different non conventional energy resources and their utilization.
- familiarise power plants economics and power tariffs.
- understand the impact of power plant effluents on environment.

**UNIT - I:**

Introduction to the Sources of Energy – Resources and Development of Power in India.

**Steam Power Plant:** Plant Layout, Working of different Circuits, Fuel and ash handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

**UNIT - II:**

**Combustion Process:** Combustion systems, Properties of coal , overfeed and underfeed fuel beds, over feed stokers- traveling grate stokers, spreader stokers. Under feed stokers-Single retort stokers, Multi -retort Stoker, pulverized fuel burning system and its components, Fluidized bed combustion, types of burners, draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. feed water treatment, Corrosion.

**UNIT - III:**

**Internal Combustion Engine Plant:** Diesel Power Plant, Introduction, types, Plant layout with auxiliaries, fuel supply system, lubrication and cooling system, super charging.

**Gas Turbine Plant:** Introduction, classification, Layout with auxiliaries, Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison.

**UNIT - IV:**

**Hydro Electric Power Plant**: Water power, Hydrological cycle, flow measurement, Hydrographs, drainage area characteristics, storage and Pondage, classification of dams and spill ways.

**Hydro Projects and Plant**: Classification, Typical layouts, plant auxiliaries, pumped storage plants.

**Power from Non-Conventional Sources:** Utilization of Solar, Energy Collectors, Principle of Working, Wind Energy –Types, HAWT, VAWT, Tidal Energy.

**Direct Energy Conversion:** Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generator.

**UNIT - V:**

**Nuclear Power Station:** Nuclear fuel, breeding and fertile materials, Nuclear reactor,Reactor operation.

**Types of Reactors:** Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding, radioactive waste disposal.

**UNIT - VI:**

**Power Plant Economics and Environmental Considerations:** Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, and load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor, related exercises. Effluents from power plants and Impact on environment, pollutants and pollution standards, Methods of Pollution control.

**Text Books:**


1. P.K.Nag, “Power Plant Engineering”, II Edition ,TMH.
2. R.K.Rajput, “ A Text Book of Power Plant Engineering”, Laxmi Publications.
3. P.C.Sharma, “A Text Book of Power Plant Engineering”,2013.


**Reference Books:**


1. K.K . Ramalingam , “Power plant Engineering”, Scietech Publications (India) Pvt Ltd.
2. s.c. Arora ,S. Domkundwar , “A Course in Power Plant Engineering”, Dhanpat Rai, 1996.
3. M.M.ElWakil, “Power station Engineering” McGraw-Hill.
4. G.D. Rai, “An Introduction to Power Plant Technology” Khanna, 1996.
5. C. Elanchezhian, L. Saravanakumar, B. Vijaya Ramnath, “Power plant Engineering” ,I.K. International Pub.


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*Elective - IV*

## DESIGN FOR MANUFACTURING & ASSEMBLY

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To introduce the design factors which will ease the manufacturing and assembly.

**Learning Outcomes:**

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.
- plan an assembly for ease of manufacture and automation.

**UNIT - I:**

**Design for manufacturing**: Reduce the cost of manufacturing process, understanding the process and constraints, standard components and process, consider the impact of DFM decisions and other factors.

**UNIT - II:**

**Design consideration in metal casting:** Mold and gating system design, directional solidification, and trouble shooting.

**UNIT - III:**

**Design for Welding:** Selection of materials for joining, welding defects, minimize the residual stresses etc.

**UNIT - IV:**

**Design for Forming** : design for forging and sheet metal .

**UNIT - V:**

**Selection of materials:** Choice of materials, organizing materials and processes.

**UNIT - VI:**

**Design for assembly and automation**: Application of design for manufacture and assembly with selection of materials and ranking of processes like casting, injection moulding, sheet metal working, die casting, investment casting, hot forging, and automation.

**Text Books:**

1. George E. Dieter, “Engineering Design – A Material Processing Approach”, McGraw Hill International ,2nd Editon, , 2001.
2. Geofrey Boothroyd, Peter Dewhurst, “Product Design for Manufacture and Assembly”, CRC Press, 3rd Edition, 2010.

**Reference Books:**

1. O. Molloy , “Design for Manufacturing and Assembly: Concepts, Architectures and Implementation”,Chapman and Hall, 1998.

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*Elective - V*

## NANOTECHNOLOGY

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To familiarize with principles of quantum mechanics on which nano materials behave
- To elucidate applications of nanotechnology

**Learning Outcomes:**

Students will be able to

- analyze the concepts and preparation methods of Nano materials.
- understand the nano material properties and their behavior.
- use various techniques for investigating nano material.
- know the importance of Nano Technology for advanced materials processing.

**UNIT - I:**

**Introduction:** Basics of quantum mechanics**,** Harmonic oscillator, magnetic phenomena ,band structure in solids, Mossbauer and spectroscopy , optical phenomena bonding in solids ,Anisotropy.

Process of synthesis of nano powders , Electro deposition , Important nano materials.

**UNIT - II:**

**Silicon carbide:** Application of silicon carbide , Nano materials preparation ,Sintering of SiC,X-ray diffraction data ,electron microscopy sintering of nano particles.

**Nano Particles Of Alumina And Zirconia:** Nano materials preparation , Charecterization ,Wear materials and Nano composites.

**UNIT - III:**

**Mechanical Properties:** Strength of Nano crystalline SiC , preparation for strength measurements, Mechanical properties , magnetic properties

**Electrical Properties**: Switching glasses with nano particles, Electronic conduction with nano particles.

**Optical properties:** optical properties , Special properties and the coloured glasses.

**UNIT - IV:**

**Investigating And Manipulating Materials In The Nano Scale:** Electron microscopics , scanning probe microscopic ,optical microscopic for nano science and technology, X-ray diffraction.

**UNIT - V:**

**Nanobiology:** Interaction between biomolecules and nanoparticle surface. Different types of inorganic materials used for the synthesis of hybrid nano-bio assemblies. Application of nano in biology,nano probe for analytical applications-A new methodology in medical diagnostics and Biotechnology,Future perspectives of Nanobiology , Nanosensors.

**UNIT - VI:**

**Nanomedicens:** Developing of Nanomedicens Nano systems in use, Protocols for nanodrug Administration , Nanotechnnology in Diagnostics applications, materials for used in Diagnostics and Therapeutic applications, molecular Nanomechanics , molecular devices , Nanotribology , Studying tribology at nanoscale , Nanotribology applications.

**Text Books:**

1. A.K.Bandyopadhyay ,"Nano materials" , New Age publishers

**Reference Books:**

1. T.Pradeep, ''Nano Essentials'', TMH publications.

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*Elective - V*

## GAS DYNAMICS & JET PROPULSION

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To analyze and solve basic problems of Subsonic and Supersonic flows of compressible fluids with Friction and Heat transfer.

**Learning outcomes:**

Students will be able to

- understand the physical origin of equations of compressible one dimensional flows.
- analyse one dimensional flows including shock wave with heat addition and friction.
- understand and analyse the effect of shock waves on compressible flows.

**UNIT - I:**

**Definitions and basic Relations:** Energy equation for a flow processes, stagnation- pressure, density, temperature, velocity, Mach number, effect of mach number on compressibility.

**Basic Equation of compressible Flow:** Application of general differential equation of continuity, momentum & energy to compressible inviscid fluids; Compressible Bernoulli's equation, Irrotational flow, Wave propagation, Velocity of Sound, Subsonic and Supersonic Flow.

**UNIT - II:**

**Steady one dimensional Flow:** Fundamental Equations, Discharge from a Reservoir, Stream tube, Area–Velocity Relation, De-laval Nozzle, diffusers, dynamic head, Measurement in Compressible Flow, Pressure Coefficient.

**UNIT - III:**

**Normal Shock Waves:** Equation of Motion for normal shock waves, the normal shock Relations, total pressure across the shock wave, Hugoniot equation, determination of Mach number of supersonic flows

**Oblique shock waves:** Nature of flow through Oblique shock wave, Relations, Prandtl's equation, Hugoniot equation, variation of flow parameters, oblique shock Relations from the normal shock equation,

**UNIT - IV:**

**Flow with Friction:** Flow in constant Area duct with friction, Fanno line, and Fanno flow equations, variation of flow properties,.

**Flow with Heat Transfer:** Flow with heating or cooling in ducts, Rayleigh line, Fundamental
Equations, Rayleigh flow relations, variation of flow properties.

**UNIT - V:**

**Propulsion**: Air craft propulsion- types of jet engines- energy flow through jet engines, thrust, thrust power and propulsive efficiency, turbojet components- diffuser, compressor, combustion chamber, turbines, exhaust systems.

**UNIT - VI:**

Performance of turbo propeller engines, ramjet and pulsejet, scramjet engines. Rocket propulsion- rocket engines, Basic theory of equations- thrust equation- effective jet velocity- specific impulse- rocket engine performance- solid and liquid propellant rockets- comparison of various propulsion systems.

**Text Books:**


1. S.M.YAHYA, “Fundamentals of compressible flow”, new Age international publications.
2. E Rathakrishnan, “Gas Dynamics”, Prentice Hall of India.


**Reference Books:**


1. Bird G A,”Molecular Gas Dynamics and the Direct Simulation of Gas Flows”, Oxford University.
2. Carlo Cercignani,”Kinetic Theory and Gas Dynamics”, Springer Verlog.
3. Maurice JosephZucrow ,”Gas Dynamics: Multidimensional Flow” TMH.
4. Liepman,”Elements of Gas Dynamics”, Dover Publications.
5. Zucrow M.J. and Holfman J.D. “Gas Dynamics”, Vol-I & Vol-II, John Wiley and Sons Inc.


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*Elective - V*

## AUTOMATION IN MANUFACTURING

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To impart the stratagies of automation in manufacturing.

**Learning Outcomes:**

Students will be able to

- explain automation strategies.
- calculate cycle times line efficiency, of Automated Flow Line.
- design Assembly system with line balance.
- choose appropriate material handling system for a given application.
- design adaptive control systems.
- apply machine vision for automotive inspection of parts.

**UNIT - I:**

**Introduction**: Types and strategies of automation, pneumatic and hydraulic components, circuits, Automation in machine tools, Mechanical feeding and tool changing and machine tool control.

**UNIT - II:**

**Automated Flow Lines**: Methods of part transport, transfer mechanism, buffer storage, control function, design and fabrication considerations.

**UNIT - III:**

**Analysis of Automated Flow Lines**: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

**Assembly system and Line Balancing**: Assembly process and systems, assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

**UNIT - IV:**

**Automated Material Handling**: Types of equipment, functions, analysis and design of material handling systems, conveyor systems, automated guided vehicle systems.

**Automated Storage Systems**: Automated storage and retrieval systems; work in process, interfacing handling and storage with manufacturing.

**UNIT - V:**

**Adaptive Control Systems**: Introduction, adaptive control with optimization, Adaptive control with constraints, Application of A.C. in Machining operations. Use of various parameters such as cutting force, temperature, vibration and acoustic emission.

**UNIT - VI:**

**Automated Inspection**: Fundamentals types of inspection methods and equipment, CMM, machine vision.

**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. Radhakrishnan & N.Subhrammanyan, " CAD/CAM/CIM", Digital Design Publications.
3. W. Buekinsham ,"Automation", PHI Publications, 3rd edition.

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*Elective - V*

## SUPPLY CHAIN MANAGEMENT

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : 3 +1* | Internal Marks | : 40 |
| Credits | : 3 | External Marks | : 60 |

**Course Objectives:**

- To impart principles of supply chain management to improve the overall organization performance and customer satisfaction

**Learning Outcomes:**

Students will be able to

- illustrate the concept of SCM and supply chain integration.
- analyze the inventory management policies.
- calculate inventory related costs and describe the role of IT in inventory management.
- design a supply chain network.
- appraise the role of information sharing in a supply chain network.
- identify appropriate supply chain strategy.
- distinguish centralized and decentralized purchasing.
- apply information systems to support collaboration and visibility of supply Chains.

**UNIT - I:**

**Introduction to Supply Chain Management (SCM):** Concept of supply chain management, Importance of supply chain flows, Core competency, Value chain, Elements of supply chain efficiency, Key issues in SCM, Decision phases, Supply chain integration, Process view of a supply chain, Competitive Strategy and supply chain strategies, Uncertainties in supply chain, Supply chain drivers.

**UNIT - II:**

**Planning & Managing Inventories in a Supply Chain:** The role of cycle inventory in a supply chain –Managing multi echelon cycle inventory – Estimating cycle inventory – related costs in practice – the role of safety inventory in a supply chain – managing safety inventory in a multi echelon supply chain – the role of information technology in inventory management – estimating and managing safety inventory in practice.

**UNIT - III:**

**Designing Supply Chain Network**: Introduction, Network design, factors influencing network design, Data collection, Data aggregation, Transportation rates, Warehouse costs, Capacities and locations, Models and data validation, Key

features of a network configuration, Impact of uncertainty on network design, Network design in uncertain environment.

**UNIT - IV:**

Value of information: Bullwhip effect, Information sharing, Information and supply chain trade-offs, Distribution strategies, Direct shipment distribution strategies, transshipment and selecting appropriate strategies.

**UNIT - V:**

Identifying appropriate supply chain strategy. Sourcing and procurement, Outsourcing benefits, Importance of suppliers, evaluating a potential supplier, Supply contracts, Competitive bidding and Negotiation. Purchasing, Objectives of purchasing , Relations with other departments, Centralized and Decentralized purchasing, Purchasing procedure, Types of orders, Tender buying, E-procurement, Role of E business in supply chains

**UNIT - VI:**

**Issues in Supply Chain Management:** Introduction, Risk management, Managing global risk, Issues in international supply chain, regional differences in logistics. Local issues in supply chain, issues in natural disaster and other calamities.

**Text Books:**


1. Sunil Chopra and Peter Meindel,"Supply Chain Management: Strategy, Planning, and Operation",Prentice Hall of India.
2. R.B. Handfield and E.L. Nochols, Jr.,"Introduction to Supply Chain Management",Prentice Hall.


**Reference Books:**


1. Jeremy F. Shapiro.,"Modeling the Supply Chain", Duxbury Thomson Learning, 2001.
2. David Simchi Levi, Philip kaminsky, and Edith Simchi Levi,"Designing and Managing the Supply Chain: Concepts, Strategies, and Case Studies",Irwin McGrawHill, 2000.
3. Coyle, Bardi and Langley,"Management of Business Logistics: A Supply Chain Perspective", Thomson Learning.


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*Self Study Course*

## GLOBAL POSITIONING SYSTEMS

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : - | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To understand the concept and usage of GPS for various applications.

**Learning Outcomes:**

Students will be able to

- explain the GPS components.
- choose a specific GPS receiver and GPS survey method.
- interpret the navigational message and signals received by the GPS satellite
- identify location of features and map the geospatial features.

**UNIT – I: Overview and Observables of GPS**

Basic concept. Space segment- constellation, satellites, operational capabilities, denial of accuracy and access. Control segment- master control station, monitor stations, ground control stations. User segment- user categories, receiver types, information services.

Observables:

Data acquisition- code pseudoranges, phase psecudoranges, Doppler data, biases and noise. Data combinations- linear phase combinations, code, psecudorange smoothing. Atmospheric effects- phase and group velocity ,ionospheric refraction, toposoheric refraction, atmospheric monitoring.

**UNIT – II: Surveying with GPS**

Introduction- terminology definitions, observation techniques, field equipment. Planning a GPS survey- General remarks, Pre survey planning, field reconnaisence, monumentation, organizational design. Surveying Procedure- preobservation, observation, postobservation, ties to control monuments. In Situ data Processing- data transfer, data processing, trouble shooting and quality control, datum transformations, computation of plane coordinates. Survey report.

**UNIT – III: Methods of Processing GPS Data**

Data processing- data handling, cycle slip detection and repair. Ambiguity resolutions- general aspects, basic approaches, search techniques, ambiguity validation. Adjustment, filtering and smoothening- least squares adjustments, kalmal filtering, smoothening. Network adjustment- single base line solution,

multipoint solution, single base line versus multi point solution, least squares adjustment of base lines. Dilutin of precision. Accuracy measures- introduction, chi-square distribution, specifications.

**UNIT – IV: Applications and Future of GPS**

General Uses of GPS- global uses, regional uses, local uses. Attitude determination- theoretical and practical considerations. Air borne GPS for photo control. Interoperability of GPS- GPS and inertial navigation systems, GPS and GLONASS, GPS and other sensors.

Future of GPS:

New application aspects. GPS modernization- future GPS satellites, augmented signal structure. GPS augmentation- ground based and satellite based augmentation. GNSS - GNSS development, GNSS/Loran-C integration.

**Text Books:**

1. B. Hofmann- Wellnhoff, H.Lichtenegger and J. Collins: GPS theory and practice, fifth edition, Springer Wien, Newyork.
2. Bradford W. Parkinson, James Spilker, Global Positioning System: Theory and Applications, Vol. I, 1996.

**Reference Books:**

1. Gunter Seeber, Satellite Geodesy Foundations, Methods and Applications, Walter de Gruyter Pub., 2003.
2. Hofmann W.B, Lichtenegger, H, Collins, J Global Positioning System – Theory and Practice, Springer-VerlagWein, 2001.

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## INTERIOR DESIGN

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : - | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To understand concepts, principles, procedures and components of communication; interpret reasons of communication failure and source respective remedies.
- To classify communication and select appropriate media; draft business letters and reports pertinent to interior designing profession.
- To work in groups and teams; demonstrate leadership quality; make use of group skills to achieve goals.

**Learning Outcomes:**

Students will able to

- implement the key features that can enhance architectural view.
- understand the need of designing construction projects.
- identify the paints and materials for specific interior design.

**UNIT – I: Interior Design and Decoration, Decoration and Tools**

Importance of design - Optimization, Economics, Time, Maintainability, Multiplicity, Role of Interior Designer-Interest of user with respect to economy, comfort, safety, security, etc, Limitations on design due to existing constraints

**Aesthetical tools**

a. Principles of Design - Balance, Emphasis, Rhythm, Harmony, Scale and Proportion

b. Elements of design - Point, Line, Shape, Form, colour and colour theory, Texture and Pattern

c. Aesthetical design consideration - Physical such as touch, smell, hearing, Social such as interactive, status symbols, Psychological such as derivable pleasure from use, emotional comfort, Ideological such as environmental, patriotic, socialistic conditions .

**Functional tools**

a. Ergonomics- Its study - Postures, Anthropometrics, Biomechanics.

b. Zoning, Grids, Modulation of space within and without, enveloping space within the room and furniture.

**UNIT – II: Design Notions**

Concepts - Manifestation of realization through contemplative germination, Period & Styles - Historical & Cultural approach with stress on ability to identify Occidental

Periods and Oriental styles and with special focus on Contemporary Indian period and styles.

a. Occidental - Classical, Medieval, 19th Century AD, Contemporary
b. Oriental - Japanese, Chinese, Thai, and Indian Themes - The common thread that binds the entire design in a story line on Beach and Mela.

**UNIT – III: Planning Process**

Understanding process of design (Need-Design brief-Information collection-Developing Alternatives-Analysis-Solution) Planning Process of Interior Design

a. Design Brief - simple and clear description about what is to be designed.
b. Relevant Data collection such as location & condition of site, Client profile & requirements, Materials, etc.
c. Data Analysis - analyzing and forming alternative schemes based on personal interpretations of design brief and relevant data using design tools and design concepts.
d. Selection- finalizing the best scheme through personal justifications.
e. Presentation- representing the final scheme in graphical manner.

**UNIT – IV: Materials, Paints, Varinishes and Coatings for Interior Design**

Cement, Lime, Sand and Gypsum: Types & Properties of Cement, Lime, Fine and Course Aggregates Types & Applications of Concretes, Mortars and Plasters Properties & Applications of Gypsum & its products.

Paints, varnishes and coatings:

Constituents (Pigment, Thinner, etc.), Classification (Water, Oil, acrylic based), Types (lime wash, distempers, acrylic emulsion, metallic, textured, etc.), Textural quality (Matt, Gloss, Satin, Lustre, etc) and Properties Process of painting (preparation of surface, primer coat, etc.) & application of paint with brush, roller, spray, etc. including applications of paints on different surfaces. Constituents, Types & uses of Varnishes, Polishes & Coatings.

**Text Books:**

1. Joseph De Chaira Jullius Panero Martin Zelnik Time Saver Standard for Interior Design & Space Planning Mcgraw Hill New York.
2. John Pile Interior Design Harry N. Adry Publishers.

**Reference Books:**

1. Jullius Panero Martin Zelnik Human Dimensions and Interior Spaces Whitney Library New York.
2. Phillis Sleen Allen Beginning of Interior Environment New York.
3. Shirish Bapat Basic Design of Anthropometry Bela books Publishers.
4. Shirish Bapat Living Area (Interior Space) Bela books Publishers.

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## ELECTRICAL SAFETY MANAGEMENT

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : - | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To provide a comprehensive exposure to electrical hazards, safety procedures.
- To familiarize the students with various grounding techniques.

**Learning Outcomes:**

Students will be able to

- describe electrical hazards and safety equipment.
- analyze and apply various grounding and bonding techniques.
- select appropriate safety method for low, medium and high voltage equipment.
- participate in a safety team.

**UNIT – I:**

Primary and secondary hazards- arc, blast, shocks-causes and effects-safety equipment- flash and thermal protection, head and eye protection-rubber insulating equipment, hot sticks, insulated tools, barriers and signs, safety tags, locking devices- electrician's safety kit.

**UNIT – II:**

The six step safety methods- pre job briefings- hot -work decision tree-safe switching of power system, safety equipment, procedure for low, medium and high voltage systems- the one minute safety audit.

**UNIT – III:**

General requirements for grounding and bonding- definitions- grounding of electrical equipment- bonding of electrically conducting materials and other equipment-connection of grounding and bonding equipment- system grounding- purpose of system grounding- grounding of low voltage and high voltage systems.

**UNIT – IV:**

Company safety team- safety policy- safety meetings- safety audit- accident prevention- first aid- rescue techniques-accident investigation- national electrical safety code- standard for electrical safety in work place- occupational safety and health administration standards.

**Text Book:**

1. *Dennis Neitzel*, Al Winfield,'Electrical Safety Handbook', McGraw-Hill Education, 4th Edition,2012.

**Reference Books:**


1. John Cadick, 'Electrical Safety Handbook', McGraw-Hill School Education Group, 1994.
2. Maxwell Adams.J, "Electrical safety- a guide to the causes and prevention of electric hazards",The Institution of Electric Engineers, 1994.
3. Ray A. Jones, Jane G. Jones, 'Electrical safety in the workplace', Jones & Bartlett Learning, 2000.


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## GREEN ENGINEERING

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : - | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To impart knowledge, how engineering fundamentals can be applied to achieve sustainability and minimize environmental impacts in all engineering disciplines across life cycles.

**Learning Outcomes:**

Students will be able to

- create sustainable products, facilities, processes and infrastructure.
- design ecofriendly products.

**UNIT - I: Introduction**

Humanity and Technology, the Concept of Sustainability, Industrial Ecology and Sustainable Engineering Concepts.The Relevance of Biological Ecology to Industrial Ecology, Metabolic Analysis, Technology and Risk, the Social Dimensions of Industrial Ecology.

**UNIT - II: Implementation**

Sustainable Engineering, Technological Product Development, Design for Environment and Sustainability: Customer Products, Design for Environment and Sustainability: Buildings and Infrastructure.

**UNIT - III: Life Cycle Assessment**

An Introduction to Life Cycle Assessment, The LCA Impact and Interpretation Stages, Streamlining the LCA Process.

**UNIT - IV: Analysis of Technological Systems**

Systems Analysis, Industrial Ecosystems, Material Flow Analysis, Energy and Industrial Ecology, Water and Industrial Ecology, Urban Industrial Ecology, Modelling in Industrial Ecology.

**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, 2011.


**References Books:**


1. Anastas, Paul T, Zimmerman, Julie B, “Innovations in Green Chemistry and Green Engineering”, Springer, First Edition, 2013.
2. Daniel A. Vallero, Chris Brasier, “Sustainable Design: The Science of Sustainability and Green Engineering”, Wiley, First Edition, 2008.


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## MANAGING INNOVATION & ENTREPRENEURSHIP

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : - | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- Understand process of innovation and its exploitation.

**Learning Outcomes:**

Students will be able to

- explore opportunities to implement innovative ideas.
- assess the level of risk involved in realizing the innovative ideas as entrepreneur.

**UNIT - I:**

Innovation and entrepreneurship. A model for innovation and entrepreneurship, the challenge of innovation strategy.

**UNIT - II:**

The challenge of social entrepreneurship, the potential of" bottom of the pyramid", challenges in managing social entrepreneurship.

**UNIT - III:**

Developing new products, services and ventures. The global business plan.

**UNIT - IV:**

International Opportunities for Innovation and Entrepreneurship. The Future Impact on Innovation on Consumers, Business and Government

**Text books:**

1. John Bessant, Joe Tidd, "Innovation and Entrepreneurship", John Wiley and sons Ltd, second edition, 2011.
2. Robert D Hisrich Claudine Kearney "Managing Innovation and Entrepreneurship" SAGE publications, 2014.

**Reference Books:**

1. Joe Tidd , John Bessant, "Managing Innovation: Integrating technological, market and organizational change" Wiley, Fifth edition, 2013.
2. Joe Tidd , John Bessant, "Strategic Innovation Management", Wiley, First edition, 2014.
3. Richard Owen , John Bessant , Maggy Heintz , "Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society", Wiley, First edition,2013.

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## INTERNET OF THINGS

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : - | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To familiarize with IOT levels and Protocols.
- To provide an insight on specific IoT domain.

**Learning Outcomes:**

Students will be able to

- integrate Internet services and physical objects.
- analyze prototypes of Internet-connected products using appropriate tools.
- apply adequate patterns for user-interaction with connected-objects

**UNIT - I: Introduction to Internet of Things**

Introduction, History , Objects and things, The identifier, Enabling technology , The internet.

**UNIT - II**: **RFID**

Introduction and principles , Components- Active, Passive, Semi-active, and Semi-passive; Future of RFID, RFID application scenarios-case study

**UNIT - III**: **Wireless Sensor Network**

Overview , History, The node, Connecting Nodes, Networking Nodes. Securing communication- standards.

**UNIT - IV: Internet of Things Protocols**

An Introduction to M2M area network physical layers , Applications, Introduction to Legacy M2M protocols for sensor networks, Examples (Mod Bus, Zig Bee). Introduction to next generation Internet of Things Protocols-IP based protocols.

**Text Books**


1. **Hakima Chaouchi, "The Internet of Things: Connecting Objects", John Wiley and sons, ISTE, Briton. (I to III Units).**
2. **Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", johnwiley and sons. (IV unit).**


**Reference Books:**


1. Sergei Evdokimov, Benjamin Fabian, Oliver Gunther, Lenka Ivantysynova, Holger Ziekow, "RFID and the Internet of Things: Technology, Applications, and Security challenges", Now Publishers Inc, 2011.
2. Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning,"The Internet of Things: From RFID to the Next-Generation Pervasive Networked systems", Auerbach Publications,CRC Press.


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## CONSUMER ELECTRONICS

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : - | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To understand working principles of various electronic gadgets and consumer products.
- To study the various technical specifications and facilities of the consumer products.

**Learning Outcomes:**

Students will be able to

- how to work with latest electronic gadgets.
- understand audio and video processing.
- keen learn with home appliances.
- should able to differentiate old and latest developments in electronic world

**UNIT - I: Audio Systems**

PA system – Microphone, Amplifier, Loudspeakers, Radio receivers – AM/FM, Audio recording and reproduction – Cassettes, CD and MP3.

**UNIT - II: Video Systems**

Video system VCR/VCD/DVD players, MP4 players, Set Top box, CATV and Dish TV, LCD, Plasma & LED TV, Projectors – DLP, Home Theatres, Remote Controls.

**UNIT - III: Landline and Mobile Telephony**

Basic landline equipment – CLI, Cordless Intercom/ EPABX system, Mobile phones – GPRS & Bluetooth GPS Navigation system.

**UNIT - IV: Electronic Gadgets**

Scanners – Barcode / Flat bed, Printers, Xerox, Multifunction units (Print, Scan, fax, and copy) Digital clock, Digital camera, Handicam, Home security system, CCTV.

**Text Books:**


1. S. P. Bali ,"Consumer Electronics", Pearson Education ,2008.
2. R. G. Gupta "Audio and Video systems: Principles, Maintenance and Troubleshooting", Tata McGraw Hill (2004).


**Reference Books:**


1. Ronald K.Jurgen, "Digital Consumer Electronics Handbook", McGraw Hill Professional Publishing, 1997.
2. R.R Gulati, "Colour Television-principles and practice", Wiley Eastern Limited, New Delhi.
3. B.R. Gupta, Vandana singhal,"Consumer Electronics", S.K. Kataria and sons, 2006.


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## e-WASTE MANAGEMENT

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : - | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To familiarize the concepts of e-Waste management.
- To gain knowledge in recycling technologies for e-Waste.

**Learning Outcomes:**

Students will be able to

- analyze the recycling techniques of e-Waste management.
- analyze various toxic releases and health complications due to e-Waste.
- apply various reuse techniques for e-Waste.
- acquire knowledge for handling and management of e-Waste.
- apply waste disposal strategy for e-Waste.

**UNIT – I: Introduction to e-Waste Management in India**

Global e-waste growth, Dark shadows of digitization on Indian horizon, e-waste generation, migration, Present practice and systems, disposal methods, Present processing practices, Initiatives to manage e-waste, Strengths and weaknesses of the current system.

**UNIT – II: WEEE (waste electrical and electronic equipment) - toxicity and health**

Hazardous substances in waste electrical and electronic equipment-toxicity and release, Occupational and environmental health perspectives of e-waste recycling.

**UNIT – III: Options and Scenarios for e-Waste Management**

Actions to be considered to achieve goals of e-waste management, Collection/ take back system, Closing the Plastic loop: Turning the supply chain into a supply cycle by mining plastics from end-of-life electronics and other durable goods.

**UNIT – IV: Recycling technologies for e-waste**

Recycling of e-scrap in a global environment-opportunities and challenges, Technologies for recovery of resources from e-waste.

**Reuse:** A Bridge from Unsustainable e-waste to sustainable e-resources.

**Text Books:**


1. Rakesh Johri, E-waste: Implications, regulations, and management in India and current global best practices .
2. Klaus Hieronymi, Ramzy Kahhat, Eric Williams, E-Waste Management: from Waste to Resource


**Reference Books:**


1. Satish Sinha, Priti Mahesh,Waste Electrical and Electronic Equipment The EU and India.
2. By Ronald E. Hester, Roy M. Harrison , Electronic Waste Management .

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# MANAGEMENT INFORMATION SYSTEMS

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : - | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To understand the scope of information systems and strategies.
- To know the types of information systems and their functionalities in an enterprise.
- To know the applications of information systems in various business areas
- To analyze and develop the system.

**Learning Outcomes**

Students will be able to

- define the basic concepts, strategies and challenges of MIS.
- describe the nature of the information system in the business process.
- analyze the applications of information system in various functional business areas.
- compare various information system design and analysis.

**UNIT – I: Introduction to Information Systems**

International Information Systems Meaning, Scope of Information Systems**,** Concepts of system and organization, strategic uses, Evolution of MIS, Challenges and New opportunities. Growth of international information systems; Managing global information Systems.

**UNIT – II: Information System in the Enterprise**

Major types of Systems in the organization; Systems from a functional perspective; Enterprise e application–Enterprise systems, Business Process Reengineering and Information Technology.

**UNIT – III: Application of Information Systems to Functional Business Areas**

Significance of Information systems; Application of Operational Information System to Business;

**UNIT – IV: Systems Analysis and Design**

Systems analysis; Structured systems analysis and design; Alternative application development and evaluation, IT Act 2000

**Text Books:**

1. Kenneth C Laudon & Jane P Laudon, Management Information Systems, 8th Edition, PHI–2003.
2. Robert Schultheis & Mary Sumner, Management Information Systems–The Managers View 20th reprint, TMH –2010.

**Reference Books:**

1. V.M.Prasad, Management Information Systems, 9th Edition, PearsonEducation–2005.
2. Robert G Murdick, Joel E Ross & James R Claggett , Information Systems for Modern Management, 3rd Edition, PHI - 2007.

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## INFORMATION & COMMUNICATION TECHNOLOGY

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : - | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To explore the use of internet to access remote information, communicate and collaborate with others.
- To familiarize with social, economic, security and ethical issues associated with the use of ICT.

**Learning Outcomes:**

Students will be able to

- understand the basic concepts of networking.
- explore internet for learning.
- understand social, economic and security issues associated with the use of ICT.
- apply the concepts of ICT for their professional growth.

**UNIT – I: Computer Networks & Internet**

Concept, Types & Functions of Computer Networks, Internet and its Applications, Web Browsers & Search Engines, Legal & Ethical Issues.

**UNIT – II: E-Learning & Web Based Learning**

E-Learning, Web Based Learning, Virtual Classroom- concept, elements, advantages and limitations, EDUSAT

**UNIT – III: Effects of using ICT**

Software Copyright, Hacking, Viruses & its Management, Employment Patterns, IT in the home, Information from the Internet, Health and Safety**.**

**UNIT – IV: ICT for Professional Development**

ICT for Personal & Professional Development: Tools & Opportunities.
Open Education Resources: Concept & Significance.

**Text Books:**

1. Roger Crawford, Heinemann IGCSE ICT, Pearson Education Limited

**Reference Books:**

1. Agarwal J.P. (2013): Modern Educational Technology. Black Prints, Delhi.
2. Barton,R.(2004).Teaching Secondary Science with ICT. McGraw Hill International
3. Bhaskar Rao (2013): Samachara Prasara Sankethika vidya Shastramu, Masterminds, Guntur.
4. Cambridge, D.(2010).E-Portfolios for Lifelong Learning and Assessment. John Wiley and Sons.

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## ORGANIZATIONAL BEHAVIOUR

IV Year – II Semester

| | | | |
|---|---|---|---|
| Lecture | : - | Internal Marks | : 25 |
| Credits | : 2 | External Marks | : 50 |

**Course Objectives:**

- To provide a basic knowledge of main ideas and key theories relating to organizational behavior.
- To understand basic concepts, theories and techniques in the field of human behaviour at the individual, group and organizational levels in the changing global scenario.
- To increase managerial effectiveness through understanding of self and others.
- To develop an interest in, an appreciation of, and a positive attitude toward the many aspects of the subject matter of management.

**Learning Outcomes:**

Students will be able to

- eemonstrate clear understanding of a number of established theorists, theories and studies relating to Organizational Behavior.
- explain and evaluate the key assumptions on which behaviour in organizations is currently managed and assess the effect of these ideas on employee attitudes and actions.
- apply problem solving and critical thinking abilities to analyze the kinds of choices available for developing alternative Organizational Behaviour approaches in the workplace.
- form an appreciation of the complexities and uncertainties of Organizational Behaviour by examining your own role in the light of experience of real-time problem settings.

**UNIT – I: Introduction**

Nature, scope & Importance – linkages with other social sciences – Individual Roles and Organizational Goals - Perspectives of Human Behavior, Approach to Organizational behavior - models of organizational behavior (Autocratic, Custodial, Supportive, Collegial & SOBC).

**UNIT – II: Perceptual Management**

Nature, importance - Process – selection, organization and interpretation – Influencing factors **-**Motivation – Concepts - Needs and Motives and theories (Maslow & Herzberg) Leadership and Motivating people - Leadership Theories. Attitudes and Values: formation - types – changes and behavior modification techniques.

**UNIT – III: Personality Development**

Nature - Stages, Factors, Determinants of Personality, Theories of personality - Johari Window - Transactional Analysis, Learning Processes - theories, Creativity and Creative Thinking. Leadership – nature – skills. Decision Making Process**:** Behavioral Dimensions, Groups and their formation - Group Dynamics, Informal Organizations, Group versus Individual Interaction.

**UNIT – IV: Inter- Personal Communication**

Listening, Feedback, Collaborative Processes in Work Groups, Team Building, Team Decision Making, Conflict Resolution in Groups and Problem Solving Techniques.

Taxonomy, Elements of Structure, Determinants of Structure, Functional Aspects of Structure, Role Impingement, Stress in Organization. Principles Underlying the Design of Organizations, Organizational Culture, Power and Authority. Organizational Development**:** Goals, processes, change – resistance to change – Nature of OD - interventions, OD techniques and OD applications.

**Text Books:**


1. Steven L McShane, Mary Ann Von Glinow, Radha R Sharma:"Organizational Behavior", Tata McGraw Hill Education, New Delhi, 2008.
2. K.Aswathappa: "Organizational Behavior-Text, Cases and Games", Himalaya Publishing House, New Delhi,


**Reference Books:**


1. Jerald Greenberg and Robert A Baron: "***Behavior in Organizations***", PHI Learning Private Limited, New Delhi, 2009.
2. Pareek Udai: "***Understanding Organizational Behavior***", Oxford University Press, New Delhi, 2007.
3. Jai B.P.Sinha: "***Culture and Organizational Behavior***", Sage Publication India Private Limted, New Delhi, 2008.
4. Sharma VS, Veluri: "***Organizational Behavior***", JAICO Publishing House, New Delhi, 2009.
5. Slocum,n Helireigel: "***Fundamentals of Organizational Behavior***", Cengage Learning India, New Delhi, 2009.


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