DEPARTMENT OF MECHANICAL ENGINEERING

CURRICULUM

&

REGULATION

under CBCS

2015

B. Tech.

MECHANICAL ENGINEERING
ACADEMIC REGULATIONS FOR B. TECH.
(Effective from 2015)

1.0 Vision, Mission and Objectives

1.1 The Vision of the Institute is “To make every man a success and no man a failure”.

The Institute has identified itself with a mission to provide every individual with a conducive environment suitable to achieve his / her career goals, with a strong emphasis on personality development, and to offer quality education in all spheres of engineering, technology, applied sciences and management, without compromising on the quality and code of ethics.

1.2 Further, the Institute always strives

- To train our students with the latest and the best in the rapidly changing fields of Engineering, Technology, Management, Science & Humanities.
- To develop the students with a global outlook possessing, state of the art skills, capable of taking up challenging responsibilities in the respective fields.
- To mould our students as citizens with moral, ethical and social values so as to fulfil their obligations to the nation and the society.
- To promote research in the field of Science, Humanities, Engineering, Technology and allied branches.

1.3 Aims and Objectives of the Institute are focused on

- Providing world class education in engineering, technology, applied sciences and management.
- Keeping pace with the ever changing technological scenario to help the students to gain proper direction to emerge as competent professionals fully aware of their commitment to the society and nation.
- To inculcate a flair for research, development and entrepreneurship.

2.0 Admission

2.1 The admission policy and procedure shall be decided from time to time by the Board of Management (BOM) of the Institute, following guidelines issued by Ministry of Human Resource Development (MHRD), Government of India. The number of seats in each branch of the B.Tech programme will be decided by BOM as per the directives from MHRD, Government of India and taking into account the market demands. Some seats for Non Resident Indians and a few seats for foreign nationals shall be made available.

2.2 (i) Full-Time:

At the time of applying for admission, the candidates should have passed / appeared and be awaiting results of the final examination of the 10+2 system or its equivalent with Mathematics, Physics and Chemistry as subjects of study.

(ii) Lateral Entry:

At the time of applying for admission, the candidates should have a Diploma in Engineering/Technology in the relevant branch of specialization awarded by the State Board of Technical Education, Tamil Nadu or any other authority accepted by the Board of Management of the University as equivalent thereto.

2.3 The selected candidates will be admitted third semester to the B.Tech programme after he/she fulfils all the admission requirements set by the Institute and after the payment of the prescribed fees.

2.4 In all matters relating to admission to the B.Tech programme, the decision of the Institute and its interpretation given by the Chancellor of the Institute shall be final.
2.5. If at any time after admission, it is found that a candidate has not fulfilled any of the requirements stipulated by the Institute, the Institute may revoke the admission of the candidate with information to the Academic Council.

3.0 Structure of the B.Tech Programme

3.1 The programme of instruction will consist of:

i) a general Core foundation (CF) programme comprising
   - English;
   - Basic Sciences (BS) including Physics, Chemistry, Mathematics;
   - Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical/Electronics/Mechanical/Computer Engineering, Instrumentation;

ii) Compulsory Core courses (CC) consisting of
   - Professional Core (PC), an engineering core programme introducing the students to the foundations of engineering in his/her branch (Department) comprising theory and Practical/ field work/ Mini project/ Project;
   - Professional Electives (PE) - an elective programme enabling the students to take up a group of courses for specialisation/ interest to him/her in his/her branch (Department);
   - Engineering Electives (EE) - Engineering electives offered by other engineering departments;
   - Open Electives (OE) - Courses offered by non-Engineering departments (Humanities and Management Schools) other than communication skills and personality development credit courses;
   - Non-CGPA courses shall be offered in any semester which are compulsory, but not calculated for GPA. The credits will be mentioned in the grade card.

In addition, a student should satisfactorily complete NSS/NCC/NSO and Professional practice like Seminar and/or Internship in Industry or elsewhere, Soft skill development.

3.2 The complete programme will consist of 4 categories: Core Foundation (CF) consists of English, Basic Sciences, Engineering Sciences; Core Courses (CC) consists of Professional Core (PC), Professional Elective (PE), and Practical/field work/projects; Engineering Elective (EE) and Open Electives (OE) distributed over seven semesters with two semesters per year. The eighth semester may be left for the project work so that the student can take up industrial project.

3.3 All the Professional Electives shall be from V semester onwards and VIII semester may be left for the project work.

3.4 The Engineering Elective and Open Elective shall start from III and IV semester respectively.

3.5 Every B. Tech. Programme will have a curriculum and syllabi (course contents) approved by Academic Council.

3.6 Credits are assigned to the courses based on the following general pattern:

- One credit for one hour/week/Semester for Theory/Lecture (L) or Tutorials (T) Courses; and,
- One credit for three hours/week/Semester for Laboratory/Practical(P) Courses;
- One credit for 4 weeks of Industrial Training and
- One credit for 4 hours of project per week per semester.

NOTE: Other student activities not demanding intellectual work or enabling proper assessments like, practical training, study tour and guest lecture not to carry Credits;

As per guidelines, Credit values for different academic activities to be represented by following the well accepted practice
### 3.7 The curriculum of any branch of the B. Tech. programme is designed to have a minimum total of **180 credits** for the award of B. Tech. degree.

### 3.8 No semester shall have more than six lecture based courses and four laboratory courses as prescribed in the curriculum carrying a maximum of 30 credits, subject to the following:

Students are permitted to register for an additional course for earning additional credits from the Vth semester onwards provided the student have at least 7.5 CGPA in earlier semester without any arrears.

However, in special cases, students of VII semester will be permitted to take two additional subjects to the following conditions:

a) The maximum number of credits registered in any semester shall not exceed 30.
b) No withdrawal from any of the courses for which a student has registered will be allowed, except as per regulation 8.0.
c) The student’s Faculty Adviser and Head of the Dept. recommends the same.

### 3.9 Every course of B. Tech. programme shall be placed in one of the four broad categories listed in Table 1.

#### Table 1: Typical Curriculum Structure for B. Tech. Degree Programmes

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Classification</th>
<th>Range of Total Credit (%)</th>
<th>Suggested (out of 180)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>% of Total Credit</td>
</tr>
<tr>
<td>1</td>
<td>Core Foundation (CF)</td>
<td>20-30</td>
<td>26</td>
</tr>
<tr>
<td>2</td>
<td>Core Courses (CC)</td>
<td>55-65</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>i) Professional Core (PC)#,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Theory</td>
<td>40-60</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>(30-40)</td>
<td></td>
<td>(37)</td>
</tr>
<tr>
<td></td>
<td>(10-20)</td>
<td></td>
<td>(14)</td>
</tr>
<tr>
<td></td>
<td>ii) Professional Electives (PE)</td>
<td>8-12</td>
<td>8</td>
</tr>
</tbody>
</table>
Engineering Electives (EE) | 5-10 | 8 | 15  
---|---|---|---
Open Electives (OE) | 5-10 | 7 | 12  
Total | | 100 | 180  

# Departments in consultation with their respective BOS are free to judiciously mix the theory and lab contents so as to meet the total credit criteria for PC.

A student must earn a minimum number of credits under each category as shown in Table-1 and also a minimum total of **180 credits** for the award of B. Tech degree. For Lateral entry students, minimum requirement is **136 credits** for the award of B. Tech degree.

3.10 The suggested course distribution per semester is shown below. However, the departments are free to distribute the credit distributions for CC as per their requirement

<table>
<thead>
<tr>
<th>Comp/ Semester</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>106</td>
</tr>
<tr>
<td>CF</td>
<td>20</td>
<td>16</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>47</td>
</tr>
<tr>
<td>EE</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>OE</td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>27</td>
<td>24</td>
<td>25</td>
<td>12</td>
<td>180</td>
</tr>
</tbody>
</table>

3.11 The medium of instruction, examination and project reports will be English.

4.0 Faculty Adviser

4.1 To help the students in planning their courses of study and for getting general advice on the academic programme, the concerned Department will assign a certain number of students to a Faculty member who will be called their Faculty Advisor.

5.0 Class Committee

5.1 Every class of the B. Tech. programme will have a Class Committee consisting of Faculty and students.

5.2 The constitution of the Class Committee will be as follows:

a) One professor not associated with teaching the particular class to be nominated by the Dean (Academic) to act as Chairman of the Class Committee.
b) Course coordinator of each of the lecture based subjects
c) Workshop Superintendent (for first two semesters)
d) Four students from the respective class; and
e) Faculty Advisers of the respective class.

All teachers offering the common courses shall be invited to attend the class committee meetings.

5.3 The basic responsibilities of the Class Committees are

a) to review periodically the progress of the classes,
b) to discuss issues concerning curriculum and syllabi and the conduct of the classes.
c) The method of assessment in the course will be decided by the teacher, in consultation with the class committee, and will be announced to the students at the beginning of the se
mester. Each class committee will communicate its recommendations to the Head of the Department and the Dean (Academic).

   d) The Class Committees without student members is responsible for the finalisation of the semester results.

   e) The Class Committees shall meet at least thrice in a semester, once at the beginning of the semester, once after first unit test, once before end semester examination.

6. Grading

6.1 A grading system as below will be adhered to.

<table>
<thead>
<tr>
<th>Range of Marks</th>
<th>Letter Grade</th>
<th>Grade Points</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 – 100</td>
<td>S</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>80 - 89</td>
<td>A</td>
<td>09</td>
<td></td>
</tr>
<tr>
<td>70 - 79</td>
<td>B</td>
<td>08</td>
<td></td>
</tr>
<tr>
<td>60 - 69</td>
<td>C</td>
<td>07</td>
<td></td>
</tr>
<tr>
<td>55 - 59</td>
<td>D</td>
<td>06</td>
<td></td>
</tr>
<tr>
<td>45 - 54</td>
<td>E</td>
<td>05</td>
<td></td>
</tr>
<tr>
<td>&lt;45</td>
<td>U</td>
<td>00</td>
<td>To Reappear for end-semester examination</td>
</tr>
</tbody>
</table>

   Failure due to insufficient attendance/ sessional marks less than minimum required in course. Subsequently to be changed into pass (E to S) or U grade in the same semester.

6.2 GPA and CGPA

GPA is the ratio of the sum of the product of the number of credits $C_i$ of course “i” and the grade points $P_i$ earned for that course taken over all courses “i” registered by the student to the sum of $C_i$ for all “i”. That is,

$$GPA = \frac{\sum C_i P_i}{\sum C_i}$$

CGPA will be calculated in a similar manner, at any semester, considering all the courses enrolled from the first semester onwards.

6.3 For the students with letter grade RA and U in certain subjects, the same will not be included in the computation of GPA and CGPA until after those grades are converted to the regular grades.

7.0 Enrolment and Registration

7.1 Enrolment:
A student will be eligible for enrolment only if he/she satisfies regulation 11 (maximum duration of the programme) and will be permitted to enrol only if he/she has cleared all dues to the Institute, Hostel, Library up to the end of the previous semester provided he/she is not debarred from enrolment on disciplinary grounds.

7.2 Registration:

Except for the first year, registration of a semester will be done in the parent department during a specified week before the start of the current semester.

Late registration/enrolment will be permitted with a fine as decided from time to time up to two weeks from the last date specified for registration.

7.3 The registration sheet contains the course number, course name, number of credits, category for each course to be taken in that semester and signature of the course instructor. The student makes the choice of course in consultation with his/her Faculty Advisor.

8.0 Registration Requirement

8.1 The curriculum for any semester, except for the first and final semester will normally carry credits between 21 and 30.

8.2 The student should make sure that the registration for CC/EE/OE courses for a particular semester is as per the student handbook. In case of non-conformity, the Faculty Advisor has the liberty to modify the registration as per the regulations that are in force, in consultation with the student.

8.3 If a student finds his/her academic/course load heavy in any semester, or for any other valid reason, he/she may drop EE/OE courses within fifteen days of the commencement of the semester but before the commencement of first unit test with the written approval of his/her Faculty Advisor and Head of the Department.

However, the student should ensure that the total number of credits registered in any semester should enable him/her to earn the minimum of 16 credits and registered all CC courses for that semester.

8.4 The number of EE/OE credits that a student can register during the semester should not exceed by more or less 6 credits of the total stipulated credits mentioned by the Department for the particular semester. However, this restriction is not applicable for final (8th) semester.

8.5 In case of an academic backlog carried forward in a semester, registration for additional subjects for extra credits will be restricted to maintain the minimum requirements as prescribed in regulations.

8.6 The students failing in EEs and OEs can opt for equivalent EEs and OEs and make up for required credits in the subsequent semesters.

9.0 Contact Courses

9.1 A contact course may be offered during the regular semester by a Department, to a student who has obtained “RA” grade due to lack of attendance or due to lack of sessional marks in a course work.

9.2 No student should register for more than two contact courses during the semester.

9.3 The assessment procedure for the contact course will be similar to the regular semester course.

9.4 The students who has obtained U grade can apply for improvement of sessional marks in case their score is above 20. The maximum marks awarded shall be 30.

10.0 Continuation of the Programme

10.1 For those students who have not earned the minimum required credit prescribed for that particular semester examination, a warning letter to the concerned student and also to his/her parents regarding the shortage of
his/her credit will be sent by the HOD after the announcement of the results of the university examinations. A student may dropout to complete the backlog requirements.

11.0 Maximum Duration of the Programme

(i) Full-Time:

A student is expected to complete the B.Tech programme in **eight semesters**. However, a student may complete the programme at a slower pace, but in any case **not more than 14 semesters**, excluding semesters withdrawn on medical grounds, etc. as per 12.0.

(ii) Lateral Entry:

A student is expected to complete the B.Tech programme in **six semesters**. However, a student may complete the programme at a slower pace, but in any case **not more than 12 semesters**, excluding semesters withdrawn on medical grounds, etc. as per 12.0.

12.0 Temporary Withdrawal from the Programme

A student may be permitted by the Dean (Academic) to withdraw from the programme for a semester or longer for reasons of ill health or other valid reasons. Normally a student will be permitted to withdraw from the programme only for a maximum continuous period of two semesters.

13.0 Discipline

13.1 Every student is required to observe discipline and decorous behaviour both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the University.

13.2 Any act of indiscipline of a student reported to the Dean (Academic) will be referred to a Discipline Committee so constituted. The Committee will enquire into the charges and decide on a suitable punishment if the charges are substantiated. The Committee will also authorize the Dean (Academic) to recommend to the Vice Chancellor the implementation of the decision. The student concerned may appeal to the Vice Chancellor whose decision will be final. The Dean (Academic) will report the action taken at the next meeting of the Council.

13.3 Ragging of any form is a criminal and non-bailable offence in our country. The current State and Central legislations provide for stringent punishment including imprisonment. Once the involvement of student(s) is established in ragging, the offending student(s) will be dismissed from the institution. Every senior student of the institute, along with the parent, shall give an undertaking every year in this regard and this should be submitted at the time of enrolment.

14.0 Attendance

14.1 A student whose attendance is less than 75% in any course, whatever may be the reason for the shortfall of the attendance, will not be permitted to appear in the end-semester examination of the course in which shortfall exists.

His/her registration for that course will be treated as cancelled, and he/she shall be awarded ‘**RA**’ grade (RA stands for registration cancelled for want of minimum attendance) in that subject. This grade shall appear in the grade card till the course is successfully completed.

In the case of a core course, the student should register for and repeat the course as per 9.0.

14.2 The teacher handling a course must finalise the attendance 3 calendar days before the last instructional day of the course in the semester.

The particulars of all students who have attendance less than 75% in that course must be announced in the class by the teacher himself/herself.
Copies of the same should be sent to the Dean (Academic) and Heads of Departments concerned. Students who get less than 75% should not be permitted to sit for the end-semester examination for that course without the permission of Dean, Academic.

14.3 Condonation of Attendance: Every student is expected to put in 100% attendance. The minimum attendance requirement is 75%. For cases of casual absenteeism, no condonation of attendance is permissible. If a student has less than 75%, he/she should be assigned ‘RA’ grade in that subject. The percentage of attendance in a subject shall be computed as:

(a) For calculation of attendance in normal cases:

For cases of casual absenteeism, actual % of attendance is computed as:

\[
\text{Actual no. of classes attended} \times 100
\]
\[
\text{Total no. of classes held till date of compilation of attendance}
\]

which should be ≥ 75%. Otherwise RA grade shall be awarded. Such cases will not come under the purview of Condonation of attendance.

(b) For the case of minor illness:

A student should have at least 65% attendance with medical certificate as calculated as per (a) above. For condonation the attendance is computed as:

\[
\text{Notional % of attendance} = \frac{\text{Actual no. of classes attended} \times 100}{(\text{Total no. of classes held in the semester}) - (\text{No. of classes held during the days of illness})}
\]

which should be ≥ 75% for condonation.

(c) For calculation of attendance in case of prolonged illness and/or hospitalisation with medical certificate:

A student should have more than 50% attendance calculated as per (a) above to be eligible for condonation.

\[
\text{Notional % of attendance} = \frac{\text{Actual no. of classes attended} \times 100}{(\text{Total no. of classes held in the semester}) - (\text{No. of classes held during the days of prolonged illness and/or hospitalization})}
\]

which should be ≥ 75% for condonation.

(d) Application for condonation recommended by the Faculty Advisor, concerned faculty member and the HOD is to be submitted to the Dean (Academic) who, depending on the merits of the case, may permit the student to appear for the end-semester examination. A student will be eligible for this concession at most in two semesters during the entire degree programme. Application for medical leave, supported by medical certificate with endorsement by a Registered Medical Officer, should reach the HOD within seven days after returning from leave or, on or before the last instructional day of the semester, whichever is earlier.

(e) University is providing an incentive to those students who are involved in extracurricular activities such as representing the University in Sports and Games, Cultural Festivals, and Technical Festivals, NCC/ NSS events. For calculation of attendance for these cases:

A student should have at least 65% attendance with relevant certificate as calculated as per (a) above. For Condonation the attendance is computed as:

\[
\text{Notional % of attendance} = \frac{\text{Actual no. of classes attended} \times 100}{(\text{Total no. of classes held in the semester}) - (\text{No. of classes held during the days of on duty})}
\]
which should be $\geq 75\%$ for condonation. All such applications should be recommended by the concerned HOD and forwarded to Dean (Academic) within seven instructional days after the programme / activity.

15.0 Assessment Procedure – Tests and Examinations

15.1 The Academic Council will decide from time to time on the system of tests and examinations in each subject in each semester.

15.2 For each theory course, the assessment will be done on a continuous basis as follows:

<table>
<thead>
<tr>
<th>Test / Exam</th>
<th>Weightage</th>
<th>Duration of Test / Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Periodical Test</td>
<td>10%</td>
<td>2 Periods</td>
</tr>
<tr>
<td>Second Periodical Test</td>
<td>10%</td>
<td>2 Periods</td>
</tr>
<tr>
<td>Model Test</td>
<td>20%</td>
<td>3 hours</td>
</tr>
<tr>
<td>Seminar/Assignments/Quiz</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>End – semester examination</td>
<td>50%</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>

No retest will be conducted for sessional examinations.

15.3 For practical courses, the assessment will be done by the subject teachers as below:

(i) Weekly assignment/Observation note book / lab records and viva – weightage 60%.
(ii) End semester examination of 3 hours duration including viva– weightage 40%.

15.4 For courses on Physical Education, NSS, etc. the assessment will be as satisfactory/not satisfactory only.

16. Project evaluation

16.1 For Project work, the assessment will be done on a continuous basis as follows:

<table>
<thead>
<tr>
<th>Review / Examination</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Review</td>
<td>10%</td>
</tr>
<tr>
<td>Second Review</td>
<td>20%</td>
</tr>
<tr>
<td>Third Review</td>
<td>20%</td>
</tr>
<tr>
<td>End-semester Examination</td>
<td>50%</td>
</tr>
</tbody>
</table>

For end – semester examination, the student will submit a Project Report in a format specified by the Dean (Academic). The first three reviews will be conducted by a Committee constituted by the Head of the Department. The end – semester examination will be based on the report and a viva-voce examination on the project conducted by a Committee constituted by the Registrar / Controller of examination. This will include an external expert.

16.2 The project reports of B.Tech students who have not completed their course work will be evaluated in that semester itself and the result sent, in confidential, to the Controller of examination. The result of the project work evaluation will be declared by Controller of examination only after the successful completion of the course requirements.

17. Declaration of results

17.1 (i) A candidate who secures not less than 45% of total marks prescribed for a course with a minimum of 50% of the marks prescribed for the end semester examination shall be declared to have passed the course and earned the specified credits for the course.

(ii) To be Eligible to appear for the end semester examinations for a particular course, a candidate will have to secure a minimum of 40% marks in the sessional for that course.
17.2 After the valuation of the answer scripts, the tabulated results are to be scrutinized by the Result Passing Boards of UG programmes constituted by the Vice-Chancellor. The recommendations of the Result Passing Boards will be placed before the Standing Sub Committee of the Academic Council constituted by the Chancellor for scrutiny. The minutes of the Standing Sub Committee along with the results are to be placed before the Vice-Chancellor for approval. After getting the approval of the Vice-Chancellor, the results will be published by the Controller of Examination/Registrar.

17.3 If a candidate fails to secure a pass in a course due to not satisfying the minimum requirement in the end semester examination, he/she shall register and re-appear for the end semester examination during the following semester. However, the sessional marks secured by the candidate will be retained for all such attempts.

17.4 If a candidate fails to secure a pass in a course due to insufficient sessional marks though meeting the minimum requirements of the end semester examination, and wishes to improve on his/her sessional marks, he/she will have to register for the particular course and attend the course as per 9.0 with permission of the HOD concerned and Dean (Academic) with a copy marked to the Registrar. The sessional and external marks obtained by the candidate in this case will replace the earlier result.

17.5 A candidate can apply for the revaluation of his/her end semester examination answer paper in a theory course within 2 weeks from the declaration of the results, on payment of a prescribed fee through proper application to the Registrar/Controller of Examinations through the Head of the Department. The Registrar/Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

17.6 After ten semesters, the sessional marks of the candidate will not be considered for a pass in a course. A candidate who secures minimum required marks for passing will be given only up to C grade irrespective of marks obtained and declared pass in the course.

18.0 Course Repetition

18.1 A student who earns U or RA grade in a core course has to repeat it compulsorily when the course is offered next as specified in 9.0.

A student securing a U or RA grade in an elective course may repeat it if he/she so desires to get a successful grade.

A course successfully completed cannot be repeated.

19.0 Grade Card

19.1 Letter grade

Based on the performance, each student is awarded a final letter grade at the end of the semester, in each subject. The letter grades and the corresponding grade points are as 6.1.

19.2 A student is considered to have completed a subject successfully and earned credits if he/she secures a letter grade other than U or RA in that subject. A letter grade U or RA in any subject implies a failure in that subject.

19.3 After results are declared, grade sheet will be issued to each student which will contain the following details:

(i) Program and branch for which the student has enrolled.
(ii) Semester of registration.
(iii) The course number, name of the course, category of course and the credits for each course registered in that semester.
(iv) The letter grade obtained in each course.
(v) Semester Grade Point Average (GPA).
(vi) The total number of credits earned by the student up to the end of that semester in each of the course categories.
(vii) The Cumulative Grade Point Average (CGPA) of all the courses taken from the first semester.

20. Class/Division

20.1 Classification is based on CGPA and is as follows:

\[
\begin{align*}
\text{CGPA} & \geq 8.0 : \text{First Class with distinction} \\
6.5 \leq \text{CGPA} < 8.0 : \text{First Class} \\
5.0 \leq \text{CGPA} < 6.5 : \text{Second Class}.
\end{align*}
\]

20.2 (i) Further, the award of ‘First class with distinction’ is subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses in his/her first appearance within the minimum duration of the programme.

(ii) The award of ‘First Class’ is further subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses within 10 semesters.

(iii) The period of authorized discontinuation of the programme (vide clause 12.0) will not be counted for the purpose of the above classification.

Transfer of credits

21.1 Within the broad framework of these regulations, the Academic Council, based on the recommendation of the transfer of credits committee so constituted by the Chancellor may permit students to earn part of the credit requirement in other approved institutions of repute and status in the country or abroad.

21.2 The Academic Council may also approve admission of lateral entry (who hold a diploma in Engineering/technology) candidates with advance credit based on the recommendation of the transfer of credits committee on a case to case basis.

22.0 Eligibility for Award of the B.Tech Degree

22.1 A student shall be declared to be eligible for award of the B.Tech degree if he/she has

(i) registered and successfully completed all the core courses and projects;
(ii) successfully acquired the minimum 180 credits within the stipulated time;
(iii) earned the specified credits in all the categories of subjects as specified in the curriculum corresponding to the branch of his/her study;
(iv) no dues to the Institute, Hostels, Libraries etc.; and
(v) no disciplinary action is pending against him/her.

The award of the degree must be recommended by the Academic Council and approved by the Board of Management of the University.

23.0 Change of Branch

23.1 If the number of students in any branch of B.Tech. class as on the last instructional day of the First Semester is less than the sanctioned strength, then the vacancies in the said branches can be filled by transferring students from other branches. All such transfers will be allowed on the basis of merit of the students. The decision of the Chancellor shall be final while considering such requests.

23.2 All students who have successfully completed the first semester of the course will be eligible for consideration for change of branch subject to the availability of vacancies.

24.0 Power to modify

Notwithstanding all that has been stated above, the Academic Council shall modify any of the above regulations from time to time subject to approval by the Board of Management.
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Note: ≠ Practical class is for demonstration purpose only.

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Note: * The Design Project by students which does not require contact hours.
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Note: **The Comprehension does not require contact hours.**

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Note:
* - Engineering Design specialization stream
# - Material Science specialization stream

For specialization, a student should earn a minimum of 15 credits in the specialization stream

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### LIST OF OPEN ELECTIVES

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</table>
SYLLABUS

SEMESTER - I

ELA101 TECHNICAL ENGLISH

L T P C
3 0 0 3

GOAL
The goal of the programme is to provide a theoretical input towards nurturing accomplished learners who can function effectively in the English language skills; to cultivate in them the ability to indulge in rational thinking, independent decision-making and lifelong learning; to help them become responsible members or leaders of the society in and around their workplace or living space; to communicate successfully at the individual or group level on engineering activities with the engineering community in particular, and on multi-disciplinary activities in general, with the world at large.

OBJECTIVES
The course should enable the students to:

1. Widen the capacity of the learners to listen to English language at the basic level and understand its meaning.
2. Enable learners to communicate in an intelligible English accent and pronunciation.
3. Assist the learners in reading and grasping a passage in English.
4. Learn the art of writing simple English with correct spelling, grammar and punctuation.
5. Cultivate the ability of the learners to think and indulge in divergent and lateral thoughts.

OUTCOME
The students should be able to:

1. Have the self-confidence to improve upon their informative listening skills by an enhanced acquisition of the English language.
2. Speak English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.
3. Read, comprehend and answer questions based on literary, scientific and technological texts.
5. Have the confidence to develop thinking skills and participate in brainstorming, mind-mapping, audiovisual activities, creative thinking and also answer tests in the job-selection processes.

UNIT I

LISTENING SKILL

Listening to the sounds, silent letters & stress in English words & sentences - Listening to conversation & telephonic conversation -- Listening for general meaning & specific information -- Listening for positive & negative comments - Listening to technical topics - Listening to prose & poetry reading - Listening exercises. Embedded language learning: Sentence definition -- Spelling & punctuation -- Imperative form Sequencing of sentences -- Gerunds -- Infinitives -- 'Wh-'questions.
Self-introduction - Expressing personal opinion - Dialogue - Conversation - Simple oral interaction - Speaking on a topic - Expressing views for & against - Speaking on personal topics like hobbies, topics of interest, present & past experiences, future plans - Participating in group discussions, role plays, debates, presentations, power-point presentations & job-interviews.


UNIT III READING SKILL

Reading anecdotes, short stories, poems, parts of a novel, notices, message, time tables, advertisements, leaflets, itinerary, content page - Reading pie chart & bar chart -- Skimming and scanning -- Reading for contextual meaning - Scanning for specific information -- Reading newspaper & magazine articles - Critical reading -- Reading-comprehension exercises.

Embedded language learning: Tenses - Active and passive voice -- Impersonal passive -- Words and their function -- Different grammatical forms of the same word.

UNIT IV WRITING SKILL

Writing emails, notes, messages, memos, notices, agendas, advertisements, leaflets, brochures, instructions, recommendations & checklists -- Writing paragraphs -- Comparisons & contrasts Process description of Flow charts - Interpretation of Bar charts & Pie charts - Writing the minutes of a meeting -- Report writing -- Industrial accident reports -- Letter-writing -- Letter to the editors - Letter inviting & accepting or declining the invitation - Placing orders - Complaints -- Letter requesting permission for industrial visits or implant training, enclosing an introduction to the educational institution -- Letters of application for a job, enclosing a CV or Resume - Covering letter.

Embedded language learning: Correction of errors - Subject-verb Concord -- Articles - Prepositions - Direct and indirect speech.

UNIT V THINKING SKILL

Eliciting & imparting the knowledge of English using thinking blocks - Developing thinking skills along with critical interpretation side by side with the acquisition of English -- Decoding diagrams & pictorial representations into English words, expressions, idioms and proverbs.

Embedded language learning: General vocabulary -- Using expressions of cause and effect -Comparison & contrast -- If-conditionals -- Expressions of purpose and means.

REFERENCES

MAA 101 – ENGINEERING MATHEMATICS – I  
(Common to All Branches)  

<table>
<thead>
<tr>
<th>MAA 101</th>
<th>ENGINEERING MATHEMATICS-I</th>
<th>4 CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIM</td>
<td>The course is aimed at developing the basic Mathematical skills of engineering students that are imperative for effective understanding of engineering subject and make use of MATLAB software to visualize the application of the concepts learnt.</td>
<td></td>
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</tbody>
</table>

**OBJECTIVES**

- To find out algebraic Eigen value problems from practical areas and obtain the Eigen solutions in certain cases using MATLAB.
- To diagonalize a matrix which would render the Eigen solution procedure very simple.
- To understand effectively the basic concepts of differentiation and partial differentiation and their applications.
- To understand effectively the methods of integration and their applications.
- To solve differential equations of certain type, that they might encounter in the same or higher semesters.
- To find the values and the expansions of trigonometric and hyperbolic functions using MATLAB

**OUTCOME**

- Visualized the Cayley-Hamilton theorem, Diagonalization of Matrix, Taylor’s series, Maxima and Minima of functions of two variables, integration- Area, volume, surface and Hyperbolic function using MATLAB.
- Functions and their interesting properties in science and engineering using MATLAB is the outcome of this paper

**UNIT I   MATRICES**  
12(8+4)  

Characteristic equation – Eigen values and Eigen vectors – Properties - Cayley Hamilton theorem (Statement only) – Verification and inverse using Cayley Hamilton theorem- Diagonalization of matrices using similarity transformation.

Lab: Eigen values and Eigen vectors, Verification and inverse using Cayley Hamilton theorem- Diagonalisation

**UNIT II   DIFFERENTIAL CALCULUS**  
12(8+4)

Lab: Taylor’s series – Maxima and minima of functions of two variables

UNIT III INTEGRAL CALCULUS 12(8+4)
Integration – Methods of integration – Substitution method - Integration by parts – Integration using partial fraction - Bernoulli’s formula. Applications of Integral Calculus: Area, Surface area and Volume.

Lab: Applications of Integral Calculus: Area, Surface area and Volume.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 12(8+4)
Second order differential equations with constant coefficients – Particular integrals \(-e^{ax}, \sin ax, \cos ax, x^m e^{ax}\) Cos bx, e \(^{ax}\) Sin bx. Solutions of homogeneous differential equations with variable coefficients - Variation of parameters.

Lab: Solution of Second order differential equations.

UNIT V TRIGONOMETRY 12(8+4)
Expansions of \(\sin n\theta, \cos n\theta, \tan n\theta\) where \(n\) is appositive integer. Expansions of \(\sin^m\theta, \cos^n\theta, \sin^n\theta\cos^m\theta\) in terms of sines and cosines of multiples of \(\theta\) where \(m\) and \(n\) are positive integers. Expansions of \(\sin \theta \cdot \cos \theta, \tan \theta\) Hyperbolic functions - Relation between trigonometric and hyperbolic functions - Inverse hyperbolic function.

Lab: Expansions of \(\sin \theta, \cos \theta, \tan \theta\) and \(\sin n\theta, \cos n\theta, \tan n\theta\) and hyperbolic functions.

TOTAL: 60

TEXT BOOK:

REFERENCES
GOAL
To impart fundamental knowledge in various fields of Physics and its applications.

OBJECTIVES
The course should enable the students to:
1. Develop strong fundamentals of properties and behaviour of the materials
2. Enhance theoretical and modern technological aspects in acoustics and ultrasonics.
3. Enable the students to correlate the theoretical principles with application oriented study of optics.
4. Provide a strong foundation in the understanding of solids and materials testing.
5. Enrich the knowledge of students in modern engineering materials.

OUTCOME
The students should be able to:
1. Understand the properties and behaviour of materials.
2. Have a fundamental knowledge of acoustics which would facilitate in acoustical design of buildings and on ultrasonics and be able to employ it as an engineering tool.
3. Understand the concept, working and application of lasers and fiber optics.
4. Know the fundamentals of crystal physics and non destructive testing methods.
5. Have an understanding of the production, characteristics and application of the new engineering materials. This would aid them in the material selection stage.

UNIT I PROPERTIES OF MATTER

UNIT II ACOUSTICS AND ULTRASONICS
Classification of sound - characteristics of musical sound - intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies. Ultrasonics - production - Magnetostriiction and Piezoelectric methods - properties - applications of ultrasonics with particular reference to detection of flaws in metal (Non - Destructive testing NDT) - SONAR.

UNIT III LASER AND FIBRE OPTICS

UNIT IV CRYSTAL PHYSICS AND NON-DESTRUCTIVE TESTING
Crystal Physics: Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number Packing factor for SC, BCC, FCC and HCP structures.

Non Destructive Testing: Liquid penetrate method - Ultrasonic flaw detection - ultrasonic flaw detector (block diagram) - X-ray Radiography - Merits and Demerits of each method.

UNIT V MODERN ENGINEERING MATERIALS AND SUPERCONDUCTING MATERIALS


Superconducting Materials: Superconducting phenomena - Properties of superconductors - Meissner effect - Type I and Type II superconductors - High Tc superconductors (qualitative) - uses of superconductors.

TOTAL : 45

TEXT BOOKS


REFERENCES

5. P.Charles, Poople and Frank J. Owens, Introduction to Nanotechnology, Wiley India,
GOAL

To impart basic principles of chemistry for engineers.

OBJECTIVES

The course should enable the students to

1. Make the students conversant with the basics of (a) Water technology And (b) Polymer science
2. Provide knowledge on the requirements and properties of a few important engineering materials.
3. Educate the students on the fundamentals of corrosion and its control.
4. Give a sound knowledge on the basics of a few significant terminologies and concepts in thermodynamics.
5. Create an awareness among the present generation about the various conventional energy sources.

OUTCOME

The students should be able to

1. Gain basic knowledge in water analysis and suitable water treatment method.
2. Get an idea on the type of polymers to be used in engineering applications.
3. Get awareness about new materials
4. Get knowledge on the effects of corrosion and protection methods will help the young minds to choose proper metal / alloys and also to create a design that has good corrosion control.
5. Get exposure on the important aspects of basic thermodynamics will be able to understand the advanced level thermodynamics in engineering applications.
6. Get a good background on the various aspects of energy sources will create awareness on the need to utilize the fuel sources effectively and also for exploring new alternate energy resources.

UNIT I   WATER TECHNOLOGY AND POLYMER CHEMISTRY

Hardness (Definition, Types, Units) - problems - Estimation of Hardness (EDTA Method) - Water softening - Carbonate conditioning and Calgon conditioning - Demineralization (Ion-Exchange Method) - Water Quality Parameters - Municipal Water Treatment- Desalination - Reverse Osmosis.

Classification of Polymers - PVC, Bakelite - preparation, properties and applications - Effect of Polymer Structure on Properties - Compounding of Plastics- Polymer Blends and Polymer Alloys Definition, Examples

UNIT II   ENGINEERING MATERIALS

Properties of Alloys - Heat Treatment of Steel - Polymer Composites - types and applications.Lubricants - Classification, properties and applications - Mechanism of Lubrication - MoS2 And Graphite - Adhesives - classification and properties - Epoxy resin (Preparation, properties and applications) - Refractories - Classification, Properties and General Manufacture - Abrasives Classification , Properties and Uses - Carbon nano tubes - preparation, properties and applications.
UNIT III ELECTROCHEMISTRY AND CORROSION

Conductometric Titration - HCl vs NaOH and mixture of acids vs NaOH - Electrochemical Series and its applications - Nernst Equation - problems - Polarization, Decomposition Potential, Over-voltage (definitions only) - Galvanic series - Corrosion (Definition, Examples, effects) - Mechanism of Dry Corrosion and Wet Corrosion - Differential aeration Corrosion, examples - Factors Influencing Corrosion - Metal and Environment - Corrosion Control - Design - Cathodic Protection methods - Protective Coatings - Galvanising - Anodising - Electroplating (Cu and Ni) and Electroless plating (Cu and Ni) Constituents of Paints and varnish.

UNIT IV CHEMICAL THERMODYNAMICS


UNIT V FUELS AND ENERGY SOURCES


TOTAL : 45

TEXT BOOKS


REFERENCES

1. B. K. Sharma, Engineering chemistry, Krishna Prakasam Media (P) Ltd., 2003
3. A. Gowarikar, Text Book of Polymer Science, 2002
4. Kuriacose & Rajaram, Vols. 1 & 2, Chemistry in Engineering and Technology, 2004
GOAL
To develop graphical skills for communicating concepts, ideas and designs of engineering products and to give exposure to national standards relating to technical drawings using Computer Aided Design and Drafting practice.

OBJECTIVES
The course should enable the students to
1. Introduce drawing standards and use of drawing instruments.
2. Introduce first angle projection.
3. Practice of engineering hand sketching and introduce to computer aided drafting
4. Familiarize the students with different type of pictorial projections.
5. Introduction to Solid modeling
6. Introduce the process of design from sketching to parametric 3D CAD and 2D orthographic drawings to BIS

OUTCOME
The students should be able to
1. Develop Parametric design and the conventions of formal engineering drawing
2. Produce and interpret 2D & 3D drawings
3. Communicate a design idea/concept graphically
4. Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
5. Get a Detailed study of an engineering artifact

Note: Only first angle projection is to be followed

Unit I – BASICS OF ENGINEERING GRAPHICS AND PLANE CURVES
Importance of graphics Use of drawing instruments - BIS conventions and specifications - drawing sheet sizes, layout and folding - lettering - Dimensioning-Geometrical constructions - Scales. Introduction to plane curves like ellipse, parabola, cycloids and involutes

Unit II – VISUALIZATION, ORTHOGRAPHIC PROJECTIONS AND FREE HAND SKETCHING
Visualization concepts and Free Hand sketching: Visualization principles — Representation of Three Dimensional objects — Pictorial Projection methods - Layout of views- Free hand sketching of multiple views from pictorial views of objects.Drafting of simple Geometric Objects/Editing
General principles of presentation of technical drawings as per BIS - Introduction to Orthographic projections - Naming views as per BIS - First angle projection method. Conversion to orthographic views from given pictorial views of objects, including dimensioning – Drafting of Orthographic views from Pictorial views.

Unit III – PROJECTIONS OF POINTS, LINES, SURFACES AND SOLIDS
Introduction to Projections of points – Projections of straight lines located in first quadrant using rotating line method only – Projections of plane surfaces when the surface of the lamina is inclined to one reference plane only – Projections of simple solids when the axis of the solid is inclined to one reference plane only – Sectioning of above solids in simple positions – Section Views. Practice includes drafting the projection of
lines and solids using appropriate software. 2D drawing commands: Zoom, Picture editing commands, Dimensioning and 2D drafting.

Unit IV GEOMETRICAL MODELING AND ISOMETRIC VIEWS 15


Unit V COMPUTER AIDED DESIGN AND DRAFTING 15

Preparation of solids of machine components like slide block, solid bearing block, bushed bearing, gland, wall bracket, guide bracket, shaft bracket, jig plate, shaft support (open type), vertical shaft support etc using appropriate modeling software.

Introduction to computer aided drafting and dimensioning using appropriate software. Generate 2D drawing from the 3D models – generate and develop the lateral surfaces of the objects. Presentation Techniques of Engineering Drawings – Title Blocks – Printing/Plotting of drawing.

TOTAL PERIODS: 75

TEXT BOOKS


REFERENCE BOOKS:

1. Introduction to AutoCAD – 2D and 3D Design, A.Yarmwood, Newnes Elsevier, 2011

Bureau of Indian Standards (BIS) for Engineering Drawing:

GOAL
To introduce computers and programming and to produce an awareness of the power of computational techniques that are currently used by engineers and scientists and to develop programming skills to a level such that problems of reasonable complexity can be tackled successfully.

OBJECTIVES
The course should enable the students to:
1. Learn the major components of a Computer system.
2. Learn the problem solving techniques.
3. Develop skills in programming using C language.

OUTCOMES
The student should be able to:
1. Understand the interaction between different components of Computer system and number system.
2. Devise computational strategies for developing applications.
3. Develop applications (Simple to Complex) using C programming language.

UNIT I COMPUTER FUNDAMENTALS

UNIT II COMPUTER PROGRAMMING AND LANGUAGES

UNIT III PROGRAMMING WITH C
Introduction to C - The C Declaration - Operators and Expressions - Input and Output in C - Decision Statements - Loop Control Statements.

UNIT IV FUNCTIONS, ARRAYS AND STRINGS
Functions - Storage Class - Arrays - Working with strings and standard functions.

UNIT V POINTERS, STRUCTURES AND UNION
Pointers - Dynamic Memory allocation - Structure and Union - Files.

TEXT BOOK

REFERENCES
OBJECTIVE

To expose the students for practical training through experiments to understand and appreciate the concepts learnt in Physics

OUTCOME

Performing the experiments related to the subject will help the students to apply the practical knowledge in industrial applications and for developing or modifying methods.

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<td>Torsional Pendulum - Determination of rigidity modulus of the material of a wire.</td>
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<td>Non Uniform Bending - Determination of Young's Modulus.</td>
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<td>4  1  3</td>
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<tr>
<td>3</td>
<td>Viscosity - Determination of co-efficient of Viscosity of a liquid by Poiseuille's flow. Lee's Disc - Determination of thermal conductivity of a bad conductor.</td>
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<td>6  1  3</td>
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<tr>
<td>4</td>
<td></td>
<td>7  1  3</td>
<td>8  1  3</td>
</tr>
<tr>
<td>5</td>
<td>Air Wedge - Determination of thickness of a thin wire.</td>
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<td>10  1  3</td>
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<tr>
<td>6</td>
<td>Spectrometer - Refractive index of a prism.</td>
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<td>12  1  3</td>
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<tr>
<td>7</td>
<td>Semiconductor laser - Determination of wavelength of Laser using Grating.</td>
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LIST OF EQUIPMENTS REQUIRED FOR A BATCH OF 30 STUDENTS

1  Torsional Pendulum (500 gm, wt, 60 cm wire Al-Ni Alloy) 5 nos.
2  Travelling Microscope (X10) 15 nos.
3  Capillary tube (length 10cm, dia 0.05mm) 5 nos.
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<tr>
<td>4</td>
<td>Magnifying lens (X 10)</td>
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<td>5</td>
<td>Lee's disc apparatus (std form)</td>
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<tr>
<td>6</td>
<td>Stop watch (+/- 1 s)</td>
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<tr>
<td>7</td>
<td>Meter scale 1m length</td>
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<td>Spectrometer (main scale 360 deg, ver 30&quot;)</td>
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<tr>
<td>9</td>
<td>Grating (2500 LPI)</td>
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<td>Laser (632.8 nm)</td>
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<td>Semi transparent glass plate</td>
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<td>Al coating, 65 nm thickness, 50% visibility</td>
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<tr>
<td>12</td>
<td>Equilateral prism (n = 1.54)</td>
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<td>Thermometer +/- 1 deg</td>
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<td>14</td>
<td>Screw gauge (+/- 0.001cm)</td>
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<td>Vernier caliper (+/- 0.01 cm)</td>
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<td>Steam Boiler 1 L</td>
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<td>Cylindrical mass 100 gms</td>
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<td>Transformer sodium vapour lamp 1 KW</td>
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<td>Sodium vapour lamp 700 W</td>
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<td>Beaker 250 mL</td>
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<tr>
<td>25</td>
<td>Spirit level</td>
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**REFERENCE**

OBJECTIVE
To expose the students for practical training through experiments to understand and appreciate the concepts learnt in Chemistry

OUTCOME
Performing the experiments related to the subject will help the students to apply the practical knowledge in industrial applications and for developing or modifying methods.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>List of Experiments</th>
<th>Batch 1 (30)</th>
<th>Batch 2 (30)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Week</td>
<td>Periods</td>
</tr>
<tr>
<td></td>
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<td>L</td>
<td>P</td>
</tr>
<tr>
<td>1</td>
<td>Estimation of Commercial soda by acid-base titration</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Determination of Percentage of nickel in an alloy</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Determination of Temporary, permanent and total hardness of water by EDTA method</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Determination of Chloride content in a water sample</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Potentiometric Estimation of iron</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Conductometric Titration of a strong acid with a strong base</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Conductometric Titration of mixture of acids.</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Determination of Degree of polymerization of a polymer by Viscometry</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

List of Glassware and Equipments required for a batch of 30 students

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Burett (50 mL)</td>
<td>30 nos</td>
</tr>
<tr>
<td>2</td>
<td>Pipette (20 mL)</td>
<td>30 nos</td>
</tr>
<tr>
<td>3</td>
<td>Conical Flask (250 mL)</td>
<td>30 nos</td>
</tr>
<tr>
<td>4</td>
<td>Distilled water bottle (1 L)</td>
<td>30 nos</td>
</tr>
<tr>
<td>5</td>
<td>Standard flask (100 mL)</td>
<td>30 nos</td>
</tr>
<tr>
<td>6</td>
<td>Funnel (small)</td>
<td>30 nos</td>
</tr>
<tr>
<td>7</td>
<td>Glass rod 20 cm length</td>
<td>30 nos</td>
</tr>
<tr>
<td>8</td>
<td>Reagent Bottle (250 mL)</td>
<td>30 nos</td>
</tr>
<tr>
<td>9</td>
<td>Reagent Bottle (60 mL)</td>
<td>30 nos</td>
</tr>
<tr>
<td></td>
<td>Item Description</td>
<td>Quantity</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>10</td>
<td>Beaker (100 mL)</td>
<td>30 nos</td>
</tr>
<tr>
<td>11</td>
<td>Oswald Viscometer Glass</td>
<td>30 nos</td>
</tr>
<tr>
<td>12</td>
<td>Measuring Cylinder (25 mL)</td>
<td>30 nos</td>
</tr>
<tr>
<td>13</td>
<td>Digital Conductivity Meter PICO make</td>
<td>8 nos</td>
</tr>
<tr>
<td>14</td>
<td>Conductivity cell (K=1)</td>
<td>12 nos</td>
</tr>
<tr>
<td>15</td>
<td>Digital Potentiometer PICO make</td>
<td>8 os</td>
</tr>
<tr>
<td>16</td>
<td>Calomel Electrode Glass</td>
<td>12 nos</td>
</tr>
<tr>
<td>17</td>
<td>Platinum Electrode Polypropylene</td>
<td>12 nos</td>
</tr>
<tr>
<td>18</td>
<td>Burette Stands Wooden</td>
<td>30 nos</td>
</tr>
<tr>
<td>19</td>
<td>Pipette stands Wooden</td>
<td>30 nos</td>
</tr>
<tr>
<td>20</td>
<td>Retard stands Metal</td>
<td>30 nos</td>
</tr>
<tr>
<td>21</td>
<td>Porcelain Tiles White</td>
<td>30 os</td>
</tr>
<tr>
<td>22</td>
<td>Clamps with Boss heads Metal</td>
<td>30 nos</td>
</tr>
</tbody>
</table>

REFERENCES

GOAL
To provide an awareness to develop the programming skills using computer languages.

OBJECTIVES
The course should enable the students to:
1. To gain knowledge about Microsoft office, Spread Sheet.
2. To learn a programming concept in C.

OUTCOME
The students should be able to
1. Use MS Word to create document, table, text formatting and Mail merge options.
2. Use Excel for small calculations using formula editor, creating different types of charts and including pictures etc,
3. Write and execute the C programs for small applications.

LIST OF EXPERIMENTS
a) Word Processing  12
1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
4. Drawing- flow Chart
b) Spread Sheet  9
5. Chart - Line, XY, Bar and Pie.
6. Formula - formula editor.
7. Spread sheet - inclusion of object, Picture and graphics, protecting the document
c) Programming in C  24
8. To write a C program to prepare the electricity bill.
9. Functions
   (a) Call by value   (b) Call by reference.
10. To write a C program to print the Fibonacci series for the given number.
11. To write a C program to find the factorial of number using recursion.
12. To write a C program to implement the basic arithmetic operations using Switch Case statement.
13. To write a C program to check whether the given number is an Armstrong number.
14. To write a C program to check whether the given string is a Palindrome.
15. To write a C program to create students details using Structures.
16. To write a C program to demonstrate the Command Line Arguments.
17. To write a C program to implement the Random Access in Files.
18. To write C programs to solve some of the Engineering applications

TOTAL: 45

HARDWARE/SOFTWARE REQUIRED FOR BATCH OF 30 STUDENTS

HARDWARE
LAN system with 33 nodes (OR) Standalone PCs - 33 Nos
Printers - 3 Nos

SOFTWARE
OS - Windows / UNIX
Application package - MS office
Software - C language
GOAL
The goal of the programme is to provide a practical input towards nurturing accomplished learners who can function effectively in the English language skills.

OBJECTIVES
The course should enable the students to
1. Extend the ability of the learners to be able to listen to English and comprehend its message.
2. Enable the learners to have a functional knowledge of spoken English.
3. Assist the learners to read and grasp the meaning of technical and non-technical passages in English.
4. Help the learners develop the art of writing without mistakes.
5. Expand the thinking capability of the learners so that they would learn how to view things from a different angle.

OUTCOME
The students should be able to
1. Listen to and evaluate English without difficulty and comprehend its message.
2. Develop a functional knowledge of spoken English so as to use it in the institution and at job interviews.
3. Read and comprehend the meaning of technical and non-technical passages in English.
4. Develop the art of writing so as to put down their thoughts and feelings in words.
5. Think independently and contribute creative ideas.

UNIT I LISTENING SKILL
Listening to conversations and interviews of famous personalities in various fields -- Listening practice related to the TV-- Talk shows - News - Educative programmes -- Watching films for critical comments - Listening for specific information - Listening for summarizing information - Listening to monologues for taking notes - Listening to answer multiple-choice questions.

UNIT II SPEAKING SKILL
Self-introduction -- Group discussion - Persuading and negotiating strategies - Practice in dialogues - Presentations based on short stories / poems -- Speaking on personal thoughts and feelings -academic topics - News reading - Acting as a compere -- Speaking about case studies on problems and solutions - Extempore speeches.

UNIT III READING SKILL
Reading anecdotes to predict the content - Reading for interpretation -- Suggested reading -- Short stories and poems -- Critical reading - Reading for information transfer - Reading newspaper and magazine articles for critical commentary - Reading brochures, advertisements, pamphlets for improved presentation.

UNIT IV WRITING SKILL
At the beginning of the semester, the students will be informed of a mini dissertation of 1000 words they need to submit individually on any non-technical topic of their choice. The parts of the dissertation will be the
assignments carried out during the semester and submitted towards the end of the semester on a date specified by the department. This can be judged as part of the internal assessment.

UNIT V  THINKING SKILL

Practice in preparing thinking blocks to decode diagrammatical representations into English words, expressions, idioms and proverbs - Inculcating interest in English using thinking blocks. Making pictures and improvising diagrams to form English words, phrases and proverbs -- Picture reading

REFERENCES


Websites for learning English

3. Intercultural: English Listening Lesson Library Online http://www.elllo.org/
GOAL
To provide the students with hands on experience on various basic engineering practices in Civil and Mechanical Engineering.

OBJECTIVES
The course should enable the students to
1. Relate theory and practice of basic Civil and Mechanical Engineering
2. Learn concepts of welding and machining practice
3. Learn concepts of plumbing and carpentry practice

OUTCOMES
The students should be able to
1. Indentify and use of tools, Types of joints used in welding, carpentry and plumbing operations.
2. Have hands on experience on basic fabrication techniques such as carpentry and plumbing practices.
3. Have hands on experience on basic fabrication techniques of different types of welding and basic machining practices.

LIST OF EXPERIMENTS

I. MECHANICAL ENGINEERING PRACTICE  
1. Welding
   Arc welding: Butt joints, Tee and lap joints.
2. Basic Machining
   Facing, turning, threading and drilling practices using lathe and drilling operation with vertical drilling machine.
3. Machine assembly practice
   Study of centrifugal pump
4. Study on
   a. Smithy operations - Productions of hexagonal headed bolt.

II. CIVIL ENGINEERING  
1. Basic pipe connection using valves, couplings, unions, reducers, elbows in household fitting.
2. Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.
3. Wood work: Sawing, Planning and making common joints.
4. Study of joints in door panels, wooden furniture.

TOTAL : 45

Reference:
List equipment and components

(For a Batch of 30 Students)

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools:
   (a) Rotary Hammer 2 Nos
   (b) Demolition Hammer 2 Nos
   (c) Circular Saw 2 Nos
   (d) Planer 2 Nos
   (e) Hand Drilling Machine 2 Nos
   (f) Jigsaw 2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.
### SEMESTER-II

**MAA 102– ENGINEERING MATHEMATICS – II**  
(Common to All Branches)

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<tr>
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<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>MAA 102</strong></th>
<th><strong>ENGINEERING MATHEMATICS-II</strong></th>
<th><strong>4 CREDITS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AIM</strong></td>
<td><strong>The course is aimed at developing the basic Mathematical skills of engineering students that are imperative for effective understanding of engineering subject using MATLAB.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>OBJECTIVES</strong></td>
<td><strong>OUTCOME</strong></td>
<td></td>
</tr>
<tr>
<td>- To understand effectively the evaluation of double and triple integrals and their applications</td>
<td>- To understand effectively the evaluation of double and triple integrals and their applications</td>
<td></td>
</tr>
<tr>
<td>- To know the basics of vector calculus comprising of gradient, divergence, curl, line surface and volume integrals along with the classical theorems involving them</td>
<td>- To know the basics of vector calculus comprising of gradient, divergence, curl, line surface and volume integrals along with the classical theorems involving them</td>
<td></td>
</tr>
<tr>
<td>- To have a sound knowledge of Laplace transform and its properties. Solutions of Laplace transform using MATLAB.</td>
<td>- To have a sound knowledge of Laplace transform and its properties. Solutions of Laplace transform using MATLAB.</td>
<td></td>
</tr>
<tr>
<td>- To understand and expand periodic functions as Fourier series using MATLAB</td>
<td>- To understand and expand periodic functions as Fourier series using MATLAB</td>
<td></td>
</tr>
</tbody>
</table>

### UNIT I  MULTIPLE INTEGRALS  
12(8+4)

Double integration – Cartesian and polar co-ordinates – Change of order of integration. Area as a double integral – Triple integration in Cartesian co ordinates – Volume as a triple integral - Change of variables between Cartesian and polar co-ordinates.

**Lab:** Area and Volume of double integration and triple integration.

### UNIT II  VECTOR CALCULUS  
12(8+4)

Gradient, Divergence and Curl – Unit normal vector, Directional derivative – angle between surfaces- Irrotational and solenoidal vector fields.
Green’s theorem - Gauss divergence theorem and Stoke’s theorem (without proof) – Verification and evaluation of the above the theorems - Simple applications to regions such as square, rectangle, triangle, cuboids and rectangular parallelopipeds.

**Lab: Green’s theorem - Gauss divergence theorem and Stoke’s theorem**

**UNIT III LAPLACE TRANSFORM 12(8+4)**


**Lab: Solutions of differential equations using Laplace transform**

**UNIT IV FOURIER SERIES 12(8+4)**

Dirichlet’s Conditions – General Fourier Series – Odd and even functions – Half range sine and cosine series – Harmonic Analysis.

**Lab: Solutions of Fourier series and Harmonic Analysis.**

**UNIT V COMPLEX VARIABLES 12(8+4)**

Functions of a complex variable – Analytic function - Cauchy - Riemann equations (Statement only) – Properties of analytic function (Statement only) – Construction of Analytic functions by Milne – Thomson method.

**Lab: Cauchy - Riemann equations, Milne – Thomson method**

TOTAL: 60

**TEXT BOOK:**


**REFERENCE:**


1.
GOAL
To impart basic principles of chemistry for engineers.

OBJECTIVES
The course should enable the students to
6. Make the students conversant with the basics of
   (a) Water technology And (b) Polymer science
7. Provide knowledge on the requirements and properties of a few important engineering materials.
8. Educate the students on the fundamentals of corrosion and its control.
9. Give a sound knowledge on the basics of a few significant terminologies and concepts in thermodynamics.
10. Create an awareness among the present generation about the various conventional energy sources.

OUTCOME
The students should be able to
7. Gain basic knowledge in water analysis and suitable water treatment method.
8. Get an idea on the type of polymers to be used in engineering applications.
9. Get awareness about new materials
10. Get knowledge on the effects of corrosion and protection methods will help the young minds to choose proper metal / alloys and also to create a design that has good corrosion control.
11. Get exposure on the important aspects of basic thermodynamics will be able to understand the advanced level thermodynamics in engineering applications.
12. Get a good background on the various aspects of energy sources will create awareness on the need to utilize the fuel sources effectively and also for exploring new alternate energy resources.

UNIT I WATER TECHNOLOGY AND POLYMER CHEMISTRY
Hardness (Definition, Types, Units) - problems - Estimation of Hardness (EDTA Method) - Water softening - Carbonate conditioning and Calgon conditioning - Demineralization ( Ion-Exchange Method) - Water Quality Parameters - Municipal Water Treatment- Desalination - Reverse Osmosis.

Classification of Polymers - PVC, Bakelite - preparation, properties and applications - Effect of Polymer Structure on Properties - Compounding of Plastics- Polymer Blends and Polymer Alloys Definition, Examples

UNIT II ENGINEERING MATERIALS
Properties of Alloys - Heat Treatment of Steel - Polymer Composites - types and applications. Lubricants - Classification, properties and applications - Mechanism of Lubrication - MoS2 And Graphite - Adhesives - classification and properties - Epoxy resin (Preparation, properties and applications) - Refractories - Classification, Properties and General Manufacture - Abrasives Classification , Properties and Uses - Carbon nano tubes - preparation, properties and applications.

UNIT III ELECTROCHEMISTRY AND CORROSION
Conductometric Titration - HCl vs NaOH and mixture of acids vs NaOH - Electrochemical Series and its applications - Nernst Equation - problems - Polarization, Decomposition Potential, Over-voltage ( definitions only) - Galvanic series - Corrosion (Definition, Examples, effects) - Mechanism of Dry Corrosion and Wet Corrosion - Differential aeration Corrosion , examples - Factors Influencing Corrosion - Metal and Environment - Corrosion Control - Design -Cathodic Protection methods - Protective Coatings - Galvanising - Anodising - Electroplating (Cu and Ni) and Electroless plating (Cu and Ni) Constituents of Paints and varnish.

UNIT IV CHEMICAL THERMODYNAMICS


UNIT V FUELS AND ENERGY SOURCES


TOTAL : 45

TEXT BOOKS


REFERENCES

6. B. K. Sharma, Engineering chemistry, Krishna Prakasam Media (P) Ltd., 2003
8. A. Gowarikar, Text Book of Polymer Science, 2002
GOAL
To impart fundamental knowledge in various fields of Physics and its applications.

OBJECTIVES
The course should enable the students to:

6. Develop strong fundamentals of properties and behaviour of the materials.
7. Enhance theoretical and modern technological aspects in acoustics and ultrasonics.
8. Enable the students to correlate the theoretical principles with application oriented study of optics.
9. Provide a strong foundation in the understanding of solids and materials testing.
10. Enrich the knowledge of students in modern engineering materials.

OUTCOME
The students should be able to:

6. Understand the properties and behaviour of materials.
7. Have a fundamental knowledge of acoustics which would facilitate in acoustical design of buildings and on ultrasonics and be able to employ it as an engineering tool.
8. Understand the concept, working and application of lasers and fiber optics.
9. Know the fundamentals of crystal physics and non destructive testing methods.
10. Have an understanding of the production, characteristics and application of the new engineering materials. This would aid them in the material selection stage.

UNIT I PROPERTIES OF MATTER

UNIT II ACOUSTICS AND ULTRASONICS
Classification of sound - characteristics of musical sound - intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies. Ultrasonics - production - Magnetostriction and Piezoelectric methods - properties - applications of ultrasonics with particular reference to detection of flaws in metal (Non-Destructive testing NDT) - SONAR.

UNIT III LASER AND FIBRE OPTICS

UNIT IV CRYSTAL PHYSICS AND NON-DESTRUCTIVE TESTING
Crystal Physics: Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number Packing factor for SC, BCC, FCC and HCP structures.

Non Destructive Testing: Liquid penetrate method - Ultrasonic flaw detection - ultrasonic flaw detector (block diagram) - X-ray Radiography - Merits and Demerits of each method.

UNIT V MODERN ENGINEERING MATERIALS AND SUPERCONDUCTING MATERIALS


Superconducting Materials: Superconducting phenomena - Properties of superconductors - Meissner effect - Type I and Type II superconductors - High Tc superconductors (qualitative) - uses of superconductors.

TOTAL : 45

TEXT BOOKS

REFERENCES
10. P.Charles, Poople and Frank J. Owens, Introduction to Nanotechnology, Wiley India,
GOAL
To provide an understanding of the effects of forces, torques and motion on a variety of structures and vehicles.

OBJECTIVES
The course should enable the students to
1. Impart knowledge on the vector and scalar representation of forces and moments
2. Impart knowledge on static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions.
3. Understand the principle of work and energy.
4. Comprehend on the effect of friction on equilibrium, the laws of motion, the kinematics of motion and the interrelationship.
5. Write the dynamic equilibrium equation.
All these should be achieved both conceptually and through solved examples.

OUTCOME
The students should be able to
1. Apply the law of forces and Newton's 2nd law in determining motion and The dynamics of particles and vehicles
2. Implement vectors in mechanics problems and Know about Energy and momentum conservation
3. Know the dynamics of a rigid body and its rotation and Do the calculation and motion of the centre of mass of a system of particles
4. Use vectors to solve mechanics problems and Develop particle and vehicle trajectory equations
5. Calculate the motion of rigid bodies and Solving problems on engineering mechanics that arise on other modules of the course.

UNIT I BASICS & STATICS OF PARTICLES 12

UNIT II EQUILIBRIUM OF RIGID BODIES 12
Free body diagram - Types of supports and their reactions - Requirements of stable equilibrium Static determinacy - Moments and Couples - Moment of a force about a point and about an axis Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions - Equilibrium of Rigid bodies in three dimensions - Examples.
Frictional force - Laws of Coulomb friction - Simple contact friction - Belt friction - Transmission of power through belts - Wedge Friction - Screw Jack - Rolling resistance.

UNIT IV PROPERTIES OF SURFACES AND SOLIDS

Determination of Areas and Volumes - Determination of first moment of area Centroid of sections, Second and product moments of plane area - Rectangle, circle, triangle, T section, I section, Angle section, Hollow section- Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia -Product moment of inertia.

UNIT V DYNAMICS OF PARTICLES


TOTAL : 60

TEXT BOOKS


REFERENCES


OBJECTIVES:
1. To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
2. To explain the fundamentals of semiconductor and applications.
3. To explain the principles of digital electronics
4. To impart knowledge of communication.

OUTCOMES:
1. ability to identify the electrical components explain the characteristics of electrical machines.
2. ability to identify electronics components and use of them to design circuits.

UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS
12

UNIT II ELECTRICAL MECHANICS
12

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS
12

UNIT IV DIGITAL ELECTRONICS
12

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING
12

TOTAL: 60 PERIODS

TEXT BOOKS:

REFERENCES:
GOAL
To introduce basic manufacturing processes and to develop theoretical skill of students.

OBJECTIVES
The course should enable the students to
1. Learn Metal joining processes
2. Learn Casting processes.
3. Learn Metal forming/high energy rate forming.
4. Learn the processing of plastics

OUTCOME
The students should be able to
1. Understand the various manufacturing methods employed in the Industry.
2. Get knowledge in Basic welding & finishing operations
3. Get knowledge in Hot & cold working of metals including High Energy Rate forming

UNIT I METAL CASTING PROCESSES
Sand casting - Sand moulds - Type of patterns - Pattern materials - Pattern allowances- Types of Moulding sand - Properties - Core making - Methods of Sand testing - Moulding machines - Types of moulding machines - Melting furnaces - Working principle of Special casting processes - Shell, investment casting - Ceramic mould - Lost Wax process - Pressure die casting - Centrifugal casting - CO2 process - Sand Casting defects - Inspection methods.

UNIT II FABRICATION PROCESS

UNIT III BULK DEFORMATION PROCESSES
Hot working and cold working of metals - Forging processes - Open and close die forging - Characteristics of the process - Types of Forging Machines - Typical forging operations - Rolling of metals - Flat strip rolling - Types of Rolling mills - Shape rolling operations - Tube piercing - Defects in rolled parts - Principles of Extrusion - Types of Extrusion - Hot and Cold extrusion -Principle of rod and wire drawing - Equipments used

UNIT IV SHEET METAL FORMING PROCESSES
Sheet metal characteristics - Typical shearing operations, bending and drawing operations - Stretch forming operations - Formability of sheet metal - Test methods - Working principle and application of special forming processes - Hydro forming - Rubber pad forming - Metal spinning - Explosive forming - Magnetic pulse forming - Peen forming - Super plastic forming - Process characteristics

UNIT V FORMING AND SHAPING OF PLASTICS 7

Types of plastics - Characteristics of forming and shaping processes - Moulding of Thermoplastics Working principles and typical applications of - Injection moulding - Plunger and screw machines Blow moulding - Rotational moulding - Film blowing - Extrusion - Typical industrial applications Thermoforming - Processing of Thermosets - Working principles and typical applications Compression moulding - Transfer moulding - Bonding of Thermoplastics - Fusion and solvent methods - Induction and Ultrasonic methods.

TOTAL : 45

TEXT BOOKS

REFERENCES
GOAL

- To enhance holistic development of students and improve their employability skills.
- To nurture the language skills and cultivate in them the ability to indulge in rational thinking, independent decision-making and lifelong learning.
- To help them become responsible members or leaders of the society in and around their workplace or living space.
- To communicate successfully at the individual or group level on engineering activities with the engineering community in particular, and on multi-disciplinary activities in general, with the world at large.

OBJECTIVES

The course should enable the students to

6. Develop interpersonal skills and be an effective goal oriented team player.
7. Develop professionals with idealistic, practical and moral values.
8. Develop communication and problem solving skills.
9. To face the challenges in the world and enable the students excel in the world of work and life.

OUTCOME

The students should be able to:

6. Have the self-confidence to improve upon their informative listening skills by an enhanced acquisition of the English language.
7. Speak English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.
8. Read, comprehend and answer questions based on literary, scientific and technological texts.
9. Have the confidence to develop thinking skills and participate in brainstorming, mind-mapping, audiovisual activities, creative thinking and also answer tests in the job-selection processes.
10. Make right decisions, communicate effectively, and develop self-management talents, to lead a healthy and productive life.
11. Imbibe the requisite employability skills, learned skills, intuitive skills and people skills

UNIT I: SPEAKING SKILLS

Art of Speaking- Body Language and speaking- Non Verbal communication- Vocal Communication Techniques- Intercultural communication- The difference in Approach in five countries- Vocabulary Enrichment- Pronunciation of words-Mark the stress on appropriate syllable-split the word into syllables-Speaking as an Art-Simple Oral Interaction-Body Language and Speaking- Five characteristics of an ideal GD-group discussions - role plays- short speeches-Extempore – JAM –Debate-Talk shows-Power point presentation and speaking

UNIT II: LANGUAGE SKILLS

Functional Grammar: Synonyms and Antonyms – Active and Passive Voice- Direct and Indirect Speech- Conditional Clauses- collocations- rearrange the jumbled sentences and make meaningful sentences- Language functions: apologising, greeting, clarifying, inviting, advising, agreeing, disagreeing, refusing, thanking, interrupting, expressing obligation, expressing preferences, CV / application letters- Job interviews-FAQ’s – e-mail etiquette
UNIT III: PEOPLE SKILLS/SOFT SKILLS
SWOT analysis- JOHARI window- Goal setting- speaking on Goals - goals to be achieved- modes of behaviour to achieve the goals- decision making- time management -stress management- power of positive attitude- leadership skills

UNIT IV: COMPREHENSION SKILLS
Art of Listening- listening to English news- listening to debates on current issues - Listening to dialogues for general meaning and specific information- listening to toast master speeches- cloze exercises-open comprehension questions-Art of Listening-Reading passages -interpreting in own words- reading articles in magazines/journals/newspapers- writing articles for newspaper-reporting events-completing the middle/end of a story

UNIT V: PERSONALITY DEVELOPMENT
Define Personality- Types of Personality-Personality test- Leadership Skills - Interpersonal Skills- Team Work - Mind Mapping- concept maps- Study skills and techniques - Edward De Bono's lateral thinking-exercises-questionnaires-project

TEXT BOOK:
English for Life and the workplace through LSRW&T skills by Dr. Dolly John, Pearson Publications

REFERENCES
2. Effective technical Communication, M. Ashraf Rizvi, Tata McGraw Hill Companies
3. Professional Speaking Skills, Aruna Koneru, Oxford University Press
Web links for reference for Flipped classroom sessions
1.  https://owl.english.purdue.edu/exercises/28/12/33
OBJECTIVE

To expose the students for practical training through experiments to understand and appreciate the concepts learnt in Physics

OUTCOME

Performing the experiments related to the subject will help the students to apply the practical knowledge in industrial applications and for developing or modifying methods.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>List of Experiments</th>
<th>Batch 2 (30)</th>
<th>Batch 1 (30)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Week</td>
<td>Periods allotted</td>
</tr>
<tr>
<td>1</td>
<td>Torsional Pendulum - Determination of rigidity modulus of the material of a wire.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Non Uniform Bending - Determination of Young's Modulus.</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Viscosity - Determination of co-efficient of Viscosity of a liquid by Poiseuille's flow.</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Lee's Disc - Determination of thermal conductivity of a bad conductor.</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Air Wedge - Determination of thickness of a thin wire.</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Spectrometer - Refractive index of a prism.</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Semiconductor laser - Determination of wavelength of Laser using Grating.</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>7</strong></td>
</tr>
</tbody>
</table>

**LIST OF EQUIPMENTS REQUIRED FOR A BATCH OF 30 STUDENTS**

1. Torsional Pendulum (500 gm, wt, 60 cm wire Al-Ni Alloy) - 5 nos.
2. Travelling Microscope (X10) - 15 nos.
3. Capillary tube (length 10cm, dia 0.05mm) - 5 nos.
4. Magnifying lens (X10) - 15 nos.
5. Lee's disc apparatus (std form) - 5 nos.
<table>
<thead>
<tr>
<th>No.</th>
<th>Equipment</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Stop watch</td>
<td>( +/- 1 s)</td>
<td>5 nos.</td>
</tr>
<tr>
<td>7</td>
<td>Meter scale</td>
<td>1 m length</td>
<td>5 nos.</td>
</tr>
<tr>
<td>8</td>
<td>Spectrometer</td>
<td>(main scale 360 deg, ver 30&quot;)</td>
<td>5 nos.</td>
</tr>
<tr>
<td>9</td>
<td>Grating</td>
<td>(2500 LPI)</td>
<td>5 nos.</td>
</tr>
<tr>
<td>10</td>
<td>Laser</td>
<td>(632.8 nm)</td>
<td>5 nos.</td>
</tr>
<tr>
<td>11</td>
<td>Semi transparent glass plate</td>
<td>Al coating, 65 nm thickness, 50% visibility</td>
<td>5 nos.</td>
</tr>
<tr>
<td>12</td>
<td>Equilateral prism</td>
<td>(n = 1.54)</td>
<td>5 nos.</td>
</tr>
<tr>
<td>13</td>
<td>Thermometer</td>
<td>+/- 1 deg</td>
<td>8 nos.</td>
</tr>
<tr>
<td>14</td>
<td>Screw gauge</td>
<td>(+/- 0.001 cm)</td>
<td>12 nos.</td>
</tr>
<tr>
<td>15</td>
<td>Vernier caliper</td>
<td>(+/- 0.01 cm)</td>
<td>8 nos.</td>
</tr>
<tr>
<td>16</td>
<td>Steam Boiler</td>
<td>1 L</td>
<td>5 nos.</td>
</tr>
<tr>
<td>17</td>
<td>Scale</td>
<td>50 cms</td>
<td>5 nos.</td>
</tr>
<tr>
<td>18</td>
<td>Cylindrical mass</td>
<td>100 gms</td>
<td>10 sets</td>
</tr>
<tr>
<td>19</td>
<td>Slotted wt</td>
<td>300 gms</td>
<td>5 sets</td>
</tr>
<tr>
<td>20</td>
<td>Heater</td>
<td>1.5 KW</td>
<td>5 nos.</td>
</tr>
<tr>
<td>21</td>
<td>Transformer sodium vapour lamp</td>
<td>1 KW</td>
<td>10 nos.</td>
</tr>
<tr>
<td>22</td>
<td>Sodium vapour lamp</td>
<td>700 W</td>
<td>5 nos.</td>
</tr>
<tr>
<td>23</td>
<td>Burette</td>
<td>50 mL</td>
<td>5 nos</td>
</tr>
<tr>
<td>24</td>
<td>Beaker</td>
<td>250 mL</td>
<td>5 nos</td>
</tr>
<tr>
<td>25</td>
<td>Spirit level</td>
<td></td>
<td>10 nos</td>
</tr>
</tbody>
</table>

REFERENCE

**OBJECTIVE**

To expose the students for practical training through experiments to understand and appreciate the concepts learnt in Chemistry

**OUTCOME**

Performing the experiments related to the subject will help the students to apply the practical knowledge in industrial applications and for developing or modifying methods.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>List of Experiments</th>
<th>Batch 1 (30)</th>
<th>Batch 2 (30)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Week</td>
<td>Periods</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L</td>
<td>P</td>
</tr>
<tr>
<td>1</td>
<td>Estimation of Commercial soda by acid-base titration</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Determination of Percentage of nickel in an alloy</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Determination of Temporary, permanent and total hardness of water by EDTA method</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Determination of Chloride content in a water sample</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Potentiometric Estimation of iron</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Conductometric Titration of a strong acid with a strong base</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Conductometric Titration of mixture of acids.</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Determination of Degree of polymerization of a polymer by Viscometry</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>24</td>
</tr>
</tbody>
</table>

**List of Glassware and Equipments required for a batch of 30 students**

1. Burett (50 mL) 30 nos
2. Pipette (20 mL) 30 nos.
3. Conical Flask (250 mL) 30 nos
4. Distilled water bottle (1 L) 30 nos
5. Standard flask (100 mL) 30 nos
<table>
<thead>
<tr>
<th></th>
<th>Item Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Funnel (small)</td>
<td>30 nos</td>
</tr>
<tr>
<td>2</td>
<td>Glass rod 20 cm length</td>
<td>30 nos</td>
</tr>
<tr>
<td>3</td>
<td>Reagent Bottle (250 mL)</td>
<td>30 nos.</td>
</tr>
<tr>
<td>4</td>
<td>Reagent Bottle (60 mL)</td>
<td>30 nos</td>
</tr>
<tr>
<td>5</td>
<td>Beaker (100 mL)</td>
<td>30 nos</td>
</tr>
<tr>
<td>6</td>
<td>Oswald Viscometer Glass</td>
<td>30 nos</td>
</tr>
<tr>
<td>7</td>
<td>Measuring Cylinder (25 mL)</td>
<td>30 nos</td>
</tr>
<tr>
<td>8</td>
<td>Digital Conductivity Meter PICO make</td>
<td>8 nos</td>
</tr>
<tr>
<td>9</td>
<td>Conductivity cell (K=1)</td>
<td>12 nos</td>
</tr>
<tr>
<td>10</td>
<td>Digital Potentiometer PICO make</td>
<td>8 nos</td>
</tr>
<tr>
<td>11</td>
<td>Calomel Electrode Glass</td>
<td>12 nos</td>
</tr>
<tr>
<td>12</td>
<td>Platinum Electrode Polypropylene</td>
<td>12 nos</td>
</tr>
<tr>
<td>13</td>
<td>Burette Stands Wooden</td>
<td>30 nos</td>
</tr>
<tr>
<td>14</td>
<td>Pipette stands Wooden</td>
<td>30 nos</td>
</tr>
<tr>
<td>15</td>
<td>Retard stands Metal</td>
<td>30 nos</td>
</tr>
<tr>
<td>16</td>
<td>Porcelain Tiles White</td>
<td>30 nos</td>
</tr>
<tr>
<td>17</td>
<td>Clamps with Boss heads Metal</td>
<td>30 nos</td>
</tr>
</tbody>
</table>

REFERENCES
LIST OF EXPERIMENTS

Electrical Engineering:
1. Wiring for a tube light. .................................................. 6
2. Wiring for a lamp and fan. .............................................. 6
3. Staircase wiring ............................................................. 3
4. Study of (i) Iron box and (ii) Fan with Regulator Electronics Engineering ............................................. 6
5. Study of Electronic components and Equipments ................................................................. 3
6. Characteristics of PN junction diode & measurement of Ripple factor of half wave and
full wave rectifier .................................................................. 9
7. Applications of OP-AMP - Inverter, Adder and Subtractor. ............................................................. 9
8. Study and verification of Logic Gates  ......................................................................................... 3

Components Required:

Electrical Engineering
Choke .................................................................................. 2 nos
Starter ............................................................................... 2 nos
Tubelight stand ................................................................. 2 nos
36W tubelight ................................................................. 2 nos
Fan ...................................................................................... 2 nos
40W lamp ........................................................................... 5 nos
Single way switch ............................................................... 10 nos
Two way switch ................................................................. 5 nos
Iron box .............................................................................. 2 nos
Fan with regulator opened .................................................. 1 no (demo purpose )

Electronics Engineering
IC Trainer Kit, Resistors, Capacitors, CRO, Function Generator,BreadBoard,Regulated Power Supply, Zener
Diode, PN Junction Diode, Potentiometer, Digital Multimeter,Ammeter, Voltmeter, Wattmeter, IC 7408,IC
7432,IC 7486, IC 7400, IC 7404, IC 7402

TEXT BOOK
Vikas Publishing house (P) Ltd., New Delhi.
OBJECTIVES
1. To provide a basic understanding of operation and characteristics of Electrical machines and Electronic devices

LIST OF EXPERIMENTS:
1. Open circuit and load test on shunt generators
2. Load test of D.C. shunt motor
3. Load test or single phase induction motor
4. Equivalent circuit of a transformer
5. Swinturn’s test
6. Diode characteristics
7. Transistor amplifier
8. SCR application
9. Frequency Response Analysis
10. Characteristics of Transducers

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS
1. Shunt Generators
2. Shunt DC motors
3. Single phase Induction motor
4. Single phase transformer
5. Three phase Squirrel Cage induction Motors
6. Diodes and Amplifiers
7. Oscilloscope
8. Transducers
SEMESTER - III

MAA 201 – ENGINEERING MATHEMATICS – III
(Common to AERO, ASP, AUTO, MECH, CSE, IT, CHEM & Bio.Tech Branches)

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

UNIT – I Partial Differential Equations 12(9+3)
Formation of partial differential equation differential equations by elimination arbitrary constant arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange’s linear equation – Linear partial differential equations of second and higher order with constant coefficients.

UNIT – II One Dimensional Wave and Heat Flow 12(9+3)
Classification of second order linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation.

UNIT – III Two Dimensional Heat Flow 12(9+3)
Steady state solution of two dimensional heat equations (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates and Polar coordinates (sector, semicircle, circle and annular regions)

UNIT – IV Fourier Transform 12(9+3)

UNIT – V Z – Transform and Difference Equations 12(9+3)

Total: 60

Text Books:

References:
GOAL
To provide an appreciation of energy conversion processes in the context of engineering applications and to introduce the laws of thermodynamics.

OBJECTIVES
The course should enable the students to
1. Understand the energy conversion processes involving heat, work and energy storage.
2. The application of thermodynamic principles to the propulsion of land, sea and air transport and in the generation of power.
3. Analysis various thermal processes and plant.
4. Identify information requirements and sources for analysis and evaluation
5. Synthesize information and ideas for use in the evaluation process.

OUTCOME
The students should be able to
1. Analyze and solve problems in a methodical fashion.
2. Relate the concepts of Energy (Heat & Work) in real life situations and Apply energy transformation in flow & non flow processes.
3. Understand the concepts of degradation of energy and its effect in practical applications
4. Understand the concepts of sensible heat, Latent heat and to understand the fundamentals of ideal and real gases and its properties.
5. Learn laws of ideal and real gases, gas mixtures and their properties.

UNIT I BASIC CONCEPTS
Applications of thermodynamics: Thermodynamic systems, concepts of continuum, some basic definitions, open and closed systems, processes, cycle, Thermodynamic properties, state and equilibrium, Definitions of heat and work, sign conventions, determination of work during different processes, temperature, zeroth law of thermodynamics.

UNIT II FIRST LAW OF THERMODYNAMICS
The First Law for closed systems. Work and heat during cyclic and non-cyclic processes. Specific heats, internal energy and enthalpy for ideal gases.
The First Law for open systems. The steady flow energy equation. Application to boiler, nozzles, throttles, turbines and heat exchangers.

UNIT III SECOND LAW OF THERMODYNAMICS
Definition of the heat engine and cycle efficiency. The Carnot heat engine; Reversed heat engines (heat pump and refrigerator) and coefficient of performance.

UNIT IV PROPERTIES OF PURE SUBSTANCE
Thermodynamic properties of pure substances, property diagram, PVT surface of water and other substances, calculation of properties, first law and second law analysis using tables and charts,

UNIT V IDEAL & REAL GASES AND THERMODYNAMIC RELATIONS
Gas mixtures - Properties of ideal and real gases, equation of state, Avagadro's law, Vander Waal's equation of states, compressibility, compressibility chart. Dalton's law of partial pressure, Exact differentials, T-D relations, Maxwell relations, Clausius Clapeyron equations, Joule Thomson Coefficient.

TEXT BOOKS
2. Rogers and Mayhew, Thermodynamic and Transport Properties of Fluids, Basil Blackwell

REFERENCES
OBJECTIVES

- To understand the structure and the properties of the fluid.
- To analyse and appreciate the complexities involved in solving the fluid flow problems.
- To study the mathematical techniques already in vogue and apply them to the solutions of practical flow problems.
- To understand the energy exchange process in fluid mechanics handling incompressible fluids.

UNIT I  BASIC CONCEPTS AND PROPERTIES  12

Fluid—Definition, distinction between solid and fluid—Units and dimensions—Properties of fluids—density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension—Fluid statics: concept of fluid static pressure, absolute and gauge pressures—Pressure measurements by manometers and pressure gauges.

UNIT II  FLUID KINEMATICS AND FLUID DYNAMICS  12

Fluid Kinematics—Flow visualization—Lines of flow—Types of flow—Velocity field and acceleration—Continuity equation (one and three dimensional differential forms)—Equation of streamline—Stream function—Velocity potential function—Circulation—Flownet—Fluid dynamics—Equations of motion—Euler’s equation along a streamline—Bernoulli’s equation—Applications—Venturi meter, Orifice meter, Pitot tube—Dimensional analysis—Buckingham’s π theorem—Applications—Similarity laws and models.

UNIT III  INCOMPRESSIBLE FLUID FLOW  12

Viscous flow—Navier-Stoke’s equation (Statement only)—Shear stress, pressure gradient relationship—Laminar flow between parallel plates—Laminar flow through circular tubes (Hagen poiseulle’s)—Hydraulic and energy gradient—Flow through pipes—Darcy weir’s equation—Pipe roughness—Friction factor—Moody’s diagram—Minor losses—Flow through pipes in series and in parallel—Power transmission—Boundary layer flows, boundary layer thickness, boundary layer separation—Drag and lift coefficients.

UNIT IV  HYDRAULIC TURBINES  12

Fluid machines: Definition and classification—Exchange of energy—Euler’s equation for turbo machines—Construction of velocity vector diagrams—Head and specific work—Components of energy transfer—Degree of reaction.


UNIT V  HYDRAULIC PUMPS  12

Pumps: Definition and classification—Centrifugal pump: classifications, working principle, velocity triangles, specific speed, efficiency and performance curves—Reciprocating pump: classification, working principle, indicator diagram, work saved by air vessels and performance curves—Cavitations in pumps—Rotary pumps: working principles of gear and vane pumps

TOTAL: 60
TEXT BOOKS


REFERENCES

GOAL
To develop knowledge on basic machine tools and machining operations and the underlying concepts to enhance productivity

OBJECTIVES
The course should enable the students to
1. Create awareness of various types of machine tools used in the Industry and their application
2. Understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping milling, drilling grinding broaching
3. Understand the basic concepts of computer numerical control (CNC) machine tool and CNC programming.

OUTCOME
The students should be able to
1. Select the cutting tools required for various machining operations;
2. Select the proper machine tools for a particular operation
3. Understand the concepts of CNC and to programme.

UNIT I THEORY OF METAL CUTTING

UNIT II CENTRE LATHE AND SPECIAL PURPOSE LATHES
Centre lathe, constructional features, cutting tools, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation.
Capstan and turret lathes - automatic lathes: semi automatic, automat - single spindle : cutting off, swiss type, automatic screw type - multi spindle; cutting off, bar type.

UNIT III RECIPROCATING AND MILLING MACHINES
Reciprocating machine tools: shaper, planer, slotter; milling : types, milling cutters, operations; hole making : drilling, reaming, boring, tapping.

UNIT IV ABRASIVE PROCESS, SAWING, BROACHING AND GEAR CUTTING
Abrasive processes: grinding wheel - specifications and selection, types of grinding process- cylindrical grinding, surface grinding, centreless grinding - honing, lapping, super finishing, polishing and buffing, abrasive jet grinding
Sawing machine: hack saw, band saw, circular saw; broaching machines: broach construction push, pull, surface and continuous broaching machines, gear cutting: forming, generation, shaping, hobbing.
UNIT V  CNC MACHINE TOOLS AND PART PROGRAMMING

Numerical control (NC) machine tools - CNC: types, constructional details, special features.

Part programming fundamentals - manual programming - computer assisted part programming- APT language.

TOTAL : 45

TEXT BOOKS


REFERENCES


GOAL
To develop a basic understanding of the properties of materials and hence provide a sound rationale for selection and use of materials in engineering.

OBJECTIVES
1. The course should enable the students to Impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials.
2. Identify and select suitable materials for various engineering applications.
3. Learn the physical origins of properties of materials and their control.
4. Understand the ways in which properties of materials govern their selection in engineering applications.
5. Show how non-metallic bonding leads to vary different properties (e.g. Ceramics and polymers)

OUTCOME
The students should be able to
1. Demonstrate how defects in atomic structure affect mechanical properties
2. Relate the kinetics of a number of apparently different materials processes to the same underlying process (diffusion)
3. Explain how strengthening mechanisms occur on the microstructural scale and how this is related to the bulk mechanical properties we require in engineering structures
4. Apply the use of phase diagrams to explain the development of microstructure and hence how alloys are designed
5. Analyse failure problems and apply the correct fracture mechanics approach

Review (Not for Exam):
Crystal structure - BCC, FCC and HCP structure - unit cell - crystallographic planes and directions, miller indices - crystal imperfections, point, line, planar and volume defects - Grain size, ASTM grain size number.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS

UNIT II HEAT TREATMENT
Definition - Full annealing, stress relief, recrystallisation and spheroidizing -normalising, hardening and Tempering of steel. Isothermal transformation diagrams - cooling curves superimposed on I.T. diagram CCR - Hardenability, Jominy end quench test - Austempering, martempering - case hardening, carburising, nitriding, cyaniding, carbonitriding - Flame and Induction hardening.

UNIT III FERROUS AND NON FERROUS METALS
Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) - stainless and tool steels - HSLA maraging steels - Gray, White malleable, spheroidal - Graphite - alloy cast irons.
Copper and Copper alloys - Brass, Bronze and Cupronickel - Aluminum and Al-Cu - precipitation strengthening treatment - Bearing alloys.

UNIT IV NON-METALLIC MATERIALS
Polymers - types of polymer, commodity and engineering polymers - Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers - Urea and Phenol Formaldehydes - Engineering Ceramics - Properties and applications of Al2O3, SiC, Si3, N4, PSZ and Sialon - Fibre and particulate reinforced composites.

UNIT V MECHANICAL PROPERTIES AND TESTING
Mechanism of plastic deformation, slip and twinning - Types of fracture - Testing of materials under tension, compression and shear loads - Hardness tests (Brinell, Vickers and Rockwell) Impact test Izod and charpy, fatigue and creep test.

TEXT BOOK

REFERENCE
LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments to find the laminar to turbulent transition for a flow in a pipe.
6. Performing an experiment and drawing the characteristic curves of submergible pump.
7. Conducting an experiment and drawing the characteristic curves of centrifugal pump.
8. Conducting an experiment and drawing the characteristic curves of reciprocating pump.
9. Conducting an experiment and drawing the characteristic curves of Gear Oil pump.
10. Performing an experiment and drawing the characteristic curves of Jet pump.
11. Conducting an experiment and drawing the characteristic curves of Pelton wheel.
12. Conducting an experiment and drawing the characteristic curves of Francis turbine.
13. Conducting an experiment and drawing the characteristic curves of Kaplan turbine.
14. Performing an experiment and drawing the characteristic curves of Turgo Impulse Wheel.

TOTAL: 45

LIST OF EQUIPMENTS

(For a batch of 30 students)

1. Orifice meter setup
2. Venturi meter setup
3. Rotameter setup
4. Reynolds Apparatus
5. Pipe Flow analysis setup
6. Submergible pump setup
7. Centrifugal pump
8. Reciprocating pump setup
9. Gear oil pump setup
10. Jet pump
11. Pelton wheel setup
12. Francis turbine setup
13. Kaplan turbine setup
14. Turgo Impulse Wheel

Quantity: one each.
GOAL
To impart knowledge on Mechanics of metal cutting & Machining Operations

OBJECTIVES
The course should enable the students to
1. Learn the Applications of mechanics of metal cutting 2. Have knowledge on milling and drilling and grinding operations
3. Introduce the CNC Machine.

OUTCOME
The students should be able to
1. Select the right tool, machining condition and relevant measurement
2. Know the methods and applications of various machining operations
3. Understanding the CNC hardware and CNC Programming

EXERCISES
1. Two or More Metal Cutting Experiments (Example: Shear Angle Measurement, Cutting Force Measurement, Cutting Temperature Measurement, Tool Wear Measurement, Life Measurement etc.)
2. Two or More Exercises in Milling Machines (Example: Milling Polygon Surfaces, Gear milling, Keyway milling, Helical Groove milling etc.)
3. Two or More Exercises in Grinding / Abrasive machining (Example: Surface Grinding, Cylindrical Grinding, Centreless Grinding, Lapping, Honing etc.)
4. Two or More Exercises in Machining Components for Assembly of different fits. (Example: Machining using Lathes, Shapers, Drilling, Milling, Grinding Machines etc.)
5. One or More Exercises in Capstan or Turret Lathes
6. One or More Exercises in Gear Machining (Example: Gear Cutting, Gear Shaping, Gear Hobbing etc.)
7. One or More Exercises in CNC Machines (Example: CNC Programming, CNC Tooling, CNC Machining etc.)

TOTAL : 45

LIST OF EQUIPMENTS
( for a batch of 30 students )
1. Centre Lathes
2. Turret and Capstan Lathe
3. Horizontal Milling Machine
4. Vertical Milling Machine
5. Surface Grinding Machine
6. Tool Dynamometer
7. Gear Hobbing Machine
8. CNC Lathe (Trainer or Industrial Type)
GOAL
To make the students to understand and practice Machine Drawing and to expose to Computer Aided Design and Drafting.

OBJECTIVES
The course should enable the students to
1. Understanding limits, Fits and Tolerances.
2. Understanding CAD software
3. Explaining and Sketching Valves, Cocks and Plugs.
4. Various parts of Machinery.

OUTCOME
The students should be able to
1. Understand the drawing conventions
2. Gain sufficient knowledge on Limits, Fits and Tolerances and their representation in the drawing
3. Have sufficient knowledge in CAD softwares and their use.

UNIT I EXPLANATION AND SKETCHING OF THE FOLLOWING ASPECTS
Dimensioning conventions of shafts, arcs, angles, holes, tapers, riveted & welded joints, threads and pipes. Conventional representation of metals and materials. Sectioning Conventions, removed sections and revolved sections, parts not usually sectioned, Conventions of gears, helical, leaf and torsional Springs.

UNIT II LIMITS, FITS AND TOLERANCES
Limits and tolerances, Surface Finish, Type of fits - Description, Hole basis System and Shaft basis system, calculations involving minimum and maximum clearances for given combination of tolerance grades - Simple problems, Geometric tolerances

UNIT III CAD DRAWING
Introduction to Computer Aided Drafting. Study of capabilities of software for Drafting and Modeling Coordinate systems (absolute, relative, polar, etc.) - Creation of simple figures like polygon and general multi-line figures. Drawing of a Title Block with necessary text and projection symbol.

UNIT IV 3D – MODELING
Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model. Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

UNIT V MACHINERY COMPONENT DRAWING
Drawing of complete machine components in assembly (Orthographic to isometric and isometric to Orthographic) with details like joints, couplings, bearing block and Glands etc.

TOTAL: 45 hours

REFERENCES

WEB SITES:
www.autodesk.com
www.ptc.com
www.solidworks.com
www.autodeskpress.com
PURPOSE:
The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential.

INSTRUCTIONAL OBJECTIVES
1. To guide thought process
2. Appear for placement aptitude tests confidently
3. To develop Communication skill
4. To build confidence
5. Acquire aptitude skills for employment

METHODOLOGY:
The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.
1. Group Activities + Individual activities
2. Collaborative learning
3. Interactive sessions
4. Ensure participation
5. Empirical learning

LOGICAL REASONING:
Number, Letter series, Analogies- Coding, Decoding – Blood relations, direct sense, Operator based questions – Clock & Calendars
Distribution, Binary Logic and Puzzles – Arrangements, Selections.
Routes & Networks, Comparison – Cubes & Venn Diagrams.

VERBAL ABILITY:
Critical Reasoning – Antonym, Synonym
Odd man – fill in the blank
Sentence Construction / Completion – Idiomatic expression
Detection of errors.
Jumbled sentences, Vocabulary, Alphabetical sequence, cloze passage.

EVALUATION:
1. University Theory Question paper
2. Activities assessed by both group and individual participation
3. Continuous assessment based on daily participation

SCHEME OF INSTRUCTION:
Marks allocated for regular participation in all oral activities in class.

SCHEME OF EXAMINATION:
Complete internal evaluation on regular basis.
GOAL
To create the awareness and comprehensive knowledge in numerical solutions.

OBJECTIVES
The course should enable the students to:
1) Learn the techniques of solving the algebraic and transcendental equations.
2) Learn to interpolate using Newton's forward and backward difference formulae for equal and unequal intervals
3) Understand the use of numerical differentiation and understands to find the approximate area using numerical integration.
4) Understand solving numerically the initial value problems for ordinary differential equations using single step and multi step method.
5) Learn the methods of solving second order partial differential equations numerically and use it to solve initial and boundary value problems for partial differential equations.

OUTCOME
The students should be able to:
1) Find out the roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations by direct and indirect methods.
2) Solve problems where huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.
3) Use the numerical differentiation and integration when the function in the analytical form is too complicated or the huge amounts of data are given such as series of measurements, observations or some other empirical information.
4) Solve engineering problems which are characterized in the form of nonlinear ordinary differential equations, since many physical laws are couched in terms of rate of change of one independent variable.
5) Solve the initial and boundary value problems related heat flow, both one and two dimensional and vibration problems. Understands the numerical techniques of solving the partial differential equation in engineering applications.

UNIT-I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 12(9+3)

UNIT-II INTERPOLATION AND APPROXIMATION 12(9+3)
UNIT-III NUMERICAL DIFFERENTIATION AND INTEGRATION 12 (9+3)


UNIT-IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12 (9+3)


UNIT-V BOUNDARY VALUE PROBLEMS 12 (9+3)

Finite difference solution for the second order ordinary differential equations. Finite difference solution for one dimensional heat equation by implicit and explicit methods – one dimensional wave equation and two dimensional Laplace and Poisson equations.

TOTAL: 60

TEXT BOOKS


REFERENCES

GOAL
To impart knowledge on how the laws of thermodynamics and basic concepts introduced in the Engineering Thermodynamics course are used in various advanced energy system engineering applications. The course will provide an insight to the applications of engineering thermodynamics and enable the student to solve more advanced problems.

OBJECTIVES
The course should enable the students to
1. Demonstrate the application of the laws of thermodynamics in more advanced and complex systems concentrating on power generation in steam and gas turbine plant.
2. Explain the properties of steam and the use of steam tables.
3. Introduce the properties of steam/air mixtures (psychrometry) and the principles of air conditioning and refrigeration.

OUTCOME
The students should be able to
1. Analyse various thermal processes and plant.
2. Identify information requirements and sources for analysis and evaluation
3. Synthesise information and ideas for use in the evaluation process

UNIT I STEAM AND VAPOUR POWER CYCLES
10

UNIT II STEAM NOZZLES
12

Stream Turbine Plants: General principle of Impulse and Reaction Turbines Compounding of steam turbines - Pressure and Velocity compounding, Stage efficiency, Overall efficiency and re-heat factor. Multi-Stage Turbines with regenerative and reheat cycles

UNIT III GAS POWER CYCLES
10
Carnot, Otto, Diesel, Dual cycles, difference between ideal and real cycles; Gas turbine cycles Brayton cycle; methods of improving performance - inter-cooling, reheat, heat exchangers, cycle configurations and applications. IC Engines performance and Heat balance test

UNIT IV AIR COMPRESSOR
12
Classification and working principle, work of compression with and without clearance. Volumetric efficiency, Isothermal efficiency and isentropic efficiency of reciprocating air compressors. Multistage air compressors and inter cooling - working of multistage air compressors, various types of compressors (Descriptive treatment only).

UNIT V PSYCHROMETRY
16

**Refrigeration and Air-conditioning:** Vapour Compression Refrigeration cycle - super heating, sub cooling, performance calculations. Working principle of vapour absorption system. Ammonia - water, Lithium bromide - water systems (Description only), Comparison between vapour compression and absorption systems.

**TEXT BOOKS**

2. Rogers and Mayhew, Thermodynamic and Transport Properties of Fluids, Basil Blackwell

**REFERENCES**

GOAL
Understand the basic concepts and techniques, both theoretical and experimental, with emphasis on the application of these to the solution of suitable problems in engineering. Provide a firm foundation for more advanced study.

OBJECTIVES
The course should enable the students to
1. Gain knowledge of simple stresses, strains and deformations components due to external loads.
2. Assess stresses and deformations through mathematical models of beams, twisting bars or combination of both.
3. Provide the Basic knowledge for use in the design courses.

OUTCOME
The students should be able to
1. Understand the basic principles of structural elasticity, including statically determinate and indeterminate systems, and the factors which affect their strength and stiffness.
2. Assess the strength and stiffness of simple structural components.
3. Apply the effect of stress and deformation concepts in practical applications.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS
Rigid and Deformable bodies - Strength, Stiffness and Stability - Stresses; Tensile, Compressive and Shear - Deformation of simple and compound bars under axial load - Thermal stress - Elastic constants - Strain energy and unit strain energy - Strain energy in uniaxial load.

UNIT II BEAMS - LOADS AND STRESSES
Types of beams: Supports and Loads - Shear force and Bending Moment in beams - Cantilever, Simply supported and Overhanging beams - Stresses in beams - Theory of simple bending - Stress variation along the length and in the beam section - Effect of shape of beam section on stress induced - Shear stresses in beams.

UNIT III TORSION
Analysis of torsion of circular bars - Shear stress distribution - Bars of Solid and hollow circular section - Stepped shaft - Twist and torsion stiffness - Compound shafts - Fixed and simply supported shafts - Application to close-coiled helical springs - Maximum shear stress in spring section including Wahl Factor - Deflection of Close-coil helical springs under axial loads - Design of helical coil springs - stresses in helical coil springs under torsion loads

UNIT IV BEAM DEFLECTION
Elastic curve of Neutral axis of the beam under normal loads - Evaluation of beam deflection and slope: Double integration method, Macaulay Method, and Moment-area Method -Columns - End conditions - Equivalent length of a column - Euler equation - Slenderness ratio - Rankine formula for columns

UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS
Biaxial state of stresses - Thin cylindrical and spherical shells - Deformation in thin cylindrical and spherical shells - Biaxial stresses at a point - Stresses on inclined plane - Principal planes and stresses - Mohr's circle for biaxial stresses - Maximum shear stress - Strain energy in bending and torsion.

REFERENCES

OBJECTIVE

To understand the principles of metrology and measurements, methods of measurement and its application in manufacturing industries.

UNIT I  CONCEPT OF MEASUREMENT  9


UNIT II  LINEAR AND ANGULAR MEASUREMENT  9

Definition of Metrology - Linear measuring instruments: Vernier, Micrometer, internal measurement, Slip gauges and classification, Interferometery, optical flats, limit gauges- Comparators: Mechanical, pneumatic and electrical types, applications.

Angular measurements: Sine bar, optical bevel protractor, angle Decker – Taper measurements

UNIT III  FORM MEASUREMENT  9

Measurement of screw threads-Thread gauges, floating carriage micrometer–measurement of gear-tooth thickness-constant chord and base tangent method-Gleason gear testing machine – radius measurements- surface finish, straightness, flatness and roundness measurements.

UNIT IV  LASER AND ADVANCES IN METROLOGY  9


UNIT V: MEASUREMENT OF POWER, FLOW AND TEMPERATURE RELATED PROPERTIES  9


TOTAL: 45

TEXT BOOKS


REFERENCES

GOAL
To gain experimental knowledge on the performance and operations of heat apparatus like compressors and air conditioning plant.

OBJECTIVES
The course should enable the students to
1. Understand the basic concepts and utilisation of heat for accomplishing specific work.
2. Understand the basic concepts of refrigeration and its COP.
3. Learn the basic principle of air conditioning.

OUTCOME
The students should be able to
1. Analyze the flue gases for its various parameters.
2. Analyze the performances of air conditioning and refrigeration.
3. Utilize the compressor for different applications.

LIST OF EXPERIMENTS
1. Performance characteristics of a constant speed air blower.
2. Verification of fan laws and static efficiency of air blower.
4. Performance test on A/C plant.
5. Performance test on single/two stage reciprocating air compressor.
6. Capillary optimization for a Refrigeration System.
8. Performance test on a Cooling Tower.

Total: 45

LIST OF EQUIPMENTS (for a batch of 30 students)
Air Blower
Cooling Tower
Solar Flat Plate Collector
Refrigeration unit with Capillary optimization
LPG Refrigerator
Walk-in cooler
Single/two stage reciprocating air compressor
Vapour Compression Refrigeration test rig
Vapour compression Air Conditioning test rig
LIST OF EXPERIMENTS

1. Calibration of Vernier / Micrometer / Dial Gauge
2. Checking Dimensions of part using slip gauges
3. Measurement of GearTooth Dimensions
4. Measurement of TaperAngle using sine bar / Tool Makers microscope
5. Measurement of Straightness and flatness
6. Measurement of Thread parameters
7. Checking the limits of dimensional tolerances using comparators (Mechanical / Pneumatic / Electrical)
8. Measurement of Temperature using Thermocouple / Pyrometer
9. Measurement of Displacement (Strain Gauge / LVDT / Wheatstone Bridge)
10. Measurement of Force
11. Measurement of Torque
12. Measurement of Vibration / Shock
13. Measurement of Coordinates for the given component using coordinate measuring machine

TOTAL: 45

LIST OF EQUIPMENTS
(for a batch of 30 students)

1. Micrometer - 5
2. Vernier Caliper - 5
3. Vernier Height Gauge - 2
4. Vernier Depth Gauge - 2
5. Slip Gauge Set - 1
6. GearTooth Vernier - 1
7. Sine Bar - 2
8. Bevel Protractor - 1
9. Floating Carriage Micrometer - 1
10. Profile Projector - 1
11. Mechanical / Electrical / Pneumatic Comparator
12. Temperature Measuring Setup
14. Displacement Measuring Setup
15. Force Measuring Setup
16. Torque Measuring Setup
17. Vibration / Shock Measuring
18. Coordinate Measuring Machine

OPTIONALEQUIPMENTS

19. Autocollimator
20. Coordinate Measuring Machine
21. Tool Makers Microscope
22. Dial Gauge Calibration
GOAL
To understand the properties of materials and metals and how to measure the same

OBJECTIVES
The course should enable the students to
1. Gain knowledge on different metals used in mechanical applications.
2. Understand the importance of strength of different components like springs, beams etc.
3. Understand the heat treatment process which alters the properties of materials.

OUTCOME
The students should be able to
1. Conduct experiments to find out different properties of metals and alloys
2. Compare the properties of metals before and after the heat treatment.

LIST OF EXPERIMENTS
1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
10. Tempering - Improvement Mechanical properties Comparison
   (i) Unhardened specimen
   (ii) Quenched Specimen and
   (iii) Quenched and tempered specimen.
11. Microscopic Examination of
   (i) Hardened samples and
   (ii) Hardened and tempered samples.

TOTAL : 45

LIST OF EQUIPMENTS (for a batch of 30 students)
1. Universal Tensile Testing machine with double shear attachment - 40 Ton Capacity - 1 No
2. Torsion Testing Machine (60 NM Capacity) - 1 No
3. Impact Testing Machine (300 J Capacity) - 1 No
4. Brinell Hardness Testing Machine - 1 No
5. Rockwell Hardness Testing Machine - 1 No
6. Spring Testing Machine for tensile and compressive loads (2500 N) - 1 No
7. Metallurgical Microscopes - 3 Nos
8. Muffle Furnace (800°C) - 1 No
PURPOSE:
The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential.

INSTRUCTIONAL OBJECTIVES
1. To guide thought process
2. Appear for placement aptitude tests confidently
3. To develop Communication skill
4. To build confidence
5. Acquire aptitude skills for employment

METHODOLOGY:
The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.
1. Group Activities + Individual activities
2. Collaborative learning
3. Interactive sessions
4. Ensure participation
5. Empirical learning

QUANTITATIVE APTITUDE:
Sample Equation, Ratio, Proportion, Variation
Percentage, Profit & Loss, Partnership
Averages, Mixtures, Allegations: Simple & Compound Interest
Time Work, Time Distance
Geometry & Mensuration
Permutation, Combination & Probability
Data Interpretation & Data Sufficiency

Analytical reasoning:
Non- Verbal Reasoning
Word problem

EVALUATION:
1. Activities assessed by both group and individual participation
2. Continuous assessment based on daily participation

SCHEME OF INSTRUCTION:
Marks allocated for regular participation in all oral activities in class.

SCHEME OF EXAMINATION:
Complete internal evaluation on regular basis.
OBJECTIVE
To expose the students the different mechanisms, their method of working, Forces involved and consequent vibration during working

OUTCOMES:
Upon completion of this course, the students can able to apply fundamentals of mechanism for the design of new mechanisms and analyse them for optimum design.

UNIT I KINEMATICS OF LINKAGE MECHANISMS

UNIT II FRICTION
Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches –Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension– Condition for maximum power transmission – Open and crossed belt drive.

UNIT III GEARING AND CAMS
Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains:Simple, compound gear trains and epicyclic gear trains - Determination of speed and torque - Cams – Types of cams – Design of profiles – Knife edged, flat faced and rollerended followers with and without offsets for various types of follower motions

UNIT IV BALANCING
Static and dynamic balancing – Single and several masses in different planes –Balancingof reciprocating masses- primary balancing and concepts of secondary balancing – Single and multi cylinder engines (Inline) – Balancing of radial V engine – direct and reversecrank method

UNIT V VIBRATION

TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES
GOAL

To expose the students in

1. The various steps involved in the Design Process
2. Understanding the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
3. Learning to use standard practices and standard data learning to use catalogues and standard machine components

OBJECTIVES

The course should enable the students to:

1. Apply engineering analysis principles and methods to the proper analysis of a variety of common mechanical system components.
2. Design these mechanical system components so as to perform safely their intended functions in harmony with other components of the system.
3. Use information resources to identify appropriate and elegant component solutions for mechanical system design problems, locate sources for these components, and understand the analysis and design methods for these components.
4. Confirm with the right codes and standards
5. Work in teams to analyze and design various types of brakes and clutches and present their designs orally and in writing.
6. Identify the characteristics of their designs that have safety and environmental impact.

OUTCOME

The students should be able to:

1. Analyze and design power screws with respect to torque requirements, overhauling, and column buckling.
2. Analyze and design bolted connections with respect to static and dynamic axial loads.
3. Analyze and design bolted riveted, pinned, welded, brazed, soldered, and glued joints with respect to static and dynamic shear and bending loads.
4. Analyze and design full cylindrical hydrodynamic bearings using design charts and custom software.
5. Compute equivalent radial loads for rolling contact bearings and select appropriate bearings for the application using printed and electronic catalogue data.
6. Analyze and design spur gears with respect to tooth bending strength and surface strength specifications and apply three different theories to the design of shafts subject to combined static and dynamic loads.

UNIT 1 INTRODUCTION TO THE DESIGN PROCESS

Factor influencing machine design, selection of materials based on mechanical properties - Direct, Bending and torsion stress equations - Impact and shock loading - calculation of principle stresses for various load
combinations, eccentric loading - Design of curved beams - crane hook and 'C' frame  Factor of safety - theories of failure - stress concentration - fatigue strength and the S-N diagram -  
Soderberg, Goodman and Gerber relations

UNIT II DESIGN OF SHAFTS AND COUPLINGS

Design of solid and hollow shafts based on strength, rigidity and critical speed - Design of keys and key ways - Design of rigid and flexible couplings - Introduction to gear and shock absorbing couplings - design of knuckle joints.

UNIT III DESIGN OF FASTENERS AND WELDED JOINTS

Threaded fasteners - Design of bolted joints including eccentric loading - Design of welded joints for pressure vessels and structures - theory of bonded joints.

UNIT IV DESIGN OF SPRINGS AND LEVERS

Design of helical, leaf, disc and torsion springs under constant loads and varying loads - Concentric torsion springs - Belleville springs - Design of Levers.

UNIT V DESIGN OF BEARINGS AND FLYWHEELS

Design of bearings - sliding contact and rolling contact types. - Cubic mean load - Design of journal bearings - McKee's equation - Lubrication in journal bearings - calculation of bearing dimensions Design of flywheels involving stresses in rim and arm.

TOTAL : 60

Note: (Use of Design Data Book is permitted in the University examination)

TEXT BOOKS

REFERENCES
OBJECTIVE

To understand the interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical and Electronic Systems.

UNIT I  MECHATRONICS, SENSORS AND TRANSDUCERS  9


UNIT II  PNEUMATICS AND ACTUATION SYSTEMS  9

Pneumatic Components: Air supply unit and distribution unit, Control Valves, Linear and rotary actuators – applications - Speed control circuits, synchronizing circuit, Electro Pneumatic circuits, Pneumatic and Electro Pneumatic Sequential circuit design for simple applications using cascade method.


UNIT III  SYSTEM MODELS AND CONTROLLERS  9


UNIT IV  PROGRAMMING LOGIC CONTROLLERS  9


– Data Handling – Analogs Input / Output – Selection of a PLC Problem.

UNIT V  DESIGN OF MECHATRONICS SYSTEM  9

Stages in designing Mechatronics Systems – Traditional and Mechatronic Design Possible Design Solutions


TOTAL: 45

TEXT BOOK


REFERENCES

OBJECTIVES

1. This course will enable the student to gain knowledge on how computers are integrated at various levels of design and manufacture.
2. Computer graphics in 2D and 3D drafting and Concepts of geometrical modeling
3. CAD Packages and its features.
4. To understand the flexible manufacturing system and to handle the product data and various software used for manufacturing. Implementation in CAD and CAM.

OUTCOMES

1. Understand the concept of computer graphics and CAD
2. Understand the concept of numerical control and manufacturing
3. Understand Graphic Standards and data exchange
4. Can develop CNC programs
5. Can implement of CAD and CAM on real time applications

UNIT I – DESIGN AND GEOMETRIC MODELING


UNIT II – CONCEPTS OF COMPUTER GRAPHICS


UNIT III – SOFTWARE PACKAGES AND LATEST TECHNOLOGY


UNIT IV – COMPUTER AIDED MANUFACTURING


UNIT V – IMPLEMENTATION OF CAD AND CAM

Implementation of CAD in - CAM - CIM - RPT, kinematic analysis, Manufacturability analysis, simulation and Animation – Types – Techniques.

TOTAL: 45 HOURS
TEXT BOOK

REFERENCES

WEB REFERENCES:
1.  www.cadcamnet.com
2.  www.cc.utah.edu/~asn8200/rapid.html
GOAL
To expose the students about the static and dynamic behavior of the machines

OBJECTIVES
The course should enable the students to:
1. Understand the use of various measurement methods
2. Verify the laws governing the dynamics of machines
3. Do the case studies on the field of Vibration

OUTCOMES
The students should be able to:
1. Develop the concept of various measurement methods
2. Know about the laws governing the dynamics of machines such as Balancing of Rotating and Reciprocating Mass, Jump phenomenon in Cams, Sensitivity effort in Governors Etc.,
3. Know about different types of vibrations and its applications.

LIST OF EXPERIMENTS
1. Governors - Determination of sensitivity, effort, etc. for Watt, Porter, Proell, Hartnell governors
2. Cam - Study of jump phenomenon and drawing profile of the cam.
5. Balancing of reciprocating masses.
8. Vibrating system - Spring mass system-Determination of damping co-efficient of single degree of freedom system.
10. Determination of transmissibility ratio - vibrating table.
11. Determination of torsional frequencies for compound pendulum and flywheel system with jumped Moment of inertia.
12. Transverse vibration -free- Beam. Determination of natural frequency and deflection of beam

TOTAL : 45

LIST OF EQUIPMENTS (for a batch of 30 students)
1. Cam analyzer.
2. Motorised gyroscope.
5. Dynamic balancing machine.
6. Static and dynamic balancing machine.
7. Vibrating table
8. Vibration test facilities apparatus
LIST OF EXPERIMENTS

1. Design and testing of pneumatic circuits for different applications
2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software.
4. Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
5. Servo controller interfacing for open loop
6. Servo controller interfacing for closed loop
8. Stepper motor interfacing with 8051 Micro controller
   (ii)full step resolution (ii) half step resolution
9. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using LAB VIEW
10. Computerized datalogging system with control for process variables like pressure, flow and temperature.

TOTAL: 45

LIST OF EQUIPMENTS
(for a batch of 30 students)

1. Basic Pneumatic Trainer Kit with manual and electrical controls - 1 each
2. Basic Pneumatic Trainer Kit with PLC control - 1 No.
3. HYDROSIM & PNEUMOSIM Software / Automation - 10 sets.
4. 8051 - Microcontroller kit with stepper motor and drive - 2 sets
5. LABVIEW software - 2 sets
6. LAB VIEW software with Sensors to measure Pressure, Flow rate, direction, speed, velocity and force.
7. - 2 sets
MEB333 CAD/CAM LAB

OBJECTIVE
1. To understand and practice the drawings for machine components and simple assemblies using standard CAD packages
2. To know – how on specifications of Indian Standards on drawing practices and standard components.

OUTCOMES
1. Can prepare solid model and assemble any mechanical component using CAD software
2. Can develop CNC program for any component for real time machining using CAD/CAM software

A) COMPUTER AIDED DESIGN (CAD) 30

1. DRAWING STANDARDS
   Code of practice for technical Drawing, BIS specifications – Welding symbols, riveted joints, keys, and fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc.

2. INTRODUCTION TO GRAPHIC SOFTWARE FOR DESIGN
   Drawing, Editing, Dimensioning, Plotting Commands, Layering concepts, Limits, Fits and Tolerances incorporated in design and drawing.

3. PREPARATION OF SOLID MODELS AND ASSEMBLY
   Screw Jack
   Plummer block
   Tailstock of Lathe
   Machine vice
   Stuffing box
   Stop valve
   Piston and connecting rod

B) COMPUTER AIDED MANUFACTURING (CAM) 15

1. MANUAL PART PROGRAMMING (Using G and M Codes) in CNC lathe
   1.1 Part programming for Linear and Circular interpolation, Chamfering and Grooving
   1.2 Part programming using standard canned cycles for Turning, Facing, Taper turning and Thread cutting

2. MANUAL PART PROGRAMMING (using G and M codes) in CNC milling
   2.1 Part programming for Linear and Circular interpolation and Contour motions.
   2.2 Part programming involving canned cycles for Drilling, Peck drilling, and Boring.

3. SIMULATION AND NC CODE GENERATION
   NC code generation using CAD/CAM software – Pos processing for standard CNC Controls like FANUC, Hiedenhain etc.
I. HARDWARES

LIST OF EQUIPMENT FOR CAD/CAM LAB (for a batch of 30 students)

1. Computer server
2. Computer nodes or systems (Intel i3 or higher with 2GB or higher RAM) networked to the server
3. Plotter
4. Laser Printer
5. Trainer CNC lathe
6. Trainer CNC milling

II. SOFTWARES

1. CAD/CAM Software
   (Pro-E or IDEAS or Unigraphics or CATIA or Solidworks)
2. CAM Software
   (CNC programming and tool path simulation for FANUC, Sinumeric
and Heiden controller)

TOTAL: 45 HOURS

REFERENCES

5. “Collab CAD Software”, National Informatics Centre (CAD Group), Govt. of India, A-Block, C.G.O. Complex, Lodhi Road, New Delhi, 2003

WEBSITES

www.collabcad.com
www.autodesk.com
www.ptc.com
www.solidworks.com
www.autodeskpress.com
PURPOSE
The purpose of this course is to build confidence and inculcate various soft skills and to help Students to identify and achieve their personal potential.

INSTRUCTIONAL OBJECTIVES
At the end of the course the students will be able to
1. Acquire the important soft skills for employment
2. Take part in group discussions and job interviews confidently
3. Gain self confidence to face the placement process.

METHODOLOGY
The entire program is designed in such a way that every student will participate in the class room activities. The activities are planned to bring out the skills and talents of the students which they will be employing during various occasions in their real life.

1. Group activities + individual activities.
2. Collaborative learning.
3. Interactive sessions.
4. Ensure Participation.

- Resume writing
- SWOT Analysis
- Interview techniques
- Presentation Skills
- Body Language for Interview
- Rules of Group Discussion
- FAQ’s

EVALUATION
1. Activities assessed by both group and individual participation
2. Continuous assessment based on daily participation

SCHEME OF INSTRUCTION
Marks allocated for regular participation in all oral activities in class.

SCHEME OF EXAMINATION
Complete internal evaluation on a regular Basis.
GOAL
A basic understanding of compressible fluid flow and its importance in industrial Gas Dynamics.

OBJECTIVES
The course should enable the students to:

1. Provide awareness and emphasis on the importance of flow physics that mechanical engineers are likely to encounter in the range of science and industry careers they follow.
2. Understand compressible fluid flow.
3. Learn the computational models of fluid flow.
4. Create an awareness of turbulent flow and its significance in industry.

OUTCOME
The students should be able to:

1. Solve simple one-dimensional flow problems by making appropriate assumptions and by applying sensible boundary conditions.
2. Solve simple problems in one-dimensional isentropic and non-entropic flow.
3. Qualitatively appreciate the complexity of turbulence and the need for computational models for turbulent flow.
4. Assess flow contexts, be aware of the types of behavior that may occur, and know where to seek further information to predict behavior.

UNIT I COMpressible Flow - Fundamentals
Energy and momentum equations for compressible fluid flows, various regions of flows, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, types of waves, Mach cone, Mach angle, effect of Mach number on compressibility.

UNIT II Flow Through Variable Area Ducts
Isentropic flow through variable area ducts, T-s and h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles.

UNIT III Flow Through Constant Area Ducts
Flow in constant area ducts with friction (Fanno flow) - Fanno curves and Fanno flow equation, variation of flow properties, variation of Mach number with duct length.

Isothermal flow with friction in constant area ducts

Flow in constant area ducts with heat transfer (Rayleigh flow), Rayleigh line and Rayleigh flow equation, variation of flow properties, maximum heat transfer.

UNIT IV Normal Shock
Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl - Meyer equation, impossibility of shock in subsonic
flows, flow in convergent and divergent nozzle with shock, normal shock in Fanno and Rayleigh flows, flow with oblique shock (elementary treatment only).

UNIT V JET PROPULSION

Aircraft propulsion, types of jet engines, energy flow through jet engines, study of turbojet engine components - diffuser, compressor, combustion chamber, turbine and exhaust systems, performance of turbojet engines, thrust, thrust power, propulsive and overall efficiencies, thrust augmentation in turbojet engine, ram jet and pulse jet engines, Rocket propulsion, rocket engines thrust equation, effective jet velocity specific impulse, rocket engine performance, solid and liquid propellants, comparison of different propulsive systems.

TOTAL : 60

TEXT BOOKS


REFERENCES

MEB305 DESIGN OF TRANSMISSION SYSTEM

L  T  P  C
3  1  0  4

GOAL
To expose the students on the principles and procedure for the design of power Transmission components

OBJECTIVES
The course should enable the students to:

1. Learn the principles and procedure for the design of power Transmission components.
2. Understand the standard procedure available for Design of Transmission Systems using standard data and catalogues
3. Calculate the force on the tooth.

OUTCOME
The students should be able to:

1. Select the Belts, Pulleys, Wire ropes, Transmission Chains and Sprockets for different applications.
2. Design Pulleys and Sprockets.
3. Know about Gear Terminology and various types of Gears and its applications.
4. Design Gear Boxes, Cam and Clutches.

UNIT I DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS
Selection of V belts and pulleys - selection of Flat belts and pulleys - Wire ropes and pulleys Selection of Transmission chains and Sprockets. Design of pulleys and sprockets.

UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS
Gear Terminology-Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects - Fatigue strength - Factor of safety - Gear materials - Module and Face width-power rating calculations based on strength and Darabiling considerations - Parallel axis Helical Gears - Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces and stresses. Estimating the size of the helical gears.

UNIT III BEVEL, WORM AND CROSS HELICAL GEARS
Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears.
Worm Gear: Merits and demerits- terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair.
Crossed helical gear: Terminology - helix angles - Estimating the size of the pair of cross helical gears.

UNIT IV DESIGN OF GEAR BOXES
Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Constant mesh gear box. - Design of multi speed gear box.

UNIT V DESIGN OF CAM, CLUTCHES AND BRAKES
**Cam Design:** Types-pressure angle and under cutting base circle determination-forces and surface contain stresses.

Design of plate clutches -axial clutches-cone clutches-internal expanding rim clutches-internal and external shoe brakes.

**TEXT BOOKS**


**REFERENCES**

6. Gear Design - Darle Dudley

**STANDARDS - IS 4460**

1. Parts 1 to 3:1995, Gears - Spur and Helical Gears - Calculation of Load Capacity.
2. I S 7443 : 2002, Methods of Load Rating of Worm Gears
GOAL
The goal of the programme is to provide a theoretical input towards nurturing accomplished learners who can function effectively in the English language skills; to cultivate in them the ability to indulge in rational thinking, independent decision-making and lifelong learning; to help them become responsible members or leaders of the society in and around their work/living space; to communicate successfully at the individual or group level on multi-disciplinary activities in particular with the community, and in general with the world at large.

OBJECTIVES
The course is expected to enable students to:

1. To widen the capacity of the learners to listen to English language at the basic level and understand its meaning.
2. To enable learners to communicate in an intelligible English accent and pronunciation.
3. To assist the learners in reading and grasping a passage in English.
4. To learn the art of writing simple English with correct spelling, grammar and punctuation.

To cultivate the ability of the learners to think and indulge in divergent and lateral thoughts.

OUTCOME
On completion of the course, the students will be able to:

1. The learners will have the self-confidence to improve upon their informative listening skills by an enhanced acquisition of the English language.
2. The learners will be able to speak English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.
3. The learners will be able to read, comprehend and answer questions based on literary, scientific and technological texts.
4. The learners will be able to write instructions, recommendations, checklists, process-description, letter-writing and report writing.
5. The learners will have the confidence to develop thinking skills and participate in brainstorming, mind-mapping, audiovisual activities, creative thinking and also answer tests in the job-selection processes.

UNIT I

Values and attitudes - Value-formation - Values & education - Terminal & Instrumental values - Civic responsibilities - The power of Personal/ Cultural/ Social values -- Behaviour and attitudes -- Features of attitudes - Developing positive attitude - Overcoming negative attitude -- People skills - Soft skills as per the Work Force Profile - The four temperaments - Sanguine - Choleric - Melancholic - Phlegmatic -- Tests for Personal Chemistry.

UNIT II

What is personality development? - Types of personalities as per (i) Heredity (ii) Environment (iii) Situation - the 16 personality factors - MBTI Tests - Personality types - Increasing self awareness: Assessing one's locus of control, Machiavellianism, self-esteem, self-monitoring, risk-taking, Type A, Type B personality elements - Intellectual and physical abilities for jobs -- Personality tests.
UNIT III


UNIT IV

Team work - Team building - Team leadership -- How to face an interview? -- How to participate in a group discussion? - How to argue for or against in a debate? - Body language - non-verbal communication - personal appearance - facial expression - posture - gestures - eye contact - Etiquette - Voluntary and involuntary body language -Gender implications -- Tests.

UNIT V


Online examination / Oral Presentations/Debates/Group Discussions

Study material will be prepared by the Department of Languages.

Tests suggested will be prepared by a senior faculty of the department.

Movies will be screened to discuss and debate on the topics introduced in each unit.

Laboratory Requirements:
Computers as a Server for Labs (with High Configuration), Headphones with Mic, Speakers with Amplifiers, Wireless Mic and Collar Mic.

TOTAL : 60

REFERENCES


Study material will be prepared by the Department of Languages.

Tests suggested will be prepared by a senior faculty of the department.

Movies will be screened to discuss and debate on the topics introduced in each unit.

Laboratory Requirements:
MEB334 DESIGN PROJECT

GOAL
To design and fabricate a device/machine/equipment and demonstrate its working

OBJECTIVES
The course should enable the students to:

1. Provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.

OUTCOMES
The students should be able to:

1. Complete understanding of making a product is achieved
2. Knowledge on preparing a technical report is gained

NOTES
• The students in convenient groups of not more than 4 members have to take one small item for design and fabrication. Every project work shall have a guide who is the member of the faculty of the institution.
• The item chosen may be small machine elements (Example-screw jack, coupling, machine vice, cam and follower, governor etc), attachment to machine tools, tooling (jigs, fixtures etc), small gear box, automotive appliances, agricultural implements, simple heat exchangers, small pumps, hydraulic/pneumatic devices etc.
• The students are required to design and fabricate the chosen item and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts relating to fabrication.
GOAL
To impart experimental knowledge on the performance and operations of I.C. Engines and steam generators

OBJECTIVES
The course should enable the students to:
1. Learn about IC engines, lubricants and fuels
2. Understand the Various dynamometers used for testing IC engines,
3. Learn Operating boilers and understand the turbines and power generation

OUTCOME
The students should be able to:
1. Conduct experiments on fuels and lubricants.
2. Analyze the performance of diesel and petrol engines used in automobiles.
3. Analyse energy transformation in steam turbines and boilers

LIST OF EXPERIMENTS
2. Performance Test on 4-stroke Diesel Engine.
3. Heat Balance Test on 4-stroke Diesel Engine.
4. Morse Test on Multicylinder Petrol Engine.
5. Retardation Test to find Frictional Power of a Diesel Engine.
7. Determination of Flash Point and Fire Point.
8. Dryness fraction of steam using calorimeters.
11. Analysis of Exhaust gas of an IC Engine
12. Combustion analysis of CI Engine
13. Flow Visualization using wind tunnel

LIST OF EQUIPMENTS (For a batch of 30 students)
23. I.C Engine - 2 stroke and 4 stroke model
24. Red Wood Viscometer
25. Apparatus for Flash and Fire Point
26. 4-stroke Diesel Engine with mechanical loading.
27. 4-stroke Diesel Engine with hydraulic loading.
28. 4-stroke Diesel Engine with electrical loading.
29. Multi-cylinder Petrol Engine
30. Low speed wind tunnel with flow visualization set up
31. Single cylinder Petrol Engine

TOTAL : 45
32. Combustion analysis setup for CI Engine
33. Emission analyser
34. Data Acquisition system with any one of the above engines –
35. Steam Boiler with turbine and calorimeter setup
GOAL
The course is intended to build up necessary background for understanding the physical behaviour of various modes of heat transfer like conduction, convection and radiation.

OBJECTIVES
The course should enable the students to:
1. Learn the physical behaviour of various modes of heat transfer like conduction, convection and radiation.
2. Know the application of various experimental heat transfer correlations in engineering calculations.
3. Understand the thermal analysis and sizing of heat exchangers.
4. Understand the concepts of Radiation Heat Transfer.
5. Learn the concepts of boundary layer and its importance in convection phenomenon.

OUTCOME
The students should be able to:
1. Understand the difference between various modes of Heat Transfer.
2. Learn the Thermal Resistance Concept used in Heat Conduction.
3. Use the basic methods in Conduction and Understand the concepts of transient conduction heat transfer and its applications.
4. Learn to apply various correlations used in Convective Heat Transfer.

UNIT I CONDUCTION

UNIT II CONVECTION

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS
UNIT IV  RADIATION  

UNIT V  MASS TRANSFER  

TOTAL: 60

TEXT BOOKS

REFERENCES
GOAL
To train the students in the principles involved in discretisation and finite element approach.

OBJECTIVES
The course should enable the students to:
1. Learn the principles involved in discretization and finite element approach
2. Form stiffness matrices and force vectors for simple elements
3. Find the various approach followed in Finite Element approach.
4. Use the various elements for discretisation.
5. Learn about shape functions.

OUTCOME
The students should be able to:
1. Know about discretion techniques, matrix algebra.
2. Learn about the Classical techniques in Finite Element Method.
3. Learn about various elements and when to choose them.
4. Form the stiffness matrix and solve them.
5. Do stress calculation for the components used in the Industries using the software.

UNIT I INTRODUCTION 12
Historical background - Matrix approach - Application to the continuum - Discretisation - Matrix algebra - Gaussian elimination - Governing equations for continuum - Classical Techniques in FEM Weighted residual method - Ritz method

UNIT II ONE DIMENSIONAL PROBLEMS 12
Finite element modeling - Coordinates and shape functions- Potential energy approach - Galarkin approach - Assembly of stiffness matrix and load vector - Finite element equations - Quadratic shape functions - Applications to plane trusses

UNIT III TWO DIMENSIONAL CONTINUUM 12

UNIT IV AXISYMMETRIC CONTINUUM 12
Axisymmetric formulation - Element stiffness matrix and force vector - Galarkin approach - Body forces and temperature effects - Stress calculations - Boundary conditions - Applications to cylinders under internal or external pressures - Rotating discs
UNIT V ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL CONTINUUM 12

The four node quadrilateral - Shape functions - Element stiffness matrix and force vector Numerical integration - Stiffness integration - Stress calculations - Four node quadrilateral for axisymmetric problems.

TOTAL : 60

TEXT BOOKS

REFERENCES
MEB403- ROBOTICS AND AUTOMATION

UNIT I   FUNDAMENTALS OF ROBOTS

UNIT II   GRIPPERS AND SENSORS

UNIT III FUNDAMENTALS OF CNC MACHINES

UNIT IV CONTROL SYSTEMS, FEED BACK DEVICES AND TOOLING
Description of a simple CNC control system. Interpolation systems. Features available in a CNC system – introduction to some widely used CNC control systems.
Qualified and pre-set tooling – Principles of location – Principles of clamping – Work holding devices

UNIT V   APPLICATIONS OF PLC
Timer Instructions On Delay, Off Delay And Retentive Timers, Up Counter, Down Counter And Up Down Counters, Control Instructions – Data Manipulating Instructions, Match Instructions: Applications of PLC – Simple materials handling applications, Automatic control of warehouse door, Automatic lubrication of supplier Conveyor belt, motor control, Bottle label detection and process control application.
GOAL

To understand the fundamental modes of heat transfer by doing experiments in various heat transfer equipment, observing data and analyzing the results.

OBJECTIVES

The course should enable the students to:

1. Conduct experiments on various heat transfer modes like conduction, convection and radiation
2. Acquire practical knowledge on working principles of heat exchanger, conduction, convection and radiation heat transfer apparatus.

OUTCOME

The students should be able to:

1. Understand the fundamentals of conduction and convection and radiation through experiments.
2. Minimize the heat loss by effective transfer.

LIST OF EXPERIMENTS

HEAT TRANSFER

1. Thermal conductivity measurement by guarded plate method
2. Thermal conductivity of pipe insulation using lagged pipe apparatus
3. Natural convection heat transfer from a vertical cylinder
4. Forced convection inside tube

Heat transfer from pin-fin (natural & forced convection modes)
5. Determination of Stefan-Boltzmann constant
6. Determination of emissivity of a grey surface
7. Thermal Conductivity measurement in Composite Wall Apparatus
8. Effectiveness of Parallel/counter flow heat exchanger
9. Determination of overall Heat transfer coefficient and effectiveness of a Shell and tube Heat Exchanger

TOTAL : 45

LIST OF EQUIPMENTS (for a batch of 30 students)

1. Guarded plate apparatus - 1 No.
2. Lagged pipe apparatus - 1 No.
3. Natural convection-vertical cylinder - 1 No.
## Apparatus

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>Forced convection inside tube apparatus</td>
<td>- 1 No.</td>
</tr>
<tr>
<td>5.</td>
<td>Pin-fin apparatus</td>
<td>- 1 No.</td>
</tr>
<tr>
<td>7.</td>
<td>Emissivity measurement apparatus</td>
<td>- 1 No.</td>
</tr>
<tr>
<td></td>
<td>Parallel/counter flow heat exchanger</td>
<td>- 1 No.</td>
</tr>
<tr>
<td>10.</td>
<td>Shell and tube Heat Exchanger</td>
<td>- 1 No.</td>
</tr>
</tbody>
</table>
GOAL
To expose the students about the kinematics, control and programming of robots

OBJECTIVES
The course should enable the students to:

1. Learn about different types of robots
2. Learn about different types of links and joints used in robots
3. Understanding about Robots and Programming
   Learn the applications of PLC for different control applications

OUTCOME
The students should be able to:

1. Know about different types of robots and their applications
2. Know about different types of kinematics and select a suitable robot for a specific application.
3. Do basic programming in Robots
4. Use PLC for different control application

LIST OF EXPERIMENTS
1. Study of different types of robots based on configuration and application.
2. Study of different type of links and joints used in robots
3. Study of components of robots with drive system and end effectors.
4. Programming of Industrial Robot for Material Handling Applications
5. Programming of Industrial Robot for Processing Applications
6. PLC for servo motor control and Induction Motor control
7. PLC for control applications like pneumatics, temperature force strain etc.

LIST OF EQUIPMENT
(For a batch of 30 students)

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of the Equipment/components</th>
<th>No. of Items</th>
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<tbody>
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<tr>
<td></td>
<td>Description</td>
<td>Quantity</td>
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</tr>
<tr>
<td>1</td>
<td>Any one type of robot configuration with at least five degrees of freedom.</td>
<td>1 set</td>
</tr>
<tr>
<td>2</td>
<td>Robot programming software inclusive of computer system.</td>
<td>15 licenses</td>
</tr>
<tr>
<td>3</td>
<td>Models of different types of end effectors drive systems.</td>
<td>5 each</td>
</tr>
<tr>
<td>4</td>
<td>Links and Joints.</td>
<td>5 each</td>
</tr>
<tr>
<td>5</td>
<td>Models of different configuration robots.</td>
<td>5 each</td>
</tr>
<tr>
<td>6</td>
<td>Instruments for measuring accuracy.</td>
<td>1 set</td>
</tr>
<tr>
<td></td>
<td>PLC Automation work bench</td>
<td>1 set</td>
</tr>
</tbody>
</table>
GOAL
To make students understand and learn about the simulation and analysis software and the solving techniques of various engineering problems

OBJECTIVES
The course should enable the students to:

1. Learn any Analysis Software
2. Solve techniques of various engineering problems

OUTCOME
The students should be able to:

1. Use any analysis software for solving various problems
2. Have a good grip on analysis of the models modelled in any of the modelling software.

LIST OF EXPERIMENTS

A. Simulation 15
1. Simulation of Air conditioning system with condenser temperature and evaporator temperatures as input to get COP using C/MAT Lab.
2. Simulation of Hydraulic / Pneumatic cylinder using C / MAT Lab.
3. Simulation of cam and follower mechanism using C / MAT Lab.

Analysis (Simple Treatment only) 30
1. Stress analysis of a plate with a circular hole.
2. Stress analysis of rectangular L bracket
3. Stress analysis of an axi-symmetric component
4. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
5. Mode frequency analysis of a 2D component
6. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
7. Harmonic analysis of a 2D component
8. Thermal stress analysis of a 2D component
9. Conductive heat transfer analysis of a 2D component
10. Convective heat transfer analysis of a 2D component

TOTAL : 45

LIST OF EQUIPMENTS (for a batch of 30 students)

- Computer System-30 Nos
- 17 " TEF Color Monitor
- Intel Core i5/i7 processor
- 500 GB HDD
- GB Graphics accelerator
- GB RAM
- Color Desk Jet Printer-1 No
- **Software**
- ANSYS Version 7 or latest-licenses
- C / MATLAB-licenses
GOAL
To make the students innovative and skilled in design and fabrication work, also to improve the conceptual knowledge of the students.

OBJECTIVES
The course should enable the students to:

1. Provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.
2. Make the students come up with new ideas in their area of interest.
3. Create interest in engineering by making them to fabricate the concept of their imagination.
4. Learn the concepts more in depth by providing guidance.
5. Enhance the knowledge and understanding of the subjects thoroughly.
6. Analyse with reasoning the various concepts involved in mechanical engineering.

OUTCOME
The students should be able to:

1. Do experiment with his ideas.
2. Troubleshoot practical problems.
3. Understand the latest trends in fabrication
4. Relate their ideas with industrial applications
5. Have adequate knowledge and conceptual skills
6. Have confidence in facing interviews and written exams
7. Qualify in competitive exams

NOTE
1. The students in convenient groups of not more than 4 members have to take one small item for design and fabrication. Every project work shall have a guide who is the member of the faculty of the institution.

2. Students will be exposed to lecture modules on Project and Thesis work followed by assignment of individual projects involving manufacturing/production/design of an engineering product. An Industrial project may also be undertaken by the student to be supervised jointly by Industry personnel and the teacher.

A student will have to appear for a Comprehensive Viva-Voce examination covering all the subjects before a board of examiners including an external expert.
GOAL
To impart basic knowledge on the significance of environmental science for engineers.

OBJECTIVES

- To make the students aware of the existing natural resources such as forest water resources etc. and to educate them to understand the need for preserving the resources.
- To educate the students about the functions of various ecosystems and biodiversity.
- To provide knowledge on the various aspects of different types of pollution such as air pollution, water pollution, soil pollution etc.
- To give a basic knowledge on the social issues such as global warming, acid rain, ozone layer depletion, nuclear hazards etc. and to educate them about the various Environmental Protection Acts and ill effects of fireworks.
- To create an awareness among the present generation about the various aspects of human population and their effect on environment.

OUTCOME

- The students would have understood the effects of over exploitation of water resources, forest resources etc. and their impact on day to day life on earth.
- Knowledge on the functions of several of ecosystems will help the students to design the processes that are eco-friendly.
- Knowledge on the different types of pollution will help the young minds to device effective control measures to reduce rate of pollution.
- Exposure on the issues such as global warming, acid rain, ozone layer depletion, nuclear hazards and ill effects of fireworks will make the students understand the significances of sustainable development and the need to enforce Environmental Acts.
- Educating on the various aspects of population explosion will create an awareness on population control for effective utilization of the resources and the need to explore new alternate energy resources for a healthy environment.

INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES

Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

ECOSYSTEMS AND BIODIVERSITY

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland
ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) –

Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

ENVIRONMENTAL POLLUTION

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

Ill effects of fireworks and upkeep of clean environment: Chemical contents of fireworks- and health hazards-Soil pollution, water pollution, air pollution and noise pollution.

Field Study of local polluted site – Urban / Rural / Industrial / Agricultural

SOCIAL ISSUES AND THE ENVIRONMENT


HUMAN POPULATION AND THE ENVIRONMENT


TOTAL: 45

TEXT BOOKS


REFERENCES

GOAL
To develop the student's Skills and make Innovation in design and fabrication work from the theoretical and practical skill acquired from the previous semesters.

OBJECTIVES
The course should enable the students to:

1. Learn the objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.
2. Make the students come up with new ideas in his area of interest.
3. Learn the concepts more in depth by providing guidance.

OUTCOME
The students should be able to:

1. Get an idea and confidence in designing, analysing and executing the project.
2. Develop knowledge of latest trends in fabrication has developed and Relate their ideas with industrial applications
3. Have complete understanding of making a product.

NOTE:
The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

Each student will be assigned any one of the following types of project/thesis work:

(a) Industrial case study
(b) Preparation of a feasibility report (c) Thesis by experimental research, and
(d) Design and development of equipment.

Each report must contain student's own analysis or design presented in the approved format.

Sessional marks will include

(a) Evaluation of the student's progress, (b) Degree of involvement and participation, (c) Merit of the project.

A student will have to defend his project/thesis and credit will be given on the merit of viva-voce examination.
PROFESSIONAL ELECTIVE COURSES - PE

MEC351 COMPOSITE MATERIALS & STRUCTURES

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<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

GOAL
To expose the students to various composites available and their manufacturing methods.

OBJECTIVES
The course should enable the students to:
1. Introduce different types of composite materials, their properties and applications.
2. Understand the advantages of Composite materials over conventional materials.

OUTCOME
The students should be able to:
1. Know about the properties, classification and applications of composites in the Industries.
2. Understand the Manufacture of composites.

UNIT I    INTRODUCTION TO COMPOSITES
Fundamentals of composites - need for composites - Enhancement of properties - classification of composites - Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) - Reinforcement - Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites.

UNIT II POLYMER MATRIX COMPOSITES

UNIT III METAL MATRIX COMPOSITES

UNIT IV CERAMIC MATRIX COMPOSITES

UNIT V    ADVANCES IN COMPOSITES

TOTAL : 45
TEXT BOOKS

REFERENCES
GOAL
To impart knowledge on Non Destructive Testing procedures

OBJECTIVES
The course should enable the students to:

1. Understand principle behind various NDT techniques and study about NDT equipments and accessories.
2. Learn working procedures of various NDT techniques
3. Learn materials that could be inspected – codes, standards, specifications.

OUTCOMES
The students should be able to:

1. Know about NDT equipments and accessories.
2. Develop the NDT techniques in practical applications.

Compare and select of various NDT techniques based on the applications

UNIT I NON-DESTRUCTIVE TESTING: AN INTRODUCTION
Introduction to various non destructive methods- Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications.

UNIT II LIQUID PENETRANT TESTING, MAGNETIC PARTICLE TESTING
Physical principles, procedure for penetrant testing,
Penetrant Testing materials, Penetrant testing methods – water washable, post – Emulsifiable methods, Applications
Principle of MPT, procedure used for testing a component , Equipment used for MPT, Applications

UNIT III EDDY CURRENT TESTING, ACOUSTIC EMISSION
Principles, Instrumentation for ECT, Absolute - differential probes, Techniques – High sensitivity Techniques, Applications
Principle of AET, Instrumentation, Applications - testing of metal pressure vessels, Fatigue crack detection in aerospace structures.

UNIT IV ULTRASONIC TESTING
Principle , Ultrasonic transducers ,Inspection Methods, Normal Incscudent Pulse – Echo Inspection , Through – transmission Testing , angle Beam Pulse – Echo testing , Techniques for Normal Beam Ispection , Ultrasonic Flaw detection Equipment , Modes of display A- scan , B-Scan , C- Scan ,Applications.
UNIT V RADIOGRAPHY, COMPARISON AND SELECTION OF NDT METHODS 9


Comparison and selection of various NDT techniques

TOTAL : 45

TEXT BOOK:


REFERENCES:

3. www.ndt.net
MEC353 MECHANICAL VIBRATION

GOAL
To expose the students to understand the sources of the vibration in automobile and other machinery and study the various methods to reduce the noise and vibration.

OBJECTIVES
The course should enable the students to:

1. Understand the sources of vibration and noise in automobiles and make design modifications
2. Learn to reduce the vibration and noise and improve the life of the components

OUTCOME
The students should be able to:

1. Translate a physical problem in mechanical vibration to an appropriate mathematical model.
2. Make engineering judgement on the problem of reducing vibration when required and the role of vibration in the design of mechanical equipment.

UNIT I BASICSS OF VIBRATION
Introduction, classification of vibration: Free and forced vibration, Undamped and damped vibration and linear and non linear vibration, Response of damped and undamped systems Under harmonic force, analysis of single degree and two degree of freedom systems, Torsional vibration, determination of natural frequencies.

UNIT II BASICSS OF NOISE
Introduction, Amplitude, Frequency, Wavelength sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, Measurement environment, Equipment, Frequency analysis Tracking analysis Sound quality analysis.

UNIT III AUTOMOTIVE NOISE SOURCES

UNIT IV CONTROL TECHNIQUES
Vibration isolation, Tuned absorbers, Untuned viscous dampers, Damping treatments, Application dynamic forces generated by IC engines, engine isolation, Crank shaft damping, Modal analysis of the mass elastic model shock absorbers.

UNIT V SOURCE OF NOISE AND CONTROL
Methods for control of engine noise Combustion noise Mechanical noise Predictive analysis, palliative treatments and enclosures Automotive noise control principles Sound in enclosures, Sound energy absorption Sound transmission through barriers.

TOTAL :45

TEXT BOOKS


REFERENCES

MEC354 MODERN CONCEPTS OF ENGINEERING DESIGN

GOAL
To expose the students the concepts of integrated design processes with practical approach and make them to develop design process with appreciate of economic and other factors.

OBJECTIVES
The course should enable the students to:

1. Provide an overview of the integrated design process with a practical bias.
2. Prepare the student to understand and develop a design process leading to a realizable product with an appreciation of the economics, environmental concerns, manufacturability and product life cycle management.
3. Understand and develop a design process leading to a realizable product

OUTCOME
The students should be able to:

1. Get an overview of the integrated design process with a practical bias.
2. Appreciate the economics, environmental concerns, manufacturability and product life cycle management.
3. Understand the concept of DFM and the principles of Prototyping.

UNIT I PRODUCT DESIGN PROCESS
Importance of product design - Design process - Design considerations - Morphology of design Marketing Organisation for design - Computer aided engineering - Codes and standards - Design review - Technological innovation and design process - Product and process cycles - Societal considerations in design.

UNIT II PRODUCT PLANNING AND SPECIFICATION
Opportunities identification - Evaluation - Resource allocation - Pre-project planning - Customer need identification - Establishing target specification - Setting the final specification.

UNIT III CONCEPT GENERATION, SELECTION AND TESTING
Activity of concept generation - Clarification of problem - External and internal searches - Concept exploration - Result analysis - Overview of selection methodologies - Concept screening - Concept scoring - Concept testing - Choice of survey population - Survey formats - measurement of customer response - Interpretation and analysis of results.

UNIT IV PRODUCT ARCHITECTURE, INDUSTRIAL DESIGN, DESIGN FOR MANUFACTURE AND PROTOTYPING
Product architecture - Implications - establishment - platform planning - system level design - Need for industrial design and its impact - The Industrial design process and its management - Assessment of quality - Overview of Design for Manufacture process - Steps in DFM-Basics principles of prototyping - Prototyping technologies - Planning for prototypes.

TOTAL : 45

TEXT BOOKS

REFERENCES
MEC356 - CHARACTERIZATION OF MATERIALS

GOAL
This course familiarizes students with characterisation of materials.

OBJECTIVE:
This course should enable the students to

1. To have comprehensive knowledge of the Characterization of materials for studying the structure of materials and to Interpret their properties.
2. To provide fundamental knowledge on Metallography, X-Ray diffraction, Electron diffraction, Scanning electron Microscope, Chemical and Thermal analysis.

OUTCOME:
After studying this subject, the student should have learnt
How to characterize materials and the various techniques used in characterization of materials and will be able to apply them

UNIT I METALLOGRAPHIC TECHNIQUES
Macro examination -applications, metallurgical microscope - principle, construction and working, metallographic specimen preparation, optic properties - magnification, numerical aperture, resolving power, depth of focus, depth of field, different light sources lenses aberrations and their remedial measures, various illumination techniques-bright field , dark field, phase-contrast polarized light illuminations, interference microscopy, high temperature microscopy; quantitative metallography – Image analysis

UNIT II X-RAY DIFFRACTION TECHNIQUES

UNIT ANALYSIS OF X-RAY DIFFRACTION
Line broadening, particle size, crystallite size, Precise parameter measurement, Phase identification, phase quantification, Phase diagram determination X-ray diffraction applicationin the determination of crystal structure, lattice parameter, residual stress – quantitative phase estimation, ASTM catalogue of Materials identification-

UNIT IV ELECTRON MICROSCOPY
Construction and operation of Transmission electron microscope – Diffraction effects and image formation, specimen preparation techniques, Selected Area Electron Diffraction, electron- specimen interactions, Construction, modes of operation and application of Scanning electron microscope, Electron probe micro analysis, basics of Field ion microscopy (FIB), Scanning Tunneling Microscope (STM) and Atomic Force Microscope(AFM).
UNIT V SURFACE ANALYSIS


TOTAL: 45 PERIODS

TEXTBOOKS:

REFERENCES:
MEC357 MECHANICAL METALLURGY

L T P C
3 0 0 3

GOAL: This course familiarizes students with metallurgy of materials and their behavior when mechanically deformed.

OBJECTIVE:
The course should enable the student to understand
1. The elastic and plastic behavior of materials when deformed.
2. The Various strengthening mechanisms of metals, structures and their behavior.
3. The theory and mechanisms of fracture.
4. The fatigue phenomenon and behavior of materials when loaded in fatigue and creep.
5. The origin of creep and creep mechanism when loaded at ambient and elevated temperatures
6. The theories of failure and should help in carrying out forensic applications.

OUTCOME
The student should be able to
1. Familiarize with various material structures and their behavior.
2. Relate the theories of materials, structure, to the causes of failure of materials in creep and fatigue
3. Understand the concept of strengthening mechanisms and specify the required materials for an intended application
4. Understand the theories of failure and help in carrying out failure analysis

UNIT I ELASTIC AND PLASTIC BEHAVIOUR

UNIT II STRENGTHENING MECHANISMS
Elementary discussion of cold working, grain boundary strengthening. Solid solution strengthening, Martensitic strengthening, Precipitation strengthening, Particulate Strengthening, Dispersion strengthening, Fiber strengthening, Examples of above strengthening mechanisms from ferrous and non-ferrous systems, Yield point phenomenon, strain aging and dynamic strain aging

UNIT III FRACTURE AND FRACTURE MECHANICS
Types of fracture, Basic mechanisms of ductile and brittle fracture, Griffith’s theory of brittle fracture, Orowan’s modification .Izod and Charpy Impacts tests, Ductile to Brittle Transition Temperature (DBTT), Factors affecting DBTT, Determination of DBTT .Fracture mechanics-Introduction, Modes of fracture, Stress intensity factor, Strain energy release rate, Fracture toughness and Determination of KIC, Introduction to COD, J integral.

UNIT IV FATIGUE BEHAVIOUR AND TESTING
Fatigue: Stress cycles, S-N curves, Effect of mean stress, Factors affecting Fatigue, Structural changes accompanying fatigue, Cumulative damage, HCF / LCF, thermo mechanical fatigue, application of fracture mechanics to fatigue crack propagation, fatigue testing machines-Pari’s Equation, Residual life prediction under Fatigue.

UNIT V CREEP BEHAVIOUR AND TESTING
Creep curve, Stages in creep curve and explanation, Structural changes during creep, Creep mechanisms, Metallurgical factors affecting creep, High temperature alloys, Stress rupture testing, Creep testing machines, Parametric methods of extrapolation. Deformation Mechanism Maps according to Frost/Ashby.

**TEXTBOOKS:**

**REFERENCES:**
MEC358 UNCONVENTIONAL MACHINING PROCESSES

L  T  P  C
3  0  0  3

GOAL
To expose the student in various unconventional machining processes

OBJECTIVES
The course should enable the students to:
1. Learn the course will impart a good perspective with adequate depth to understand the unconventional machining processes
2. Learn relative advantages over conventional machining techniques.

OUTCOME
The students should be able to:
1. Know about the working principle of various Unconventional Machining Processes.
2. Understand the relative advantages over conventional techniques and their applications.

UNIT I INTRODUCTION
5
Unconventional machining Process - Need - clarification - Brief overview of all techniques.

UNIT II MECHANICAL ENERGY BASED PROCESSES
10
Abrasive Jet Machining - Water Jet Machining - Ultrasonic Machining. (AJM, WJM and USM),Working Principles - equipment used - Process parameters - MRR-Variation in techniques used - Applications.

UNIT III ELECTRICAL ENERGY BASED PROCESSES
8

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES
12

UNIT V THERMAL ENERGY BASED PROCESSES
10
Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining (EBM). Principles-Equipment-Types-Beam control techniques - Applications.

TOTAL : 45

TEXT BOOK
REFERENCES


GOAL:
To introduce the basic principles of operation of various Refrigeration & Air conditioning systems and components.

OBJECTIVES:

The course should enable the students to
1. Understand the basic refrigeration cycles
2. Understand the various components used in Refrigeration and air conditioning systems
3. Know the components of the psychrometric chart and how to use in air conditioning applications
4. Know the various conventional and unconventional air conditioning systems

OUTCOMES:

The students should be able to
1. Describe and compare the various refrigeration cycles
2. Identify the major components and its use in application
3. Plot the various Air conditioning processes in the psychrometric chart
4. Demonstrate the working principles of conventional and unconventional refrigeration and air conditioning systems

UNIT I REFRIGERATION CYCLE

UNIT II REFRIGERANTS AND SYSTEM COMPONENTS

UNIT III PSYCHROMETRY
Psychrometric processes use of psychrometric charts – Grand and Room Sensible Heat Factors – bypass factor – air washers, requirements of comfort air conditioning, summer and Winter Air conditioning.

UNIT IV AIR CONDITIONING SYSTEMS

UNIT V UNCONVENTIONAL REFRIGERATION CYCLES
Vapour Absorption system – Steam jet refrigeration, thermo electric refrigeration. Applications in ice plant, food storage plants, milk chilling plants.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCE BOOKS:
GOAL
To expose the students in various components, operations and applications of different types of power plants.

OBJECTIVES
The course should enable the students to:
1. Know the Layout of various types of Power Plant.
2. Understand the details of Steam Boilers and the Cycles.
3. Know about Nuclear Power plants
4. Understand the Economics of various Power Plants.

OUTCOME
The students should be able to:
1. Understand process of working of Steam Boilers, Combustion equipment.
2. Know the Fuel and Ash Handling Units.
3. Know the principle of working of the Nuclear Power Plant.
4. Compare the economics of various types of Power Plants.

UNIT I     INTRODUCTION TO POWER PLANTS & BOILERS
9
Layout of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles - Comparison and Selection, Load Duration Curves.
Steam Boilers and Cycles - High Pressure and Super Critical Boilers - Fluidized Bed Boilers

UNIT II     STEAM POWER PLANT
9
Fuel and Ash Handling, Combustion Equipment for burning coal, Mechanical Stokers, Pulverizer,
Electrostatic Precipitator, Draught - different types, Surface Condenser Types, Cooling Towers

UNIT III NUCLEAR AND HYDEL POWER PLANTS
9
Nuclear Energy - Fission, Fusion Reaction, Types of Reactors, pressurized water reactor, Boiling Water Reactor, Waste Disposal and safety.

UNIT IV DIESEL AND GAS TURBINE POWER PLANT
9
Types of Diesel Plants, Components, Selection of Engine Type, Applications Gas Turbine Power Plant - Fuels - Gas Turbine Material - Open and Closed Cycles - Reheating - Regeneration and Intercooling - Combined Cycle.

UNIT V OTHER POWER PLANTS AND ECONOMICS OF POWER PLANTS

Geo thermal - OTEC - Tidel - Pumped storage - Solar thermal central receiver system. Cost of Electric Energy - Fixed and operating Costs - Energy Rates - Types of Tariffs - Economics of load sharing, comparison of economics of various power plants.

TOTAL: 45

TEXT BOOKS


REFERENCES

6. T.Morse Frederick, Power Plant Engineering, Prentice Hall of India, 1998
GOAL
To expose the students to numerical methods and to solve complex problems in fluid flow and heat transfer analysis using software.

OBJECTIVES
The course should enable the students to:

1. Introduce numerical modelling and its role in the field of heat transfer and fluid flow.
2. Enable the students to understand the various discretisation methods and solving methodologies.
3. Create confidence to solve complex problems in the field of heat transfer and fluid dynamics by using high speed computers.
4. Understand the process of converting the PDE to difference equations using various discretisation techniques.

OUTCOME
The students should be able to:

1. Know the equations governing fluid flow and heat transfer.
2. Appreciate the tools available for solving the algebraic equations.
3. Appreciate the problems associated with discretisation of incompressible flow

UNIT I  GOVERNING EQUATIONS AND BOUNDARY CONDITIONS  9

UNIT II  DISCRETISATION AND SOLUTION METHODOLOGIES  9

UNIT III  HEAT CONDUCTION  9
Finite difference and finite volume formulation of steady/transient one-dimensional conduction equation, Source term linearization, Incorporating boundary conditions, Finite volume formulations for two and three dimensional conduction problems

UNIT IV  CONVECTION AND DIFFUSION  9
Finite volume formulation of steady one-dimensional convection and Diffusion problems, Central, upwind, hybrid and power-law schemes - Discretisation equations for two dimensional convection and diffusion.

UNIT V    CALCULATION OF FLOW FIELD

Representation of the pressure - Gradient term and continuity equation - Staggered grid - Momentum equations - Pressure and velocity corrections - Pressure - Correction equation, SIMPLE algorithm and its variants. Turbulence models: mixing length model, Two equation (k-?) models.

TOTAL : 45

TEXT BOOKS


REFERENCES


MEC362 PROCESS PLANNING & COST ESTIMATION

GOAL
To impart knowledge on work study and ergonomics and cost estimation.

OBJECTIVES
The course should enable the students to:
1. Understand the process planning concepts
2. Prepare cost estimation for various products after process planning

OUTCOME
The students should be able to:
1. Understand the characteristics of different types of tools and techniques available and their applications.
2. Approach the process planning activities, selection of machine based on process requirement and develop the manufacturing logic.
3. Determine data required for Cost estimation and estimate the production cost for different jobs.

UNIT I WORK STUDY AND ERGONOMICS

UNIT II PROCESS PLANNING
Definition - Objective - Scope - approaches to process planning - Process planning activities - Finished part requirements - operating sequences - machine selection - material selection parameters - Set of documents for process planning - Developing manufacturing logic and knowledge - production time calculation - selection of cost optimal processes.

UNIT III INTRODUCTION TO COST ESTIMATION
Objective of cost estimation - costing - cost accounting - classification of costs - Elements of cost.

UNIT IV COST ESTIMATION
Types of estimates - methods of estimates - data requirements and sources - collection of cost - allowances in estimation.

UNIT V PRODUCTION COST ESTIMATION
Estimation of material cost, labour cost and over heads, allocation of overheads - Estimation for different types of jobs.
TEXT BOOK


REFERENCES

GOAL: To expose the students on the study and application of the principles of friction, lubrication and wear

OBJECTIVE:
1. To impart knowledge in the friction, wear and lubrication aspects of machine components.
2. To understand the material properties which influence the tribological characteristics of surfaces.
3. To understand the analytical behaviour of different types of bearings an design of bearings based on analytical / theoretical approach.

OUTCOME:
1. Ability to select material / surface properties based on the tribological requirements.
2. Methodology for deciding lubricants and lubrication regimes for different operating conditions.
3. Analysis ability of different types of bearings for given load / speed conditions.

UNIT I SURFACE INTERACTION AND FRICTION
Topography of Surfaces – Surface features-Properties and measurement – Surface interaction – Adhesive Theory of Sliding Friction – Rolling Friction-Friction properties of metallic and non-metallic materials – friction in extreme conditions – Thermal considerations in sliding contact

UNIT II WEAR AND SURFACE TREATMENT

UNIT III LUBRICANTS AND LUBRICATION REGIMES

UNIT IV THEORY OF HYDRODYNAMIC AND HYDROSTATIC LUBRICATION
Reynolds Equation, - Assumptions and limitations-One and two dimensional Reynolds Equation-Reynolds and Sommerfeld boundary conditions- Pressure wave, flow, load capacity and friction calculations in Hydrodynamic bearings- Long and short bearings- Pad bearings and Journal bearings-Squeeze film effects-Thermal considerations-Hydrostatic lubrication of Pad bearing- Pressure, flow, load and friction calculations- Stiffness considerations- Various types of flow restrictors in hydrostatic bearings

UNIT V HIGH PRESSURE CONTACTS AND ELASTO HYDRODYNAMIC LUBRICATION
Rolling contacts of Elastic solids- contact stresses – Hertzian stress equation-Spherical and cylindrical contacts- Contact Fatigue life- Oil film effects- Elasto Hydrodynamic lubrication Theory- Soft and hard EHL-Reynolds equation for elastohydrodynamic lubrication- - Film
shape within and outside contact zones-Filmthickness and friction calculation- Rolling bearings- Stresses and deflections-Tractiondrives

TEXTBOOKS


REFERENCES:

MEC364 COMPUTER INTEGRATED MANUFACTURING

GOAL
To impart knowledge on how computers are integrated at various levels of planning and manufacturing.

OBJECTIVES
The course should enable the students to:
1. Introduce the flexible manufacturing system and
2. Handle the product data and various software used for manufacturing

OUTCOME
The students should be able to:
1. Appreciate the changing manufacturing scenario
2. Develop the role of CAD/CAM
3. Understand implementation of CIM.

UNIT I INTRODUCTION
The meaning and origin of CIM- the changing manufacturing and management scene - External communication - Islands of automation and software-Dedicated and open systems- Manufacturing automation protocol - Product related activities of a company- Marketing engineering - Production planning - Plant operations - Physical distribution- Business and financial management.

UNIT II GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING
Process planning - role of process planning in CAD/CAM integration - Approaches to computer aided process planning - Variant approach and generative approaches - CAPP and CMPP process planning systems.

UNIT III SHOP FLOOR CONTROL AND INTRODUCTION OF FMS
Shop floor control-phases - Factory data collection system -Automatic identification methods - Bar code technology-Automated data collection system.
FMS-components of FMS - types -FMS workstation -Material handling and storage systems- FMS layout -Computer control systems-Application and benefits.

UNIT IV CIM IMPLEMENTATION AND DATA COMMUNICATION
CIM and company strategy - System modelling tools - IDEF models - Activity cycle diagram - CIM open system architecture (CIMOSA) - Manufacturing enterprise wheel-CIM architecture - Product data management-CIM implementation software.

Communication fundamentals - Local area networks - Topology - LAN implementations - Network management and installations.

UNIT V  OPEN SYSTEM AND DATABASE FOR CIM  8

Open systems - Open system inter connection - Manufacturing automations protocol and technical office protocol (MAP /TOP) - Development of databases - Database terminology - Architecture of database systems - Data modelling and data associations - Relational data bases - Database operators Advantages of data base and relational database.

TOTAL : 45

TEXT BOOK


REFERENCES

GOAL:
Metal casting is one of the important manufacturing process used for manufacturing components. The content of the syllabus focuses on imparting knowledge on casting practices of Alloy steels, Magnesium, Aluminium, Zinc and Copper alloys.

OBJECTIVES:
To expose the students to
1. The various casting processes both ferrous and non-ferrous materials
2. The various alloy and the properties of these ferrous which are widely used in engineering applications

OUTCOME:
By studying this course the students would have learnt
1. The different types of alloys and their properties to enable the student to select the proper alloys for the purpose maintained
2. The suitability of their alloys for various casting methods

UNIT I MAGNESIUM ALLOYS
Introduction to different types of Magnesium alloys – Process for Manufacturing Magnesium alloys – Production considerations – Die casting consideration – die life productivity – applications of Magnesium alloy cast parts.

UNIT II ALUMINIUM ALLOYS
Introduction to different types of Aluminium alloys – Process for Manufacturing Aluminium alloys - Production considerations – die life – productivity – applications of Aluminium Cast Parts.

UNIT III ALLOY STEELS
Introduction to different types of Alloy steels – process for manufacturing alloy steels – production considerations – productivity – applications of alloy cast parts.

UNIT IV ZINC ALLOYS

UNIT V COPPER ALLOYS

PERIODS
TEXTBOOKS:
REFERENCES:
GOAL
To familiarize the students in the various types of heat treatment processes of metals

OBJECTIVE:
This course should enable the students
1. To expose to the various heat treatment processes practiced in Industries structural
2. To provide knowledge as to how mechanical properties can be improved by these processes applicable to ferrous metals
3. To provide comprehensive understanding of microstructure and property created by controlled heat treatment processes

OUTCOME
After studying this course the student should be able to
1. Understand the micro changes that take place and improve mechanical properties.
2. Understand the application areas heat treatment to suit changes needed for end users.
3. Understand the functioning of various types of heat treatment equipment
4. compare the properties of metals before and after the heat treatment.
5. Understand the heat treatment process which alters the properties of materials.

UNIT I  TRANSFORMATIONS IN STEELS

UNIT II HEAT TREATMENT PROCESSES

UNIT III CASE HARDENING

UNIT IV FURNACES, ATMOSPHERE AND PROCESS CONTROL
Various heating atmosphere used for heat treatment, Temperature Measurement Control devices – quenching media and their characteristics, Stages of Quenching, Various Heat Treatment furnaces- Roller and Mesh type continuous furnaces- fluidised bed furnaces, cryo-chamber, cryo-treatment of steels, plasma equipment-Elements of Process control systems-PLC ,PID controllers and continuous monitoring systems.

UNIT V HEAT TREATMENT OF SPECIFIC ALLOYS
Heat treatment of special purpose steels – tool steels, high speed steels, maraging steels, HSLA steels and die steels, heat treatment of cast irons – gray cast irons, white cast irons and...

Total: 45

TEXTBOOKS:

REFERENCES:
GOAL:
Students are exposed to the correlation of properties of materials and their structure.

OBJECTIVE:
The subject introduces the correlation of properties of materials and their structure. It revises student’s knowledge of crystal structure and phase diagrams of various alloy systems. The course not only covers metals, mainly ferrous and non-ferrous alloys, but also structures and properties of ceramics, polymers, elastomers and composites.

OUTCOME:
After successful completion of the course students can
1. Understand the science of solids and mechanics of crystallization
2. Understand about the ferrous & non ferrous materials, their properties & applications
3. Understand about the ceramics, composites, polymers and the applications

UNIT I STRUCTURE OF SOLIDS

UNIT II PHASE DIAGRAMS

UNIT III ERROUS AND NON FERROUS MATERIALS

UNIT IV CERAMIC AND COMPOSITE MATERIALS

UNIT V POLYMERS AND ELASTOMERS

TEXTBOOKS:

REFERENCES:
OBJECTIVE

To learn about the basics of economics and cost analysis related to engineering so as to take economically sound decisions.

UNIT I  INTRODUCTION TO ECONOMICS  8


UNIT II  VALUE ENGINEERING  10

Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications- Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series Present worth factor, Equal payment series capital recovery factor. Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT III  CASH FLOW  9

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV  REPLACEMENT AND MAINTENANCE ANALYSIS  9

Replacement and Maintenance analysis- Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT V  DEPRECIATION  9

**TEXT BOOK**


**REFERENCES**

MEC453 DESIGN OF JIGS  FIXTURES & PRESS TOOLS

GOAL
To expose the students to understand the design principles of work holding and guiding devices.

OBJECTIVES
The course should enable the students to:
1. Understand the principles, functions and design practices of Jigs, Fixtures and dies for press working
2. Understand the Principles of locating principles, locating elements and clamping Devices.

OUTCOME
The students should be able to:
1. Develop the jigs and fixture design
2. Appreciate the Design considerations in forging, extrusion, casting and plastic dies

UNIT I PURPOSE TYPES AND FUNCTIONS OF JIGS AND FIXTURES  8
Tool design objectives - Production devices - Inspection devices - Materials used in Jigs and Fixtures - Types of Jigs - Types of Fixtures-Mechanical actuation-pneumatic and hydraulic actuation-Analysis of clamping force-Tolerance and error analysis.

UNIT II JIGS  9
Drill bushes -different types of jigs-plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jigs components. Design and development of Jigs for given components.

UNIT III FIXTURES  9
General principles of boring, lathe, milling and broaching fixtures- grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures- Modular fixtures. Design and development of fixtures for given component.

UNIT IV PRESS WORKING TERMINOLOGIES AND ELEMENTS OF DIES AND STRIP LAY OUT  10
Selection of standard die sets strip lay out-strip lay out calculations
UNIT V  DESIGN AND DEVELOPMENT OF DIES

Design and development of progressive and compound dies for Blanking and piercing operations.
Bending dies - development of bending dies-forming and drawing dies-Development of drawing dies. Design considerations in forging, extrusion, casting and plastic dies.

TOTAL : 45

TEXT BOOKS

REFERENCES
GOAL
To expose the students in Hydraulic and Pneumatic Power Systems, its various components and methods of designing.

OBJECTIVES
The course should enable the students to:

1. Know the advantages and applications of Fluid Power Engineering and Power Transmission Systems.

2. Learn the Applications of Fluid Power System in automation of Machine Tools and others equipments.

OUTCOME
The students should be able to:


2. Differentiate the merits between the Hydraulic and Pneumatic Power Systems.


UNIT I FLUID POWER SYSTEMS AND FUNDAMENTALS

UNIT II HYDRAULIC SYSTEM & COMPONENTS

UNIT III DESIGN OF HYDRAULIC CIRCUITS

UNIT IV PNEUMATIC SYSTEMS AND COMPONENTS
Pneumatic Components: Properties of air - Compressors - Filter, Regulator, Lubricator Unit - Air control valves, Quick exhaust valves, pneumatic actuators.

Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Pneumatic and Hydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT V  DESIGN OF PNEUMATIC CIRCUITS  
Servo systems - Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics - Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

TOTAL : 45

TEXT BOOK


REFERENCES

MEC455 THERMAL TURBO MACHINES

L T P C
3 0 0 3

GOAL
To expose the students to various turbo machineries and their design aspects.

OBJECTIVES
The course should enable the students to:
1. Appreciate the unified theory applicable for all classes of turbo machines
2. Gain the fundamental knowledge about the design variations of thermal turbo machines.
3. Perform the design of the thermal turbo machines.

OUTCOME
The students should be able to:
1. Appreciate the unified theory applicable for all classes of Turbo Machines
2. Know about the construction details for all classes of Turbo Machines.
3. Gain the fundamental knowledge about the design variations of thermal turbo machines.

UNIT I INTRODUCTION TO TURBO MACHINES

Turbines, Pumps, Compressors, Fans and Blowers - Stages of Turbo machines - Energy transfer between fluid and rotor - Stage velocity triangles

Thermal Turbo machines - Classification - General energy equation - Modified to turbo machines compression and expansion process - Velocity triangles - Work - T-S and H-S diagram, Total - to Total and Total - to Static efficiencies.

Dimensional analysis - Non dimensional parameters of compressible flow Turbo machines - Similarity laws, applications and limitations.

UNIT II CENTRIFUGAL FANS AND BLOWERS

Definition, selection and classifications - Types of blading design-velocity triangles - Stage Parameters - Flow analysis in impeller blades - Design parameter- Volute and Diffusers - Efficiencies and Losses - Fan noises - Causes and remedial measures.

Centrifugal Compressors: - Constructional details - Stage velocity triangles -- Stage work - Stage pressure rise - Stage efficiency - Degree of reaction - Slip factor - H-S diagram - Efficiencies Performance characteristics.

UNIT III AXIAL FANS AND PROPELLERS

Definition and classifications - Stage parameters - Types of fan stages-performance characteristics.

Cascade of blades - Cascade tunnel - Blade geometry-Cascade variables-Energy transfer and loss in terms of lift and drag - Axial Flow Compressors: definition and classifications - Constructional details - Stage velocity triangles - Stage work - Stage pressure rise - H-S
UNIT IV AXIAL FLOW TURBINES

Construction details - 90° IFR turbine - Stage work - Stage Velocity triangles - Stage pressure rise Impulse and reaction stage - Effect of degree of reaction - H-S diagram - Efficiencies and Losses Performance characteristics.

UNIT V RADIAL FLOW TURBINES AND WIND TURBINES

Constructional details -- Stage velocity triangles - H-S diagram - Stage efficiencies and losses - Performance characteristics.

Wind turbines: definition and classifications - Constructional details - Horizontal axis wind turbine - Power developed - Axial thrust - Efficiency.

TOTAL : 45

TEXT BOOK


REFERENCES

MEC456 MAINTENANCE ENGINEERING

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GOAL
To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.

OBJECTIVES
The course should enable the students to:

1. Explain the different maintenance categories like Preventive maintenance, condition monitoring and repair of machine elements.
2. Illustrate some of the simple instruments used for condition monitoring in industry.

OUTCOME
The students should be able to:

1. Understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
2. Know about different maintenance practices followed in the industry like Preventive maintenance, condition monitoring and repair of machine elements.

UNIT I PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING
10
Basic Principles of maintenance planning - Objectives and principles of planned maintenance activity Importance and benefits of sound Maintenance systems - Reliability and machine availability MTBF, MTTR and MWT - Factors of availability - Maintenance organization - Maintenance economics.

UNIT II MAINTENANCE POLICIES - PREVENTIVE MAINTENANCE
9
Maintenance categories - Comparative merits of each category - Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication - TPM.

UNIT III CONDITION MONITORING
9
Condition Monitoring - Cost comparison with and without CM - On-load testing and off-load testing Methods and instruments for CM - Temperature sensitive tapes - Pistol thermometers - wear-debris analysis.

UNIT IV REPAIR METHODS FOR BASIC MACHINE ELEMENTS
10
Repair methods for beds, slideways, spindles, gears, lead screws and bearings - Failure analysis Failures and their development - Logical fault location methods - Sequential fault location.

UNIT V REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT
8
Repair methods for Material handling equipment - Equipment records - Job order systems - Use of computers in maintenance.

TOTAL: 45
TEXT BOOKS

REFERENCES
GOAL
To expose the students in concepts of fuels and combustion, and analysis of Steam Turbines

OBJECTIVES
The course should enable the students to:
1. Know the advanced concepts of fuel and combustion
2. Know the concepts of steam, its working principle and flow through the blades
3. Understand Fuel Injection systems used in SI and CI Engine.
4. Understand Principle of working of IC Engine and types.

OUTCOME
The students should be able to:
1. Compare the Cycles.
2. Understand the process of Combustion related to SI and CI Engines and the methods of reduction of detonation of the same.
3. Understand the details of Steam Turbines.
4. Understand the concepts of Flow through the Turbine Blades.

UNIT I I.C. ENGINE
Principle of working; basic engine types; comparison of air standard cycles; air cycle analysis with variable specific heats; introduction to fuel air cycle analysis; actual cycles; mep; thermal efficiency.
Availability analysis for engine processes.

UNIT II COMBUSTION
Fuel oil injection in C.I. Engine; fuel injection systems; injection pumps and nozzles.

UNIT III SUPERCHARGING AND SCAVENGING
Theories of combustion in S.I and C. I. Engines - methods for reduction of detonation and knock; Octane number and Cetane number.
Supercharging and Scavenging: Supercharging in I.C. Engine; supercharging limits; Scavenging of I.C. engines, two stroke S.I. and C.I. engines; scavenging parameters; ideal scavenging processes; actual scavenging; scavenging pumps.
UNIT IV STEAM TURBINE

Steam Generation - introduction to Boilers; Principles of action of turbines, classification, relative advantages of turbines as prime movers, isentropic flow through nozzle, nozzle shape, critical pressure ratio and maximum flow, effect of friction in nozzle flow, under-expansion and over-expansion in nozzles, supersaturated flow through nozzles.

UNIT V FLOW THROUGH TURBINE BLADE

Flow through impulse turbine blade, velocity diagram, blade work, blade efficiency, optimum velocity ratio, multi-staging and its advantage, velocity compounded impulse turbine, pressure compounded impulse turbine, reheat factor, internal efficiency, state point locus.

Flow through reaction turbine blade, velocity diagram, degree of reaction, blade work, blade height, stage efficiency, optimum velocity ratio, axial thrust in reaction turbine, erosion of turbine blades.

TEXT BOOKS

1. Internal Combustion Engines by V.Ganesan, TMH.
2. Gas Turbine Theory, Cohen, Pearson Education

REFERENCES

2. Steam and Gas Turbines by R.Yadav, Central Book Depot.
3. Theory and Design of Steam and Gas Turbines by Lee
MEC458 INDUSTRIAL AUTOMATION & ROBOTICS

GOAL
To expose the students in basic concepts of robots, familiarise them with the various drive systems for robot, sensors and their applications in robots, programming of robots.

OBJECTIVES
The course should enable the students to:
1. Learn the basic concepts, parts of robots and types of robots
2. Understand the various drive systems for robot, sensors and their applications in robots, programming of robots
3. Learn the various applications of robots, justification, implementation and safety of robots.

OUTCOME
The students should be able to:
1. Understand the various drive systems for robot, sensors and their applications in robots, programming of robots
2. Have a knowledge in Image Processing
3. Having knowledge in usage of various Mechanisms in Robot applications.

UNIT I  FUNDAMENTALS OF ROBOT
Robot - Definition - Robot Anatomy - Co-ordinate Systems, Work Envelope, types and classification - Specifications - Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load - Robot Parts and their Functions - Need for Robots - Different Applications

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS
Pneumatic Drives - Hydraulic Drives - Mechanical Drives - Electrical Drives - D.C. Servo Motors, Stepper Motor, A.C. Servo Motors - Salient Features, Applications and Comparison of all these Drives

End Effectors - Grippers - Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations

UNIT III SENSORS AND MACHINE VISION
Requirements of a sensor, Principles and Applications of the following types of sensors - Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors), Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors,
Compliance Sensors, Slip Sensors

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) - Deviations and Problems

Teach Pendant Programming, Lead through programming, Robot programming Languages - VAL Programming - Motion Commands, Sensor Commands, End effector commands, and Simple programs

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS

RGV, AGV; Implementation of Robots in Industries - Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots - Pay back Method, EUAC Method, Rate of Return Method.

TOTAL : 45

TEXT BOOK


REFERENCES

GOAL
To create awareness about optimization in utilization of resources.

OBJECTIVES
The course should enable the students to:
1. Understand and apply operations research techniques to industrial applications
2. Understand Linear Programming concepts
3. To understand sequencing and game theory
4. Understand the concepts of PERT/CPM

OUTCOME
The students should be able to:
1. Understand the characteristics of different types of decision making environmental and appropriate decision making approaches and tools to be used in each type.
2. Build and solve Transportation models and assignment models.
3. Design simple models like CPM and PERT to improve decision making
4. Develop critical thinking and objective analysis decision making.

UNIT I LINEAR PROGRAMMING PROBLEM
Formulation - Graphical Solution - Bounded and Unbounded Solutions - Simplex Method - Big M method- Duality - Two phase Method - Dual Simplex method.

UNIT II SEQUENCING AND GAME THEORY
Johnson's Algorithm - Two Machine and three Machine problem - Game theory with saddle point and without saddle point - Dominance properties - Graphical Solutions. Dynamic Programming

UNIT III ASSIGNMENT AND TRANSPORTATION PROBLEM
Hungarian Method - Maximization and unbalanced assignment problem - Basic feasible solution of transportation problem - Mode method - Degeneracy - Unbalanced Transportation problem - Travelling Salesman Problem.

UNIT IV PERT - CPM - DECISION THEORY
Network diagram - Representation - Labelling - CPM - PERT probabilities of CPM - PERT probabilities of project duration - Laplace minimax, maxmini Hurwitz criterian.

UNIT V DETERMINATION OF EOQ
Purchase Model with and without Shortages - Manufacturing Model with and without shortages Probabilistic Model.
TEXT BOOKS

2. J.K. Sharma, Operations Research, Macmillan
GOAL
To expose the students to the concepts of quality, standards followed, sampling techniques to improve reliability.

OBJECTIVES
The course should enable the students to:
1. Introduce the concept of SQC
2. Understand process control and acceptance sampling procedure and their application.
3. Learn the concept of reliability.

OUTCOME
The students should be able to:
1. Understand the attributes in process control.
2. Appreciate the role of sampling procedure.
3. Understand the system reliability.

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES 10
Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost-Variation in process- factors - process capability- process capability studies and simple problems - Theory of control chart- uses of control chart -Control chart for variables - X chart, R chart and ? chart.

UNIT II PROCESS CONTROL FOR ATTRIBUTES 8
Control chart for attributes -control chart for proportion or fraction defectives - p chart and np chart control chart for defects - C and U charts, State of control and process out of control identification in charts.

UNIT III ACCEPTANCE SAMPLING 9
Lot by lot sampling - types - probability of acceptance in single, double, multiple sampling techniques - O.C. curves - producer's Risk and Consumer's Risk. AQL, LTPD, AOQL concepts- standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT IV LIFE TESTING - RELIABILITY 9
Life testing - Objective - failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate, system reliability, series, parallel and mixed configuration - simple problems. Maintainability and availability - simple problems. Acceptance sampling based on reliability test - O.C Curves.

UNIT V QUALITY AND RELIABILITY 9
Reliability improvements - techniques- use of Pareto analysis - design for reliability - redundancy unit and standby redundancy - Optimization in reliability - Product design - Product analysis - Product development - Product life cycles.

TOTAL : 45

TEXT BOOKS


REFERENCES

GOAL
To expose the students the advanced concepts of stresses & deformations through mathematical models.

OBJECTIVES
The course should enable the students to:
1. Analyse the stresses and deformations through advanced mathematical models.
2. Estimate the design strength of various industrial equipments.

OUTCOME
The students should be able to:
1. Use appropriate model for the analysis.
2. Analyse the stresses and deformations through advanced mathematical models.

UNIT I ANALYSIS OF PLATES
Mathematical modelling of plates with normal loads - Point and Distributed Loads - Support conditions - Rectangular plates - Stresses along coordinate axes - Plate deformations - Axisymmetric plates - Radial and tangential stresses - plate deflections.

UNIT II THICK CYLINDERS AND SPHERES
Equilibrium and compatibility conditions - Lame's Theorem - Boundary conditions - distribution of radial and tangential stresses - Compound cylinders - Interference fits - Stresses due to temperature distributions.

UNIT III ROTATING DISCS
Lame-Clayperon Theorem - Radial and tangential stresses in discs due to centrifugal effects - Boundary conditions - Solid and hollow discs - Interference fit on shafts - Strengthening of the hub - residual stresses - Auto frettege - Discs of variable thickness - Disc profile for uniform strength.

UNIT IV BEAMS ON ELASTIC FOUNDATION
Infinite beam subjected to concentrated load - Boundary Conditions - Infinite beam subjected to a distributed load segment - Triangular load - Semi infinite beam subjected to loads at the ends and concentrated load near the ends - Short beams.

UNIT V CURVED BEAMS AND CONTACT STRESSES
Analysis of stresses in beams with large curvature - Stress distribution in curved beams - Stresses in crane hooks and C clamps - Contact Stresses - Hertz equation for contact stresses - applications to rolling contact elements.

TOTAL : 45
TEXT BOOKS

2. Dally J.W. and Riley W.F, Experimental Stress Analysis, John Wiley and Sons 2003

REFERENCES

To impart practical knowledge to the students about Computer Aided Design and Drawing of Machine Elements.

**OBJECTIVES**

The course should enable the students to:

1. Understand Design concept, selection of materials and manufacturing considerations in design.
2. Do Computer Aided Design concepts and applications.
3. Design and Drawing of Fasteners and connection and Power transmission elements.

**OUTCOME**

The students should be able to:

1. Create design in Computer Aided Design concepts.
2. Design various components of Machine Elements with the aid of various Software.
3. Do Design and Drawing of Friction clutches and Brakes.

**UNIT I ENGINEERING DESIGN AND COMPUTER AIDED DESIGN**  

The design process, concept, analysis, feasibility, Selection of materials and manufacturing considerations in design, Design with reference to repairs and reconditioning, specifically for working out at sea with its restrictions and limitations.


**UNIT II COMPUTER AIDED DESIGN AND FINITE ELEMENT ANALYSIS**  

Creation of Graphic Primitives - Graphical input techniques - Display transformation in 2-D and 3-D Viewing transformation - Clipping - hidden line elimination - Mathematical formulation for graphics Curve generation techniques - Geometric Modelling - Wire frame, Surface and Solid models - CSG and B-REP Techniques - Features of Solid Modelling Packages - Parametric and features - Interfaces to drafting, Design Analysis - Exposure to FEA packages (for demonstration purpose only).

**UNIT III TYPES OF LOADING AND DESIGN CRITERIA**  

Static loads, impact loads, repeated loads, variable and cyclic loads, combined and reversible loads. Stress concentration and design factors, fatigue strength, modes of failure, design stresses, factor of safety, theories of failure, wear, corrosion, design criteria, S-N curve Goodman and Soderberg equations.

**UNIT IV JOINTS, SHAFTS AND COUPLINGS**  

Design of cotter joints, knuckle joints, bolted joints, welded joints, riveted joints. Design of shafts and couplings - Drafting using CAD packages.
UNIT V  BELTS, FRICTION CLUTCHES AND BRAKES

Design of Belt drives and hoists (Wire ropes), Multiple plate clutches, cone clutch, centrifugal clutch block brakes, internally expanding shoe brakes, external band brakes, differential band brakes Solid modelling using CAD packages.

TOTAL: 45

TEXT BOOKS


REFERENCES


GOAL:
To impart adequate knowledge on dynamics of productivity, fundamentals of process re-engineering and the implementation of re-engineering projects

OBJECTIVES:
1. To understand the various factors that affect productivity and learn the system approach to measure productivity
2. Implementation to analyze the organizational transformation
3. To know re-engineering process, understand the improvement models and its implementation.

OUTCOME:
1. At the end the course the students will be in position to understand macro and micro factors of productivity and its measurement methods.
2. And to learn the principles of organizational transformation and re-engineering.
3. Also to develop process improvement models through re-engineering and implementation.

UNIT I PRODUCTIVITY
Productivity Concepts – Macro and Micro factors of productivity – Dynamics of Productivity - Productivity Cycle Productivity Measurement at International, National and Organization level - Productivity measurement models

UNIT II SYSTEMS APPROACH TO PRODUCTIVITY MEASUREMENT
Conceptual framework, Management by Objectives (MBO), Performance Objectivated Productivity (POP) – Methodology and application to manufacturing and service sector.

UNIT III ORGANISATIONAL TRANSFORMATION
Elements of Organisational Transformation and Reengineering-Principles of organizational transformation and re-engineering, fundamentals of process reengineering, preparing the workforce for transformation and re-engineering, methodology, guidelines, LMI CIP Model – DSMC Q & PMP model.

UNIT IV RE-ENGINEERING PROCESS IMPROVEMENT MODELS
PMI models, PASIM Model, Moen and Nolan Strategy for process improvement, LMI CIP Model, NPRDC Model.

UNIT V RE-ENGINEERING TOOLS AND IMPLEMENTATION
Analytical and process tools and techniques – Information and Communication Technology – Implementation of Reengineering Projects – Success Factors and common implementation Problem – Cases.

TOTAL : 45

REFERENCES


GOAL
To expose the students the various aspects of design process, concepts to product costing, optimisation at the design and make form to apply in practical.

OBJECTIVES
The course should enable the students to:
1. Understand the several aspects of the design process and to apply them in practice.
2. Train the student in the concept of product costing and manufacturing economics in optimization of product design.

OUTCOME
The students should be able to:
1. Develop the concepts of product costing and other manufacturing economics in optimization of product design
2. Know about the various tools available in the product design.

UNIT I PRODUCT DESIGN AND DEVELOPMENT 8
Principles of creativity in design- integrated product development and concurrent engineering - Product analysis - Criteria for product design - Market research - Design for customer and design for manufacture - Product life cycle.

UNIT II ECONOMICS OF DESIGN 9
Breaks even point - Selection of optimal materials and processes - Material layout planning - Value analysis - Re-engineering and its impact on product development.

UNIT III PRODUCT MODELING 9
Product modelling - Definition of concept - fundamental issues - Role and basic requirement of process chains and product models -Types of product models - Model standardization efforts - types of process chains - Industrial demands.

UNIT IV PRODUCT COSTING 10
Bill of materials - Outline Process charts - Concepts of operational standard time - Work measurement by analytical estimation and synthesis of time - Budgets times - Labor cost and material cost at every stage of manufacture - W.I.P. costing

UNIT V RECENT ADVANCES AND CONCEPTS IN PRODUCT DESIGN 9
Fundamentals of FEM and its significance to product design - Product life cycle management Intelligent information system - Concept of Knowledge based product and process design.

TOTAL : 45

TEXT BOOKS


REFERENCES

1. Harry Nystrom - Creativity and Innovation, John Wiley & Sons, 1979


GOAL:
To make the students to gain the concepts on modal analysis, measurement system, review test procedure and to derive the mathematical models.

OBJECTIVES:
To impart knowledge on modal testing, modal analysis of single and multi-degree of freedom systems.

OUTCOME:
It helps the students to get familiarized with the modal testing, modal analysis of single and multidgree of freedom systems.

UNIT I OVERVIEW

UNIT II THEORETICAL BASIS

UNIT III MOBILITY MEASUREMENT TECHNIQUES

UNIT IV MODAL PARAMETER EXTRACTION METHODS

UNIT V DERIVATION OF MATHEMATICAL MODELS

REFERENCES:
MEC466 DYNAMICS AND CONTROL

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GOAL

Establish the fundamental techniques for modeling dynamic systems.

Analyse and manipulate system models in the time and frequency domain.

Develop an understanding of feedback control systems and the parameters that influence their stability and performance.

OBJECTIVES

The course should enable the students to:

1. Learn Low order linear mathematical models of physical systems and their manipulation.
2. Know how negative feedback affects dynamic response and its characterization by primary analysis and performance measures.
3. Learn Fundamental mathematical tools used in system analysis and design.

OUTCOMES

The students should be able to:

1. Derive a model, making justifiable assumptions, from a description of a physical system and determine criteria for desired system performance and interpret trade-offs in different design configurations.
2. Analyze time and frequency domain response characteristics from plots, determine stability and predict responses for modified plots.
3. Apply standard design techniques to achieve satisfactory closed-loop performance.
4. Apply these skills in specific domains, e.g. Flight mechanics, vibrations and automotive systems.

UNIT I LINEAR SYSTEMS THEORY

Review of time domain analysis of linear systems dynamics - stability, performance measures and design process - state space and process models - example control systems.

System Representation in the s-domain: The Laplace transform and system transfer function - free/ forced behaviour and the characteristic equation - system poles and zeros, relative and absolute stability, root loci - steady-state error and the final value theorem.

UNIT II FREQUENCY RESPONSE OF LINEAR SYSTEMS

Sinusoidal excitation and Fourier Series - forecasting gain and phase, the frequency response function - graphical representation of frequency response, Bode plots.

UNIT III CLOSED-LOOP CONTROL SYSTEMS
Open/closed loop transfer function definitions - performance measures in control system design control system design examples - PID control system definitions and characteristics.

UNIT IV CONTROL SYSTEM STABILITY ANALYSIS
Stability in the s-domain, the Root locus method - stability in the frequency domain, Nyquist criterion - performance measures in the frequency domain - gain and phase margins, closed loop frequency response.

UNIT V DESIGN OF FEEDBACK CONTROL SYSTEMS
System compensation objectives and characteristics - lead-lag compensation, root locus and frequency response methods

TOTAL : 45

TEXT BOOK

REFERENCES
GOAL:
To expose the basics of polymer, polymerisation, condensation, their properties and overview of manufacturing to the students.

OBJECTIVE:
The subject exposes students to the basics of polymer, polymerisation, condensation, their properties and overview of manufacturing.

OUTCOME:
After studying this course the students should able:

1. To understand various polymerization processes and their reactions
2. To calculate the molecular weight through difference methods
3. To understand the significant of transition temperature, solution properties and relationship between the properties.
4. To know the various processing methods of process and their features.

UNIT I  POLYMERIZATION

UNIT II MOLECULAR WEIGHTS OF POLYMERS
Number average and weight average molecular weights – Degree of polymerization – molecular weight distribution – Polydispersity – Molecular weight determination- Different methods – Gel Permeation Chromatography

UNIT III TRANSITIONS IN POLYMERS

UNIT IV SOLUTION PROPERTIES OF POLYMERS

UNIT V POLYMER PROCESSING
Overview of Features of Single screw extruder –Tubular blown film process - Coextrusion.- Injection Moulding systems – Compression & Transfer Moulding - Blow Moulding –

**TOTAL:** 45

**PERIODS**

**TEXTBOOKS:**

**REFERENCES:**
GOAL
To understand the principles of testing of metal powders, manufacturing techniques of powder metallurgy and the application of their components.

OBJECTIVE:
2. To expose student in the various aspects of manufacturing of Powder Metallurgical components and testing.
2. To enable the student to understand the applications of Powder Metallurgy in aerospace, automobile etc.,

OUTCOME
Student should be able to
1. Identify suitable manufacturing processes for the production of Powder Metallurgy Components.
2. Identify the application areas of powder metallurgy and to select suitable process.

UNIT I POWDER MANUFACTURE AND CONDITIONING
Mechanical methods Machine milling, ball milling, atomization, shotting- Chemical methods, condensation, thermal decomposition, carbonyl Reduction by gas-hydrde, dehydrde process, electro deposition, precipitation from aqueous solution and fused salts, hydro metallurgical method. Physical methods: Electrolysis and atomisation processes, types of equipment, factors affecting these processes, examples of powders produced by these methods, applications, powder conditioning, heat treatment, blending and mixing, types of equipment, types of mixing and blending, Self-propagating high-temperature synthesis (SHS), sol-gel synthesis-Nano powder production methods.

UNIT II CHARACTERISTICS AND TESTING OF METAL POWDERS
Sampling, chemical composition purity, surface contamination etc. Particle size, and its measurement. Principle and procedure of sieve analysis, microscopic analysis: sedimentation, elutriation, permeability, adsorption methods and resistivity methods: particle shape, classifications, microstructure, specific surface area, apparent and tap density, green density, green strength, sintered compact density, porosity, shrinkage.

UNIT III POWDER COMPACTION
Pressure less compaction, slip casting and slurry casting, pressure compaction- lubrication, single ended and double ended compaction, iso static pressing, powder rolling, forging and extrusion, explosive compaction.

UNIT IV SINTERING
Stage of sintering, property changes, mechanisms of sintering, liquid phase sintering and infiltration, activated sintering, hot pressing and Hot Isostatic Pressing (HIP), vacuum sintering, sintering furnaces-batch and continuous-sintering atmosphere, Finishing operations – sizing, coining, repressing and heat treatment, special sintering processes- microwave
sintering, Spark plasma sintering, Field assisted sintering, Reactive sintering, sintering of nanostructured materials.

UNITVAPPLICATIONS


TOTAL: 45

TEXTBOOKS:

REFERENCES:
GOAL:
The useful life of components is often limited by the fracture, fatigue and creep properties of the materials used. The students study the fundamental principles leading to failure of technical components.

OBJECTIVES:
By studying this course the students will learn
1. The structure of materials and their defects
2. The behaviors of materials when subject to creep and fatigue loads leading to their failure in service
3. The privative methods to be adopted to overcome their failures

OUTCOME:
The students would have learnt
1. Failure mechanisms due to creep and fatigue.
2. The methods to be adopted in the design stage of the product to avoids their failure.

UNIT I INTRODUCTION

UNIT II HIGH – TEMPERATURE DEFORMATION RESPONSE

UNIT III CYCLIC STRES AND STRAIN FATIGUE
Macrofractrography fatigue failures - cyclic stress and strain controlled fatigue - Fatigue life estimation for notched components – Crack initiation mechanisms.

UNIT IV FATIGUE CRACK PROPAGATION
Stress and crack lengths correlations with FCP – Fracture modes in Fatigue – Microscopic fracture mechanisms – Crack growth behavior at Δk extremes – Influences – Micro structural aspects of FCP in metal alloys.

UNIT V ANALYSIS OF ENGINEERING FAILURES
Typical defects – Microscopic surface examination – metallographic and fractographic examination – Component failure analysis – Fracture surface preservation – Cleaning and replication techniques and image interpretation.

PERIODS
TEXTBOOKS:
REFERENCES:
GOAL
To familiarize students with the concepts of fracture mechanics and failure analysis.

OBJECTIVE
1. To make the students to understand Crack formation, growth and failure
2. To understand the theories of crack Initiation and growth due to static and dynamic loading.
3. To understand the failure safe mechanisms to be incorporated in the product design.

OUTCOME
1. Student should be able to comprehend the origin, formation and mechanisms of crack growth.
2. Diagonise the causes of fracture and failure on the basis of fracture mechanics.
3. Deploy the methodology of Forensic Engineering to be followed in the event of a failure.

UNIT I BASIC CONCEPTS IN FRACTURE MECHANICS
The geometry of stress and strain, elastic deformation, plastic and elasto-plastic deformation, Brittle fracture: Griffiths theory, Ductile fracture, Probabilistic aspects of fracture mechanics - Microstructure

UNIT II MECHANICS OF FRACTURE- STATIC LOADING

UNIT III FAILURE ANALYSIS OF FATIGUE FRACTURE

UNIT IV FAILURE ANALYSIS OF CREEP RUPTURE
Fracture at elevated temperature: Time dependent mechanical behavior, stress rupture, Micro Structural changes during creep, Mechanism of creep deformation and Creep deformation maps, Prediction of time to rupture, Creep-fatigue interaction. Some case studies in analysis of creep failures.

UNIT V FAILURE ANALYSIS OF CORROSION AND WEAR

TOTAL: 45
TEXT BOOKS:


REFERENCES:

OBJECTIVES

• To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.

• To know the recent trends like Manufacturing Requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I INTRODUCTION

Objectives and benefits of planning and control - Functions of production control - Types of production - job, batch and continuous - Product development and design - Marketing aspect - Functional aspects - Operational aspect - Durability and dependability aspect - Aesthetic aspect. Profit consideration - Standardization, Simplification & specialization - Breakeven analysis - Economic of a new design.

UNIT II WORKSTUDY

Method study, basic procedure - Selection - Recording of process - Critical analysis, Development - Implementation - Micromotion and memomotion study - Work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Pre-determined motion time standards.

UNIT III PRODUCT PLANNING AND PROCESS PLANNING

Product planning - Extending the original product information - Value analysis - Problems in lack of product planning - Process planning and routing - Pre requisite information needed for process planning - Steps in process planning - Quantity determination in batch production - Machine capacity, balancing - Analysis of process capabilities in a multi-product system.

UNIT IV PRODUCTION SCHEDULING

Production Control - Systems - Loading and scheduling - Master Scheduling - Scheduling rules - Gantt charts - Perceptual loading - Basic scheduling problems - Line of balance - Flow production scheduling - Batch production scheduling - Product sequencing - Production Control systems - Periodic batch control - Material requirement planning - Kanban - Dispatching - Progress reporting and expediting - Manufacturing lead time - Techniques for aligning completion times and due dates.

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC

Inventory control - Purpose of holding stock - Effect of demand on inventories - Ordering procedures - Two bin system - Ordering cycle system - Determination of Economic order quantity.
and economic lot size-ABC analysis-Recorder procedure-Introduction to Computer Integrated Production Planning systems-elementsofJustInTime Systems-Fundamentals of MRPII and ERP.

**TEXT BOOK**


**REFERENCE**

GOAL
To expose the students to advanced concepts involved in improving the performance of IC engines.

OBJECTIVES
The course should enable the students to:

1. Understand the significance of various processes in I.C Engines.
2. Understand the combustion phenomena

OUTCOME
The students should be able to:

1. Compare the theoretical cycles with the actual one and distinguish the combustion process as applicable to SI and CI Engine.
2. Know about the advances taken place in IC engines and the important role played by engine management system in improving the performance.

UNIT I CYCLE ANALYSIS
Otto, Diesel, Dual, Stirling and Brayton cycles, comparison of air standard, fuel air and actual cycles, simple problems on the above topics.

UNIT II COMBUSTION
Combustion reactions and stoichiometry, heat of reaction, adiabatic flame temperature in constant pressure and constant volume systems, fuels for internal combustion engines and their properties, premixed and diffusion combustion as applicable to SI and CI engines, concepts of burning rate and flame velocity, fuel spray characteristics and combustion in diesel engines.

UNIT III COMBUSTION MODELLING
Basic concepts of engine simulation, governing equations, simulation of various engine processes for SI and CI engines. Adiabatic flame temperature, Heat release calculations. Thermodynamic and Fluid mechanic based models.

UNIT IV ADVANCES IN IC ENGINES
LHR engines, surface ignition concept and multi fuel engines, stratified charge and lean burn engines, performance and emission characteristics, merits and demerits.

UNIT V ELECTRONIC ENGINE MANAGEMENT
Computer control of SI & CI engines for better performance and low emissions, closed loop control of engine parameters of fuel injection and ignition

TOTAL : 45
TEXT BOOKS

REFERENCES
GOAL
To impart knowledge on the Propeller, Geometry, Design, Performance and defects.

OBJECTIVES
The course should enable the students to:

1. Know Various types of Propulsion systems, Propeller geometry, Propeller theory, propeller operating environment
2. Understand the Interaction between hull and the propeller
3. Do Performance and maintenance of propellers

OUTCOME
The students should be able to:

1. Know the effect of environment on the performance.
2. Understand the Propeller theory, Cavitation and the analytical tools used in the Industry.

UNIT I PROPULSION SYSTEMS AND PROPELLER GEOMETRY

Fixed pitch propellers, Ducted propellers, Podded and azimuthing propulsors, Contrarotating propellers, Overlapping propellers, Tandem propellers, Controllable pitch propellers, Waterjet propulsion, Cycloidal propellers paddle wheels, Magnetohydrodynamic propulsion, Superconducting motors for marine propulsion.

Frames of reference, Propeller reference lines, Pitch, Rake and skew, Propeller outlines and area, Propeller drawing methods Section geometry and definition, Blade thickness distribution and thickness fraction, Blade interference limits for controllable pitch propellers, Controllable pitch propeller offdesign section geometry, Miscellaneous conventional propeller geometry terminology.

UNIT II PROPELLER ENVIRONMENT & PERFORMANCE CHARACTERISTICS


UNIT III PROPELLER THEORY, CAVITATION & NOISE
The basic physics of cavitation, Types of cavitation experienced by propellers, Cavitation considerations in design, Cavitation inception, Cavitation-induced damage, Cavitation testing of propellers, Analysis of measured pressure data from a cavitating propeller, Propeller - rudder interaction.

Physics of underwater sound, Nature of propeller noise, Noise scaling relationships, Noise prediction and control, Transverse propulsion unit noise, Measurement of radiated noise.

**UNIT IV PROPELLER-SHIP INTERACTION, SHIP RESISTANCE AND PROPULSION**

Bearing forces, Hydrodynamic interaction, Froude's analysis procedure, Components of calm water resistance, Methods of resistance evaluation, Propulsive coefficients, The influence of rough water, Restricted water effects, High-speed hull form resistance, Air resistance.

**UNIT V SERVICE PERFORMANCE, TOLERANCE AND MAINTENANCE  9**

Effects of weather, Hull roughness and fouling, Hull drag reduction, Propeller roughness and fouling, Generalized equations for the roughness-induced power penalties in ship operation, Monitoring of ship performance.

Propeller tolerances, Propeller inspection, Causes of propeller damage, Propeller repair, Welding and the extent of weld repairs, stress relief

**TEXT BOOK**

ENGINEERING ELECTIVES

MED251 APPLIED THERMODYNAMICS FOR ENGINEERS

L  T  P  C
3  0  0  3

OBJECTIVES:
The course should enable the students to
1. Understand the fundamentals of thermodynamics and to be able to use it in accounting for the bulk behaviour of the sample physical systems.
2. Integrate the basic concepts into various thermal applications like IC engines, gas turbines, steam boiler, steam turbine, compressors
3. Understand the concepts of refrigeration and air conditioning.

OUTCOMES:
The students should be able to
1. Describe the fundamentals of thermodynamics and to be able to apply in real life systems
2. Demonstrate the concepts of various thermal applications like IC engines, gas turbines, steam boiler, steam turbine, compressors
3. Demonstrate and apply the concepts of refrigeration and air conditioning for different applications.

(Use of standard steam tables, refrigeration tables and heat transfer data book are permitted)

UNIT I  BASIC CONCEPTS AND LAWS OF THERMODYNAMICS


UNIT II  IC ENGINES


UNIT III  STEAM BOILERS AND TURBINES

Formation of steam - Properties of steam – Use of steam tables and charts – Steam power cycle(Rankine) - Modern features of high-pressure boilers – Mountings and accessories – Testing of boilers. Steam turbines: Impulse and reaction principle – Velocity diagrams – Compounding and governing methods of steam turbines (qualitative treatment only) - Layout and working principle of a steam power plant.

UNIT IV  COMPRESSORS, REFRIGERATION AND AIR CONDITIONING

Positive displacement compressors – Reciprocating compressors – Indicated power – Clearance volume – Various efficiencies – Clearance ratio - Volume rate - Conditions for
perfect and imperfect intercooling - Rotary positive displacement compressors – Construction and working principle of centrifugal and axial flow compressors.

UNIT V  REFRIGERATION AND AIR CONDITIONING  9
Modes of heat transfer, Refrigeration - Various methods of producing refrigerating effects (RE) – Vapour compression cycle: P-H and T-S diagram - Saturation cycles - Effect of subcooling and super heating - (qualitative treatment only) - Airconditioning systems – Basic psychrometry - Simple psychrometric processes - Types of air conditioning systems - Selection criteria for a particular application (qualitative treatment only). Cooling of electronic components, Thermoelectric cooling, Chip cooling.

TOTAL : 45

PERIODS

TEXT BOOKS:

REFERENCES:
GOAL
This course is intended to provide the knowledge on different types of power developing engines for transports like roadways, airways and waterways. The students will able gain knowledge on heavy and medium vehicle engine, aircraft engines and marine engine in detail.

OBJECTIVES
The course should enable the students to
1. Understand the various aspects of power development in engines
2. Understand the construction and working of road transport engines
3. Understand various types aircraft engine and its basic components
4. Understand the various marine engine components
5. Understand the concept of trouble shooting and inspection of transportation engine

OUTCOMES
The students should be able to
1. Gain knowledge in the basics of principle and operation of 2 and 4 stroke engine
2. Demonstrate the constructional features and principles of road transport engine
3. Identify various types of aircraft engine and operation
4. Identify and apply various operational systems of marine engine
5. Demonstrate the measurement, inspection and troubleshooting method of power developing engines

UNIT I Introduction
Compression ignition and Spark ignition engine, Two stroke and Four Stroke cycle - Timing diagram for 2 and 4 stroke engine, Otto, diesel and dual cycle operation, Deviation from ideal condition in actual engine.

UNIT II Road transport engine and Components
Engine Classification, Constructional details of SI and CI engine, Two stroke SI and CI engine – Construction and working, Firing order, Air fuel ration requirements, Carburetion, Fuel injection for CI engine, Need for governor in CI engine, Direct and In-direct combustion chamber for CI engine

UNIT III Aircraft engine and components
Types of aircraft engines – Principle of operation – Function of components – Material used – Details of starting the engine – Details of carburetion and injection system for small and large engines – Ignition system components – spark plug details – Engine operation condition at various altitudes

UNIT IV Marine Engine and components
Comparative study of Slow, medium and high speed marine diesel engine, V-type engine details – Construction and operation, Main propulsion diesel engine, Marine engine starting
and reversing system, Safety provisions – Engine slowdown and shutdown – Restoration of operation.

UNIT V Measurement, Inspection and Trouble shooting

Automotive engines Measurement of friction, Cylinder pressure measurement. Engine performance maps, Engine testing standards
Aero engines Maintenance and inspection check to be carried out. Inspection and maintenance and troubleshooting – Inspection of all engine components-
Marine engines trouble shooting related to various types of marine diesel engines and condition monitoring – causes, effects, remedies and prevention of engine not turning on Air and Fuel, knocking at TDC and BDC, black smoke in funnel, poor compression and combustion.

Total : 45 Periods

Text and Reference books

GOAL

This course is intended to expose the students in the art of manufacturing new products due to the development of new materials and processes. The students will totally get a feel of the relevant suitable process while evaluating and deciding.

OBJECTIVES

The course should enable the students to

6. To make the students aware of the various alternative manufacturing processes available.
7. To develop an altitude to look for the unconventional manufacturing process to machine
8. To make them to understand and appreciate the latest manufacturing process for micro fabrication and devices.

OUTCOMES

The students should be able to

6. The students will gain knowledge in the alternative manufacturing methods in use.
7. Identify the unconventional manufacturing processes for better and timely productivity.
8. Gain knowledge in the latest manufacturing techniques for micro fabrication and devices.

UNIT I  MACHINING PROCESSES - I


UNIT II  MACHINING PROCESS – II


UNIT III  MACHINING PROCESS – III


UNIT IV  FABRICATION OF MICRO DEVICES


UNIT V  MICROFABRICATION TECHNOLOGY

Wafer preparation – monolithic processing – moulding – PCB board hybrid & mcm technology – programmable devices & ASIC – electronic material and processing.– stereolithography SAW devices, Surface Mount Technology,
REFERENCES:

1. Serope kelpekijian & stevan r. schmid- manufacturing process engg material – 2003
MED252 CNC Machines and Controls

GOAL
To expose the students to different types of machining methods adopted recently with the present technologies which provides lesser manufacturing lead-time and accuracy to the components. Therefore studying the fundamentals, construction details and other controls are very much essential for the Mechatronics engineering students.

OBJECTIVES
The course should enable the students to:

1. Learn the fundamentals of CNC machines.
2. Understand the constructional features of CNC machines and Retrofitting.
3. Learn the concepts of control systems, Feedback devices and tooling.
4. Understand the CNC part programming
5. Learn about the economics and maintenance of CNC machines

OUTCOMES
The students should be able to:

1. Develop knowledge on the hardware of CNC machines.
2. Know the concepts of constructional features CNC machines.
3. Know the different controls, Feedback devices, tooling and their selection.
4. Develop the CNC part programming for different profiles and to get the knowledge in maintenance of CNC machines.

UNIT I FUNDAMENTALS OF CNC MACHINES 9

UNIT II CONSTRUCTIONAL FEATURES OF CNC MACHINES AND RETROFITTING 10

UNIT III CONTROL SYSTEMS, FEED BACK DEVICES AND TOOLING 10
Description of a simple CNC control system. Interpolation systems. Features available in a CNC system – introduction to some widely used CNC control systems.


UNIT IV  CNC PART PROGRAMMING  9


UNIT V  ECONOMICS AND MAINTENANCE  7

Factors influencing selection of CNC Machines – Cost of operation of CNC Machines – Practical aspects of introducing CNC machines in industries – Maintenance features of CNC Machines – Preventive Maintenance, Other maintenance requirements.

TOTAL : 45 PERIODS

TEXT BOOK


REFERENCES

GOAL
To expose the student in various unconventional machining processes

OBJECTIVES
The course should enable the students to:

1. Learn the course will impart a good perspective with adequate depth to understand the unconventional machining processes
2. Learn relative advantages over conventional machining techniques.

OUTCOME
The students should be able to:

1. Know about the working principle of various Unconventional Machining Processes.
2. Understand the relative advantages over conventional techniques and their applications.

UNIT I INTRODUCTION
Unconventional machining Process - Need - clarification - Brief overview of all techniques.

UNIT II MECHANICAL ENERGY BASED PROCESSES

UNIT III ELECTRICAL ENERGY BASED PROCESSES

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES
Chemical Machining and Electro-Chemical Machining (CHM and ECM)- Etchants-maskant techniques of applying maskants-Process Parameters, Principles of ECM - equipments Electrical circuit - Process Parameters-ECG and ECH Applications.

UNIT V THERMAL ENERGY BASED PROCESSES
Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining (EBM). Principles-Equipment-Types-Beam control techniques - Applications.

TOTAL: 45 PERIODS

TEXT BOOK
MED256 NON-DESTRUCTIVE TESTING

GOAL

To impart knowledge on Non Destructive Testing procedures

OBJECTIVES

The course should enable the students to:

1. Understand principle behind various NDT techniques and study about NDT equipments and accessories.
2. Learn working procedures of various NDT techniques
3. Learn materials that could be inspected – codes, standards, specifications.

OUTCOMES

The students should be able to:

1. Know about NDT equipments and accessories.
2. Develop the NDT techniques in practical applications.
3. Compare and select of various NDT techniques based on the applications

UNIT I NON-DESTRUCTIVE TESTING: AN INTRODUCTION

Introduction to various non destructive methods- Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications.

UNIT II LIQUID PENETRANT TESTING

Physical principles, procedure for penetrant testing, Penetrant Testing materials, Penetrant testing methods – water washable, post – Emulsifiable methods, Applications

UNIT III EDDY CURRENT TESTING, ACOUSTIC EMISSION

Principles, Instrumentation for ECT, Absolute - differential probes, Techniques – High sensitivity Techniques, Applications

Principle of AET, Instrumentation, Applications - testing of metal pressure vessels, Fatigue crack detection in aerospace structures.

UNIT IV MAGNETIC PARTICLE TESTING

Principle of MPT, procedure used for testing a component, Equipment used for MPT, Applications

UNIT V ULTRASONIC TESTING

Principle, Ultrasonic transducers ,Inspection Methods, Normal Incident Pulse – Echo Inspection, Through – transmission Testing , angle Beam Pulse – Echo testing , Techniques for Normal Beam Ispection , Ultrasonic Flaw detection Equipment , Modes of display A-scan , B-Scan , C- Scan , Applications.

TOTAL: 45
TEXT BOOK:


REFERENCES:

3. www.ndt.net
MED257 COMPUTER WORKSTATION ERGONOMICS

OBJECTIVES:

1. To introduce the basic concepts of Ergonomics and the development of Ergonomics
2. To train students to perceive human body as a mechanical structure using human biomechanics
3. To introduce methods of measuring mental workload and to manage occupational stress and strain
4. To provide guidelines based on ergonomics principles for designing computer (office) workstation
5. To expose students to the problems faced by children, women, elders and the disabled for designing computer workstation for the special population

OUTCOMES:

The students completing this course will be able to:

1. apply the ergonomic principles to the development of computer workstations in which people play a significant role.
2. recognize the human as the most important component of our current technological systems.
3. become as Ergonomists who can apply the Ergonomic aspects in the design of office (computer) workstations to fit and accommodate the human.
4. identify problems faced by different kinds of people and to design suitably to reduce the discomfort experienced by them.

UNIT I INTRODUCTION


UNIT II ANATOMICAL AND MECHANICAL STRUCTURE OF HUMAN BODY


UNIT III HOW THE MIND WORKS

The “Traditional” and the “Ecological” Concepts – Organization of the Nervous system – Responding to Stimuli – Mental Workload: “Stress” on Individuals and Crews – Strain Experienced by an Individual – Strain Experienced by Confined groups. Enhancing Performance: General Findings – Specific Findings – Enhancing Team work
UNIT IV THE OFFICE (COMPUTER) WORK STATION


UNIT V DESIGNING FOR SPECIAL POPULATION


TOTAL: 45 PERIODS

Text Book

References
GOAL

The course is intended to impart knowledge on energy conservation and efficiency aspects from mechanical engineering machinery applications. Refrigeration and air conditioning which consumes nearly 40 percent of total power in buildings and fire safety are dealt in detail (only qualitative treatment only).

OBJECTIVES

The course should enable the students to:

1. Understand the various aspects of energy and its conservation.
2. Understand the governing principles of refrigeration and air conditioning.
3. Understand various types of HVAC systems.
4. Understand the application of various types of HVAC systems.
5. Understand the fire safety systems

OUTCOMES

The students should be able to

1. Demonstrate their understanding of energy sources, its distribution and its conservation
2. Demonstrate the refrigeration cycles and indoor air requirements
3. Identify various air conditioning systems for the required applications.
4. Identify and apply various types of HVAC systems.
5. Demonstrate their understanding of firefighting devices and apply it for different classes of fire.

UNIT I HISTORY AND GROWTH OF ENERGY UTILISATION


UNIT II BASIC PRINCIPLES OF REFRIGERATION AND AIR CONDITIONING

Reversed Carnot cycle, refrigerants and Eco friendly refrigerants, tonne of refrigeration, COP, vapor compression refrigeration cycles, vapor absorption refrigeration cycles, Geothermal air conditioning, Maisotsenko cycle, Kalina cycle. Psychrometric processes, Infiltration and indoor air quality.

UNIT III RECENT ADVANCES IN HVAC SYSTEMS


UNIT IV EMERGING TRENDS IN ENERGY CONSERVATION AND MANAGEMENT

9
Thermal modelling, Star ratings - Energy efficient refrigerators and air conditioners, Energy efficient ventilation of large enclosures, Energy efficiency in domestic buildings, school and college environments, Hospital buildings, auditoriums theaters and malls.

UNIT V FIRE SAFETY AND CASE STUDIES


TOTAL : 45 PERIODS

TEXT BOOKS


REFERENCES

GOAL
This course is intended to provide the knowledge on different types advanced metrological devices available to measure the dimension of the components and the correct procedure to be adopted to measure the dimension of the component.

COURSE OBJECTIVES

The course should enable the students to
1. Understand about the fundamentals of General Measurement system & Errors in Measurement
2. Understand the Surface Metrology Concepts and terminology
3. Understand the Basics of Optical Interference and Interferometry Optoelectronic measurements
4. Understand the contact measuring devices and method of measurements.
5. Understand the working principle and various non contact measuring devices.

COURSE OUTCOMES

1. The students should be able to
2. Gain knowledge in the basics of principle and operation metrological devices.
3. Demonstrate the different measurement technologies.
4. Identify various types of measurement technologies used in industries.
5. Identify and apply the various contact and non contact measuring device in industrial sector.

UNIT -1 MECHANICAL MEASUREMENT:

Need of mechanical measurement, Basic definitions: Hysteresis, Linearity, and Resolution of measuring instruments, Threshold, Drift, Zero stability, loading effect and system response. Measurement methods, Generalized Measurement system, Static performance characteristics, Errors and their classification

UNIT-2 METROLOGY OF SURFACE FINISHES


UNIT-3 MISCELLANEOUS METROLOGY:

UNIT -4 CONTACT MEASURING DEVICES:


UNIT-5 NON-CONTACT MEASURING DEVICES:


Text Books:
4. Engineering Metrology and Measurements, Bentley, Pearson Education
5. Theory and Design for Mechanical Measurements, 3rd Edition, Richard S Figliola, Donald E Beasley, Wiley India
MED353 FUNDAMENTALS OF COMPUTER INTEGRATED MANUFACTURING  

GOAL
To impart knowledge on how computers are integrated at various levels of planning and manufacturing.

OBJECTIVES
The course should enable the students to:
4. Introduce the flexible manufacturing system and
5. Handle the product data and various software used for manufacturing

OUTCOME
The students should be able to:
4. Appreciate the changing manufacturing scenario
5. Develop the role of CAD/CAM
6. Understand implementation of CIM.

UNIT I  INTRODUCTION  8
The meaning and origin of CIM- the changing manufacturing and management scene - External communication - Islands of automation and software-Dedicated and open systems- Manufacturing automation protocol - Product related activities of a company- Marketing engineering.

UNIT II GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING  10

UNIT III SHOP FLOOR CONTROL AND INTRODUCTION OF FMS  9
Shop floor control-phases - Factory data collection system -Automatic identification methods - Bar code technology-Automated data collection system. FMS-components of FMS - types - FMS workstation -Material handling and storage systems

UNIT IV CIM IMPLEMENTATION AND DATA COMMUNICATION  10
CIM and company strategy - System modelling tools -IDEF models - Activity cycle diagram - CIM open system architecture (CIMOSA)- Manufacturing enterprise wheel-CIM architecture - Product data management-CIM implementation software.
UNIT V  OPEN SYSTEM AND DATABASE FOR CIM

Open systems - Open system inter connection - Manufacturing automations protocol and technical office protocol (MAP /TOP) - Development of databases - Database terminology -

TOTAL : 45

TEXT BOOK


REFERENCES

GOAL:
To impart knowledge on the various design procedures involved in engineering.

OBJECTIVES:
The course should enable the students to

1. To impart the importance of design in today’s context of global competition, environmental awareness and customer oriented market.
2. To impart the basic concepts and various aspects of design using simple examples and case studies.

OUTCOMES:
The students should be able to

1. Appreciate the aspects of need for design, design process, materials and processes used for designing various components.
2. Students will be acquainted with the knowledge of designing creative components and legal, human and marketing factors during the design of products.
3. Students will be equipped with tools for improving quality, reliability and performance of a product.
4. Students will thus be self-assured of the technique to promote innovative and successful designs.

UNIT I DESIGN FUNDAMENTALS

Importance of design- The design process-Considerations of Good Design – Morphology of Design – Organization for design – Computer Aided Engineering – Designing to codes and standards – Concurrent Engineering

UNIT II CUSTOMER ORIENTED DESIGN & SOCIETAL CONSIDERATIONS


UNIT III DESIGN METHODS


UNIT IV MATERIAL SELECTION PROCESSING AND DESIGN

UNIT V PROBABILITY CONCEPTS IN DESIGN FOR RELIABILITY


TOTAL: 45 PERIODS

TEXT BOOKS:


REFERENCES:

GOAL:
To impart knowledge on the various aspects of refrigeration and air-conditioning in mechanical engineering.

OBJECTIVES:
The course should enable the students to

1. To understand the underlying principles of operation in different Refrigeration & Air conditioning systems and components.
2. To provide knowledge on design aspects of Refrigeration & Air conditioning systems

OUTCOMES:
The students should be able to

1. Upon completion of this course, the students can able to demonstrate the operations in different Refrigeration & Air conditioning systems and also able to design Refrigeration & Air conditioning systems.

UNIT I INTRODUCTION
Introduction to Refrigeration - Unit of Refrigeration and C.O.P.– Ideal cycles- Refrigerants Desirable properties – Classification - Nomenclature - ODP & GWP.

UNIT II VAPOUR COMPRESSION SYSTEM

UNIT III OTHER REFRIGERATION SYSTEMS
Working principles of Vapour absorption systems and adsorption cooling systems - Steam jet refrigeration- Ejector refrigeration systems- Thermoelectric refrigeration- Air refrigeration - Magnetic - Vortex and Pulse tube refrigeration systems.

UNIT IV PSYCHROMETRIC PROPERTIES AND PROCESSES
UNIT V AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION

Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection: fresh air load, human comfort & IAQ principles, effective temperature & chart, calculation of summer & winter air conditioning load.

TEXT BOOK:


REFERENCES:

GOAL:
To impart knowledge on the various components, operations and applications of different types of power plants.

OBJECTIVES:
The course should enable the students to

1. Understand the present power scenario in India and the various types of Boilers
2. Understand the arrangement and various components involved in Thermal power plant
3. Understand the arrangement and various components involved in Nuclear and Hydel power plant
4. Understand the arrangement and various components involved in Diesel and Gas turbine power plant
5. Understand the principles of operation of unconventional power plants and concepts of power plant economics

OUTCOMES:
The students should be able to

1. Classify the various types of boilers and identify their application area
2. Demonstrate the arrangements of various power plants and the components involved in it
3. Demonstrate the working principles of unconventional power plants
4. Classify and interpret the power plant economics

UNIT I  INTRODUCTION TO POWER PLANTS AND BOILERS
Conventional and unconventional power plants, Present power scenario in India, Installed capacity of various power plants in India. Steam boilers – Low pressure, High pressure, Super Critical Boilers – Fluidized Bed Boilers

UNIT II  STEAM POWER PLANT
Layout of Steam Power Plants, Fuel and ash handling, Combustion Equipment for burning coal, Pulveriser, Electrostatic Precipitator, Draught- Different Types, Surface condenser and cooling Towers

UNIT III  NUCLEAR AND HYDEL POWER PLANTS
Layout of Nuclear Power Plant, Nuclear Energy-Fission, Fusion Reaction, Types of Reactors, Pressurized water reactor, Boiling water reactor, Layout of Hydroelectric Power Plants, Essential elements, governing of Turbines- Micro hydel developments

UNIT IV  DIESEL AND GAS TURBINE POWER PLANT

UNIT V  UNCONVENTIONAL POWER PLANTS AND ECONOMICS OF POWER PLANTS
MHD, Geo thermal - OTEC- Tidel- Pumped storage –Solar central receiver system, Cost of electric Energy - Load duration Curves, Fixed and operating costs - Energy rates - Types tariffs.

TOTAL: 45 PERIODS

TEXT BOOKS:


REFERENCES:

MED357 INDUSTRIAL AUTOMATION

OBJECTIVES:

1. To introduce the basic concepts of automation in production systems.
2. To make the student familiar with the various material handling systems.
3. To familiarize students in inspection and control technologies in Automation.

OUTCOMES:

The Student will be able to:

1. Design automated manufacturing systems.
2. Employ suitable inspection technology depending on the applications.
3. Control automated systems.

UNIT I INTRODUCTION & AUTOMATIC DATA CAPTURE


UNIT II MATERIAL HANDLING AND IDENTIFICATION TECHNOLOGIES


UNIT III AUTOMATED MANUFACTURING SYSTEMS

Components, Classification and Overview of Manufacturing Systems, GT and Cellular Manufacturing – Part Families, Parts Classification and Coding, Production Flow Analysis, Cellular Manufacturing, Application Consideration in GT, FMS – FMS Components, FMS Application and Benefits FMS Planning and Implementation issues.

UNIT IV INSPECTION TECHNOLOGIES FOR AUTOMATION

Inspection Metrology, Contact vs. Non contact inspection Technologies, Coordinate Measuring Machines Technologies, Machine Vision, Optical Inspection Techniques and Non-contact Non-optical Inspection Technologies.

UNIT V CONTROL TECHNOLOGIES IN AUTOMATION


TEXT BOOKS:

REFERENCE BOOKS:
MED358 - MECHATRONICS SYSTEM DESIGN

GOAL
To expose the students to an integrated approach to the design of complex engineering systems involving Electrical, Mechanical and Computer Engineering.

OBJECTIVES
The course should enable the students to:

1. Introduce the Mechatronics system.
2. Learn real time interfacing.
3. Understand case studies on Data Acquisition and control.
4. Learn about advanced applications in Mechatronics.

OUTCOME
The students should be able to:

1. Know the difference between traditional and mechatronics system.
2. Get knowledge in real time interfacing.
3. Solve case studies on data acquisition and control.
4. Gain the knowledge on advanced applications in mechatronics.

UNIT I  INTRODUCTION TO MECHANICS SYSTEM DESIGN  10

UNIT II  INTERFACING AND DATA ACQUISITION  7
Real-time interfacing – Introduction - Elements of data acquisition and control - Overview of I/O process, Analog signals, discrete signals, and Frequency signals – Overframing.

UNIT III  CASE STUDIES – FORCE AND DISPLACEMENT  10

UNIT IV  CASE STUDIES – TEMPERATURE AND MOTION  10
UNIT V  ARTIFICIAL INTELLIGENCE

Advanced applications in Mechatronics: Sensors for condition Monitoring – Mechatronic Control in Automated Manufacturing – Artificial intelligence in Mechatronics – Fuzzy Logic Applications in Mechatronics – Microsensors in Mechatronics

TOTAL: 45

Text Book


REFERENCES


GOAL:
The objective is to give an extensive information and application of virtual instrumentation for all types of measurement systems and analysis.

OBJECTIVES

The course should enable the students to:

1. Learn about the basics of the Virtual instrumentation
2. Learn about the architecture of LABVIEW
3. Learn about programming in LABVIEW

OUTCOME

The students should be able to:

1. Know about the basics of the Virtual instrumentation
2. Know about the architecture of LABVIEW
3. Know about programming in LABVIEW

UNIT I INTRODUCTION

Historical perspective and traditional bench-top instruments - General functional description of a digital instrument - Block diagram of a Virtual Instrument – Physical quantities and analog interfaces - Hardware and Software – User Interfaces – Advantages of Virtual Instruments over conventional instruments – Architecture of a Virtual Instruments and its relation to the operating system.

UNIT II BASIC FUNCTIONS


UNIT III LOOPS AND ARRAYS

FOR Loops, WHILE loops, Shift Registers, CASE structure, formula nodes-Sequence structures- Arrays and Clusters- Array operations – Bundle, Unbundle – Bundle/Unbundle by name, graphs and charts – string and file I/O – High level and Low level file I/Os – attribute nodes local and global variables.

UNIT IV DATA ACQUISITION SYSTEMS

Basics of DAQ Hardware and Software – Concepts of Data Acquisition and terminology – Installing Hardware, Installing drivers - Configuring the Hardware – addressing the hardware in LabVIEW- Digital and Analog I/O function – Buffered I/O – Real time Data Acquisition.

UNIT V ADVANCED CONCEPTS
Simple programs in VI- Advanced concepts in LabVIEW- TCP/IP VI’s, Synchronization – other elements of Virtual Instrumentation – Bus extensions – PXI - Computer based instruments - Image acquisition –Motion Control.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

**REFERENCES**
MED360 DESIGN OF BUILDING AUTOMATION

OBJECTIVES:
1. This course will examine various services in high rise buildings.
2. Understand how services integration can translate into an intelligent and energy efficient system which will enable sustainability of the structure.

OUTCOME
1. Students can apply some or all of these services in one of their design projects.

UNIT I INTRODUCTION
Standards of high Rise buildings- Indian Standards and Global Standards on High Rise Buildings; Introduction to various services; their significance with regards to High Rise Buildings; Some examples of Buildings and services used in them A brief on evolution of High Rise Buildings. Aspects and Integration of services- Concepts of Intelligence Architecture and Building Automation

UNIT II MECHANICAL SYSTEMS
Natural and Mechanical Ventilation systems- Air conditioning systems and load estimation- Planning and design for efficiency- Basic concepts- Automation and Energy Management concepts.

UNIT III HVAC AND ELECTRICAL SYSTEMS
Natural lighting systems- Energy efficiency in lighting systems- load and distribution- Planning and Design for energy efficiency- Automation- basic concepts, Glass and Glazing system for natural lighting. Types of elevators, systems and services- Lobby design- Escalators- safety principles, Some latest Trends, NBC’s recommendations

UNIT IV SAFETY AND SECURITY

UNIT V CASE STUDIES
Case Studies of High Rise buildings and skyscrapers through appropriate examples- Norman Foster; Ove Arup; Ken Yeang, etc.

TEXTBOOKS

REFERENCES:
GOAL
This course is intended to provide the knowledge about safety in manufacturing industries in the engineering field especially with the new technologies and advancements.

COURSE OBJECTIVES
The course should enable the students to
1. Understand about the fundamentals of industrial safety and management
2. Understand the prevention and protective equipment in the industry
3. Understand the Basics safety acts
4. Understand the principles and practices of maintenance planning.
5. Understand the Maintenance policies and preventive maintenance.

COURSE OUTCOMES
The students should be able to
1. Gain knowledge in the basics of principle Industrial safety.
2. Demonstrate the different protective equipment’s.
3. Identify various types of Maintenance policies used in industries.
4. Identify and apply the various Maintenance schedule and implementation.

UNIT -1 Introduction to the development of industrial safety and management: 9
Implementation of factories act, Formation of various councils, Safety and productivity, Safety organizations. Safety committees, safety committee structure, Roll of management and roll of Govt. in industrial safety, Safety analysis

UNIT-2 Accident preventions, protective equipments and the Acts 9
Personal protective equipment, Survey the plant for locations and hazards, Part of body to be protected. Education and training in safety, Prevention causes and cost of accident, Housekeeping, First aid, Fire fighting equipment. Accident reporting, Investigations, Industrial psychology in accident prevention, Safety trials.

UNIT-3 Safety Acts: 9

UNIT -4 Principles and practices of Maintenance planning: 9

Total Hours

Text Books:

Reference Books:
GOAL
To expose the students to the concepts of quality, standards followed, sampling techniques to improve reliability.

OBJECTIVES
The course should enable the students to:
4. Introduce the concept of SQC
5. Understand process control and acceptance sampling procedure and their application.
6. Learn the concept of reliability.

OUTCOME
The students should be able to:
4. Understand the attributes in process control.
5. Appreciate the role of sampling procedure.
6. Understand the system reliability.

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES
Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost-Variation in process- factors - process capability- process capability studies and simple problems - Theory of control chart- uses of control chart -Control chart for variables - X chart, R chart and ? chart.

UNIT II PROCESS CONTROL FOR ATTRIBUTES
Control chart for attributes -control chart for proportion or fraction defectives - p chart and np chart control chart for defects - C and U charts, State of control and process out of control identification in charts.

UNIT III ACCEPTANCE SAMPLING
Lot by lot sampling - types - probability of acceptance in single, double, multiple sampling techniques - O.C. curves - producer's Risk and Consumer's Risk. AQL, LTPD, AOQL concepts- standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT IV LIFE TESTING - RELIABILITY
Life testing - Objective - failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate, system reliability, series, parallel and mixed configuration - simple problems. Maintainability and availability - simple problems. Acceptance sampling based on reliability test - O.C Curves.

UNIT V QUALITY AND RELIABILITY

Reliability improvements - techniques - use of Pareto analysis - design for reliability - redundancy unit and standby redundancy - Optimization in reliability - Product design - Product analysis - Product development - Product life cycles.

TOTAL : 45

TEXT BOOKS

REFERENCES
GOAL
To expose the students in Hydraulic and Pneumatic Power Systems, its various components and methods of designing.

OBJECTIVES
The course should enable the students to:

4. Learn the Applications of Fluid Power System in automation of Machine Tools and others equipments.

OUTCOME
The students should be able to:

5. Differentiate the merits between the Hydraulic and Pneumatic Power Systems.

UNIT I FLUID POWER SYSTEMS AND FUNDAMENTALS

UNIT II HYDRAULIC SYSTEM & COMPONENTS

UNIT III DESIGN OF HYDRAULIC CIRCUITS

UNIT IV PNEUMATIC SYSTEMS AND COMPONENTS
Pneumatic Components: Properties of air - Compressors - Filter, Regulator, Lubricator Unit - Air control valves, Quick exhaust valves, pneumatic actuators.

Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Pneumatic and Hydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT V DESIGN OF PNEUMATIC CIRCUITS

Servo systems - Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics - Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

TOTAL : 45

TEXT BOOK


REFERENCES

MED454 NON-DESTRUCTIVE TESTING METHODS

L T P C
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GOAL
To impart knowledge on Non Destructive Testing procedures

OBJECTIVES
The course should enable the students to:

4. Understand principle behind various NDT techniques and study about NDT equipments and accessories.
5. Learn working procedures of various NDT techniques
6. Learn materials that could be inspected – codes, standards, specifications.

OUTCOMES
The students should be able to:

3. Know about NDT equipments and accessories.
4. Develop the NDT techniques in practical applications.

Compare and select of various NDT techniques based on the applications

UNIT I NON-DESTRUCTIVE TESTING: AN INTRODUCTION

Introduction to various non destructive methods- Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications.

UNIT II LIQUID PENETRANT TESTING, MAGNETIC PARTICLE TESTING

9

Physical principles, procedure for penetrant testing,
Penetrant Testing materials, Penetrant testing methods – water washable, post – Emulsifiable methods, Applications
Principle of MPT, procedure used for testing a component , Equipment used for MPT, Applications

UNIT III EDDY CURRENT TESTING, ACOUSTIC EMISSION

9

Principles, Instrumentation for ECT, Absolute - differential probes, Techniques – High sensitivity Techniques, Applications
Principle of AET, Instrumentation, Applications - testing of metal pressure vessels, Fatigue crack detection in aerospace structures.
UNIT IV ULTRASONIC TESTING

Principle, Ultrasonic transducers, Inspection Methods, Normal Incident Pulse – Echo Inspection, Through – transmission Testing, angle Beam Pulse – Echo testing, Techniques for Normal Beam Inspection, Ultrasonic Flaw detection Equipment, Modes of display A-scan, B-Scan, C-Scan, Applications.

UNIT V RADIOGRAPHY, COMPARISON AND SELECTION OF NDT METHODS

Basic principle, Effect of radiation on Film, Radiographic imaging, Inspection Techniques – Single wall single image, Double wall Penetration, Multiwall Penetration technique.

Comparison and selection of various NDT techniques

TOTAL: 45

TEXT BOOK:


REFERENCES:


3. www.ndt.net


GOAL
This course is intended to provide the knowledge about safety in manufacturing industries in the engineering field especially with the new technologies and advancements.

COURSE OBJECTIVES
The course should enable the students to
6. Understand about the fundamentals of industrial safety and management
7. Understand the prevention and protective equipment in the industry
8. Understand the Basics safety acts
9. Understand the principles and practices of maintenance planning.
10. Understand the Maintenance policies and preventive maintenance.

COURSE OUTCOMES
The students should be able to
5. Demonstrate the different protective equipments.
6. Identify various types of Maintenance policies used in industries.
7. Identify and apply the various Maintenance schedule and implementation.
8. Identify and apply the condition monitoring.

UNIT -1 Introduction to the development of industrial safety and management:
Implementation of factories act, Formation of various councils, Safety and productivity, Safety organizations. Safety committees, safety committee structure, Roll of management and roll of Govt. in industrial safety, Safety analysis

UNIT-2 Accident preventions, protective equipments and the Acts
Personal protective equipment, Survey the plant for locations and hazards, Part of body to be protected. Education and training in safety, Prevention causes and cost of accident, Housekeeping, First aid, Fire fighting equipment. Accident reporting, Investigations, Industrial psychology in accident prevention, Safety trials.

UNIT -3 Principles and practices of Maintenance planning:

UNIT-4 Maintenance policies and preventive maintenance:

UNIT-5 Condition Monitoring:

**Total Hours**

45

Text Books:


Reference Books:

OPEN ELECTIVE OFFERED BY MECHANICAL DEPARTMENT

Semester – V

MEF 351 – Standards and Practices in Mechanical Engineering

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GOAL
This course is intended to highlight the different type of standards applied in engineering practices. Emphasis is put on Mechanical standards which will help the student to gain adequate knowledge.

OBJECTIVES
The course should enable the students to

1. To make student aware of the standards available
2. Applying the standard techniques in design
3. To choose the standards and its application
4. To make the student aware of the drawing standards
5. Material codes and their compositions for effective and efficient designs.
6. When critical components are used which standards to be applied

OUTCOMES
The students should be able to

1. Student will be familiar with different standards
2. Standards will be effectively applied in sensitive applications
3. Design and drawing standard will be used for further projects.
4. Improve the knowledge of student and will benefit him in projects in future.

UNIT 1  INTRODUCTION TO STANDARDS AND PRACTICES

Introduction to standards- definition of standards- different stands in engineering- Mechanical engineering standards- ISO standards-standard dimensions and units.

UNIT 2  MECHANICAL ENGINEERING STANDARDS – ASME


UNIT 3  DRAWING STANDARDS

UNIT 4 MATERIAL STANDARDS


UNIT 5 OTHER ENGINEERING STANDARDS

Civil engineering-electrical-aero-electronics standards-IEEE-Engineering standards & codes- British standards-methods of testing (other than mechanical tests)

Total : 45 Periods

Text and Reference books

2. ASME Standards and Certification Published By American Society of Mechanical Engineers. 2017
5. Bureau of Indian Standards Published Bureau of Indian Standards, New-Delhi. 2017