REGULATIONS, CURRICULUM AND SYLLABUS

for

B. TECH

MECHANICAL ENGINEERING

PONDICHERRY UNIVERSITY
PONDICHERRY-605 014
1. **Conditions for Admission:**

(a) Candidates for admission to the first semester of the 8 semester B.Tech Degree programme should be required to have passed:

The Higher Secondary Examination of the (10+2) curriculum (Academic Stream) prescribed by the Government of Tamil Nadu or any other examination equivalent there to with minimum of 45% marks (a mere pass for OBC and SC/ST candidates) in aggregate of subjects - Mathematics, Physics and any one of the following optional subjects: Chemistry / Biotechnology / Computer Science / Biology (Botany & Zoology) or an Examination of any University or Authority recognized by the Executive Council of the Pondicherry University as equivalent thereto.

(b) For Lateral entry into third semester of the eight semester B.Tech programme:

The minimum qualification for admission is a pass in three year diploma or four year sandwich diploma course in engineering / technology with a minimum of 60% marks (50% marks for OBC and a mere pass for SC/ST candidates) in aggregate in the subjects covered from 3rd to final semester or a pass in any B.Sc. course with mathematics as one of the subjects of study with a minimum of 60% marks (50% marks for OBC and a mere pass for SC/ST candidates) in aggregate in main and ancillary subjects excluding language subjects. The list of diploma programs approved for admission for each of the degree programs is given in Annexure A.

2. **Age Limit:**

The candidate should not have completed 21 years of age as on 1st July of the academic year under consideration. For Lateral Entry admission to second year of degree programme, candidates should not have completed 24 years as on 1st July of the academic year under consideration. In the case of SC/ST candidates, the age limit is relaxable by 3 years for both the cases.

3. **Duration of Programme:**

The Bachelor of Technology degree programme shall extend over a period of 8 consecutive semesters spread over 4 academic years - two semesters constituting one academic year. The duration of each semester shall normally be 15 weeks excluding examinations.
4. **Eligibility for the award of Degree:**

No candidate shall be eligible for the award of the degree of Bachelor of Technology, unless he/she has undergone the course for a period of 8 semesters (4 academic years) / 6 semesters (3 academic years for Lateral Entry candidates) in the faculty of Engineering and has passed the prescribed examinations in all the semesters.

5. **Branches of Study:**

- Branch I - Civil Engineering
- Branch II - Mechanical Engineering
- Branch III - Electronics & Communication Engineering
- Branch IV - Computer Science & Engineering
- Branch V - Electrical & Electronics Engineering
- Branch VI - Chemical Engineering
- Branch VII - Electronics & Instrumentation Engineering
- Branch VIII - Information Technology
- Branch IX - Instrumentation & Control Engineering
- Branch X - Biomedical Engineering

or any other branches of study as and when offered. The branch allocation shall be ordinarily done at the time of admission of the candidate to the first semester.

6. **Subjects of Study:**

The subjects of study shall include theory and practical courses as given in the curriculum and shall be in accordance with the prescribed syllabus. The subjects of study for the first two semesters shall be common for all branches of study.

7. **Examinations:**

The theory and practical examinations shall comprise continuous assessment throughout the semester in all subjects as well as university examinations conducted by Pondicherry University at the end of the semester (November / December or April / May).

(a) Theory courses for which there is a written paper of 75 marks in the university examination.

The Internal Assessment marks of 25 has to be distributed as 10 marks each for two class tests and 5 marks for class attendance in the particular subject. The distribution of marks for attendance is as follows.

- 5 marks for 95% and above
- 4 marks for 90% and above but below 95%
In total, three tests are to be conducted and the better two are to be considered for assessment.

(b) Practical courses for which there is a university practical examination of 50 marks:
The internal assessment marks of 50 has to be distributed as 20 marks for the periodic practical works and records submitted thereof, 15 marks for an internal practical examination, 5 marks for an internal viva voce, and 10 marks for class attendance in the particular subject. The distribution of marks is as given below.

<table>
<thead>
<tr>
<th>Percentage Range</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>95% and above</td>
<td>10</td>
</tr>
<tr>
<td>90% and above</td>
<td>8</td>
</tr>
<tr>
<td>85% and above</td>
<td>6</td>
</tr>
<tr>
<td>80% and above</td>
<td>4</td>
</tr>
<tr>
<td>75% and above</td>
<td>2</td>
</tr>
</tbody>
</table>

8. Requirement for appearing for University Examination:

A candidate shall be permitted to appear for university examinations at the end of any semester only if:

(i) He / She secures not less than 75% overall attendance arrived at by taking into account the total number of periods in all subjects put together offered by the institution for the semester under consideration.

(Candidates who secure overall attendance greater than 60% and less than 75% have to pay a condonation fee as prescribed by University along with a medical certificate obtained from a medical officer not below the rank of Asst. Director)

(ii) He / She earns a progress certificate from the Head of the institution for having satisfactorily completed the course of study in all the subjects pertaining to that semester.

(iii) His / Her conduct is found to be satisfactory as certified by the Head of the institution.

A candidate who has satisfied the requirement (i) to (iii) shall be deemed to have satisfied the course requirements for the semester.
9. Procedure for completing the course:

A candidate can join the course of study of any semester only at the time of its normal commencement and only if he/she has satisfied the course requirements for the previous semester and further has registered for the university examinations of the previous semester in all the subjects as well as all arrear subjects if any.

However, the entire course should be completed within 14 consecutive semesters (12 consecutive semesters for students admitted under lateral entry).

10. Passing Minimum:

(i) A candidate shall be declared to have passed the examination in a subject of study only if he/she secures not less than 50% of the total marks (Internal Assessment plus University examination marks) and not less than 40% of the marks in University examination.

(ii) A candidate who has been declared “Failed” in a particular subject may reappear for that subject during the subsequent semesters and secure a pass. However, there is a provision for revaluation of failed or passed subjects provided he/she fulfills the following norms for revaluation.

(a) Applications for revaluation should be filed within 4 weeks from the date of declaration of results or 15 days from the date of receipt of marks card whichever is earlier.

(b) The candidate should have attended all the college examinations as well as university examinations.

(c) If a candidate has failed in more than two papers in the current university examination, his/her representation for revaluation will not be considered.

(d) The request for revaluation must be made in the format prescribed duly recommended by the Head of the Institution along with the revaluation fee prescribed by the University.

The internal assessment marks obtained by the candidate shall be considered only in the first attempt for theory subjects alone. For the subsequent attempts, University examination marks will be made up to the total marks. Further the University examination marks obtained in the latest attempt shall alone remain valid in total suppression of the University examination marks obtained by the candidate in earlier attempts.
11 Award of Letter Grades:

The assessment of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain points, will be awarded as per the range of total marks (out of 100) obtained by the candidate, as detailed below:

<table>
<thead>
<tr>
<th>Range of Total Marks</th>
<th>Letter Grade</th>
<th>Grade Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 to 100</td>
<td>S</td>
<td>10</td>
</tr>
<tr>
<td>80 to 89</td>
<td>A</td>
<td>9</td>
</tr>
<tr>
<td>70 to 79</td>
<td>B</td>
<td>8</td>
</tr>
<tr>
<td>60 to 69</td>
<td>C</td>
<td>7</td>
</tr>
<tr>
<td>55 to 59</td>
<td>D</td>
<td>6</td>
</tr>
<tr>
<td>50 to 54</td>
<td>E</td>
<td>5</td>
</tr>
<tr>
<td>0 to 49</td>
<td>F</td>
<td>0</td>
</tr>
<tr>
<td>Incomplete</td>
<td>F</td>
<td></td>
</tr>
</tbody>
</table>

‘F’ denotes failure in the course. ‘FA’ denotes absent / detained as per clause 8.

After results are declared, grade sheets will be issued to the students. The grade sheets will contain the following details:

(a) The college in which the candidate has studied.

(b) The list of courses enrolled during the semester and the grades scored.

(c) The Grade Point Average (GPA) for the semester and The Cumulative Grade Point Average (CGPA) of all enrolled subjects from first semester onwards.

(d) GPA is the ratio of sum of the products of the number of credits (C) of courses registered and the corresponding grades points (GP) scored in those courses, taken for all the courses and sum of the number of credits of all the courses

\[
GPA = \frac{\text{Sum of } (C \times GP)}{\text{Sum of } C}
\]

CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. FA grades are to be excluded for calculating GPA and CGPA.
The conversion of CGPA into percentage marks is as given below

\[ \% \text{Marks} = (CGPA - 0.5) \times 10 \]

12 Award of Class and Rank:

(i) A candidate who satisfies the course requirements for all semesters and who passes all the examinations prescribed for all the eight semesters (six semesters for lateral entry candidates) within a maximum period of 7 years (6 years for lateral entry candidates) reckoned from the commencement of the first semester to which the candidate was admitted shall be declared to have qualified for the award of degree.

(ii) A candidate who qualifies for the award of the degree passing in all subjects pertaining to semesters 3 to 8 in his/her first appearance within 6 consecutive semesters (3 academic years) and in addition secures a CGPA of 8.50 and above for the semesters 3 to 8 shall be declared to have passed the examination in FIRST CLASS with DISTINCTION.

(iii) A candidate who qualifies for the award of the degree by passing in all subjects relating to semesters 3 to 8 within a maximum period of eight semesters after his/her commencement of study in the third semester and in addition secures CGPA not less than 6.5 shall declared to have passed the examination in FIRST CLASS.

(iv) All other candidates who qualify for the award of degree shall be declared to have passed the examination in SECOND CLASS.

(v) For the Award of University ranks and Gold Medal for each branch of study, the CGPA secured from 1st to 8th semester alone should be considered and it is mandatory that the candidate should have passed all the subjects from 1st to 8th semester in the first attempt. Rank certificates would be issued to the first ten candidates in each branch of study.

13 Provision for withdrawal:

A candidate may, for valid reasons, and on the recommendation of the Head of the Institution be granted permission by the University to withdraw from writing the entire semester examination as one Unit. The withdrawal application shall be valid only if it is made earlier than the commencement of the last theory examination pertaining to that semester. Withdrawal shall be permitted only once during the entire course. Other conditions being satisfactory, candidates who withdraw are also eligible to be awarded DISTINCTION whereas they are not eligible to be awarded a rank.
14. **Discontinuation of Course:**

If a candidate wishes to temporarily discontinue the course for valid reasons, he/she shall apply through the Head of the Institution in advance and obtain a written order from the University permitting discontinuance. A candidate after temporary discontinuance may rejoin the course only at the commencement of the semester at which he/she discontinued, provided he/she pays the prescribed fees to the University. The total period of completion of the course reckoned from the commencement of the first semester to which the candidate was admitted shall not in any case exceed 7 years, including of the period of discontinuance.

15. **Revision of Regulations and Curriculum:**

The University may from time to time revise, amend or change the regulations of curriculum and syllabus as and when found necessary.
### NNEXURE – A

<table>
<thead>
<tr>
<th>B.Tech courses in which admission is sought</th>
<th>Diploma courses eligible for admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Engineering</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td></td>
<td>Civil and Rural Engineering</td>
</tr>
<tr>
<td></td>
<td>Engineering Architectural Assistance</td>
</tr>
<tr>
<td></td>
<td>Agricultural Engineering</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td></td>
<td>Automobile Engineering</td>
</tr>
<tr>
<td></td>
<td>Agricultural Engineering</td>
</tr>
<tr>
<td></td>
<td>Mechanical and Rural Engineering</td>
</tr>
<tr>
<td></td>
<td>Engineering Refrigeration and Air-conditioning Agricultural Engineering</td>
</tr>
<tr>
<td></td>
<td>Technology</td>
</tr>
<tr>
<td></td>
<td>Metallurgy</td>
</tr>
<tr>
<td></td>
<td>Production Engineering</td>
</tr>
<tr>
<td></td>
<td>Machine Design &amp; Drafting</td>
</tr>
<tr>
<td></td>
<td>Machine tool maintenance and Repairs</td>
</tr>
<tr>
<td></td>
<td>Printing Technology / Engineering</td>
</tr>
<tr>
<td></td>
<td>Textile Engineering / Technology</td>
</tr>
<tr>
<td></td>
<td>Tool Engineering</td>
</tr>
<tr>
<td>Electrical and Electronics Engineering</td>
<td>Electrical Engineering</td>
</tr>
<tr>
<td>Electronics &amp; Communication Engineering</td>
<td>Electrical and Electronics Engineering</td>
</tr>
<tr>
<td></td>
<td>Electronics and Instrumentation</td>
</tr>
<tr>
<td></td>
<td>Engineering</td>
</tr>
<tr>
<td>Electronic and Instrumentation Engineering</td>
<td>Instrumentation Engineering / Technology</td>
</tr>
<tr>
<td>Instrumentation and Control Engineering</td>
<td>Electronics and Communication Engg.</td>
</tr>
<tr>
<td>Bio Medical Engineering</td>
<td>Electronics Engineering</td>
</tr>
<tr>
<td></td>
<td>Medical Electronics</td>
</tr>
<tr>
<td></td>
<td>Instrumentation and Control Engineering</td>
</tr>
<tr>
<td></td>
<td>Applied Electronics</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td></td>
<td>Chemical Technology</td>
</tr>
<tr>
<td></td>
<td>Petrochemical</td>
</tr>
<tr>
<td></td>
<td>Technology Petroleum</td>
</tr>
<tr>
<td></td>
<td>Engineering Ceramic Technology</td>
</tr>
<tr>
<td></td>
<td>Plastic Engineering</td>
</tr>
<tr>
<td></td>
<td>Paper &amp; Pulp Technology</td>
</tr>
<tr>
<td></td>
<td>Polymer Technology</td>
</tr>
<tr>
<td>Information Technology</td>
<td>Computer Science and Engineering</td>
</tr>
<tr>
<td>Computer Science &amp; Engineering</td>
<td>Computer Technology</td>
</tr>
<tr>
<td></td>
<td>Electrical and Electronics Engineering</td>
</tr>
<tr>
<td></td>
<td>Electronics &amp; Communication Engineering</td>
</tr>
<tr>
<td></td>
<td>Engineering Electronics &amp; Instrumentation Engineering</td>
</tr>
<tr>
<td></td>
<td>Instrumentation Engineering / Technology</td>
</tr>
</tbody>
</table>
## CURRICULUM
B.Tech. – CIVIL ENGINEERING

### I SEMESTER

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Name of the Subjects</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
<th>IA</th>
<th>UE</th>
<th>TM</th>
<th>Periods</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T 101</td>
<td>Mathematics – I</td>
<td>3</td>
<td>1</td>
<td></td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T 102</td>
<td>Physics</td>
<td>4</td>
<td></td>
<td></td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T 103</td>
<td>Chemistry</td>
<td>4</td>
<td></td>
<td></td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T 104</td>
<td>Basic Electrical and Electronics Engineering</td>
<td>3</td>
<td>1</td>
<td></td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T 105</td>
<td>Engineering Thermodynamics</td>
<td>3</td>
<td>1</td>
<td></td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T 106</td>
<td>Computer Programming</td>
<td>3</td>
<td>1</td>
<td></td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P 101</td>
<td>Computer Programming Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P 102</td>
<td>Engineering Graphics</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P 103</td>
<td>Basic Electrical &amp; Electronics Lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>22</td>
<td>4</td>
<td>9</td>
<td>29</td>
<td>300</td>
<td>600</td>
<td>900</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### II SEMESTER

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Name of the Subjects</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
<th>IA</th>
<th>UE</th>
<th>TM</th>
<th>Periods</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T 107</td>
<td>Mathematics – II</td>
<td>3</td>
<td>1</td>
<td></td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T 108</td>
<td>Material Science</td>
<td>4</td>
<td></td>
<td></td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T 109</td>
<td>Environmental Science</td>
<td>4</td>
<td></td>
<td></td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T 110</td>
<td>Basic Civil and Mechanical Engineering</td>
<td>4</td>
<td></td>
<td></td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T 111</td>
<td>Engineering Mechanics</td>
<td>3</td>
<td>1</td>
<td></td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T 112</td>
<td>Communicative English</td>
<td>4</td>
<td></td>
<td></td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P 104</td>
<td>Physics lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P 105</td>
<td>Chemistry lab</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P 106</td>
<td>Workshop Practice</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P 107</td>
<td>NSS / NCC *</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>22</td>
<td>2</td>
<td>9</td>
<td>27</td>
<td>300</td>
<td>600</td>
<td>900</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*To be completed in I and II semesters, under Pass / Fail option only and not counted for CGPA calculation.*
### III Semester

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Sub. Code</th>
<th>Subject</th>
<th>Periods</th>
<th>Credits</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MAT31</td>
<td>Mathematics - III</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>MET32</td>
<td>Mechanics of Solids</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>MET33</td>
<td>Mechanics of Fluids</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>MET34</td>
<td>Applied Thermodynamics</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>MET35</td>
<td>Engineering Metallurgy</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>MET36</td>
<td>Manufacturing Process – I</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Practical | MEP31 | Material Testing and Metallurgy Lab | 0 | 0 | 3 | 2 | 50 | 50 | 100 |
| Practical | MEP32 | Fluid Mechanics Lab                | 0 | 0 | 3 | 2 | 50 | 50 | 100 |
| Practical | MEP33 | Manufacturing Processes Lab - I    | 0 | 0 | 3 | 2 | 50 | 50 | 100 |
| Total     |       |                                        | 20| 4 | 9 | 26| 300| 600| 900 |

### IV Semester

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Sub. Code</th>
<th>Subject</th>
<th>Periods</th>
<th>Credits</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MAT41</td>
<td>Mathematics - IV</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>MET42</td>
<td>Kinematics of Machinery</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>MET43</td>
<td>Fluid Machinery</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>MET44</td>
<td>Heat and Mass Transfer</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>MET45</td>
<td>Machine Drawing</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>MET46</td>
<td>Electrical &amp; Electronics Engine</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Practical | MEP41 | Computational Methods Lab      | 2 | 0 | 3 | 3 | 50 | 50 | 100 |
| Practical | MEP42 | Fluid Machinery Lab            | 0 | 0 | 3 | 2 | 50 | 50 | 100 |
| Practical | MEP43 | Electrical & Electronics Lab   | 0 | 0 | 3 | 2 | 50 | 50 | 100 |
| Practical | MEP44 | Physical Education*            |     |   |   | 2 |    |    |    |
| Total     |       |                                | 19| 5 | 14| 27| 325| 575| 900 |

* Pass / Fail option only and not counted for CGPA calculation.
### V Semester

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Sub. Code</th>
<th>Subject</th>
<th>Periods</th>
<th>Credits</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td>1</td>
<td>MET51</td>
<td>Dynamics of Machinery</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>MET52</td>
<td>Design of Machine Elements</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>MET53</td>
<td>Metrology and Quality Control</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>MET54</td>
<td>Thermal Engineering (IC Engines, Gas dynamics and Propulsion)</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>MET55</td>
<td>Manufacturing Process – II</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>MET56</td>
<td>Control System Engineering</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Practical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>MEP51</td>
<td>Manufacturing Processes Lab : II</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>MEP52</td>
<td>Dynamics of Machines Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>MEP53</td>
<td>Computer Aided Machine Drawing</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>MEP54</td>
<td>General Proficiency - I</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total** 19 5 12 29 400 600 1000

### VI Semester

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Sub. Code</th>
<th>Subject</th>
<th>Periods</th>
<th>Credits</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td>1</td>
<td>MET61</td>
<td>Operations Research</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>MET62</td>
<td>Design of Transmission Systems</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>MET63</td>
<td>Power Plant Engineering</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>MET64</td>
<td>Advanced Manufacturing Technology</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>MET65</td>
<td>Mechanical Measurements</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>Elective - I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Practical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>MEP61</td>
<td>Manufacturing Processes Lab - III</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>MEP62</td>
<td>Mechanical Measurements and Metrology Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>MEP63</td>
<td>Thermal Engineering Lab – I</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>MEP64</td>
<td>General Proficiency - II</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**Total** 19 5 12 29 400 600 1000
### VII Semester

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Sub. Code</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
<th>IA</th>
<th>UE</th>
<th>TM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MET71</td>
<td>Computer Aided Design</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>MET72</td>
<td>Computer Integrated. Manufacturing</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>MET73</td>
<td>Refrigeration, Air Conditioning and Cryogenics</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Elective – II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Elective - III</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Elective - IV</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Practical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>MEP71</td>
<td>Thermal Engineering Lab – II</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>8</td>
<td>MEP72</td>
<td>CAD Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>9</td>
<td>MEP73</td>
<td>Comprehensive Viva - Voce</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>10</td>
<td>MEP74</td>
<td>Industrial Visit / Training Report</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>100</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>11</td>
<td>MEPW7</td>
<td>Project Work (Phase I)*</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>19</td>
<td>5</td>
<td>12</td>
<td>29</td>
<td>400</td>
<td>600</td>
<td>1000</td>
</tr>
</tbody>
</table>

*Note: 15 marks of Internal Assessment of Project Work (Phase II) should be based on Project Work (Phase I) of VII Semester*

### VIII Semester

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Sub Code</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
<th>IA</th>
<th>UE</th>
<th>TM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Theory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MET81</td>
<td>Industrial Engineering &amp; Management</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>MET82</td>
<td>Maintenance and Safety Engineering</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>MET83</td>
<td>Energy &amp; Environmental. Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Elective - V</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Elective - VI</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Practical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>MEPW8</td>
<td>Project Work (Phase II)</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>8</td>
<td>50</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>7</td>
<td>MEP81</td>
<td>Seminar</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>100</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td>8</td>
<td>MEP82</td>
<td>Professional Ethics and Indian Constitution</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>100</td>
<td>-</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>14</td>
<td>2</td>
<td>18</td>
<td>25</td>
<td>375</td>
<td>425</td>
<td>800</td>
</tr>
</tbody>
</table>

*Note: 15 marks of Internal Assessment of Project Work (Phase II) should be based on Project Work (Phase I) of VII Semester*
LIST OF ELECTIVES

Elective – I

MEE61  Industrial Casting Technology
MEE62  Total Quality Management
MEE63  Design of Heat Exchangers
MEE64  Finite Element Methods
MEE65  IT Applications in Manufacturing
MEE66  Theory of Metal Cutting
MEE67  Engineering Tribology

Elective – II, III & IV

MEE71  Automobile Engineering
MEE72  Fuzzy Logic and Neural Networks
MEE73  Integrated Materials Management
MEE74  Metal Forming Processes
MEE75  Nuclear Power Engineering
MEE76  Plastics Engineering
MEE77  Product Design and Development
MEE79  Computational Fluid Dynamics
MEE710  Mechatronics
MEE711  Renewable Energy
MEE712  Advanced Welding Techniques

Elective – V & VI

MEE81  Automotive Fuels, Pollution, and Control
MEE82  Composite Materials
MEE83  Direct Energy Conversion Systems
MEE84  Fluid Power Automation
MEE85  Industrial Robotics
MEE86  Pressure Vessel Design
MEE87  Project Management
MEE88  Modeling & Simulation in Manufacturing
MEE89  Solar Power Engineering
T101 MATHEMATICS – I

Unit I - Calculus

Curvature, radius of curvature, evolutes and involutes. Beta and Gamma functions and their properties.

Unit II - Multiple Integrals And Applications

Multiple integrals – change of order of integration. Applications: Areas (double integration) and volumes by triple integration (Cartesian and polar) – mass and center of mass (constant and variable densities).

Unit III - Analytical Solid Geometry

Directional cosines and ratios – angle between two lines – the equation of plane - equations to a straight line and shortest distance between two skew lines.

Unit IV - Differential Equations

Exact equations, First order linear equations, Bernoulli’s equation, orthogonal trajectories, growth and decay, geometrical applications and electric circuits. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut’s type.

Unit V - Differential Equations (Higher order)

Linear differential equations of higher order – with constant coefficients, the operator D - Euler’s linear equation of higher order with variable coefficients - simultaneous linear differential equations – solution by variation of parameters method – simple applications to electric circuits.

Text Book


Reference Book

T102 PHYSICS

Unit I – Acoustics & NDT

Ultrasonics - Ultrasonic Waves Productions (Piezoelectric & Magnetostriction method) – Detections (Acoustic Grating)
Acoustics - Factors affecting Acoustic of Buildings (Reverberation, Loudness, Focusing, Echo, Echelon Effect and Resonance) and their Remedies - Sabine’s formula for Reverberation Time
NDT applications - Pulse Echo Method - Liquid Penetrant Method

Unit II – Optics

Interference - Air Wedge - Michelson’s Interferometer - Wavelength Determination - Interference Filter - Antireflection Coatings
Diffraction - Diffraction Grating - Dispersive power of grating - Resolving Power of Grating & Prism
Polarisation - Huygens Theory of Double Refraction - Quarter and Half Wave Plates - Specific Rotary Power - Laurent Half Shade Polarimeter

Unit III – Lasers & Fiber Optics

Fiber Optics - Principle and Propagation of light in optical fiber - Numerical aperture and acceptance angle - Types of optical fibers (material, refractive index, mode)

Unit IV – Wave Mechanics

Matter Waves - de Broglie Wavelength - Uncertainty Principle - Schrödinger Wave Equation - Time Dependent - Time Independent - Application to Particle in a One Dimensional Box - Quantum Mechanical Tunneling - Tunnel Diode.

Unit V – Nuclear Energy Source

General Properties of Nucleus (Size, Mass, Density, Charge) - Mass Defect - Binding Energy - Disintegration in fission - Nuclear Fusion (p-p & C-N cycle) - Nuclear Reactor: Materials Used in Nuclear Reactors. - PWR - BWR - FBTR
Text Books


Reference Books

Unit I - Water


Unit II - Polymers


Unit III - Electrochemical Cells


Unit IV - Corrosion and Its Control


Unit V - Phase Rule

Definition and derivation of phase rule. Application to one component system - water and sulphur systems. Thermal analysis, condensed phase rule. Two component alloy systems - Pb-Ag, Cu-Ni and Mg-Zn systems.

Text books

Reference Books
Unit – I


Unit – II

Node and mesh methods of analysis of DC circuits and simple AC circuits. Introduction to three phase circuits, Introduction to three phase system - phase and line parameters – relations, power measurement – voltmeter and ammeter method, two and three wattmeter methods.

Unit – III

Principle of DC generator and motor, Transformer, synchronous generator, induction motor (single phase). Sources for electrical energy conversion-thermal and hydraulic plant (Block diagram approach only). Components of AC transmission and distributions systems – line diagram.

Part B – Electronics

Unit – IV

Half-wave rectifier and Full-wave rectifier- filters - Amplifiers-common emitter and common collector amplifiers- Hartley oscillator and RC phase shift oscillator. Transducers – Resistance temperature detector (RTD) – Linear variable differential transformer (LVDT) - Strain gauge – Piezo electric transducer.

Unit – V


Unit – VI

Model of communication system – Analog and digital – Wired and wireless channel. Block diagram of various communication systems – Microwave, satellite, optical fiber and cellular mobile system. Network model – LAN, MAN and WAN – Circuit and packet switching – Overview of ISDN.
Text Books


Reference Books

T105 THERMODYNAMICS

Unit I - Basic Concepts and Definitions

Energy conversion and efficiencies - System, property and state - Thermal equilibrium - Temperature - Zeroth law of Thermodynamics.

Unit II - First Law of Thermodynamics

The concept of work and adiabatic process - First law of thermodynamics - Conservation of Energy principle for closed and open systems - Calculation of work for different processes of expansion of gases

Unit III - Second Law of Thermodynamics

Equilibrium and the second law - Heat engines - Kelvin-Planck statement of second law of thermodynamics - Reversible and irreversible processes - Carnot principle - Clausius inequality- Entropy

Unit IV - Gas Power Cycles

Air standard cycles: The air standard Carnot cycle - Air standard Otto cycle, diesel cycle, dual cycle and Bryton cycles and their efficiencies

Unit V - Refrigeration Cycles and Systems

Reverse Carnot cycle - COP - Vapor compression refrigeration cycle and systems (only theory) - Gas refrigeration cycle - Absorption refrigeration system (only theory)- Liquifaction and solidification of gases

Text Books

Reference Books
T106 COMPUTER PROGRAMMING

Unit – I


Unit – II

Problem solving techniques – Program – Program development cycle – Algorithm design – Flowchart - Pseudo code.
Introduction to C – C tokens – data types – Operators and expressions – I/O functions

Unit – III

Decision making statements – branching and looping – arrays – multidimensional arrays – Functions – Recursion – Passing array to functions
Storage classes – Strings – String library functions

Unit – IV

Structures – Arrays and Structures – nested structures – passing structures to functions – user defined data types– Union
Pointers – pointers and arrays – pointers and functions - pointers and strings - pointers and structures

Unit – V

Files – operations on a file – Random access to files – command line arguments
Introduction to preprocessor – Macro substitution directives – File inclusion directives – conditional compilation directives – Miscellaneous directives

Text Books


Reference Books

P101 COMPUTER PROGRAMMING LAB
List of Exercises

OS Commands, Word Processor and Spreadsheets

1. Study of OS commands-Compilation and execution of simple C programs
2. Use of mail merge in word processor
3. Use of spreadsheet to create Charts(XY, Bar, Pie) and apply the formulae wherever necessary C Programming (Flowcharts and algorithms are essential for the programming exercises)
4. Greatest of three numbers using conditional operator and if statement
5. Read two numbers and swap those two numbers using temporary variable and without using temporary variable.
6. Solve quadratic equation for different sets of inputs.
7. Use of Switch….Case statements
8. Generation of prime and Fibonacci series
9. Evaluate the COSINE series using for, while and do..while loops
10. Matrix operations
   a) Addition
   b) Transpose
   c) Multiplication
11. Evaluate the sin(x) series using functions and recursive functions
12. Read a string and find solution to remove the duplicates of a given string from the given sentence
13. Create an array of structures for a list of items with the following details

<table>
<thead>
<tr>
<th>Item_Code</th>
<th>Item_Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>102</td>
<td>Paste – Colgate</td>
</tr>
<tr>
<td>102</td>
<td>Paste – Pepsodent</td>
</tr>
<tr>
<td>102</td>
<td>Paste – Close-up</td>
</tr>
<tr>
<td>101</td>
<td>Soap – Cinthol</td>
</tr>
<tr>
<td>101</td>
<td>Soap – Lux</td>
</tr>
<tr>
<td>101</td>
<td>Soap – Hamam</td>
</tr>
<tr>
<td>101</td>
<td>Soap – Dove</td>
</tr>
</tbody>
</table>
Arrange the set of items in ascending order of its Item_Code and descending order of its Item_name as given below

<table>
<thead>
<tr>
<th>Item_Code</th>
<th>Item_Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>Soap-Lux</td>
</tr>
<tr>
<td>101</td>
<td>Soap-Hamam</td>
</tr>
<tr>
<td>101</td>
<td>Soap-Dove</td>
</tr>
<tr>
<td>101</td>
<td>Soap-Cinthol</td>
</tr>
<tr>
<td>102</td>
<td>Paste–Pepsodent</td>
</tr>
<tr>
<td>102</td>
<td>Paste–Colgate</td>
</tr>
</tbody>
</table>

14. Use of Structure to define a user defined data type, input the data and write the data into the file

15. Use of pointers and array of pointers

16. Functions with static data types

17. Write command line program to implement the following DOS commands using files

- Del
- Copy
Unit 0
Introduction to Standards for Engineering Drawing practice, Lettering, Line work and Dimensioning

Unit I
Conic sections, Involute, Spirals, Helix. Projection of Points, Lines and Planes

Unit II
Projection of Solids and Sections of Solids.

Unit III
Development of surfaces - Intersection of surfaces (cylinder-cylinder, cylinder-cone)

Unit IV
Isometric projections and Orthographic projections

Unit V
Computer Aided Drafting: Introduction to Computer Aided Drafting hardware - Overview of application software - 2D drafting commands (Auto CAD) for simple shapes - Dimensioning.

Text Books

Reference Books
ELECTRICAL LAB

1. Study of tools and accessories
2. Study of joints
3. Staircase wiring
4. Doctor’s room wiring
5. Godown wiring
6. Tube Light and Fan connection
7. Lamp controlled from three different places — wiring

ELECTRONICS LAB

1. Rectifiers
   Construction of half wave and full wave rectifiers with and without filters — Calculation of ripple factors.

2. Frequency Response of RC Coupled Amplifiers
   Determination of frequency response of given RC coupled amplifier — Calculation of bandwidth.

3. Verification of Kirchoff’s Voltage and Current Laws
   Determine the voltage and current in given circuits using Kirchoff’s laws theoretically and verify the laws experimentally.

4. Study of Logic Gates
   a. Verification of Demorgan’s theorems
   b. Verification of truth tables of OR, AND, NOT, NAND, NOR, EX-OR, EX-NOR gates and Flipflops - JK, RS, T and D
   c. Implementation of digital functions using logic gates

5. Study of CRO
   a. Measurement of AC and DC voltages
   b. Frequency and phase measurements (using Lissajou’s figures)

6. Study of Transducers
   a. Displacement and load measurements with transducers
   b. Temperature measurement with thermocouple
Unit I - Algebra

Binomial, exponential and logarithmic series (without proof) – problems on summation, approximation and coefficients.

Unit II – Matrices

Inverse of matrix by row transformation – Eigen values and Eigen vectors - Cayley-Hamilton theorem (without proof) – Diagonalisation – rank of matrix – solution of a general system of m linear algebraic equations in n unknowns (m ≤ n).

Unit III – Trigonometry

Expansions for \( \sin^n \theta, \cos^n \theta, \tan^n \theta, \sin (n\theta), \cos(n\theta), \tan (n\theta) \). Exponential, circular, hyperbolic, inverse hyperbolic and logarithmic functions of a complex variable – separation of real and imaginary parts.

Unit IV - Vector Analysis

Scalar fields and Vector fields – Gradient, Divergence and Curl – their properties and relations – Gauss and Stokes theorems (without proof), simple problems for their verification.

Unit V – Statistics

Moments, kurtosis and skewness based on moments only. Probability distributions: Binomial, Poisson and Normal – evaluation of statistical parameters for these three distributions. Correlation and regression – rank correlation.

Text Books

Reference Books
Unit I - Crystal structure and Defects
Crystal Systems – Bravais Lattices – Coordination Number, Atomic Radius, Packing Factor for FCC & HCP structures – Miller Indices for a cubic crystal– Powder X Ray Diffraction Method - Lattice defects - Qualitative ideas of point, line, surface and volume defects

Unit II – Dielectric properties
Dielectric Polarization and Mechanism - Internal or local Field - Clausius-Mossotti relation - Dielectric loss - Temperature and frequency dependence of dielectric constant - Measurement of Dielectric constant and loss using Scherring bridge - Elementary ideas of Piezoelectrics, Ferroelectrics and Pyroelectric materials and its Applications

Unit III – Magnetic Properties

Unit IV – Semiconductors and superconductors

Unit V – Advanced Materials
Liquid Crystals - Types - Application as Display Devices - Metallic Glasses - Nanomaterials (one, Two & three Dimensional) - Physical Properties and Applications of Carbon Nano Tubes

Text books

Reference Books
T109 ENVIRONMENTAL SCIENCE

Unit I - Environmental Segments and Natural Resources


Unit II - Ecosystem & Biodiversity


Unit III - Air Pollution

Air pollution-sources of air pollution. Sources, effects and control measures of oxides of nitrogen, oxides of sulphur, oxides of carbon, hydrocarbon, chlorofluoro carbons and particulates. Green house effect-causes and effects on global climate and consequences. Ozone depletion-causes, mechanism and effect on the environment. Smog-sulfurous and photochemical smog-effect on the environment. Acid rain-theory of acid rain and effects.

Unit IV - Water Pollution and Solid Waste Management

Sources, effects and control measures of -water pollution, soil pollution, marine pollution, noise pollution, thermal pollution and radioactive pollution. Solid waste management - causes, effect and control measures of urban and industrial wastes.

Unit V - Social Issues and the Environment

Text Books


Reference Books

2. G. S. Sodhi, Fundamental concepts of environmental chemistry, Narosa publishing house, New Delhi
Unit I - Buildings, Building Materials

Buildings: Definition - Classification according to NBC: plinth area, floor area, carpet area, floor space index - construction materials: stone, brick, cement, cement-mortar, concrete, steel: their properties and uses.

Unit II - Buildings and their components


Unit III - Basic Infrastructure


PART B Mechanical Engineering

Unit IV - Internal and external combustion systems

Working principles of IC engines - Classification - Diesel and petrol engines: two stroke and four stroke engines. Steam generators (Boilers) - Classification - Constructional features (of only low pressure boilers) - Boiler mountings and accessories. Conventional Power Generation Systems

Hydraulic, steam and gas turbines power plants – Schemes and layouts – Selection criteria of above power plants.

Unit V - Non-Conventional Energy Systems (Description Only)

Solar thermal systems – Solar photovoltaic – Solar pond – wind, wave, tidal, geothermal and ocean thermal energy conversion systems.

Casting

Green and dry sand moulding processes for ferrous and non-ferrous metals – applications.

Unit VI - Metal Joining

Elements of arc and gas welding, brazing and soldering – Bolted joint types – Adhesive Bonding; classification of adhesives – applications.

Sheet Metal Processing

Punching, blanking, shearing, bending, and deep drawing processes; descriptions and applications.
Text Books

Reference Books
Unit I - Fundamental of Mechanics

Basic Concepts Force System and Equilibrium, Definition of Force, Moment and Couple, Principle of Transmissibility, Varignon’s theorem, Resultant of force system – Concurrent and non concurrent coplanar forces, Condition of static equilibrium for coplanar force system, stability of equilibrium, concept of free body diagrams, applications in solving the problems on static equilibrium of bodies.

Unit II - Plane Trusses

Degrees of freedom, Types of supports and reactions, Types of loads, Analysis of Trusses-method of joints, method of sections
Friction
Introduction, Static dry friction, simple contact friction problems, ladders, wedges, screws and belt friction.

Unit III - Properties of Surfaces

Properties of sections – area, centroids of lines, areas and volumes, moment of inertia first moment of inertia, second moment of inertia and product moment of inertia, polar moment of inertia, radius of gyration, mass moment of inertia.

Unit IV - Kinematics and Kinetics of Particles


Unit V - Kinematics and Kinetics of Rigid bodies

Plane motion, Absolute motion, Relative motion, translating axes and rotating axes, work and energy, impulse and momentum

Text Books

Reference Books
T112 COMMUNICATIVE ENGLISH

Unit I – Basic Communication Theory

Importance of Communication – stages of communication, modes of communication – barriers to communication – strategies for effective communication – Listening: Importance, types, barriers – Developing effective listening skills.

Unit II – Comprehension And Analysis

Comprehension of technical and non-technical material – Skimming, scanning, inferring- Note making and extension of vocabulary, predicting and responding to context- Intensive Reading and Reviewing

Unit III – Writing

Effective sentences, cohesive writing, clarity and conciseness in writing – Introduction to Technical Writing – Better paragraphs, Definitions, Practice in Summary Writing – Four modes of writing – Use of dictionaries, indices, library references – making bibliographical entries with regard to sources from books, journals, internet etc.

Unit IV – Business Writing / Correspondence


Unit V – Oral Communication


Reference Books

List of experiments (Any 10 Experiments)

1. Thermal conductivity - Lee's DISC
2. Thermal conductivity - Radial flow
3. Spectrometer - Prism or Hollow prism
4. Spectrometer - Transmission grating
5. Spectrometer - Ordinary & Extraordinary rays
6. Newton’s rings
7. Air - wedge
8. Half shade polarimeter - Determination of specific rotatory power
9. Jolly’s experiment - determination of $\alpha$
10. Magnetism: i - h curve
11. Field along the axis of coil carrying current
12. Vibration magnetometer - calculation of magnetic moment & pole strength
13. Laser experiment: wavelength determination using transmission grating, reflection grating (vernier calipers) & particle size determination
14. Determination of optical absorption coefficient of materials using laser
15. Determination of numerical aperture of an optical fiber
P105 CHEMISTRY LABORATORY

List of experiments (Any 10 Experiments)

1. Determination of dissolved oxygen in water.
2. Determination of total hardness of water by EDTA method.
3. Determination of carbonate and bicarbonate in water.
4. Estimation of chloride content in water.
5. Estimation of magnesium by EDTA.
7. Estimation of ferrous by permanganometry.
8. Estimation of ferrous and ferric iron in a solution mixture by dichrometry.
10. Estimation of copper in copper sulphate solution.
11. Estimation of calcium by permanganometry.
12. Estimation of iron by colorimetry.

Demonstration Experiments (Any two of the following)

1. Determination of COD of water sample.
2. Determination of lead by conductometry.
3. Percentage composition of sugar solution by viscometry.
P106 WORKSHOP PRACTICE

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Trade</th>
<th>List of Exercises</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Fitting</td>
<td>Study of tools and Machineries. Exercises on symmetric joints and joints with acute angle.</td>
</tr>
<tr>
<td>2.</td>
<td>Welding</td>
<td>Study of arc and gas welding equipment and tools – Edge preparation – Exercises on lap joint and V Butt joints – Demonstration of gas welding</td>
</tr>
<tr>
<td>3</td>
<td>Sheet metal work</td>
<td>Study of tools and Machineries – exercises on simple products like Office tray and waste collection tray.</td>
</tr>
<tr>
<td>4.</td>
<td>Carpentry</td>
<td>Study of tools and Machineries – Exercises on Lap joints and Mortise joints</td>
</tr>
</tbody>
</table>

List of Exercises

I Fitting
1. Study of tools and Machineries
2. Symmetric fitting
3. Acute angle fitting

II Welding
1. Study of arc and gas welding equipment and tools
2. Simple lap welding (Arc)
3. Single V butt welding (Arc)

III Sheet metal work
1. Study of tools and machineries
2. Funnel
3. Waste collection tray

IV Carpentry
1. Study of tools and machineries
2. Half lap joint
3. Corner mortise joint.
NCC/NSS training is compulsory for all the Undergraduate students

1. The above activities will include Practical/field activities/Extension lectures.
2. The above activities shall be carried out outside class hours.
3. In the above activities, the student participation shall be for a minimum period of 45 hours.
4. The above activities will be monitored by the respective faculty incharge and the First Year Coordinator.
5. Pass /Fail will be determined on the basis of participation, attendance, performance and behaviour. If a candidate Fails, he/she has to repeat the course in the subsequent years.
6. Pass in this course is mandatory for the award of degree.
UNIT - I
**Laplace Transform:** Definitions – Laplace transform of unit impulse and step functions – Laplace transform of periodic functions – Exponential shift formula – Initial and final value theorems – Laplace transform of derivatives and integrals – Convolution theorem – Inverse Laplace transform – Methods of determining inverse Laplace transform – Solution of linear differential equations using Laplace transforms. (12 hrs)

UNIT - II
**Function of a Complex Variable:** Functions of a complex variable – continuity, derivative and analytic function – Cauchy-Reimann equations – Necessary and sufficient conditions for analyticity – Harmonic and orthogonal properties of real and imaginary parts – Conformal mapping – Bilinear transformations. (12 hrs)

UNIT - III
**Complex Integration:** Cauchy’s theorem – Cauchy’s integral formula – Taylor’s and Laurent series – Residue theorem- Contour integration round the unit circle and semicircular contour. (12 hrs)

UNIT - IV
**Fourier Series:** Dirichlet’s conditions – Expansion of periodic functions into Fourier series – Change of interval – Half range Fourier series. Complex form of Fourier series – Root mean square value – Parseval’s theorem on Fourier coefficients – Harmonic analysis. (12 hrs)

UNIT - V
**Fourier Transform:** Fourier integral (statement only), Fourier transform, Inverse Fourier transform, Fourier sine and Cosine transforms, definitions and properties. (12 hrs)

**TEXT BOOKS:**

**REFERENCE BOOKS:**
MET32 MECHANICS OF SOLIDS (3 1 0 3)

Unit - I

Simple Stresses and Strain – Relation between three modulus and Poisson’s ratio – Thermal Stress – Principal stress and Principal planes - Shear Force – Bending Moment – Cantilever and simply supported beams subjected to point loads and uniformly distributed loads. (12 hours)

Unit – II

Theory of simple bending - stress variation in beam cross Section; Normal and Shear stress in Beams – Beam of uniform strength for bending, combined direct and bending stresses. (12 hours)

Unit – III

Double integration method – moment area method – Introduction to strain energy method and Principle of virtual work. (12 hours)

Unit – IV

Torsion of circular solid and Hollow shafts – Shafts in Series and parallel – Combined bending and torsion -Application of Torsion in helical springs: Open and closed coil springs, Leaf Springs. (12 hours)

Unit – V


Text Books :

Reference Books :
Unit – I


Unit – II


Unit – III

Introduction to mass, momentum and energy transfer – momentum equation – Navier Stoke’s equation – impulse momentum equation and its applications – dimensions and equations – Buckingham □ theorem – dimensionless numbers and its significance – models – laws of similitude. (12 hours)

Unit – IV

Concept of boundary layer – boundary layer growth over a flat plate- boundary layer thickness, displacement, momentum and energy thickness – Solution of simplified Navier Stokes equation: Blasius solution – laminar and turbulent boundary layers – drag force in laminar and turbulent flow – boundary layer separation and control. (12 hours)

Unit – V


Text Books :

Reference Books :
Unit – I


Unit – II

Exergy analysis – introduction to exergy – closed system exergy balance – flow exergy – exergy rate balance for control volume – second law efficiencies. (12 hours)

Unit – III


Unit – IV


Unit – V

Combustion Reactions – Enthalpy of formation – Steady flow analysis of reacting mixtures – Adiabatic combustion temperature – Enthalpy of reaction and heating values – Second law analysis of chemical reactions – Availability analysis of chemical reactions. (12 hours)

Text Books :

Reference Books :
Unit - I

Crystal structures - Solid Solutions - Types - Metallography - Metallurgical microscopes - specimen preparation - Cooling curves - Allotropy concept (12 hours)

Unit - II

Construction and interpretation of binary phase diagrams - Types - Eutectic, Eutectoid, Petitectic and Peritectoid systems - Iron Carbon equilibrium diagrams - classification of steels and alloy steels - types, manufacture, properties and applications of cast irons. (12 hours)

Unit - III

Heat treatment of steel: Critical temperature on heating and cooling, effects of residual stresses - Annealing, normalizing, hardening, Hardenability tests, tempering - construction and interpretation of TTT diagram - Martensitic transformation - Sub zero treatment - Surface hardening processes. (12 hours)

Unit - IV

Non ferrous metals and alloys: Copper, Aluminium, Nickel, Zinc and Lead based alloys - concept and applications of metal matrix composites. Mechanical properties of materials - Testing of materials: Tensile, compression, torsion, hardness (micro & macro) and impact testing. (12 hours)

Unit - V

Plastic deformation, Slip and twinning - Hot, cold and warm working - recovery and recrystallization concepts. Introduction to fracture mechanics - Types - ductile to brittle transition - Creep and Fatigue failures - Testing. (12 hours)

Text Books:


Reference Books:

MET 36 MANUFACTURING PROCESSES – I (3 0 0 3)

Unit I:
Introduction to manufacturing processes – classification – steps involved in casting process –
different types of casting – pattern and core making – materials, types and allowances – moulding
tools and equipment - properties of moulding sand - casting defects and remedies.  
(9 hours)

Unit II:
Types of welding processes – weldability - gas welding – oxy acetylene welding - Introduction to
arc welding – types and equipment – resistance welding – types and applications - welding defects
– Introduction to welding standards – welding of dissimilar metals and non-metals.  
(9 hours)

Unit III:
Classification of metal forming processes – Rolling, Forging, Extrusion, Drawing and other Sheet
metal operations : terminology used, processes, machines and defects.  
(9 hours)

Unit IV:
Surface Finishing Processes : Surface Finish and Surface Roughness Honing – Lapping –
Grinding : Types of grinding – Types of Grinding machines – Size and specification of Grinding
(9 hours)

Unit V:
Plastics and polymers – structure of polymers – additives in plastics – thermoplastics and
thermosetting plastics – manufacturing of plastic products – different moulding methods -
forming or shaping methods – laminating methods – machining of plastics – joining plastics -
industrial applications of plastics.  
(9 hours)

Note: Elementary treatment only for all the five units

Text Books:


Reference Books:

1. E.Paul DeGarmo, J.T.Black and Ronald A.Kosher – Materials and Processes in Manufacturing,
   Ltd., 1997.
Materials Testing Laboratory

1. Tension test - metals and composites
2. Compression Test - metals and composites
3. Hardness test: Rockwell and Brinell
4. Ductility test: Sheet metals (Al, GI and MS).
5. Impact Test

Metallurgy Laboratory

1. Study of microstructure in metals
2. Specimen preparation & microscopic study of ferrous/nonferrous metals
3. Effect of heat treatments viz., Annealing and hardening on ferrous/nonferrous metals
4. Study of various Quenching mediums
5. Jominy end quenching test
1. Determination of Metacentric height of a buoy
2. Determination of force due to impact of jets
3. Determination of co-efficient of discharge of venturi meter
4. Determination of co-efficient of discharge of orifice meter
5. Determination of co-efficient of discharge of orifice by (a) constant head method and (b) variable head method
6. Determination of co-efficient of discharge of mouth piece by (a) constant head method and (b) variable head method
7. Determination of major losses in pipe flow
8. Determination of minor losses in pipe flow
9. Measuring discharge using V notch
10. Measuring discharge using rectangular weir
**TURNING:**
1. Study of Lathe
2. Plain turning and facing
3. Step turning, Grooving & Chamfering
4. Taper turning by swiveling compound rest method
5. Taper turning by attachment method
6. V – Thread cutting

**SHAPING:**
7. Study of Shaper
8. Cube shaping
9. Step shaping

**MILLING:**
10. Study of Milling Machine
11. Cube Milling
12. Step Milling
Partial Differential Equations

Unit - I

Formation of PDE by elimination of arbitrary constants and arbitrary functions – General singular. Particular and complete integrals – Lagrange’s linear first order equation – Higher order differential equations with constant coefficients. (12 hours)

Unit - II

Solution of partial differential equation by the method of separation of variables – Boundary value problems – Fourier series solutions – Transverse vibration of an elastic string. (12 hours)

Unit - III

Fourier series solution for one dimensional heat flow equation – Fourier series solutions for two dimensional heat flow equations under steady state conditions (Cartesian and polar forms). (12 hours)

Applied Statistics

Unit - IV

Curve fitting by the method of least squares – fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. (12 hours)

Unit - V

Small samples: Test for single mean, difference of means and correlation coefficients – test for ratio of variances – Chi–Square test for goodness of fit and independence of attributes. (12 hours)

TEXT BOOK:

REFERENCE BOOKS:
Unit – I:
Introduction: Mechanisms and machines; Elements of kinematic chain, mobility and range of movements, Definition & Concept - inversion of single and double slider chain and four bar chain and its applications
Mechanism with lower pairs -Pantograph, Straight line mechanism- exact and approximate Motion, Engine indicator, Motor car Steering gears, Hooke joint, Toggle mechanism.

Unit-II
Kinematic Analysis of Mechanisms: Analysis of displacement, velocity & acceleration diagrams of simple planar mechanisms by graphical (Instantaneous center method and relative velocity method ), analytical and computer aided methods (for four-bar and slider crank mechanism only ), coriolis component of acceleration .

Unit – III
Kinematic Synthesis of Mechanisms: Kinematic synthesis, graphical method using relative pole method, Inversion method and overlay 3 point synthesis problems - Motion, path & function generation, Chebyshev’s spacing of accuracy points Freudenstein Method of 3 point synthesis of four link mechanism and slider crank mechanism. Coupler curves

Unit – IV
Cams:Types of cams and followers, displacement velocity and acceleration curves for uniform velocity, uniform acceleration and retardation, SHM, cycloidal motion, layout of profile of plate cams of the above types with reciprocating, oscillating, knife-edge, roller and flat faced followers. Cylindrical and face cams, polynomial cams, cams with special contours. Tangent cams with reciprocating roller follower, circular arc cam with flat faced follower.

Unit - V
Gears and Gear Trains: Classification and terminology used, Fundamental law of gearing - friction wheel, teeth for positive action and condition for constant velocity ratio. Conjugate profiles cycloidal and involute teeth profiles. Involute construction, properties and computation of path of contact and contact ratio. Interference and undercutting- Minimum number of teeth to avoid Interference.


Text Books :

Reference Books :
Unit - I

Principles of Turbo Machinery: Fluid Machines – Classification – Impact of Fluid Jet on Stationary plates, Moving Plates and Vanes – Unit and Specific Quantities. (12 hours)

Unit – II


Unit - III


Unit – IV


Unit - V


Text Books :

Reference Books :
Unit – I
(12 hours)

Unit – II
(12 hours)

Unit – III
(12 hours)

Unit – IV
(12 hours)

Unit – V
Similarity between phenomena of heat transfer and mass transfer – diffusion mass transfer, Fick’s Law of diffusion, species conservation equation-initial and boundary conditions, steady state molecular diffusion-diffusive mass transfer and convective mass transfer- momentum, heat and mass transfer analogies, convective mass transfer correlations, evaporation of water into air.
(12 hours)

Text Books :

Reference Books :
1. A.Bejan, Heat Transfer, John Wiley & Sons, 1993,
UNIT -I
Conventions for sectioning and dimensioning, screw threads, rivets, bolts, nuts, pins, keys, cotter, gear, springs and welds.
Component drawing assigning fits and tolerance machine symbol, surface finish geometrical tolerance.

L – 6 Hours + P – 9 Hours

UNIT – II
Preparation of drawings of parts and assembly of:-
Joints
riveted joints - butt joints and lap joints
pin joints - knuckle joints
cotter joints -sleeve, socket and spigot joints

Couplings:-
Split muff couplings, flexible type flange coupling, universal coupling

Bearing:-
pedestal bearing, swivel bearing, Plumber block

Screw jack

Connecting rods

Tail stock

Four way tool post

Stop valve – steam

Centrifugal pump

L – 24 Hours + P – 36 Hours

Text books

Reference books:
Unit – I: Transformers


(9 hours)

Unit – II: AC Machines


(9 hours)

Unit – III: Alternators


(9 hours)

Unit – IV: Electronics


(9 hours)

Unit – V


(9 hours)

Text Books:


Reference Books:

Introduction to Fortran 95: Comparison with C. – Variables declarations, Handling of Arrays, Data Files handling, Input/Output statements, Functions and Subroutines (Explanation only)

Finding roots of an equation using Newton Raphson Method and secant method of a given equation.

Solution of an simultaneous algebraic equations using LU decomposition / Gauss elimination / Gauss Seidel methods

Obtaining the temperature distribution in a fin with tip insulation through Runge-Kutta method and compare with the theoretical solution.

Solving Eigen value by simple iterative method like Power Method.

Obtain the shear force and bending moment diagrams for a simply supported beam or Cantilever beam subjected to multiple pointed loads and uniform distributed loads.

Introduction to FDM/FEM/FVM (Explaining the differences)

Using FDM obtain the solution of Fin Equation with insulated tip. Use Thomas Algorithm to solve the resulting algebraic equations

Using FDM obtain the solution for deflection for a simply supported beam with pointed loads and uniform distributed loads.

Solving one dimensional transient heat conduction equations for a plate when it is subjected to convection. Compare with Hesiler Charts.

Solving two dimensional heat conduction equation prescribed temperature on the boundary and obtain isothermal lines. Compare the solution with theoretical solution. (Explicit Implicit and semi-implicit methods)

Introduction to Optimization: Difference between minimization and root finding, Golden section method to find minimum of a single variable objective function (Explanation only)

Obtain the minimum of a multi dimensional objective function using steepest descent method / Conjugate gradient method / Variable matric method

Solving a sparse matrix equations using conjugate gradient method / bi-conjugate gradient method (2D Conduction equation).

Reference Books:

SUGGESTED LIST OF EXPERIMENTS

Study and performance test of the following hydraulic machines

1. Centrifugal Pump
2. Self-Priming Pump
3. Reciprocating Pump
4. Jet – Pump
5. Submersible Pump
6. Vertical Turbine Pump
7. Parallel & Series Pump
8. Gear Pump
9. Vacuum Pump
10. Pelton Wheel Turbine
11. Francis Turbine
12. Kaplan Turbine
SUGGESTED LIST OF EXPERIMENTS

1. OC and SC Test on Single Phase Transformer
2. Load Test on Single Phase Transformer
3. Load Test on 3 Phase Transformer
4. Load Test on Single Phase Induction Motor
5. Two Wattmeter Method of Power Measurement
6. OCC of Alternator
7. Inverting and Non-Inverting Amplifier Using 741 IC
8. Astable Multivibrator Using 555 IC
9. Counter Using 7490 IC
10. Adder / Subtractor Using 741 IC
Physical Education is compulsory for all the Undergraduate students

1. The activities will include games and sports / extension lectures.
2. Two Hrs. / Week will be allocated for physical education in the third and fourth semesters. Minimum of 75% attendance is mandatory.
3. These activities will be monitored by the Director of Physical Education.
4. Pass / Fail will be determined on the basis of participation, attendance, and performance. If a candidate Fails, he/she has to repeat the course in the subsequent years
5. Pass in this course is mandatory for the award of degree.
Unit - I
D’Alembert’s Principle-Inertia forces of reciprocating parts, Dynamic analysis of four link and slider-crank mechanisms, Engine force Analysis Turning moment on crankshaft, Dynamically Equivalent system, Inertia forces in a reciprocating engine, Turning Moment diagrams, Fluctuations of Energy and speed, Flywheel.

(12 hours)

Unit - II

(12 hours)

Unit - III
Transverse vibrations of beams-Natural frequency by energy method, Dunkerly’s method, Whirling of shafts- calculation of whirling speed for loaded shafts. Torsional vibrations-causes of Torsional vibration. Torsional Vibration of two and three rotor systems. Equivalent shaft system, Geared system.

(12 hours)

Unit - IV
Governors - Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors - Characteristics - Effect of friction - Controlling Force - other Governor mechanisms. Gyroscopes - Gyroscopic forces and Torques - Gyroscopic stabilization - Gyroscopic effects in Automobiles, ships and airplanes

(12 hours)

Unit - V
Static and dynamic balancing of rotating masses in different planes - partial balancing of reciprocating masses of inline, V, W and radial engines.

(12 hours)

Text Books :

Reference Books :
**Unit – I**

**Unit – II**
Strength and Stability Criteria, Design of Power Screws. Threaded Joints – Bolted Joints under fluctuating load, Combined Stresses, and eccentric loading. (12 hours)

**Unit - III**
Design of Couplings – Design of Rigid and flange Couplings – Types of Clutches and Design of Clutches. Types of Brakes – Design of Brakes. (12 hours)

**Unit - IV**
Introduction to Design of Helical Springs-Design of Helical Springs for Variable Load-Design of Leaf Springs- Design of Pipe Joints – Cotter and Knuckle joints (12 hours)

**Unit - V**
Design of Shafts under static load: members subjected to Eccentric loading – stresses in curved beams. Design of Shafts under Fluctuating Load: Design for Finite and Infinite life – Soderberg and Goodman equations – combined stresses. (12 hours)

**Text Books :**

**Reference Books :**
UNIT 1:

UNIT 2:

UNIT 3:

Unit – IV :
Objectives of Statistical Quality Control – inspection and its importance – differences between inspection and quality Control – Causes and types of variations – Concept of zero defect – theory of control charts, control charts for attributes – p, np, c and u charts.

Unit – V :
Control charts for variables, x and R charts, standard deviation charts, median chart and mid range chart -Moving range chart. Acceptance sampling: Fundamental concepts and terms, OC curves, sampling plan, BIS Codes.

TEXT BOOKS
R.C.Gupta, Statistical Quality Control, Khanna Publishers, 1995

REFERENCE BOOKS:
UNIT I

Fuels: solid, liquid and gaseous fuel and their characteristics – Combustion of fuel – flash point, fire point, calorific value, Combustion reaction; heat of formation, heat of combustion – combustion analysis. combustion process in IC engines – Flame propagation, normal and abnormal combustion, delay period, knocking and detonation, knocking rate of fuel, cetane number, octane number, supercharging and turbo charging – combustion chamber and types.

(12 hours)

UNIT II


(12 hours)

UNIT III


(12 hours)

UNIT IV


(12 hours)

UNIT V


(12 hours)

TEXT BOOKS:


REFERENCE BOOKS

MET55 Manufacturing Processes - II (4 0 0 3)

Unit – I
Turning operations: Lathe – Types, Designation, Work holding devices – Cutting Speed, Feed and Depth of Cut, MRR - Operations, Machining Time. (12 hours)

Unit – II
Drilling and Allied Operations: Drilling Machines - Types, Operations, MRR, Machining Time - Boring, Reaming and Tapping (Definition of operations only) (12 hours)

Unit – III
Basic Machining Operations: Shaper, Types, Shaping Operations, MRR, Planner, Types, Planning Operation, MRR, Slotting Machine Operations. (12 hours)

Unit – IV
Advanced Machining Operations – II Milling Machine, Types, Milling Process, Milling Operations, MRR, Machining Time (12 hours)

Unit - V

TEXT/REFERENCE BOOKS:
1. Drilling and Boring  
2. Turning between centers  
3. Drilling and Tapping  
4. Square and multi start thread cutting  
5. Eccentric turning  
6. Shaping and V-slot grooving  
7. Study of Grinding machine  
8. Cylindrical grinding operation  
9. Spline Milling  
10. Spur Gear Milling  
11. Keyway milling
SUGGESTED LIST OF EXPERIMENTS

1. Demonstration of four bar inversion mechanism

2. Natural frequency of single mass, single helical spring system.

3. Natural frequency of combination of springs – springs in parallel, springs in series

4. Natural frequency of undamped torsional single rotor, double rotor system. Effect of inertia (I) and stiffness (k).

5. Determination of radius of gyration of a given compound pendulum


7. Damping coefficient of torsional single rotor system – Effect of depth of immersion in oil and damping ratio

8. Resonance frequency of equivalent spring mass system – undamped and damped condition. To plot amplitude Vs frequency graph for different damping.


10. Static and Dynamic balancing.

11. Whirling of shafts/ determination of critical speed with and with out Rotors.


13. Journal bearing – pressure distribution of different loads at different Speeds.

14. Cam motion analysis.

15. Generation of involute gear profile.

16. Tracing of coupler curves.

17. Determination of error in straight line drawn by watt chain mechanism.
Using Auto CAD Script file, draw the orthographic views for the given simple 3D blocks

Preparation of Drawings for Parts and Assembly of the following by using AutoCAD.

1) Joints : Riveted Joints - Butt & Lap joints, Knuckle joint,

2) Couplings : flexible type flange coupling, Universal coupling.

3) Bearing : Pedestal bearing.

4) Screw jack

5) Connecting rod

6) Tail stock

7) Steam Stop valve

8) Ramsbottom Safety Valve

Text Books:

5. Auto CAD user Manual
UNIT -I : ART OF COMMUNICATION

Verbal and Non-verbal Communication - Barriers to Communication - Importance of Body Language - Effective Listening - Feedback

UNIT - II : INTRODUCTION TO SOFT SKILLS

Attitude - Self-Confidence - Leadership Qualities - Emotional Quotient - Effective Time Management Skills - Surviving Stress - Overcoming Failure - Professional Ethics - Interpersonal Skills

UNIT – III : WRITING

Importance of Writing - Written Vs Spoken Language - Formal and Informal Styles of writing - Resources for improving writing - Grammar and Usage - Vocabulary Building - SWOT analysis

UNIT – IV : SPEAKING PRACTICE

Dialogue - Telephone Etiquette - Public Speaking - Debate - Informal Discussions - Presentations

UNIT – V : APTITUDE

Verbal and Numerical Aptitude

REFERENCES :

Unit – I
Linear Programming Problems - Formulation and Duality concepts. Methods of solving LPP -
Graphical Method, Simplex method (Computational Procedure) - Two Phase, Dual Simplex -
Sensitivity analysis.
Integer Programming : Introduction - Cutting plane method. (12 hours)

Unit – II
Revised Simplex method - Transportation problem - optimal solution - MODI method -
Transshipment problem. Assignment problem - various types.
Dynamic programming - Solving General allocation, Investment, Stagecoach, Equipment
replacement problems. (12 hours)

Unit – III
Inventory Control Fundamentals-Inventory concepts and costs, Deterministic Inventory models -
Single item models-Classic EOQ and gradual replacement / manufacturing models with and
without shortages, EOQ with price breaks, Introduction to inventory control applications.
Game theory- Two persons zero sum games- Pure strategies, Mixed strategies, Dominance
property, Graphical solution of (2xn) and (mx2) games. (12 hours)

Unit – IV
PERT and CPM - Network diagram, Critical path, Crashing, probability considerations, Resource
leveling and allocation. (12 hours)

Unit – V
Waiting line problems - Poisson arrivals and exponential service times, single channel and single
stage problems. Logical flow charts for single server and Parallel server Queuing Models.
(12 hours)

Text Books :

Reference Book :
1. Harvey M.Wagner, Principles of Operations Research with applications to managerial
Unit-I
Theory of hydrodynamic bearing – Design of Journal bearing - Heat dissipation - Elementary ideas of hydrostatic bearings - bearing materials and lubricants. Rolling contact bearings - Load capacity and Life - Selection of rolling contact bearings for radial and axial loads. (12 hours)

Unit – II
Belt Drives – Types – Selection and Design of Flat and V-Belts
Chain Drives – Roller Chains – Polygonal effect – Sprocket Wheels – Silent Chain (12 hours)

Unit- III
Advantage of Gear drives over other drives, Nomenclature, failures of gear tooth, Design of gears - based on bending and wear criteria - based on Lewis and Buckingham equation. (12 hours)

Unit – IV
Bevel Gears – Nomenclature - Design of gears-based on bending and wear criteria- based on Lewis and Buckingham equation, Worm and Worm Wheel – Nomenclature – Design procedure . (12 hours)

Unit – V
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. Speed reducer – Design of Speed reducer using spur and helical gears (12 hours)

Text Books :

Reference Books :
Unit – I
Accessories: Feed water Pump, feed water heaters / economiser, air-preheaters, Superheaters, separators, Separator drums, scale cleaners, soot blowers – Fuels: method of firing – Fluidised bed boilers. (12 hours)

Unit – II

Unit – III

Unit – IV

Unit – V
Fluctuating loads – terms and definitions, load curves, effect of variable load, methods to meet variable load – peo load plants: demand, requirements and load analysis. Power plant economics: Estimation of cost of electrical energy, selection of type of generation and equipment, economic analysis of performance and operating characteristics, methods of tariff for electrical energy. (12 hours)

Text Books:

Reference Books:
1. Frederick T. Morse, Power Plant Engineering, Affiliated East-west Press Ltd., 1953.
Unit – I:
Introduction to unconventional machining – EDM, ECM, ECG, AJM and USM.

Unit – II
NC machines – Introduction, Types, Economics, Advantages and Applications. CNC, DNC (Direct and Distributed), and Adaptive Control.

Unit – III
Turning and Machining Centers – Description and types of ATC, Applications.

Unit – IV:
Automated Material Handling and Storage Systems – Types, Design and Interfacing Preliminaries.

Unit – V:
Group Technology : Part Families – Parts Classification and Coding, Examples.
ROC Algorithm. Applications.
Introduction to Lean and Agile Manufacturing Systems – Comparison.

Text Books:
1. Mikel P.Groover, Automation, Production Systems and Computer Integrated Manufacturing, PHI Ltd.,
   New Delhi, 2003.

Reference Books:
UNIT-I
Basic detector transducer elements, intermediate modifying systems, terminating devices and methods. Classification of instruments as indicators, recorders and integrators- their working principles, precision and accuracy, measurement of error and analysis, properties of errors.

UNIT-II
Pressure measurement: Gravitational, Bourdon, elastic transducers, strain gauge, pressure cells, measurement of high and low pressure, dynamic characteristics of pressure measuring devices.
Strain measurement: Strain gauges, types, Wheatstone circuit, temperature compensation, Gauge rosettes, Calibration.

UNIT-III
Measurement of displacement-LVDT-Hall effect devices.
Vibration-characteristics, analysis of vibration sensing devices, accelerometer-types-signal conditioner-voltage and charge amplifiers-vibration exciters-calibration.
Speed Measurement – Stroboscope

UNIT-IV
Force measurement: scales and balance, elastic force meter, strain gauge, load cells, hydraulic and pneumatic load cells.

UNIT-V
Temperature measurement: Bimetallic, pressure and resistance thermometers, thermocouples, pyrometers and thermistors, calibration.
Fourier transform analysis – FFT Analyser-concepts and techniques.

Text Books :
Harshavardhan, “Measurements – Principles and Practice”, Macmillan India Limited, 1993

Reference Books :
MEP61 MANUFACTURING PROCESS LAB-III (0 0 3 2)

FOUNDRY
1. Study of Foundry tools
2. Mould preparation using solid patterns
3. Mould preparation using split patterns

GEAR CUTTING
4. Helical gear milling
5. Study of gear hobbing machine
6. Spur gear hobbing

TOOL GRINDING
7. Study of tool and cutter grinder
8. Grinding of single point cutting tool

CNC PROGRAMMING
9. Study of CNC turning and milling machines
10. Programming and TPG of CNC turning
11. Programming and TPG of CNC milling
SUGGESTED LIST OF EXPERIMENTS

1. Calibration of Micrometer.
3. Calibration of Plain Plug Gauge.
5. Surface Roughness Measurement (Talysurf method)
6. Inspection of Screw Threads (Effective Diameter).
7. Calibration of Inclined Tube Manometer.
12. Study of Displacement using LVDT and RVDT.
14. Measurement of speed using stroboscope
15. Inspection of gear tooth profile using profile projectors
16. Tool Maker Microscope (inspection of screws)
17. Inspection of internal and external surfaces (C M M)
SUGGESTED LIST OF EXPERIMENTS

1. Determination of Kinematic Viscosity using Redwood viscometer
2. Determination of Flash and Fire Points using Cleaveland Apparatus.
3. Determination of Calorific value of Solid Fuel using Bomb Calorimeter
4. Determination of Calorific value of Gaseous Fuel using Junker’s Gas Calorimeter
5. Performance test on Reciprocating Air Compressor
6. Performance test on Centrifugal Air Blower
7. Study on the composition of Exhaust gas of an IC engine using Orsat Apparatus under various loads.
8. Determination of Thermal Resistance and Conductivity of a Composite Wall
9. Heat Transfer from Cylindrical Surface by Natural Convection
10. Heat Transfer from Cylindrical Surface by Forced Convection
11. Heat Transfer from Pin Fin by Forced Convection
UNIT – I: COMPOSITION ANALYSIS

Technical and Non-Technical Passages (GRE Based) – Differences in American and British English – Analyzing Contemporary issues – Expanding Terminology

UNIT – II: WRITING

Job Application Letter Writing – Resume Writing

UNIT – III: ORAL SKILLS

Group Discussion – Introduction and Practice – Team Work – Negotiation Skills – Organizing and Attending Meetings – Facing Interviews

UNIT – IV: ADAPTING TO CORPORATE LIFE

Corporate Etiquette – Grooming and Dressing

UNIT – V: APTITUDE

Verbal and numerical aptitude

REFERENCES

Unit – I
Design process - Morphology of design, Types of design models, Application of design models, concurrent Engineering – CAD system architecture.
CAD Hardware: workstation – CPU, mass storage, input devices (keyboard, light pen, thumb wheel joy stick, mouse, digitizer etc.,) and output devices (printers, plotters) Display Devices : storage tube – raster scan, vector refresh, plasma panel and LCD.

Unit – II

Unit – III
Classification of Geometric Modeling – Wire frame, Surface and Solid Modeling, applications – representation of curves and surfaces – Parametric form – Design of curved shapes- Cubic spline – Bezier curve – B-spline – Design of Surfaces - features of Surface Modeling Package - Solid Primitives, CSG, B-rep and description of other modeling techniques like Pure primitive instancing, cell decomposition, spatial occupancy enumeration, Boolean Operations (join, cut, intersection), Creating 3D objects from 2D profiles (extrusion, revolving etc)

Unit – IV
Standards for computer graphics (GKS) and Data exchange standards – IGES, STEP. Data structures for Entity storage – Data structures for interactive modelling- Relational databases – introduction to SQL language . Role of OOPS in CAD.

Unit – V
Parametric and variational modeling, Feature based modeling, Design information system
An overview of modeling software like PRO-E, CATIA, IDEAS, SOLID EDGE etc.

Text Books :
1. Chris Mcmahon and Jimmie Browne - CAD/CAM – Principle Practice and Manufacturing Management,

Reference Books:
2. M.P.Groover and E.W.Zimmers - CAD/CAM; Computer Aided Design and Manufacturing,
   Tata McGraw Hill
Unit – I

(12 hours)

Unit – II
Data base: Introduction – Manufacturing data- Data base models, Data base Management - Data base required for a shop floor control (Fundamentals only)
Product Design: Design Process , Design for Manufacturability, CAD – areas of Application, Benefits, CAD to CAM, CAE (Fundamentals only)

(12 hours)

Unit – III
Concurrent / Simultaneous engineering: Introduction, Design for manufacturing and assembly, and other product design objectives. Advanced Manufacturing Planning,
Introduction to Reverse Engineering.

(12 hours)

Unit – IV
Production Planning and Control: Computerized PPL, Aggregate Production Planning, MPS, MRP, MRP II, ERP and JIT. Automated Data Collection – Bar Codes, OCR, Image Processing, RF Identification, Magnetic Identification, Voice Technology, Comparison, Control Types – PLC.

(12 hours)

Unit – V
Introductory Study on Integration and Implementation issues in CIM – Indian Scenario.

(12 hours)

Text Books :

Reference Books :
Unit – I
Basic Components of Control System – Open loop and Closed loop system – Automatic Control System.
Mathematical Modeling, Analogous Models – Mathematical modeling of fluid system and thermal systems – Transfer Function – Block diagram reduction Techniques. (12 hours)

Unit – II
Modes of Controls: Proportional, Integral, Derivative – proportional plus integral – proportional plus Derivative– proportional Plus integral plus derivative controls – examples from Mechanical system. (12 hours)

Unit – III
Standard test signals and transient response of first and second order systems. Sources of errors, static and dynamic error constants. (12 hours)

Unit – IV
Frequency Response – Bode Plot – Polar Plot.
Stability Analysis – Relative stability – Routh Hurwitz Stability Criteria. (12 hours)

Unit – V
Design Principles – an outline of Control System Design - Control of the A/F ratio in an Automotive Engine – Control of Read/Write Head Assembly of a Hard Disk.
Introduction to Fuzzy logic – Fuzzy set – Fuzzy Control – PLC – micro controller (12 hours)

Text Books :

Reference Books :
Unit I
Basics of refrigeration – Methods of refrigeration: ice refrigeration, evaporative refrigeration, expansion cooling, throttling – Unit of refrigeration – Performance of refrigeration systems – Air refrigeration system, vapour compression refrigeration system, vapour absorption refrigeration system, vapour jet refrigeration system, thermoelectric refrigeration system, vortex tube refrigeration, pulse tube refrigeration and adiabatic demagnetization cooling – Refrigerants: primary and secondary refrigerants – Working pairs of absorption refrigeration system – Properties of refrigerants – Selection of refrigerants.

Unit I

Unit III

Unit IV
Introduction to cryogenics – Applications involving cryogenic engineering – Cryogenic fluids and properties – Low-temperature properties of solids: mechanical, thermal, electrical and magnetic properties – Superconductivity – Production of low temperature: Joule-Thomson effect – Inversion curve – Adiabatic expansion – Cryogenic liquefaction systems: Linde-Hampson system, pre-cooled Linde-Hampson system, Linde dual pressure system, Claude system, pre-cooled Claude system, Kapitza system, Heylandt system, Collin’s helium-liquefaction system and Simon helium-liquefaction system.

Unit V
Text books:

Reference: Books:
SUGGESTED LIST OF EXPERIMENTS

1. Valve and port timing diagrams of 4 stroke and 2 stroke IC engines respectively

2. Tests on single cylinder petrol engine:
   (a) Load test   (b) finding air-fuel ratio

3. Tests on multi-cylinder petrol engine:
   (a) Load test   (b) Morse test    (c) heat balance test

4. Tests on single cylinder 4 stroke diesel engine:
   (a) Load test   (b) Finding air-fuel ratio   (c) Retardation test

5. Test on multi-cylinder diesel engine:
   (a) Load test   (b) Heat balance test

6. Engine exhaust gas analysis using Gas analyzer/ Gas Chromatograph

7. Performance test on cooling tower.

8. Performance test on refrigeration system.

9. Performance test on air-conditioning system.


11. Performance test on steam turbine.

12. Determination of dryness fraction of steam using calorimeter.
PART - A

Computer aided design of machine components:

Transmission shafts,
Journal bearings,
Flange couplings etc.
1. Using solvers namely
TK SOLVER
Education Asia, 2001, appendix F, p.no:1001.)
And
2. Autolisp
[Minimum of three exercises using TK SOLVER and two exercises using Autolisp.]

PART-B

I. Generation of Auto lisp file to draw the orthographic views of a given isometric diagram.
II. 3D Modelling:
Introduction to 3-D modelling – skinner, part design, assembly and drafting workbenches.
Generation of various 3D Models through Protrusion, revolve, shell sweep. Creation of
various features. Study of parent child relationships. Feature based and Boolean based
modeling surfaces.
Assembly modelling of components having a minimum of six machine elements.
[Minimum of two exercises in part modelling and one exercise in assembly]
(Use of ANY ONE of these packages such as CATIA, ProE, SOLIDWORKS, IDEAS is
recommended)
III. FE Analysis:
Using any FEA software packages like ANSYS / NISA etc., solve for
1) Plane Stress Analysis on Plate with Central hole
2) SF and BMD diagrams for all kinds of beams
3) 1-D heat transfer analysis of a simple plate.
[Minimum of three exercises]
Note: In university practical examination, students has to answer one question each
from part A and part B.
MEP73  COMPREHENSIVE VIVA - VOCE

The student will be tested for his understanding of basic principles of the core Mechanical Engineering subjects. The internal assessment for a total of 50 marks will be made by an internal assessment committee. The committee will conduct two written examinations of objective or short questions type from all the core subjects. The external university examination, which carries a total of 50 marks, will be a Viva Voce examination conducted by a committee of one external examiner and one internal examiner appointed by the University.

MEP74  INDUSTRIAL VISITS / TRAINING REPORT

During the course of study from 3rd to 7th semester each student is expected to undertake a minimum of four industrial visits or undertake a minimum of two weeks of industry/field training. The students are expected to submit a report, which shall be evaluated by an internal assessment committee at the end of seventh semester for 100 marks.

MEPW7  PROJECT WORK (PHASE I)

The objective of the project is to enable the students to work in groups of not more than four members in each group on a project involving analytical, experimental, design or combination of these in the area of Mechanical Engineering. Each project shall have a guide. The student is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. The evaluation is based on continuous internal assessment by an internal assessment committee. The internal assessment marks for Phase I will be carried over to Phase II.
Unit I:
Plant Location: influencing factors - rural and urban locations - evaluation of location alternatives for Single facility location problems - solving simple problems.
Plant Layout: classification of production systems - principles of layout - basic types of layout - line balancing - simple problems in line balancing using Ranking Positional Weight Method.
Material Handling: functions - principles - classification of material handling equipments (only classification and no description) - factors to be considered in selection of material handling equipment.

(9 hours)

Unit II:
Method Study: objectives - basic procedure - various recording techniques - process charts, multiple activity charts, SIMO chart, Flow diagram, string diagram, cyclegraph and chronocyclegraph - principles of motion economy - Therbligs - micromotion study & memomotion study.
Work Measurement: purpose - basic procedure - various techniques of work measurement - stop watch time study - time study equipments - different systems of performance rating - time allowances - PMTS - work sampling - simple problems involving the determination of standard time and compensation.

(9 hours)

Unit III:
Production Planning and Control: functions - qualitative and quantitative techniques of forecasting - simple problems in forecasting using moving average, weighted moving average, simple exponential smoothing and regression methods - routing - loading and scheduling - different methods of scheduling - expediting - dispatching - functions and objectives of materials management - Introduction to inventory control and ABC analysis.

(9 hours)

Unit IV:
Management: Basic Concepts - Scientific management - Fayol’s principles - functions of management.

(9 hours)

Unit V:

(9 hours)

Text Books:

Reference Books:
Unit – I
Objectives of maintenance - types of maintenance – Breakdown, preventive and predictive maintenance - Repair cycle - Repair Complexity, Lubrication and Lubricants. Maintenance of Mechanical transmission systems and process plants.  

(12 hours)

Unit – II
Predictive Maintenance - vibration and noise as maintenance tool - wear debris analysis - Condition monitoring concepts applied to industries - Total Productive Maintenance (TPM) - Economics of Maintenance- Computer aided maintenance. 

(12 hours)

Unit – III
Reliability: Definition, concept of reliability based design, failure rate, MTTF, MTBF, failure pattern, system reliability: Series, Parallel and Mixed configurations - Availability and Maintainability concepts- Applications. 

(12 hours)

Unit – IV
Safety and productivity - causes of accidents in industries - accident reporting and investigation - measuring safety performance - Safety organizations and functions - Factories act and rules. 

(12 hours)

Unit – V

(12 hours)

Text Books :

Reference Books :
Unit – I
Energy conversion – global energy scenario – Indian context of energy – environmental aspects of fossil, nuclear, hydro and biomass energy conversion – gaseous emissions – solid waste – liquid waste. (9 hours)

Unit – II
Energy management – need for energy conservation – energy auditing – role of energy manager – energy audit instruments – first and second law approach towards energy conservation. (9 hours)

Unit – III
Energy conservation in boilers – procedure for efficiency calculation – energy conservation in industries: pumps, fans, compressed air systems, refrigeration and air conditioning systems, DG sets, electrical motors, variable speed motors. (9 hours)

Unit – IV
Pollutants – types – physical and chemical properties of air pollutants – behavior and fate of air pollutants – air pollutants and global climate – air pollutant effects. Pollution control laws and regulation – national and international – role of environmental monitoring in environmental management systems – continuous emissions monitoring systems. (9 hours)

Unit – V
Pollution Control – review of pollution control methods in thermal power plants – industrial – nuclear – automobiles – disposal/treatment of solid and liquid wastes – alternate fuels. (9 hours)

Text Books :

Reference Books :
MEPW8  PROJECT WORK (PHASE II)

Project work phase II will be an extension of the project work started in the seventh semester. On completion of the work, a project report should be prepared and submitted to the department. The project work and the report will be evaluated by an internal assessment committee for 50 marks. Out of these 50 marks 15 marks are based on Internal assessment marks obtained in Phase I. The external university examination, which carries a total of 50 marks, will have report evaluation and viva voce examination conducted by a committee of one external examiner and one internal examiner appointed by the University.

MEP81  SEMINAR

Each one of the students will be assigned a Seminar Topic in the current and frontier areas. The student has to conduct a detailed study/survey on the assigned topic and prepare a report. The student will make an oral presentation followed by a brief question and answer session. The Seminar (presentation and report) will be evaluated by an internal assessment committee for a total of 100 marks.

MEP82  PROFESSIONAL ETHICS AND INDIAN CONSTITUTION

The course should cover the following topics by way of Seminars, Expert Lectures and Assignments:

1. Engineering Ethics – Moral issues, Ethical theories and their uses
2. Engineering as Experimentation – Code of Ethics
3. Engineer’s responsibility for safety
4. Responsibilities and rights
5. Global issues of engineering ethics
6. Fundamental Rights and Constitution of India

Reference Book

Unit - I

Patterns and Moulding Sands: Introduction to casting - pattern making - requirements, pattern materials, machines and tools for pattern making - pattern allowances - metal and consumable type of patterns - life expectancy, storage and repair of patterns - moulding sands and sand conditioning - testing of moulding sands - cores - types of cores - core sands and core making - machine moulding. (12 hours)

Unit - II

Melting equipment for foundries - crucible furnace - open hearth furnace - air furnace - rotary furnace - cupola furnace - electric furnaces - refractories for melting units - metallurgical characteristics of cast metals - Solidification of metals. (12 hours)

Unit - III

Gating and Risering of castings - gating systems - different types of gates - calculation of gating system dimensions - risering of castings - open and blind risers - design and positioning of risers - directional solidification - methods to achieve directional solidification - form design of castings. (12 hours)

Unit - IV

Moulding Processes: special sand moulding processes - Permanent mould casting - Pressure die casting - Low pressure die casting - Squeeze casting - Centrifugal casting - continuous casting - Electro slag casting - Vacuum moulding process - plastic moulding processes: compression moulding, transfer moulding, injection moulding, extrusion and blow moulding. (12 hours)

Unit - V

Cleaning and inspection - Fettling and repair of castings - Heat treatment of castings, Defects in castings, Inspection and testing of castings - Pollution control in foundries - Plant layout for foundries - Areas of mechanization. (12 hours)

Text Books:
3. Serobe Kalpakjian and Steven R. Schmid, Manufacturing Engineering & Technology, Pearson Education Asia, 2000 (For Plastic Moulding Processes only)

Reference Books:
MEE62  TOTAL QUALITY MANAGEMENT  (4 0 0 3)

Unit – I

Introduction to TWM – Strategies concepts and objectives – Total quality model – TQM as applied to Indian Industries – Quality circle concepts – concepts, objectives and functions of quality circles – Benefits of the organization – Training of quality Circle members – Implementation.  (12 hours)

Unit – II

Tools and Techniques – The seven management tools =- Technique for analyzing a quality process – Statistical process Control – Introduction to S-S concepts

(12 hours)

Unit – III

Cost of quality – Tauchi’s quality loss function – House keeping concepts for industries, tool room, production shop – processing industries.

(12 hours)

Unit – IV


(12 hours)

Unit – V


(12 hours)

TEXT/REFERENCE BOOKS

Unit – I : Basics of Heat Exchangers


Unit – II : Double Pipe Heat Exchangers

Double Pipe Heat Exchanger – Application and Design Parameters – Film Coefficient for Fluids in Pipes and Tubes – Caloric Temperature and wall Temperature – Series and Parallel Arrangement – Design Procedure – Pressure Drop Calculation. (12 hours)

Unit – III : Shell and Tube Heat Exchangers


Unit – IV : Condensor, Evaporator and Re-Boiler

Types of Condensor and their selection – Design Procedure – types of Evaporators – Shell and Tube Re-Boilers – Types and Thermal Design. (12 hours)

Unit – V : Heat Exchanger Network


Text Books :

Reference Books :
Unit – I
Basic Concept of FEM, discretisation, comparison with finite difference method, advantages and disadvantages, history of development, application. Variational and Weighted Residual Formation: Boundary value problems, approximated methods of solution, review of variational calculus, geometric and natural boundary condition, method of Weighted residuals, Rayleigh Ritz and Galerkin methods of finite element formulations and convergence criteria, weak formulation - simple problems. (12 hours)

Unit – II
Classification of C⁰, C¹ continuous problems - Parameter functions, its properties - completeness and compatibility condition, One-dimensional elements, Global coordinates, Two-dimensional elements, three noded triangular elements and four noded quadrilateral elements. Natural co-ordinate systems – Lagrangian Interpolation Polynomials - Serendipity Formulation - Difference between Superparametric, Subparametric and Isoparametric Elements, Isoparametric Elements Formulation, length coordinates - 1D bar elements, C⁰ continuous shape function, beam elements, C¹ continuous shape function - 2D Triangular elements, Rectangular elements. - Area coordinates - Numerical integration - simple Problems using Gauss quadrature Technique. (12 hours)

Unit – III
One dimensional second order equations, discretisation of domain into elements, derivation of element equations, assembly of element equation, imposition of boundary conditions, solution of equations - post processing, extension of fourth order equations and their solutions – examples from solid mechanics, heat transfer. (12 hours)

UNIT – IV
Basic Boundary Value Problems in 2 Dimensions - Introduction to Theory of Elasticity - Plane Stress - Plain Strain and Axisymmetric Formulation - Principle of virtual work - Weak Formulation - Triangular, Quadrilateral elements - Element matrices using energy approach. - Simple problems using three noded triangular elements only - Frontal Solution Method - Static condensation. (9 hours)

Unit – V

Text Books:

Reference Books:
3. G.Buchaman, Schaum’s Outline of finite Element Analysis, McGraw Hill,
Unit – I

Introduction to IT – Definition of IT – Application of IT in day to day design and manufacturing, Data base – Classification.

(12 hours)

Unit – II


(12 hours)

Unit – III

Multimedia – details on hardware, Software and its application, introduction to Internet-Internet Service providers – naming and addressing – Email and browsing - Intranet and extranet: introduction and applications.

(12 hours)

Unit – IV

Application of IT in – supply chain management, Inventory, Manufacturing resource Planning, Decision Support system and logistics.

(12 hours)

Unit – V

Enterprise Computing, Introduction to ERP, Activities under ERP, Benefits of ERP.

(12 hours)

Text Books :

Unit – I

Tool geometry – cutting tool geometry for turning, drilling and milling tools – tool signature – tool designation: ASM, DIN – their relationship. (12 hours)

Unit - II

Unit – III

Unit – IV
Machinability – mechanisms of tool wear – Taylor’s tool life equation – tool failure criteria (direct and indirect) – effect of cutting variables on tool life, maintainability index. (12 hours)

Unit – V
Cutting fluids – types, different methods of application, economics of machining – basic concepts, tool materials (HSS, carbide and coated tools, CBN and ceramics) – Chatter in machining. (12 hours)

Note: Simple problems wherever applicable.

Text Books:

Text / Reference Books:
Unit – I
Introduction to Tribology – Objectives of Tribology - Surfaces - Nature of metal surfaces, surface properties, surface parameters and measurements - Fundamental of Contact between Solids - Surface Treatment - modification - coatings (12 hours)

Unit – II

Unit – III
Theory of hydrodynamic lubrication, Reynolds equation, assumptions and simplifications, variable density and compressibility, hydrodynamic journal bearings, pressure equation for short and finite bearings, journal bearing parameters, friction in journal bearings. (12 hours)

Unit – IV
Introduction to Computation Hydrodynamics – Non - dimensionalization of Reynolds Equation - Hydrostatic Lubrication – Basics of Elasto-hydrodynamic Lubrication, boundary and extreme pressure lubrication (12 hours)

Unit – V
Tribo Measurement and Instrumentation – Surface topography measurements – AFM and SFA – Friction and Wear Measurements – Bearing performance and Vibration Measurements (12 hours)

Text Books :
1. Gwidon W. Stachowiak Andrew W. Batchelor Engineering Tribology, Butterworth Heinemann, UK,2005
2. Prasanta Sahoo Engineering Tribology, Printice-Hall of India Pvt Ltd, New Delhi,2005

Reference Books :
Unit I

Classification of vehicles - drives - general layout. Engine - Diesel and Petrol engines for automobiles - two stroke and four stroke engines - comparison of performance - factors affecting choice - power requirements of an automobile - rolling, wind and gradient resultant factors affecting resistance and power requirement. (12 hours)

Unit II

Power transmission system - requirement of transmission system - clutches - plate clutches - semi automatic & automatic clutches - Gear box: manual shift four speed and positive speed gear boxes - synchromesh devices - fluid transmission - fluid flywheel and torque converter-automatic transmission - drive line - differential, conventional and non-slip types - drive axle. (12 hours)

Unit III

Suspension system - requirements - rigid axle and independent suspension - types of suspension - leaf spring - coil spring - torsion rod and air suspension - shock absorbers. Front axle: types - front wheel geometry - conditions for true rolling. Steering geometry - Ackerman and Davis steering - steering linkages - steering gear box: power and power assisted steering.
Wheel alignment - Tyres: materials and types static and rolling properties of pneumatic tyres. (12 hours)

Unit IV

Braking system - hydraulic braking systems - drum type and disc type brakes - power and power assisted brakes - factors affecting brake performance - tests on brakes - skid and skid prevention.
Chassis - types of bodies - chassis frame - integral body - vehicle stability. (12 hours)

Unit V

Battery: types - Chemical reaction - charging - battery rating - battery life - battery testing. Starting motor: constructional features and operation - series wound motor - drive arrangements: types,
Ignition: types - ignition coil - contact breaker - distributor - firing order - spark plug. Generator - constructional features of D.C.generator and Alternator - Rectifier - Generator regulation - Automotive lighting - Electronics in automobile. (12 hours)

Text Books:

Reference Books:
Unit – I

Knowledge Representation and processing - Knowledge and Intelligence - logic - Frames - production systems. Fundamentals of Fuzzy logic - Fuzzy sets - Fuzzy Relation - composition and Inference. (12 hours)

Unit – II

Membership Function Estimation - Importance - Fuzzy to crisp conversion - methods – Fuzzy extension principle - Fuzzy tautologies - Implication operation Composition operation. (12 hours)

Unit – III

Basics of Fuzzy Control - Architectures of Fuzzy Control - examples of Fuzzy Control system Design - Robotic Control system - Industrial applications. (12 hours)

Unit – IV

Hybrid Intelligence - Basic concepts of neural network - Inference and learning - Classification Models - Association models, Optimization models - Neural Network learning. (12 hours)

Unit – V

Rule Based Neural Networks - Network Training - Application of Neural Network in Mathematical Modeling - knowledge based approaches - applications in Mechanical Engineering - Fuzzy-Neural, examples, Neuro-Fuzzy examples – Intelligence in Automation. (12 hours)

Text Books :


Reference Books :

Unit – I
Quality specification – source selection – creative purchasing – purchase systems – price forecasting and price calculation – negotiation – delivery conditions. (12 hours)

Unit – II

Unit – III
Inventory Management – various costs – lead time, safety stock and reorder point – Basic EOQ model – quantity discounts – P & Q systems of inventory replenishment – ABC analysis – simple problems on inventory and ABC analysis – Materials Requirement Planning (MRP). (12 hours)

Unit – IV
Concepts of Physical distribution – need, importance and management – Warehouses – location and layout types – receiving and shipping procedures – Application of OR techniques (Transportation problems only).

Unit – V
New organizational paradigm – managing supply chain of the future – role of information in the virtual supply chain – route map to integrated supply chain. (12 hours)

Text Books:
3. Martin Christopher, Logistics and Supply Chain Management, Pitman Publishing, 2000. (For Unit V Logistics and Supply Chain Management)

Reference Books:
Unit - I

Classification of forming processes - flow curves and their significance in forming - Effect of temperature, speed and metallurgical structure on forming processes - Effect of friction on forming processes. Basic concepts of yield criteria - types. (12 hours)

Unit - II

Classifications of forging processes - Forging equipment - forging die design procedure for simple products - forging defects - determination of forging load - concept of P/M forging - Applications. (12 hours)

Unit - III

Rolling mills - Estimation of rolling load and power - rolling defects - Applications. Direct extrusion equipment - hydrostatic extrusion - extrusion of tubes - determination of extrusion stress - extrusion defects - Applications. (12 hours)

Unit - IV

Drawing of rods, wires and tubes-Determination of drawing loads through conical dies, sheet metal forming: Shearing, blanking, bending, punching, piercing, stretch forming, deep drawing, rubber pad forming -Applications. (12 hours)

Unit - V

High rate energy forming processes : Introduction - Effect on mechanical properties and microstructures - Explosive forming, Electro hydraulic forming - Electro magnetic forming, Water hammer forming. (12 hours)

Note: Elementary treatment with simple problems only.

Text Books:


Text/Reference Books:

MEE75  NUCLEAR POWER ENGINEERING  (3 1 0 3)

Unit – I
Nuclear fuels-occurrence and extraction, fissile characteristics, enrichment, fission process - thermal and fast fission - energy released from fission - chain reaction - reaction control. Neutron balance - fast fission - resonance capture - thermalisation - geometric effects - burn-up - introduction to reactor kinetics. (12 hours)

Unit – II

Unit – III
The nuclear fuel cycle - Waste classification - Spent fuel storage - Transportation - Reprocessing - High-Level waste disposal - low-level waste generation and treatment - Low-level waste disposal - Nuclear power plant decommissioning. (12 hours)

Unit – IV
Biological effects of radiation - radiation dose - Basic for limits and exposure - Sources of radiation dosage - Gas counters - Neutron detectors - Scintillation counters - Solid state detectors - Statistics of counting - Pulse height analysis - Protective measures - calculation of dose - effects of distance and shielding - Internal exposure - The Radon problem - Environmental radiological impact - radiation standards. (12 hours)

Unit – V
Reactors for naval propulsion - Space reactors - Space isotopic power generator - Energy economics - Components of electrical power - cost forecast versus Reality - Challenges and opportunities - Technical and institutional improvements - Developments in nuclear reactor. (12 hours)

Text Books :

Reference Books :
3. Domkundwar, A Course in Power Plant Technology, Dhanpat Rai Sons, 1993
Unit – I

Evolution of Plastics and composites - Reinforced Plastics - Polyester and epoxy resins - Phenolics and Silicones - High temperature Resistant polymers - Glass fibers - Manufacturing, Chemistry, Properties, Applications. (12 hours)

Unit – II


Unit – III

Continuous Production methods, joining and machining techniques of composites, winding process, molding compounds, prepregs, ablation, Tooling for composite production, Thermal expansion, density of tool weight, thermal mass. (12 hours)

Unit – IV

Design of Composite materials- Analytical methods – micro mechanics and macro mechanics, Boron- epoxy air craft structure- structural analysis and design. Testing of reinforced Plastics and Advanced Composites – Tension, compression, shear, Flexture, elevated temperature test, shear modulus and void content test and Non-destructive evaluation for quality check. (12 hours)

Unit – V

Application – General, structural, marine structure, automotives, aircraft and aerospace. Future Trends and Scope for advanced composites. (12 hours)

Text Books :


Reference Books :

2. Georgre Lubin, Handbook of Fiber glass and Advanced Plastics Composites,
Unit – I
Definition – Design by Evolution and by Innovation - factors to be considered for product design – Production-Consumption cycle - The morphology of design - Primary design Phases and flow-charting. Role of Allowance, Process Capability, and Tolerance in Detailed Design and Assembly Product strategies, Market research - identifying customer needs – Analysis of product – locating ideas for new products, Selecting the right product, creative thinking, curiosity, imagination and brain storming - product specification. (12 hours)

Unit – II

Unit – III

Unit – IV

Unit – V


Text Books :
Unit - I
Steps in design process - thermal system design aspects - workable - optimal - near optimal designs - regression analysis and equation fitting - importance of modeling in design - types of models - selection.

(12 hours)

Unit - II
Modeling of thermal equipment - heat exchangers - evaporators - condensers - turbo machines - distillation columns - System simulation - different classes - methods used in simulation - examples of energy systems.

(12 hours)

Unit - III
Optimization of thermal systems - analytical and numerical optimization techniques - unconstrained and constrained multivariable optimization using Lagrange Multipliers and search methods - application to energy systems.

(12 hours)

Unit - IV
Optimization of heat exchanger networks - concepts of pinch technology - temperature enthalpy rate difference diagram - composite curves and process pinch - maximum energy recovery - calculation of utility loads - grand composite curve - estimation of the required total heat transfer surface area - HEN design - integration of HEN with other components.

(12 hours)

Unit - V
Applications of second law analysis in heat and fluid flow - relationship between entropy generation and viscous dissipation - local entropy generation in convective heat transfer - fluid friction vs. heat transfer irreversibility - entropy generation minimization in extended surfaces and heat exchangers subject to constraints.

(12 hours)

Text Books :

Reference Books :
Unit - I
Governing equations: Continuity, momentum & energy equations applied to viscous & inviscid flows. Mathematical properties of equations of fluid dynamics – Classification of partial differential equations: linear & non-linear equations – second -order equations: elliptic equations, parabolic equations, hyperbolic equations, system of first order equations, system of second order equations – initial and boundary conditions.(12 hours)

Unit - II

Unit - III

Unit - IV
Strong and weak formulation of a boundary value problem: Strong formulations, weighted residual formulation, Galerkin formulation, weak formulation, variational formulation – shape function in two dimensions: Finite element interpolation triangular elements, quadrilateral Lagrange elements, quadrilateral serendipity elements, isoparametric elements – implementation of FEM; Analysis, numerical integration, solution procedure – case studies applied to incompressible and compressible flows. (12 hours)

Unit - V
Introduction to FVM – Grids in FVM – FVM through finite difference techniques: central type discretization, upwind type discretization. FVM through finite element techniques: Cell – centred formulation; single stage time stepping, multistage time stepping – accuracy – cell-vertex formulation: single stage time stepping with non-overlapping control volumes, multistage time stepping with over lapping control volumes – MAC formulation – FLIC formulation – Case studies applied to heat and fluid flow. (12 hours)
Text Books:


Reference Books:

MEE710  MECHATRONICS  (3 1 0 3)

Unit – I

(12 hours)

Unit – II

(12 hours)

Unit – III

(12 hours)

Unit – IV

(12 hours)

Unit – V

(12 hours)

Text Books :
MEE711  RENEWABLE ENERGY  (4 0 0 3)

Unit – I

Solar Radiation – Components of solar radiation – diffuse, beam & global – solar constant-
estimation of average solar radiation – solar thermal energy conversion systems – solar
photovoltaic systems.
Introduction to Geothermal energy – types of geothermal resources – geothermal power plants –
vapour and liquid dominated power plants.  
(12 hours)

Unit – II

Introduction to Wind Energy – Application and Background – Mean wind velocity – wind power
wind farms.  (12 hours)

Unit – III

Biomass energy resources : urban solid waste, agriculture waste and aquatic waste – conversion
processes : direct combustion, thermo chemical, biochemical, incineration, pyrolysis and
fermentation process – biogas from land fills.  (12 hours)

Unit – IV

Off-shore & On-shore energy resources – advantages and limitations of ocean energy – Ocean
energy conversion technologies : OTEC, Ocean wave energy conversion systems and Tidal energy
conversion systems.  (12 hours)

Unit – V

Magneto Hydro Dynamics (MHD) – Fuel cells – Natural Gas – Methanol – Bio-fuel – Hydrogen
energy – Nuclear energy – Hydro energy – combined cycle power plants.  (12 hours)

Text Books:

Reference Books:
Unit – I


Unit – II


Unit – III

Introduction to Under water Welding - Applications. (12 hours)

Unit – IV


Unit – V


Text Books :


Reference Books :

Unit – I


Unit – II


Unit – III

Formation of hydrocarbons, oxides of nitrogen, sulphur and carbon monoxide in SI and CI engines. Formation of particulate emission from CI engine – Formation of aldehydes – Effect of operating parameters on the formation of pollutants. (12 hours)

Unit – IV

Chassis Dynamometer tests - CVS methods - Sampling techniques - Emission measurement - Chemiluminescence and NDIR Analyzers - Flame ionization detector – smoke measurement: Comparison and obscurations methods - Bosch smoke meter-measurement of particulate matter. (12 hours)

Unit – V

Influence of operating parameters in the control of pollutants - changes in the design of combustion chamber – Fuel modification - Exhaust gas recirculation - Catalytic convertors for spark ignition engines - NO\textsubscript{x} reduction methods – Fuel additives to control emission - particulate traps. (12 hours)

Text Books:


Reference Books:

2. Obert, Edward, Internal Combustion Engines and Air Pollution, Harper and Row
MEE82 COMPOSITE MATERIALS (4 0 0 3)

Unit – I

Definition of Composite materials – Classification of composites, Need and General characteristics – advantages and limitations. (12 hours)

Unit – II

Matrices – Polymers – thermo set – thermo plastics, metal matrix – types, ceramics, reinforcement – Types, continuous, whiskers and particles – reinforcing materials. (12 hours)

Unit – III

Primary processing – Bag moulding, compression moulding – Pultrusion and Filament winding, Solid state processing, Liquid state processing, In situ methods. Secondary processing and heat treatment of MMCs. (12 hours)

Unit – IV

Introduction to Physical Properties, mechanical properties, fatigue, creep and damping properties – Effects of environment on the properties. (12 hours)

Unit – V

Selection of constituents for end application, Design considerations, Applications – case studies. (12 hours)

Text Books :


Reference Books :

MEE83    DIRECT ENERGY CONVERSION SYSTEMS       (3 1 0 3)

Unit – I

Direct and Indirect energy conversion – Fuels for Energy conversion – Introduction to irreversible
thermodynamics.       (12 hours)

Unit – II

Basic ideas of quantum physics – Pauli Exclusion Principle – Shell structure of electrons – Fermi
semiconductors – junctions – types.       (12 hours)

Unit – III

Photovoltaic conversion – solar cell configurations – characteristics of solar cells – performance of
solar cells – Thermoelectric converters – Thermoelectric refrigerators – Thermionic converters and
other thermal – electric conversion systems.       (12 hours)

Unit – IV

Introduction to plasma physics – Temperature and ionization – confinement of plasma: Magnetic
confinement and Inertial confinement – Principles of Magneto hydrodynamic conversion – Ideal and
practical MHD generators performance – MHD technology.       (12 hours)

Unit – V

Fuel cells and Batteries – Principles of EMF generation – Description of fuel cells – Applications of
fuel cells – Description of batteries: Primary, Secondary, Reserve and advanced battery system –
Types – Characteristics – applications.       (12 hours)

Text Books :

1. S.W.Angrist, Direct Energy Conversion, Allyn and Bacon, Boston, 1982
New Delhi-2000.

Reference Books :

1. K.Messerle Hugo, Magneto hydrodynamic Electric Power Generator, John Wiley & Sons,
1995.
4. Rakosh Das Begamudre, Energy Conversion System, New Age International (P) Ltd., New
Delhi, 2000.
Unit - I

Unit – II

Unit – III
Reciprocation operation of multicylinder – Quick return – sequencing – Accumulator Circuits – use of pressure switches & limit switches – Hydrostatic transmission Circuits – Fluid Power maintenance and safety. (12 hours)

Unit – IV

Unit – V
Basic Pneumatic Circuits – Speed Control – Sequencing of Motion – Hydro Pneumatic Circuits – Cascade Methods – Automation and Principle of Circuit design – Pneumatic Control applications in Machine Tool and other Mechanical fields – Maintenance. (12 hours)

Text Books:

Reference Books:
Unit – I

Unit – II
Robot control systems and components – basic control systems and models – concepts – control system analysis – robot activation and feedback components – power transmission system – robot joint control design (9 hours)

Unit – III
Method of robot programming – lead through programming methods – capabilities and limitations – Textual robot languages – generations of robot programming language, robot language structure, constants, variables, and other data objects, motion comments, end effectors and sensor commands, computations and operations, program control and subroutines, communications and data processing, monitor mode commands. (Simple Problems in Programming). (9 hours)

Unit – IV
Robot cell layouts – multiple robots and machine interface, consideration in work cell design, work cell control, interlocks, error detection and recovery, Robot cycle time analysis – graphical simulation of Robot work cells – AI and robotics. (9 hours)

Unit – V
Robot applications in manufacturing – Robot material handling, material transfer applications, loading and unloading – processing operation – spot welding, continuous arc welding, spray coating – assembly and inspection – parts presentation methods, assembly operations, compliance & the remote center compliance device, assembly system configuration, designing for robotic assembly, inspection automation – future applications. (9 hours)

Text Books:

Reference Books:
UNIT - I

Pressure vessels - introduction – functional requirements, size and shape, fluid contained, method of support, location of attachment and penetrations, operational requirements and limitations, loading, severity of duty, principal design codes, safety devices, pressure testing. (9 hours)

Unit - II

Stresses in pressure vessels – stresses in a circular ring, cylinder and sphere – Dilation of pressure vessels – Intersecting spheres – Membrane stresses in vessels under internal pressures – stresses in thick cylinders and spheres – Built up cylinders – Auto frettage of thick cylinders – Thermal stresses due to thermal gradients – Ultra-high pressure vessel design principles. (9 hours)

Unit - III


Unit - IV

Fatigue and crack growth – causes – dynamic loading, stress concentration, surface effects and material properties – creep effects at elevated temperatures – thermal stress fatigue – embrittlement – fracture control. (9 hours)

Unit - V

Buckling of pressure vessels under external pressure (cylinders and spheres) – Effect of supports and imperfections on buckling – economics of pressure vessel fabrication – modern trends in pressure vessel construction - use of codes. (9 hours)

Text Books :


Reference Books :

3. IS: 2825 – 1969 -Code for Unfired Pressure Vessels, Bureau of Indian Standards,
Unit – I
Indian project management scenario, Projects - Project ideas and preliminary screening. Developments - Project planning to Project completion - Pre-investment phase, Investment phase, operational phase - Governmental Regulatory framework. Capital Budgeting : Capital cost-time-value (CTV) system, managing project resources flow. (12 hours)

Unit – II
Stages - Opportunity studies - General opportunity studies, specific opportunity studies, pre-feasibility studies, functional studies or support studies, feasibility study expansion projects, data for feasibility study.
Market and Technical Appraisal : Market and Demand analysis, Market Survey, Demand forecasting. Technical analysis- Materials and inputs, Choice of Technology, Product mix, Plant location, capacity, Machinery and equipment. (12 hours)

Unit – III
Appraisal process, Concepts and Techniques, Cost and Benefit from Financial angle - Basic principles for measuring costs and benefits, components of cash flow. Time value of money - Present and future value. Appraisal criteria - Urgency, Payback period, Rate of return, Debt service coverage ratio, Net present value, Benefit cost ratio, Internal rate of return, Annual capital charge, Investment appraisal in practice. (12 hours)

Unit – IV
Cost of capital - Cost of different sources of finance, Cost of debt, preference capital, and Equity capital, Weighted average Cost of capital, Marginal cost of capital. Risk analysis- Measures of risk, Sensitivity analysis, and Decision tree analysis. Social cost benefits analysis (SCBA) - Rationale for SCBA, UNIDO approach.

Unit – V
Forms of Project Organization, Project Planning, Implementation, and Control - Network construction, CPM, PERT, Development of Project schedule, Crashing of Project Network, Scheduling based on the availability of Resources (Manpower and Release of Funds).
Introduction to Foreign collaboration projects - Governmental policy framework, Need for foreign technology, Royalty payments, Foreign investments and procedural aspects. (12 hours)

Text Books :

Reference Books :
2. UNIDO Series on Project Management
**MEE88  MODELING AND SIMULATION IN MANUFACTURING  (3 1 0 3)**

Unit – I

Introduction to Simulation - areas of applications - systems - Components - discrete and continuous systems - types of models - simulation study steps – simulation examples – simulation of queuing systems, inventory systems and reliability problem.  

(9 hours)

Unit – II


Introduction to programming languages – simulation in FORTRAN, GPSS, SIMAN, SLAM and MODSIM – Comparison.  

(9 hours)

Unit – III

Simulation of manufacturing systems – models, goals and performance measures issues - some preliminary case studies of simulation of manufacturing - study of Softwares available in the market – SIM FACTORY II.5, ProModel, AutoMod, Arena, AIM, Witress, Taylor - II.  

(9 hours)

Unit – IV


Basic concepts of queuing models and estimation of performance measures.  

(9 hours)

Unit – V

Analysis of simulation data - nput data models, Collection of data, identification of statistical distribution, estimating parameters and testing for goodness of it.  

Verification and validation of simulation models - Face validity, Validation of assumptions, Input - Output validation.  

(9 hours)

**Text Books :**


**Reference Books :**

MEE89  SOLAR POWER ENGINEERING  (4 0 0 3)

Unit – I

Solar radiation - radiation at the earth’s surface - measurement of solar radiation - solar radiation data geometry - solar radiation on tilted surfaces - relationship among absorption and emittance and reflectance - Selective surfaces.  (12 hours)

Unit – II

Flat plate collectors - transmissivity of cover system - collector efficiency - liquid plate collector - performance of flat Plate collector.  Concentrating collectors - flat plate collector with plane reflector - cylindrical parabolic collector - compound parabolic collector - central receiver collector.  (12 hours)

Unit – III

Solar heating - air heating system - solar energy heat pump system - solar water heating system: forced and natural circulation system - passive solar heating system - green house effect.  Solar cooling - absorption cooling - vapour absorption refrigeration - solar desiccant Cooling- Solar drier and dehumidifier - solar pond - domestic, commercial and industrial applications of solar heating / cooling systems.  (12 hours)

Unit – IV

Photovoltaic Principle - materials for photovoltaic cells - design and fabrication of photovoltaic cells - performance analysis of photovoltaic cells - Thermoelectric generator solar cell - photochemical solar cells - solar cells in terrestrial and space applications.  (12 hours)

Unit – V

Solar power systems - electrical power generation - solar thermal power plants - low, medium and high temperature power generation systems: using flat plate collectors or solar ponds, concentrating collectors, central receiver and solar chimneys - solar energy process economics.  (12 hours)

Note: Simple problems wherever applicable.

Text Books :

Reference Books :