REGULATIONS & SYLLABUS

Of

Five Year Dual Degree (B.Tech + M.Tech)

Mechanical Engineering

(W.e.f 2010-11 admitted batch)

Gandhi Nagar Campus, Rushikonda
VISAKHAPATNAM – 530 045
Website: www.gitam.edu
1.0 ADMISSIONS

1.1 Admissions into Five year Dual Degree (B.Tech. + M.Tech) programme in Mechanical Engineering of GITAM University are governed by GITAM University admission regulations.

2.0 ELIGIBILITY CRITERIA

2.1 A minimum of 60% marks aggregate in Physics, Chemistry and Mathematics and First class or equivalent grade in 10+2 or equivalent examination approved by GITAM University in single attempt.

2.2 Admissions into Five year Dual Degree (B.Tech. + M.Tech) programme will be based on an All India Entrance Test (GAT) conducted by GITAM University and the rule of reservation, wherever applicable.

3.0 STRUCTURE OF FIVE YEAR DUAL DEGREE (B.Tech. + M.Tech.) PROGRAMME

3.1 The Programme of instruction consists of:

(i) A general core programme comprising Basic Sciences, Basic Engineering, Humanities & Social Sciences and Mathematics.
(ii) An engineering core programme imparting to the student the fundamentals of engineering in the branch concerned.
(iii) The electives of the programme from V Semester onwards enabling the students to take up a group of specialized courses.
(iv) A specialization for M.Tech. can be opted by the students from the specialized groups offered by the Department.
(v) The M.Tech. specialization of the student shall be decided on the merit based choice.

In addition, a student has to

(i) carry out two technical projects in VIII and X semesters approved by the Department and submit a report.
(ii) undergo internship / industrial training in an industry for a period of 12 weeks and submit a report.

3.2 Each academic year consists of two semesters. Five year Dual Degree (B.Tech. + M.Tech) programme in Mechanical Engineering has a curriculum and course content (syllabi) for the courses recommended by the Board of Studies concerned and approved by Academic Council.
4.0 CREDIT BASED SYSTEM

4.1 Each course is assigned certain number of credits which will depend upon the number of contact hours (lectures & tutorials) per week.

4.2 In general, credits are assigned to the courses based on the following contact hours per week per semester.

One credit for each Lecture / Tutorial hour.
One credit for two hours of Practicals.
Two credits for three (or more) hours of Practicals.

4.3 The curriculum of Five year Dual Degree (B.Tech. + M.Tech) programme in Mechanical Engineering is designed to have a total of 235 credits for the award of B.Tech + M.Tech. degree.

5.0 MEDIUM OF INSTRUCTION

The medium of instruction (including examinations and project reports) shall be English.

6.0 REGISTRATION

Every student has to register himself/herself for each semester individually at the time specified by the Institute / University.

7.0 CONTINUOUS ASSESSMENT AND EXAMINATIONS

7.1 The assessment of the student’s performance in each course will be based on continuous internal evaluation and semester-end examination. The marks for each of the component of assessment are fixed as shown in the Table 2.
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Component of assessment</th>
<th>Marks allotted</th>
<th>Type of Assessment</th>
<th>Scheme of Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Theory</td>
<td>40</td>
<td>Continuous evaluation</td>
<td>(i) Two mid semester examinations shall be conducted for 10 marks each. (ii) Two quizzes shall be conducted for 5 marks each. (iii) 5 marks are allotted for assignments. (iv) 5 marks are allotted for attendance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The semester-end examination in theory courses will be for a maximum of 60 marks.</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>60</td>
<td>Semester-end examination</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Practicals</td>
<td>100</td>
<td>Continuous evaluation</td>
<td>(i) 40 marks are allotted for record work and regular performance of the student in the lab. (ii) One examination for a maximum of 20 marks shall be conducted by the teacher handling the lab course at the middle of the semester (iii) One examination for a maximum of 40 marks shall be conducted at the end of the semester (as scheduled by the Head of the Department concerned).</td>
</tr>
<tr>
<td>3</td>
<td>Project work</td>
<td>100</td>
<td>Project evaluation</td>
<td>(i) 50 marks are allotted for continuous evaluation of the project work throughout the semester by the guide. (ii) 50 marks are allotted for the presentation of the project work &amp; viva-voce at the end of the semester.*</td>
</tr>
<tr>
<td>4</td>
<td>Internship / Industrial Training</td>
<td>100</td>
<td>Internship / Industrial training evaluation</td>
<td>(i) 50 marks are allotted for report submission and seminar presentations after completion of the training. (ii) 50 marks are allotted for the viva-voce at the end of the semester.*</td>
</tr>
</tbody>
</table>

* Head of the Department concerned shall appoint two examiners for conduct of the examination.
8.0 RETOTALLING, REVALUATION & REAPPEARANCE

8.1 Retotalling of the theory answer script of the end-semester examination is permitted on a request made by the student by paying the prescribed fee within ten days of the announcement of the result.

8.2 Revaluation of the theory answer script of the end-semester examination is also permitted on a request made by the student by paying the prescribed fee within fifteen days of the announcement of the result.

8.3 A Student who has secured ‘F’ Grade in any theory course / Practicals of any semester shall have to reappear for the semester end examination of that course / Practicals along with his / her juniors.

8.4 A student who has secured ‘F’ Grade in Project work / Industrial Training shall have to improve his report and reappear for viva – voce Examination of project work at the time of special examination to be conducted in the summer vacation after the last academic year.

9.0 SPECIAL EXAMINATION

9.1 A student who has completed the stipulated period of study for the degree programme concerned and still having failure grade (‘F’) in not more than 5 courses (Theory / Practicals), may be permitted to appear for the special examination, which shall be conducted in the summer vacation at the end of the last academic year.

9.2 A student having ‘F’ Grade in more than 5 courses (Theory/practicals) shall not be permitted to appear for the special examination.

10.0 ATTENDANCE REQUIREMENTS

10.1 A student whose attendance is less than 75% in all the courses put together in any semester will not be permitted to attend the end-semester examination and he/she will not be allowed to register for subsequent semester of study. He /She has to repeat the semester along with his / her juniors.

10.2 However, the Vice Chancellor on the recommendation of the Principal / Director of the University College / Institute may condone the shortage of attendance to the students whose attendance is between 66% and 74% on genuine medical grounds and on payment of prescribed fee.
11.0 GRADING SYSTEM

11.1 Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester in each course. The letter grades and the corresponding grade points are as given in Table 3.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Grade points</th>
<th>Absolute Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>O</td>
<td>10</td>
<td>90 and above</td>
</tr>
<tr>
<td>A+</td>
<td>9</td>
<td>80 – 89</td>
</tr>
<tr>
<td>A</td>
<td>8</td>
<td>70 – 79</td>
</tr>
<tr>
<td>B+</td>
<td>7</td>
<td>60 – 69</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>50 – 59</td>
</tr>
<tr>
<td>C</td>
<td>5</td>
<td>40 – 49</td>
</tr>
<tr>
<td>F</td>
<td>Failed, 0</td>
<td>Less than 40</td>
</tr>
</tbody>
</table>

11.2 A student who earns a minimum of 5 grade points (C grade) in a course is declared to have successfully completed the course, and is deemed to have earned the credits assigned to that course. However, a minimum of 24 marks is to be secured at the semester end examination of theory courses in order to pass in the theory course.

12.0 GRADE POINT AVERAGE

12.1 A Grade Point Average (GPA) for the semester will be calculated according to the formula:

\[
\text{GPA} = \frac{\sum [C \times G]}{\sum C}
\]

Where

- C = number of credits for the course,
- G = grade points obtained by the student in the course.

12.2 Semester Grade Point Average (SGPA) is awarded to those candidates who pass in all the courses of the semester.

12.3 To arrive at Cumulative Grade Point Average (CGPA), a similar formula is used considering the student’s performance in all the courses taken in all the semesters completed up to the particular point of time.
12.4 The requirement of CGPA for a student to be declared to have passed on successful completion of the 5 year dual degree (B.Tech+M.Tech) programme and for the declaration of the class is as shown in Table 4.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Distinction</td>
<td>≥ 8.0*</td>
</tr>
<tr>
<td>First Class</td>
<td>≥ 7.0</td>
</tr>
<tr>
<td>Second Class</td>
<td>≥ 6.0</td>
</tr>
<tr>
<td>Pass</td>
<td>≥ 5.0</td>
</tr>
</tbody>
</table>

* In addition to the required CGPA of 8.0, the student must have necessarily passed all the courses of every semester in **first attempt**.

13.0 **ELIGIBILITY FOR AWARD OF THE B.Tech. + M.Tech. DEGREE**

13.1 **Duration of the programme:**

A student is ordinarily expected to complete the Dual degree (B.Tech.+ M.Tech.) programme in ten semesters of five years. However a student may complete the programme in not more than seven years including study period.

13.2 However the above regulation may be relaxed by the Vice Chancellor in individual cases for cogent and sufficient reasons.

13.3 A student shall be eligible for award of the B.Tech + M.Tech. degree if he / she fulfills all the following conditions.

a) Registered and successfully completed all the courses and projects.

b) Successfully acquired the minimum required credits as specified in the curriculum corresponding to the branch of his/her study within the stipulated time.

c) Has no dues to the Institute, hostels, Libraries, NCC / NSS etc, and

d) No disciplinary action is pending against him / her.

13.4 **Two degrees will be awarded to students after successful completion of the Programme- B.Tech & M.Tech.**
RULES

1. With regard to the conduct of the end-semester examination in any of the practical courses of the programme, the Head of the Department concerned shall appoint one examiner from the department not connected with the conduct of regular laboratory work, in addition to the teacher who handled the laboratory work during the semester.

2. In respect of all theory examinations, the paper setting shall be done by an external paper setter having a minimum of three years of teaching experience. The panel of paper setters for each course is to be prepared by the Board of Studies of the department concerned and approved by the Academic Council. The paper setters are to be appointed by the Vice Chancellor on the basis of recommendation of Director of Evaluation / Controller of Examinations.

3. The theory papers of end-semester examinations will be evaluated by internal/external examiner.

4. Panel of examiners of evaluation for each course is to be prepared by the Board of Studies of the department concerned and approved by the Academic Council.

5. The examiner for evaluation should possess post graduate qualification and a minimum of three years teaching experience.

6. The appointment of examiners for evaluation of theory papers will be done by the Vice Chancellor on the basis of recommendation of Director of Evaluation / Controller of Examinations from a panel of examiners approved by the Academic Council.

7. Project – II in VIII semester shall be evaluated by two examiners at the semester end examination. One examiner shall be internal and other examiner will be external. The Vice-chancellor can permit appointment of second examiner to be internal when an external examiner is not available.

8. The attendance marks (maximum 5) shall be allotted as follows:

<table>
<thead>
<tr>
<th>Percentage of Attendance</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>76% to 80%</td>
<td>1</td>
</tr>
<tr>
<td>81% to 85%</td>
<td>2</td>
</tr>
<tr>
<td>86% to 90%</td>
<td>3</td>
</tr>
<tr>
<td>91% to 95%</td>
<td>4</td>
</tr>
<tr>
<td>96% to 100%</td>
<td>5</td>
</tr>
</tbody>
</table>
## Course structure

**Five Year Dual degree (B. Tech + M.Tech)**

**Programme Code: EIRME201000**

### I Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Name of the Course</th>
<th>Category</th>
<th>Instruction hours per week</th>
<th>Maximum Marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIREG 101</td>
<td>ENGLISH WRITING SKILLS</td>
<td>HS</td>
<td>3</td>
<td>60</td>
<td>3</td>
</tr>
<tr>
<td>EIRMT 102</td>
<td>ENGG. MATHEMATICS –I</td>
<td>MT</td>
<td>4</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>EIRPH 103</td>
<td>ENGG. PHYSICS</td>
<td>BS</td>
<td>4</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>EIRCH 104</td>
<td>ENVIRONMENTAL STUDIES</td>
<td>HS</td>
<td>3</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>EIRCS 105</td>
<td>PROGRAMMING WITH C</td>
<td>BE</td>
<td>3</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>EIRME 106</td>
<td>GEOMETRICAL DRAWING</td>
<td>BE</td>
<td>1</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>EIRCS 111</td>
<td>PROGRAMMING WITH C LAB</td>
<td>BE</td>
<td>3</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>EIRPH 112</td>
<td>ENGINEERING PHYSICS LAB</td>
<td>BS</td>
<td>3</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>EIRME 113</td>
<td>WORKSHOP TECHNOLOGY LAB</td>
<td>BE</td>
<td>3</td>
<td>100</td>
<td>2</td>
</tr>
</tbody>
</table>

**TOTAL** 26

### II Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Name of the Course</th>
<th>Category</th>
<th>Instruction hours per week</th>
<th>Maximum Marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIRMT 201</td>
<td>ENGG. MATHEMATICS –II</td>
<td>MT</td>
<td>3</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>EIRMT 202</td>
<td>ENGG. MATHEMATICS –III</td>
<td>MT</td>
<td>3</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>EIRCH 203</td>
<td>ENGG. CHEMISTRY</td>
<td>BS</td>
<td>4</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>EIRPH 204</td>
<td>MATERIAL SCIENCE</td>
<td>BS</td>
<td>3</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>EIRME 205</td>
<td>ENGINEERING MECHANICS</td>
<td>BE</td>
<td>3</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>EIRME 206</td>
<td>ENGINEERING ECONOMICS</td>
<td>BE</td>
<td>3</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>EIRCH 211</td>
<td>ENGINEERING CHEMISTRY LAB</td>
<td>BS</td>
<td>3</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>EIREG212</td>
<td>ENGLISH LANGUAGE LAB</td>
<td>HS</td>
<td>3</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>EIRME 213</td>
<td>ENGINEERING GRAPHICS LAB</td>
<td>BE</td>
<td>3</td>
<td>100</td>
<td>2</td>
</tr>
</tbody>
</table>

**TOTAL** 26
### III Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Name of the Course</th>
<th>Category</th>
<th>Instruction hours per week</th>
<th>Maximum Marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIRME301</td>
<td>MANUFACTURING TECHNOLOGY – I</td>
<td>CE</td>
<td>3 L 1 T 3 P 40 60 100 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIRME302</td>
<td>MECHANICS OF SOLIDS – I</td>
<td>CE</td>
<td>2 L 1 T 3 40 60 100 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIRME303</td>
<td>APPLIED THERMODYNAMICS – I</td>
<td>CE</td>
<td>2 L 1 T 3 40 60 100 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIRME304</td>
<td>METALLURGY</td>
<td>CE</td>
<td>3 L 3 40 60 100 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIRME305</td>
<td>FLUID MECHANICS</td>
<td>CE</td>
<td>2 L 1 T 3 40 60 100 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIREE306</td>
<td>BASIC ELECTRICAL AND ELECTRONICS ENGINEERING</td>
<td>BE</td>
<td>3 L 1 4 40 60 100 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIRME 311</td>
<td>MECH. ENGG. –I LAB</td>
<td>CE</td>
<td>3 L 3 100 -- 100 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIRME 312</td>
<td>MANUFACTURING TECHNOLOGY – II</td>
<td>CE</td>
<td>3 L 3 100 -- 100 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIREE 313</td>
<td>ELECTRICAL ENGINEERING LAB</td>
<td>BE</td>
<td>3 L 3 100 -- 100 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIRME 314</td>
<td>INDUSTRIAL TOUR</td>
<td>IT</td>
<td>-- T -- NA 25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### IV Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Name of the Course</th>
<th>Category</th>
<th>Instruction hours per week</th>
<th>Maximum Marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIRME 401</td>
<td>INDUSTRIAL ENGINEERING AND MANAGEMENT</td>
<td>CE</td>
<td>3 L 1 T 3 40 60 100 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIRME 402</td>
<td>MANUFACTURING TECHNOLOGY – II</td>
<td>CE</td>
<td>3 L 1 T 3 40 60 100 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIRME 403</td>
<td>APPLIED THERMODYNAMICS – II</td>
<td>CE</td>
<td>2 L 1 T 3 40 60 100 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIRME 404</td>
<td>MECHANICS OF SOLIDS –II</td>
<td>CE</td>
<td>2 L 1 T 3 40 60 100 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIRME 405</td>
<td>THEORY OF MACHINES-I</td>
<td>CE</td>
<td>2 L 1 T 3 40 60 100 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIRME 406</td>
<td>HYDRAULIC MACHINERY AND SYSTEMS</td>
<td>CE</td>
<td>2 L 1 T 3 40 60 100 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIRME 411</td>
<td>MECH. ENGG. –II LAB</td>
<td>CE</td>
<td>3 L 3 100 -- 100 2</td>
<td></td>
<td></td>
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<tr>
<td>EIRME 412</td>
<td>MECHANICS OF SOLIDS LAB</td>
<td>CE</td>
<td>3 L 3 100 -- 100 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIRME 413</td>
<td>MACHINE DRAWING</td>
<td>CE</td>
<td>3 L 3 100 -- 100 2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL 25
### V Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Name of the Course</th>
<th>Category</th>
<th>Instruction hours per week</th>
<th>Maximum Marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIRME 501</td>
<td>THEORY OF MACHINES-II</td>
<td>CE</td>
<td>2 1 3</td>
<td>40 60 100</td>
<td>3</td>
</tr>
<tr>
<td>EIRME 502</td>
<td>METROLOGY</td>
<td>CE</td>
<td>3</td>
<td>40 60 100</td>
<td>3</td>
</tr>
<tr>
<td>EIRME 503</td>
<td>POWER PLANT ENGINEERING</td>
<td>CE</td>
<td>2 1 3</td>
<td>40 60 100</td>
<td>3</td>
</tr>
<tr>
<td>EIRME 504</td>
<td>MACHINE DESIGN</td>
<td>CE</td>
<td>3 1 4</td>
<td>40 60 100</td>
<td>4</td>
</tr>
<tr>
<td>EIRME 505</td>
<td>INSTRUMENTATION AND CONTROL SYSTEMS</td>
<td>CE</td>
<td>2 1 3</td>
<td>40 60 100</td>
<td>3</td>
</tr>
<tr>
<td>EIRME 506</td>
<td>OPERATIONS RESEARCH</td>
<td>CE</td>
<td>2 1 3</td>
<td>40 60 100</td>
<td>3</td>
</tr>
<tr>
<td>EIRME 511</td>
<td>FLUID MECHANICS &amp; HYDRAULIC MACHINERY LAB</td>
<td>CE</td>
<td>3</td>
<td>-- 100</td>
<td>2</td>
</tr>
<tr>
<td>EIRME 512</td>
<td>MANUFACTURING TECHNOLOGY-II LAB</td>
<td>CE</td>
<td>3</td>
<td>-- 100</td>
<td>2</td>
</tr>
<tr>
<td>EIREG 513</td>
<td>ENGLISH COMMUNICATION SKILLS LAB</td>
<td>HS</td>
<td>3</td>
<td>-- 100</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

### VI Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Name of the Course</th>
<th>Category</th>
<th>Instruction hours per week</th>
<th>Maximum Marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIRME 601</td>
<td>COMPUTATIONAL METHODS IN ENGINEERING</td>
<td>CE</td>
<td>3 1 4</td>
<td>40 60 100</td>
<td>4</td>
</tr>
<tr>
<td>EIRME 602</td>
<td>HEAT AND MASS TRANSFER</td>
<td>CE</td>
<td>2 1 3</td>
<td>40 60 100</td>
<td>3</td>
</tr>
<tr>
<td>EIRME 603</td>
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Manufacturing Technology Specialization

VII Semester

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VIII Semester

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<td>CNC MACHINES &amp; PART PROGRAMMING</td>
<td>CE</td>
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### IX Semester

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<td>FINITE ELEMENT METHODS LAB</td>
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**EIRME 804  Elective – 1  Inter Departmental (Common with B.Tech Mechanical)**

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<td>DATABASE MANAGEMENT SYSTEMS</td>
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<td>2</td>
<td>EIRME804B</td>
<td>ARTIFICIAL INTELLIGENCE IN MANUFACTURING</td>
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<td>EIRME804C</td>
<td>WEB TECHNOLOGY</td>
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<td>EIRME804D</td>
<td>DATA STRUCTURES</td>
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**List of Electives in Manufacturing Stream**

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<td>EIRME903MA</td>
<td>RAPID PROTOTYPING AND VIRTUAL PROTOTYPING</td>
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<td>EIRME903MB</td>
<td>JOINING PROCESSES</td>
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<td>EIRME903MC</td>
<td>ADVANCED MATERIALS AND PROCESSING</td>
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<td>MANAGEMENT INFORMATION SYSTEMS</td>
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<td>EIRME905MA</td>
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<td>MACHINE TOOL DESIGN</td>
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# Thermal Engineering Specialization

## VII Semester

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<td>EIRME 702T</td>
<td>COMPUTATIONAL FLUID DYNAMICS</td>
<td>CE</td>
<td>3 1 4</td>
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<td>CE</td>
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<td>CAD/CAM LAB</td>
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**EIRME 804 Elective – 1 Inter Departmental (Common with B.Tech Mechanical)**

**List of Electives in Thermal Stream**

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### English Writing Skills (EIREG 101)

**Hours per week:** 3  
**Credits:** 3  
**End Examination:** 60 Marks  
**Sessionals:** 40 Marks

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<td>Drafting Curriculum vitae</td>
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### Engineering Mathematics – I (EIRMT 102)

**Hours per week:** 4  
**Credits:** 4  
**End Examination:** 60 Marks  
**Sessionals:** 40 Marks
The objective of the course is to impart knowledge in Basic concepts of Mathematics relevant to Engineering applications.

Unit - I.

Linear Differential Equations of Higher order
Definition, Complete solution, Operator D, Rules for finding complementary function, Inverse operator, Rules for finding particular integral, Method of variation of parameters.

Unit-II
Equations reducible to Linear Differential Equations and Applications
Cauchy’s and Legendre’s linear equations, Simultaneous linear equations with constant coefficients and applications of linear differential equations to Oscillatory Electrical circuits L-C, LCR – Circuits, Electromechanical Analogy.

Unit –III
Multiple Integrals and its Applications:
Double integrals, Change of order of integration, Double integrals in Polar coordinates, Areas enclosed by plane curves, Triple integrals, Volume of solids, Change of variables, Area of a curved surface.

Unit –IV
Special Functions and its Applications:
Beta function, Gamma function, Relation between beta and gamma functions, Dirichlet integrals of type I and type II.

Unit–V
Infinite Series
Definitions of convergence, divergence and oscillation of a series, General properties of series, Series of positive terms, Comparison tests, Integral test, D’Alembert’s Ratio test, Raabe’s test, Cauchy’s root test, Alternating series, Leibnitz’s rule, Power series, Convergence of exponential, Logarithmic and binomial series (without proofs).

Text Prescribed:

References:

Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- First Semester
EIRPH 103 ENGINEERING PHYSICS

Hours per week: 4
Credits: 4
End Examination: 60 Marks
Sessionals: 40 Marks
The aim of the course is to impart knowledge in Basic Concepts of Physics relevant to Engineering applications.

UNIT – I
ELECTROMAGNETIC OSCILLATIONS AND ALTERNATING CURRENTS: Energy Stored in a Capacitor and an Inductor - LC Oscillations (Qualitative and Quantitative) - Analogy to Mechanical Motion-Damped Oscillations - Damped Oscillations in an RLC Circuit - Alternating Current (Including Equations for Voltages and Currents) - Fundamental Definitions - (Cycle, Time period, Frequency, Amplitude, Phase, Phase Difference, Root Mean Square (RMS) value, Average Value, Form Factor, Quality Factor, Power in Alternating Current Circuits) - Forced Oscillations and Resonance - The Series RLC Circuit.


UNIT-II


UNIT – III
ULTRASONICS: Introduction - Production of Ultrasonics by Magnetostriction and Piezoelectric Effects - Detection and Applications of Ultrasonics.


UNIT-IV
DIFFRACTION: Introduction - Differences between Fresnel and Fraunhofer Diffractions - Single Slit Diffraction (Qualitative and Quantitative Treatment) - Differences between Interference and Diffraction - Gratings and Spectra-Multiple Slits - Diffraction Grating - X-ray Diffraction - Bragg’s Law.

POLARISATION: Introduction - Double Refraction - Negative Crystals and Positive Crystals - Nicol’s Prism - Quarter Wave Plate and Half Wave Plate - Production and Detection of Circularly and Elliptically Polarised

UNIT-V
**FIBRE OPTICS:** Introduction - Optical Paths in Fibre - Optical Fibre and Total Internal Reflection - Acceptance Angle and Cone of a Fibre - Fibre Optics in Communications - Applications.

**Prescribed Books:**
- Physics Part I & II: Resnick, Halliday, Krane. John Wiley & Sons

**Reference Books:**
- Materials Science: M. Arumugam Anuradha Agencies, Kumbhakonam.
- The Feynman Lectures on Physics: Addison-Wesley.

**Five Year Dual degree (B. Tech + M.Tech) Mechanical Engineering- First Semester**

**EIRCH 104: ENVIRONMENTAL STUDIES**

Hours per week: 4
Credits: 4
End Examination: 60 Marks
Sessionals: 40 Marks

The objective of the syllabus is to provide knowledge in the basic concepts of the Environmental Studies in Engineering subjects.

**Unit – I**

**Multidisciplinary nature of environmental studies & Natural Resources:**

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

Unit - II
Ecosystems and Biodiversity and its conservation:


Unit – III
Environmental Pollution

Environmental Pollution: Definition, causes, effects and control measures of :- Air Pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management: Causes, Effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster Management: floods, earthquake, cyclone and landslides.

Unit – IV
Social Issues and the Environment:


Unit - V
Human Populations and the Environment and Environment Production Act and Field Work:


**Text Book:**


**References:**


**Five Year Dual degree (B. Tech + M.Tech) Mechanical Engineering- First Semester EIRCS 105: PROGRAMMING with C**

<table>
<thead>
<tr>
<th>Hours per week: 3</th>
<th>End Examination: 60 Marks</th>
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<td>Credits: 3</td>
<td>Sessionals: 40 Marks</td>
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The Aim of the course is to acquaint the student with C and the applications of C.

**UNIT – I**

**Variables, Expressions and Basic Input-Output:**

Introduction to C, Historical Development of C, Features of C, Compilers, Linker, Preprocessor, Character Set, Constants, Variables, Data Types and Keywords, Typedef statement, Operators, Operator – Precedence and Associativity, Typecasting.


**UNIT – II**

**Control Structures:** Introduction, the if statement, if-else statement, Multiway decision, Compound statements, Loops-for Loop, While Loop, do-while Loop, Break statement, Switch statement, Continue statement, Goto statement, simple examples algorithms and flowcharts.

**UNIT – III**
**Functions:** Introduction, Function main, where are functions useful, Functions accepting more than one parameter, User Defined and Library functions, Concepts Associated with Functions, Function Parameters, Call by Value and Call by Reference, Return Values, Recursion, Comparison of Iteration and Recursion, Variable Length Argument Lists.

**Storage classes:** Automatic, Register, Static and external storage classes.

**UNIT – IV**

**Arrays And Strings:** Introduction to Arrays, Initialization of Array, How arrays are useful, Multi dimensional Arrays.

**Strings:** What are Strings, Arrays of Strings and Standard Library String Functions.

**Pointers:** Introduction, Definition and use of pointers, Address operator, Pointer variables, Dereferencing Pointers, Void Pointers, Pointer Arithmetic, Pointers to Pointers, Pointers and Arrays, Passing arrays to Functions, Pointers and Functions.

**UNIT – V**

**Structures, Unions And Files:**

**Files:** Introduction, File Structure, File handling functions, File Types, Unbuffered and Buffered Files, Error Handling.

**Text Books:**


**Reference Books:**

Programming with ANSI and Turbo C by Ashok N. Kamthane, PEARSON Education
Let us C by Yashwant Kanetkar, published by BPB Publications.

**Five Year Dual degree (B. Tech + M.Tech)**
Mechanical Engineering- First Semester
EFRME106: GEOMETRICAL DRAWING

Hours per week: 3
Credits: 3
End Examination: 60 Marks
Sessionals: 40 Marks
Unit I

Orthographic projections and Projection of points
Introduction to orthographic projections: First angle projection and third angle projection.
Projection of points

Projection of straight lines
Projection of straight lines: line parallel to one or both planes, line perpendicular to one of the planes, line inclined to one plane, line inclined to both the planes. True length of straight line and true angles and its traces.

Unit II

Projections of planes
Introduction, types of planes, perpendicular planes, perpendicular to one pane and parallel to other plane, perpendicular to one plane and inclined to other plane, oblique planes.
Projections on auxiliary planes: types of auxiliary planes, perpendicular to one pane and parallel to other plane, perpendicular to one plane and inclined to other plane, oblique planes.

Unit III

Projections of solids
Introduction, types of solids, polyhedral tetrahedron- prism, pyramid and solids of revolution- cylinder, cone. Projections of solids, simple positions, axis inclined to one plane and parallel to other, axis inclined to both the planes.

Unit IV

Developments of surfaces
Developments of lateral surfaces of right solids- cube, prisms, cylinders, pyramids and cones.

Sections of solids:
Introduction, section planes, sections and true shape of a section. Sections and sectional views of solids- prism, pyramid, cylinder and cone.

Unit V

Isometric projections:
Introduction, isometric axes, lines and planes. Isometric scale, isometric view and projections of solids in simple position- prism, pyramid, cylinder, cone and sphere.

Text books:


Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- First Semester
EIRCS111: C-PROGRAMMING LAB

Hours per week: 3
Credits: 2
Sessionals: 100 Marks

1. Write a program to read the coordinates of a triangle and find the area. Check whether the given points form a triangle or a straight line.
2. Write a program to find the roots of a quadratic equation.
3. Write a program to check whether the given number is prime or not.
4. Write a program to print the Pascal triangle.
5. Write a program to print Fibonacci series up to a given number.
6. Write a function to find the value of nCr.
7. Write a program to implement binary search.
8. Write a function to swap to numbers by using call by reference.
9. Write a program to delete redundant elements in a given set of values.
10. Write a program to find maximum element of a given array
11. Write a program to arrange the elements in an ascending order.
12. Write a program for addition, multiplication of two given matrices of order M x N.
13. Write a program to check whether the given square matrix is symmetric or not.
14. Write a program to count the no. of words and no. of each vowel in a given sentence.
15. Write a function to sort the given list of names in dictionary order. (use string handling functions)
16. Write a program to read N student records having fields (sno, sname, sex, cgpa) and sort them by CGPA.

Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- First Semester
EIRPH112 ENGINEERING PHYSICS LAB

Hours per week: 3
Credits: 2
Sessionals: 100 Marks

The main aim of the course is to acquaint the students with basic concepts in Engineering Physics using the following illustrative list of experiments.

2. Thermal Conductivity of a Bad Conductor – Lee’s Method.
10. Determination of Refractive Indices (o and e) of a Bi-Refringent Material (Prism).
15. Determination of Band Gap in a Semiconductor.

Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- First Semester
EIRME113: WORKSHOP TECHNOLOGY LAB

Hours per week: 3
Credits: 2
Sessionals: 100 Marks

The main aim of Workshop Technology is to acquaint the student with the basic tools used in Workshop Technology and to develop skills in using these tools to perform simple tasks. The students should be able to work with these tools to prepare simple jobs in Wood Work Technology, Sheet Metal Working, Forging Technology and Fitting Technology.

An illustrative list of tasks to be performed by the student is given below:

I. Wood Working Technology - Familiarity with different types of woods used and tools used in wood Working technology.

Tasks to be performed:
1) To make Half – Lap joint
2) To make Mortise and Tenon joint
3) To make Corner Dovetail joint
4) To make Briddle joint.

II. Sheet Metal Working – Familiarity with different types of tools used in sheet metal working, developments of sheet metal jobs from GI sheets, knowledge of basic concepts of soldering.

Tasks to be performed:
1) To make Square Tray
2) To make Taper side Tray
3) To make Conical Funnel
4) To make Elbow Pipe.

III. Forging Technology – Familiarity with different types of tools used in forging technology.

Knowledge of different types of furnaces like coal fired, electrical furnaces etc...

Tasks to be performed:
1) To make round M.S rod to square
2) To make L bend in given M.S. Rod.
3) To make S bend in given M.S. Rod.  4) To perform heat treatment tests like annealing, normalizing etc..

IV. Fitting Technology – Familiarity with different types of tools used in fitting technology.

Tasks to be performed:

1) To make “V” – fitting
2) To make Rectangular fitting
3) To make Dovetail fitting
4) To make Semi circular fitting
5) To make Hexagon fitting

❖ **Student is required to work individually and complete at least three jobs in each technology.**

Dress Code:

❖ **For Boys**: Blue Colour Long Apron, Khaki Trousers, Half Sleeve Shirt (Tucked-in), Black Leather Shoes.
❖ **For Girls**: Blue Colour Long Apron, Salwar Suit, Black Shoes.

Reference Book:


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**Five Year Dual degree (B. Tech + M.Tech)**

**Mechanical Engineering- Second Semester**

**EIRMT 201: Engineering Mathematics - II**

*Hours per week: 4  
End Examination: 60 Marks  
Credits: 3  
Sessionals: 40 Marks*

The objective of the course is to impart knowledge in Basic concepts of Mathematics relevant to Engineering applications.

**Unit – I**

**Partial Differentiation:**

Introduction to Partial differentiation, Total derivative, Differentiation of implicit functions, Geometrical interpretation, Tangent plane and normal to a surface, Change of variables, Jacobians, Taylor’s theorem for functions of two variables.

**Unit – II**

**Applications Of Partial Differentiation:**
Total differential, Maxima and minima of functions of two variables, Lagrange’s method of undetermined multipliers, Differentiation under the integral sign, Leibnitz’s Rule.

Unit-III

Partial Differential Equations:
Introduction, Formation of partial differential equations, Solutions of a partial differential equation, Equations solvable by direct integration, Linear equations of the first order, Non-linear equations of the first order, Homogeneous linear equations with constant coefficients, Rules for finding the complementary function, Rules for finding the particular integral.

Unit-IV

Linear Algebra-1:

Unit-V

Linear Algebra – 2:
Eigen value and eigen vectors of a matrix, Cayley-Hamilton theorem, Reduction to diagonal form, Quadratic forms and canonical forms, Hermitian and Skew Hermitian matrix, Unitary matrix.

Text Books Prescribed:

References:

Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Second Semester
EIRMT 201: Engineering Mathematics - III

Hours per week: 4
Credits: 3
End Examination: 60 Marks
Sessionals: 40 Marks

The objective of the course is to impart knowledge in Basic concepts of Mathematics relevant to Engineering applications.

Unit-I

Fourier Series:
Euler’s formulae, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Odd and even functions, Expansions of odd or even periodic functions, Half range series and practical Harmonic Analysis.

Unit-II

Laplace Transforms:
Transforms of elementary functions, Properties of Laplace transforms, Existence conditions,
Inverse transforms, Transforms of derivatives, Transforms of integrals, Multiplication by $t^n$, Division by $t$, Convolution theorem.

**Unit-III**

**Applications Of Laplace Transforms:**
Applications to ordinary differential equations and simultaneous linear equations with constant coefficients, Unit step function, Unit impulse function, Periodic functions (without proofs).

**Unit-IV**

**Vector Calculus (Differentiation-):**
Scalar and vector fields, Gradient, Divergence, Curl, Directional derivative, Identities, Irrotational and Solenoidal fields.

**Unit-V**

**Vector Calculus (Integration):**
Line integral, Surface integral, Volume integral, Green’s theorem in the plane, Stoke’s and Gauss divergence theorems with proofs, Introduction of orthogonal curvilinear co-ordinates, Cylindrical co-ordinates, Spherical polar co-ordinates (without proof)

**Text Prescribed:**

**References:**

Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Second Semester
EIRCH 203 Engineering Chemistry

Hours per week: 4
End Examination: 60 Marks
Credits: 4
Sessionals: 40 Marks

**Unit-I:**

**ELECTROCHEMISTRY & CORROSION AND ITS CONTROL:**

**UNIT-II.**
FUEL TECHNOLOGY: CALORIFIC VALUE AND SOLID FUELS:

UNIT-III.
FUEL TECHNOLOGY: LIQUID FUELS:
Refining of Petroleum - Petroleum products used as Fuels - Gasoline - Knocking and Octane Number of Gasoline, Synthetic Petrol –Bergius and Fishcher Tropsch methods. Diesel - Cetane Number, High speed and low speed Diesel oil.- Power Alcohol: Manufacture, Advantages and Disadvantages - LPG.

Unit-IV:
ENGINEERING MATERIAL SCIENCE:
Introduction to nano materials- structure sensitive materials-Elementary ideas about electrical, thermal and magnetic properties of materials
Refractories:– Classification - criteria of a good refractory. Preparation and properties of silica, magnesite and silicon carbide refractories - clay bond, silica nitride bond and self bond in silicon carbide.

Lubricants:
Classification-Properties- Viscosity and Oiliness, Flash and Fire - Points, Cloud and Pour - Points. Aniline point, Saponification number – Carbon residue, Emulsification number volatilities, precipitation number, specific gravity, neutralization number. Principles and Mechanism of Lubrication - Fluid Film, Boundary and Extreme - Pressure Lubrications

Unit-V:
HIGHPOLYMERS & COMPOSITE MATERIALS: 8hours


Text Books Prescribed :
Chemistry of Engg materials by Jain &Jain Dhanapath Rai & Sons, Delhi.
Physical chemistry by Laidler
Reference Books :
Material Science and Engineering, V.Raghavan. Prentice-Hall India Ltd.

Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Second Semester
EIRPH 204 MATERIALS SCIENCE

Hours per week: 4 End Examination: 60 Marks
Credits: 4 Sessionals: 40 Marks

UNIT I


CRYSTAL IMPERFECTIONS: Point Defects - Impurities - Dislocations: Edge and Screw Dislocation - Stacking Faults.

UNIT II


UNIT III


UNIT IV

UNIT V

NANOSCIENCE: Definition of Nanoscience and Nanotechnology - Energy Bands - Band Structure in Nano - Surface Energy (Qualitative) - Size Dependent Properties (Qualitative): Mechanical and Electrical - Growth Techniques: Top Down (Lithography) - Bottom Up (Sol-Gel and Co-Precipitation) - Characterization Techniques: SEM and TEM - Applications - Optoelectronics - Micro- and Nanomechanics

Prescribed Books:

Materials Science and Engineering: A First Course            V. Raghavan    PHI
Introduction to Nanotechnology                             Charles P. Poole, Frank J. Owens    Wiley

Reference Books:

Materials Science                                           M. Arumugam. Anuradha Agencies, Kumbhakonam.

Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Second Semester
EIRME 205 ENGINEERING MECHANICS

Hours per week: 4                                          End Examination: 60 Marks
Credits: 4                                                  Sessionals: 40 Marks

UNIT – I


UNIT – II


UNIT- III

Properties of Surfaces and Solids: First moment of area and the Centroid of sections, Centroid of Composite Areas, Centroid of an Area Bounded by two Curves, Centre of Gravity of a

UNIT - IV

**Kinematics:** Introduction to Translation, Rotation and Plane Motion of a Rigid Body. Rectilinear Motion of a Particle with Constant Acceleration and Variable Acceleration, Curvilinear Motion of a Particle using Rectangular Coordinates, and Normal and Tangential Coordinates, Angular Motion of Rigid Body with Constant Angular Acceleration and Variable Angular Acceleration, Plane Motion of Rigid Body. Instantaneous centre for Plane Motion

**Kinetics: Force, Mass and Acceleration:** Introduction, Newton’s Laws of Motion, Equations of Motion of a Particle in Rectilinear and Curvilinear Motion, Motion of Mass centre of a System of Particles, Equations of Motion of a Rigid Body in Rotation and Plane Motion, D’ Alembert’s Principle.

UNIT – V


**Text Books:**


**Reference Books:**

2. Engineering Mechanics – Statics and Dynamics by Irving Shames, Prentice Hall of India
Five Year Dual degree (B. Tech + M.Tech)  
Mechanical Engineering- Second Semester  
EIRME 206: ENGINEERING ECONOMICS

Hours per week: 3  
Credits: 3  
End Examination: 60 Marks  
Sessionals: 40 Marks

UNIT-I:  
**Economics:** Utility, Value, Wealth, Consumption, Wants – Necessaries, Comforts and Luxuries.  
**Demand:** Laws of Demand, Elasticity of Demand – Price Elasticity of Demand, Factors affecting Elasticity of Demand.

UNIT II:  
**Forms of Business organization:** Single Trader, Partnership and Public Limited Company.  
**Costing:** Cost Concepts, Elements of Cost, Methods of Distribution of Overhead Costs. Unit Costing, Job Costing and Process Costing.

UNIT-III:  
**Break-Even Analysis:** Assumptions, Break – Even Charts, Simple problems.  
**Depreciation:** Depreciation Methods.

UNIT-IV:  
**Accounts:** Preparation of Profit and Loss account and Balance sheet (Outlines only).  
**Principles of Organization:** Types of organization – Span of management – Authority Delegation and Decentralization - Source of Formal Authority- Difference between Authority and Power – Line and Staff Authority.

UNIT-V:  

Text Books:  
2. Industrial Engineering and Management by O.P.Khanna, Khanna publishers Ltd

References:  
3. Cost accounts by Shukla and Grewal, S.Chand& company, 14th ed.  
4. Principles and Practice of Management by L.M.Prasad, Sultan Chand & Sons
EIRCH 211: ENGINEERING CHEMISTRY LAB

The objective of the Laboratory Practical is to make the student to acquire the basic concepts in Engineering Chemistry.

2. Determination of sodium carbonate in soda ash.
4. Estimation of copper (II) present in a brass sample (iodometric method)
5. a) Determination of Viscosity of a Liquid. 
   b) Determination of Surface Tension of a Liquid.
6. Determination of Mohr’s Salt by potentiometric method.
7. Determination of Strength of an acid by pH metric method.
8. Conduct metric titration of mixture of weak and strong acid with sodium Hydroxide.
10. Colorimetry
    a) Estimation of Manganese
    b) Estimation of Iron (III)

EIREG 212: English Language Lab

<table>
<thead>
<tr>
<th>Topics</th>
<th>Periods</th>
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</thead>
<tbody>
<tr>
<td>Introduction to Phonetics</td>
<td>1</td>
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<td>Accent / Stress</td>
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<tr>
<td>Intonation</td>
<td>1</td>
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<tr>
<td>Telephone Etiquette</td>
<td>1</td>
</tr>
<tr>
<td>Synonyms</td>
<td>1</td>
</tr>
<tr>
<td>Antonyms</td>
<td>1</td>
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<tr>
<td>One word Substitutes</td>
<td>1</td>
</tr>
<tr>
<td>Foreign Phrases</td>
<td>1</td>
</tr>
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<td>Idiomatic Expressions</td>
<td>2</td>
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<td>Vocabulary &amp; Grammar Exercises</td>
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</table>
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Second Semester
EIRME 213 ENGINEERING GRAPHICS LAB

Hours per week: 3
Credits: 2

1. Introduction to AutoCAD, Beginning a new drawing, exploring and interacting with the drawing window, saving and opening a file, Coordinate systems (Cartesian, polar and relative co-ordinate system)
2. Introduction to draw commands – line, circle, rectangle, polygon etc.
3. Introduction to modify commands – extend, trim, chamfer, rotate, etc.
4. Introduction to dimensioning and object properties.
6. Projection of planes
7. Sections and sectional views of solids – prism, pyramid, cylinder, cone
9. Intersection of solids- prism to prism, cylinder to cylinder

Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Third Semester
EIRME301: MANUFACTURING TECHNOLOGY – I

Hours per week: 3
Credits: 3

UNIT I
Moulding & casting processes: Sand Moulding, Types – Green, Dry, Skin Dried, Loam Sands. Cores, types of Cores, Core making, Core Prints. CO₂ Moulding, Shell Moulding. Investment Casting, Centrifugal Casting, die Casting–Gravity & Pressure die Casting (hot chamber, cold chamber)

UNIT II

**Melting & Casting**: Melting Furnaces – Crucible Furnace, Cupola, Charge Calculations, arc Furnace, Solidification of Casting, Casting Defects, Remedies.

**UNIT III**

**Arc Welding**: Equipment, Electrodes, Electrode Coatings, Principle of Arc, Mode of Metal Transfer, V-I Characteristics of Power Source, Shielded Metal arc Welding, Submerged arc Welding, Plasma arc Welding, Tungsten Inert Gas Welding (TIG), Metal Inert Gas (MIG) welding.

**Gas Welding**: Equipment, Oxy – Acetylene Flame, Types, Gas Welding Procedure, Oxygen – Hydrogen Welding, Gas Cutting.

**UNIT IV**


**Rolling**: Rolling Fundamentals, Analysis of Rolling Process, Rolling Stand Arrangements, Rolling Passes.

**UNIT V**

**Forging**: Fundamentals, Forging, Die Forging, Roll Forging, Press Forging, Upset Forging

**Sheet Metal working**: Principles of Sheet Metal Working – Spring Back & Shearing. Types of Dies, Drawing, Bending, Punching, Blanking, Spinning, Coining, Embossing.

**Text Books:**

**References:**
Five Year Dual degree (B. Tech + M.Tech)  
Mechanical Engineering- Third Semester  
EIRME302 MECHANICS OF SOLIDS-I

Hours per week: 3  
Credits: 3  
End Examination: 60 Marks  
Sessionals: 40 Marks

UNIT I  
**Simple Stresses and Strains:** Classification of Loads, Stress, Strain, Stress and Elongation Produced in a Bar due to its self weight, Tie Bar of uniform strength, Elongation in case of a Taper Rod, Poisson’s Ratio, Relation Between the Elastic Modulii, Stresses Induced in Compound Bars, Thermal Stress and Strain.

UNIT II  
**Shear Force and Bending Moment:** Basic Definitions, Classification of Beams, Types of Loads, Types of Supports, S.F. and B.M. Diagrams for Cantilever, Simply Supported and Overhanging Beams for different types of Loadings, The Point of Contraflexure, General Relation between the Load, the Shearing Force and the Bending Moment-Problems.

UNIT III  
**Bending and Shear Stresses in Beams:** Theory of Simple Bending (Bending equation/ Flexural Formula), Position of Neutral Axis, Section Modulus, Practical Application of Bending Equation, Shear Stresses in Beams, Variation of Shear Stress Distribution for Rectangular, Circular and I-Sections-Problems.

UNIT IV  
**Complex and Principal Stresses:** Introduction, Stresses on an oblique plane under Uniaxial loading, Stresses on an oblique plane under Biaxial Loading, Complementary Shear Stress, Simple Shear, Pure Shear, Biaxial stresses combined with Shear stresses, Principal stresses and principal planes, Mohr’s circle for Complex stresses.  
**Torsion of Circular Shafts:** Shafts, Torsion of Shafts, Torsion equation, Hollow Circular Shafts, Torsional Rigidity, Power Transmitted by the Shaft, Importance of Angle of Twist and Shear Stresses in Shafts, Shafts in Series, Shafts in Parallel, comparison of Solid and Hollow Shafts, Combined Bending and Torsion.

UNIT V  
**Deflection of Beams:** Beam Deflection, Relation between Slope, Deflection and Radius of Curvature, Slope and Deflection at a Section, Double Integration Method, Macaulay’s Method and Moment Area Method for Cantilever, Simply Supported, overhanging, propped cantilever Beams.
Text Book:

References:
Five Year Dual degree (B. Tech + M.Tech)  
Mechanical Engineering- Third Semester  
EIRME303: APPLIED THERMODYNAMICS – I

Hours per week: 3  
End Examination: 60 Marks  
Credits: 3  
Sessionals: 40 Marks

UNIT I


UNIT II
Second law of Thermodynamics: Kelvin Plank Statement and Clausius Statement and their Equivalence, Corollaries- Perpetual Motion Machines of first kind and second kind- Reversibility and Irreversibility- Cause of Irreversibility- Carnot Cycle- Heat Engines and Heat Pumps- Carnot Efficiency- Clausius Theorem- Clausius Inequality- Concept of Entropy- Principles of Increase of Entropy..


UNIT III


UNIT IV
UNIT V
Reciprocating and Rotary Compressors: Classification of Reciprocating Compressors, Effect of Clearance- Volumetric Efficiency, Single Stage and Multi Stage Compressors, Effect of Inter-Cooling and Pressure Drop in Multi - Stage Compressors. – Analysis of Reciprocating Compressors. Theory of Roots blower, Vane type Blower, Centrifugal Compressor - Axial Flow Compressors.

Text Books:

References:
5. Thermodynamics-Van wylen and Sunntagg
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Third Semester
EIRME 304: METALLURGY

Hours per week: 3  End Examination: 60 Marks
Credits: 3  Sessionals: 40 Marks

UNIT I
Constitution of Alloys: Necessity of alloying, types of solid solutions, Hume-Rothery rules, intermediate alloy phases and electron compounds.

UNIT II
Heat Treatment of Steels: Annealing, Normalizing, Isothermal Transformations Curves, Hardening, Tempering, Austempering and Martempering of steels.
Surface hardening of Steels: Carburizing, Nitriding, Cyaniding, Flame and Induction Hardening methods.

UNIT III

UNIT IV

UNIT V

Text Books:

References:
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Third Semester
EIRME305: FLUID MECHANICS

Hours per week: 3
Credits: 3
End Examination: 60 Marks
Sessionals: 40 Marks

UNIT I

UNIT II

UNIT III
Laminar Boundary Layer: Momentum Integral Equation- Flow over a Flat Plate- Displacement Thickness, Momentum Thickness and Energy Thickness.

UNIT IV

UNIT V

Text Books:
2. Fluid Mechanics , by Douglas and swasfield, Pearson asia
References:
6. Fluid Mechanics and Hydraulic Machines-P.K.Nag
Five Year Dual degree (B. Tech + M.Tech)  
Mechanical Engineering- Third Semester  
EIREE306: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Hours per week: 4  
Credits: 4  
End Examination: 60 Marks  
Sessionals: 40 Marks

UNIT I

UNIT II

UNIT III
Transformers: Transformer working principle, EMF equation of transformer, Transformer on load, Equivalent circuit of transformer, Voltage regulation of transformer, Losses in a transformer, Calculation of efficiency and regulation by open circuit and short circuit tests.

UNIT IV

UNIT V
Introduction to Electronics and Microprocessors: Semiconductor diode, Zenor diode, Transistor, Rectifiers and SCR (Elementary treatment only). Fundamentals of digital electronics, Number system and codes, Logic gates, Boolean algebra, Arithmetic-logic units, The Intel-8085 microprocessor; Architecture, Instruction set, Addressing modes.

Text Books:
2. Digital logic & Computer Design, M.Morris Mano (Prontice, Hall of India Private Limited)

References:
1. A First Course in Electrical Engineering by D.P.Kothari.
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Third Semester
EIRME311: MECHANICAL ENGINEERING - I LAB

Hours per week: 3
Credits: 2

Continuous Evaluation: 100 Marks

1. Study the variation of Kinematic viscosity of given sample of oil with temperature using Redwood viscometer-I
2. Study the variation of Kinematic viscosity of given sample of oil with temperature using Redwood viscometer-II
3. Study the variation of Kinematic viscosity of given sample of oil with temperature using Saybolt viscometer
4. Calibration of the given pressure gauge.
5. Valve timing diagram of four stroke diesel engine
6. Port timing diagram of two stroke diesel engine
7. Port timing diagram of two stroke petrol engine
8. Determine the flash point of given sample using Pensky-Martens apparatus
9. Determine of flash and fire point of a given sample using Cleavelands open cup tester.
10. Determine the moment of inertia of flywheel about its own axis of rotation.
11. Determine the moment of inertia of connecting rod and circular disc
15. Determination of Cloud and Pour Point of given oil sample.
16. Study of boilers, various mountings and accessories
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Third Semester
EIRME 312: MANUFACTURING TECHNOLOGY – I LAB

Hours per week: 3
Credits: 2
Continuous Evaluation: 100 Marks

Molding Practice:
1. Preparation of a green sand mould using Single piece pattern.
2. Preparation of a green sand mould using Split piece pattern.
3. Preparation of a green sand mould using Split Piece Pattern with Core.
4. Preparation of a green sand mould using Connecting rod pattern.

Sand testing:
5. Determination of Grain fineness number for sand sample using sieve shaker.
6. Estimation of a). The clay content and
   b). The moisture content in a given sand sample.
7. Determination of Permeability of the given moulding sand specimen.
8. Determination of a). Compression strength and
   b). Shear strength of a given sand specimen.

Welding practice:
9. Preparation of a Butt joint using electric arc welding.
Five Year Dual degree (B. Tech + M.Tech)  
Mechanical Engineering- Third Semester  
EIREE 313: ELECTRICAL ENGINEERING LAB

Hours per week: 3  
Continuous Evaluation: 100 Marks  
Credits: 2

3. Verification of KCL and KVL.  
4. Superposition Theorem.  
5. Parameters of choke coil  
7. Load test on D.C.  
8. Swinburne’s Test series Motor.  
9. O.C. Test on D.C. separately Excited DC Generator  
10. Load test on single phase transformer.  
11. OC and SC Tests on Transformer.  
12. 3-Phase Induction Motor load Test.

Five Year Dual degree (B. Tech + M.Tech)  
Mechanical Engineering- Third Semester  
EIRME 314: INDUSTRIAL TOUR

Hours per week: 7-10 Days  
Cont. Evaluation: NA  
Credits: NA
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Fourth Semester
EIRME401: INDUSTRIAL ENGINEERING AND MANAGEMENT

Hours per week: 3
Credits: 3
End Examination: 60 Marks
Sessionals: 40 Marks

UNIT I

UNIT II
Materials Management: Strategic importance of materials in manufacturing industries, Inventory control models, Inventory control systems, Safety stock, selective Inventory control – ABC, FSN, VED analysis.

UNIT III
Production Planning and Control: Objectives, Types of productions, Production cycle, product design and development, process planning, Forecasting, Functions of production control.
Plant Layout & Material Handling: Plant layout and location. Types of layouts, principles, concept of unit load, selection of material handling equipment.

UNIT IV
Industrial Management: Concepts, Principles of management, Growth of management thought, Functions of management, principles of organizations, Types of organizations.

UNIT V

Text Books:
2. Industrial Engineering and Management by O P Khanna.

References:
1. Principles of management by Koontz & Donnel
2. Production and operations management by Evcret Adam and Ronald Ebert.
4. Industrial Engineering and Production Management by Telsay, S Chand & Co
UNIT I

UNIT II

UNIT III

UNIT IV
Abrasive Machining: Abrasive wheels- Manufacturing, Specifications, Grinding Machines-Classification, Precision Grinding Processes- Polishing, Buffing, Honing, and Lapping.

UNIT V

Text Books:
1. Workshop Technology, by Raghuvamsi, Khanna Publishers
2. A Text book of Production Technology by P.C.Sharma, S.Chand & Company Ltd

References:
1. Work Shop Technology by W.AJ Chapman
2. Metal Cutting Theory & Practice, by Bhattacharya. A, Central book publishers
3. Manufacturing Science, by Ghosh & Mallik
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Fourth Semester
EIRME403: APPLIED THERMODYNAMICS – II

Hours per week: 3
Credits: 3

End Examination: 60 Marks
Sessionals: 40 Marks

UNIT I

UNIT II
Steam Turbines: Classification of Steam Turbines- Impulse Turbine and Reaction Turbine-Compounding in Turbines- Velocity Diagrams in Impulse and Reaction Turbines- Degree of Reaction- Condition for Maximum Efficiency of Reaction Turbines- Losses in Steam Turbines-Reheat Factor- Governing of Turbines.

UNIT III

UNIT IV

UNIT V

Text Books:
2. Treatise on heat engineering by P.Vasandani and D.S.Kumar, Metropolitan Co.Pvt.Ltd.

References:
2. Thermal Engineering by P.L.Ballaney
3. I.C.Engines, by Mathur and Mehta
4. Gas Turbines, by Cohen, Rogers and Sarvana Mutto, Addison Wesley – Long Man
5. I.C. Engines by V. Ganesan.
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Fourth Semester
EIRME404: MECHANICS OF SOLIDS-II

Hours per week: 3
Credits: 3
End Examination: 60 Marks
Sessionals: 40 Marks

UNIT I
**Fixed Beams:** Fixing moments for a fixed beam of uniform section, Moment area method, Macaulay’s method and strain energy method, Effect of sinking support, slope and deflection.

UNIT II
**Continuous beams:** Analysis, Reaction at the supports, Clapeyron’s three moment equation and strain energy method, Effect of sinking of supports.

UNIT III
**Columns and Struts:** Columns with one end free and the other fixed, Both ends fixed, One end fixed and other end hinged, Limitation of Euler’s formula, Column with initial curvature, Column carrying eccentric load, Laterally loaded columns, Empirical formulae.

UNIT IV
**Thin Cylinders and Spherical Shells:** Stresses and strains (principal stress, principal strain, shear stress, shear strain and volumetric strain) in thin cylinders, thin spherical shell; wire wound cylinders
**Thick cylinders:** Thick cylinders Coursed to internal and external pressure and compound cylinders; different stresses induced; Lames equation, stresses due to shrink fit.

UNIT V
**Bending of Curved Bars:** Stresses in bars of circular, rectangular and trapezoidal sections.
**Stresses due to rotation:** Wheel rim, disc of uniform thickness, disc of uniform strength.

Text Books:
1. Strength of materials by Dr. Sadhu Singh, Kanna Publications
2. Elements of Strength of materials by SP Timoshenko and D.H. Young, East-West press Pvt. Ltd

References:
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Fourth Semester
EIRME405: THEORY OF MACHINES – I

Hours per week: 3                      End Examination: 60 Marks
Credits: 3                             Sessionals: 40 Marks

UNIT I
Mechanisms and machines: Introduction, mechanism and machine, rigid and resistant bodies, link, kinematic pair, degrees of freedom, classification of kinematic pairs, kinematic chain, mechanism and structure, classifications of mechanisms, equivalent mechanisms, four bar mechanism, inversions of four bar mechanism, slider crank chain and double slider crank chain.
Lower pairs: Introduction, pantograph, straight line mechanism, automobile steering gears, engine indicators, types of steering gear, Hooke’s joint, double Hooke’s joint.

UNIT II
Velocity Analysis: Introduction, absolute and relative motions, motion of a link, angular velocity of links, velocity of rubbing, slider crank mechanism, crank and slotted lever mechanism, instantaneous center method, number of instantaneous centers, Kennedy’s theorem, angular velocity by instantaneous center method, centroid.
Acceleration analysis: Acceleration of a link, four bar mechanism, angular acceleration of links, acceleration of intermediate and offset points, slider crank mechanism, and Coriolis acceleration component, crank and slotted lever mechanism.

UNIT III
Cams: Introduction, types of cams, types of followers, motion of the follower, uniform velocity, SHM uniform acceleration and retardation, profile of cams, cams with specified contours—tangent cam with roller follower and Circular arc cam with Flat-Faced follower.

UNIT IV
Gears and Gear trains: Introduction and classification of gears, gear terminology, law of gearing, velocity of sliding, forms of teeth, cycloidal profiles, involute profiles, path of contact, arc of contact, numbers of pairs of teeth in contact interference in volute gears, minimum number of teeth, interference between rack and pinion, under cutting, helical and spiral gears, velocity ratios, and centre distance of helical gears, helical gear forces and efficiency, worm and worm gears, bevel gears. Simple gear trains, compound gear trains, reverted gear train, epicyclic gear train, analysis and torques in epicyclic gear trains, sun and planet gear, differential gear.

UNIT V
Computer aided analysis of mechanism: Introduction, Four Bar mechanism, slider crank mechanism, coupler curves.
Graphical and computer aided synthesis of mechanisms: Pole, Relative pole, design of mechanisms by Relative pole method, Inversion method, design of mechanisms by Inversion method, computer aided synthesis of mechanisms.
Text Books:

References:
1. Theory of Machines by Thomas Bevan.
2. Theory of Machines by W.G.Green.
4. Theory of Machines by Dr. Jagadishlal
5. Theory of Machines by P.L.Ballaney
UNIT I
Impact of jets: Hydrodynamic force of jets on stationary and moving flat, inclined and curved waves, jet striking centrally and at tip – velocity triangles at inlet and outlet – expressions for work done and efficiency – angular momentum principle.

UNIT II
Hydraulic Turbines: Classification- Pelton wheel- Reaction turbines- Inward and outward radial flow reaction turbines- Francis turbine- Axial flow reaction turbine- Kaplan turbine- Draft tube- Types- Theory- and efficiency of draft tube.
Performance of Turbines: Specific Speed: Determination- Significance- Unit quantities- Unit speed- Unit discharge and unit power- Characteristic curves of hydraulic turbines-Constant head curves- Constant speed curves and Iso-efficiency curves- Governing of turbines.

UNIT III
Centrifugal Pumps: Main parts- Efficiency- Minimum speed for starting- Multi-stage centrifugal pumps- Specific speed of a centrifugal pump- Priming of a centrifugal pump- Characteristic curves- Main, Operational and constant efficiency curves- Cavitation- Effects- Cavitations in Hydraulic machines.

UNIT IV
Reciprocating Pumps: Main parts- Classification- Velocity and acceleration variation in suction and delivery pipes due to piston acceleration- Effect of variation of velocity on friction in suction and delivery pipes- Effect of acceleration in suction and delivery pipes on indicator diagram- Effect of friction- Maximum speed of reciprocating pump- Air vessels.

UNIT V

Text Books:

References:
2. Fluid Mechanics and Hydraulic Machines by K.R.Arora
3. Fluid Mechanics and Hydraulic Machines by R.K.Rajput
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Fourth Semester
EIRME411: MECHANICAL ENGINEERING-II LAB

Hours per week: 3
Credits: 2
Continuous Evaluation: 100 Marks

1. Conduct a load test on Research Engine with Petrol fuel and draw various performance curves.
2. Conduct a load test on Research Engine with petro- blends and draw various performance curves.
3. Conduct a load test on Research Engine with Bio fuel and draw various performance curves.
4. Conduct a load test on Research Engine with diesel and bio fuel blends and draw various performance curves.
5. Conduct an experiment on two-stage reciprocating air compressor to determine various efficiencies.
6. Conduct Morse test on high-speed four-stroke multi cylinder S.I MARUTI Engine to determine F.P and Mechanical efficiency.
10. Conduct an experiment on vapor compression refrigerator to determine C.O.P.
11. Study of dynamic balancing machine
12. Study of Automotive Components
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Fourth Semester
EIRME412: MECHANICS OF SOLIDS LAB

Hours per week: 3  
Credits: 2  
Continuous Evaluation: 100 Marks

1. To study the Stress Strain Characteristics (Tension & Compression) of Metals by using UTM.
2. To study the Stress Strain Characteristics of Metals by using Hounsefield Tensometer.
3. Determination of Compressive Strength of wood
4. Determination of hardness using different hardness testing Machines- Brinnels, Vickers, and Rockwell’s.
5. Impact Test by using Izod and Charpy Methods.
6. Deflection test on Beams using UTM.
7. Tension Shear Test on MS Rods.
8. To find Stiffness and Modulus of Rigidity by Conducting Compression Test on Springs.
9. Torsion Test on Circular Shafts.
10. Buckling of Sand
11. Punch Shear Test, Hardness Test and Compression Test by using Hounsefield Tensometer.
Five Year Dual degree (B. Tech + M.Tech)  
Mechanical Engineering- Fourth Semester  
EIRME413: MACHINE DRAWING LAB

Hours per week: 3  
Continuous Evaluation: 100 Marks  
Credits: 2

Screw threads: Definitions, V-Threads, Square Thread, Conventional Representation of Threads, Right Hand and Left Hand Threads.  
Keys and Cotter Joints: Introduction, Taper Key, Sunk Taper Key, Round Key, Saddle Key, Feather Key, Splined Shaft, Woodruff Key, Socket and Spigot Joint, Knuckle Joint.  
Shaft Couplings: Box and Split Muff Coupling, Flanged, Universal and Oldham’s Coupling.  
Note: 1)The above Mechanical Components can be Drawn using Mechanical Drafting packages like AutoCAD/MDT/CATIA.  
2) Drawings as per IS.  
3) All Drawings are in 2-D in which one chapter should be drawn in 3-D.

Text Books:  
References:  
UNIT I

Static Force Analysis: Introduction, Static Equilibrium, Equilibrium of Two-force and Three-force members, Member with Two force and a torque, Force convention, free body diagrams, Superposition.

Dynamic force Analysis: Introduction, D’Alemberts principle, Equivalent Offset inertia force, Dynamic analysis of Four bar and Single slider mechanisms, Klein’s construction, velocity and acceleration of piston, angular velocity and angular acceleration of connecting rod, piston effort, turning moment on crank shaft, Inertia of connecting rod, Inertia forces in reciprocating Engines(Graphical method).

UNIT II

Gyroscope: Introduction, Precessional angular motion, gyroscopic couple, effect of gyroscopic couple on an aero plane, effect of gyroscopic couple on a naval ship during steering, gyroscopic couple on a naval ship during pitching, gyroscopic couple on a naval ship during rolling, stability of a four wheel drive moving in a curved path, stability of a two wheel vehicle taking a turn.

UNIT III


UNIT IV

Balancing: Introduction, Static balancing, dynamic balancing, balancing of several masses in same planes, balancing of several masses in different planes, Balancing of Reciprocating masses, balancing of locomotives, balancing of inline engines, balancing of V-engines.

UNIT V


Transverse and Torsional Vibrations: Natural frequency of free transverse vibrations due to point load and UDL acting over a simply supported shaft- transverse vibration for a shaft Course ed to number of point loads-energy method- dunkerley’s method, critical speed of a shaft. Natural frequency of free torsional vibrations- free torsional vibrations of a single rotor system, two rotor and three rotor system and gear system.
Text Books:

References:
1. Theory of Machines by Thomas Bevan.
2. Theory of Machines by W.G. Green.
4. Theory of Machines by Dr. Jagadishlal
5. Theory of Machines and Mechanisms by PL Ballaney
6. Theory of Machines and Mechanisms by Amitaba Ghosh and Ashok kumar Mallik(EWP)
7. Design of Machinery by R.L. Norton
Five Year Dual degree (B. Tech + M.Tech) 
Mechanical Engineering- Fifth Semester 
EIRME502: METROLOGY

Hours per week: 3
Credits: 3
End Examination: 60 Marks
Sessionals: 40 Marks

UNIT I
Linear Measuring Instruments: Vernier height gauge, Vernier depth gauge, Depth Micrometer, Dial Gauge, Slip Gauges.

UNIT II
Comparators: Characteristics of comparators, Types of comparators- Mechanical, Pneumatic, Optical level and Electrical. Advantages and disadvantages of comparators.

UNIT III
Limits, Fits, Tolerances & Limit Gauges: ISO system of limits, fits, tolerances as per IS 919, hole base system, shaft base system, interchangeability, selective assembly, plain limit gauges; Plug gauges, Ring gauges.

UNIT IV
Metrology of Screws & Gears: Metrology for screw threads, measurement of major diameter, minor diameter, effective diameter. Measurement of spur gear, pitch, backlash, tooth thickness. Miscellaneous Gauges: Radius gauges, Screw, pitch gauges, gauges for external threads. Feeler gauges.

UNIT V
Measurement of surface finish: methods of measuring surface finish, surface texture
Machine tool acceptance tests: Acceptance tests for lathe, drilling machines.

Text Books:

References:
1. A.S. T.M.E. Hand Book of Industrial Metrology, Prentice Hall of India, New Delhi
2. Technology of the metal Trade, Wiley Eastern Limited.
4. CAD/CAM by M.P.Groover
Five Year Dual degree (B. Tech + M.Tech)  
Mechanical Engineering- Fifth Semester  
EIRME503: POWER PLANT ENGINEERING

Hours per week: 3  
End Examination: 60 Marks  
Credits: 3  
Sessionals: 40 Marks

UNIT I  

UNIT II  
**Nuclear power plants:** Classification of reactors, Fuels, Fuel moderator and coolant, Control and safety rods, Special properties of structural materials required, Induced radioactivity, Gas cooled reactors, Radiation hazards and shielding, Radioactive waste disposal.  
**Wind Energy:** Introduction, classification, horizontal axis wind turbine (HAWT) - vertical axis wind turbine (VAWT) - rotor design considerations - blade profile - 2/3 blades and teetering – coning - upwind / downwind - power regulation - Yaw system - inverters.

UNIT III  
**Solar Energy:** solar radiation, its measurement and prediction. Solar angles - day length, angle of incidence on tilted surface. Flat plate collectors: liquid and air type.  
**Hydro Electric Plants:** Selection of site, Hydrology, Hydrometric survey rainfall, Catchment, Reservoir, Run-off flow and fall, Storage and pondage. Losses due to percolation, evaporation and transpiration. General layout of the plant. Different types of plants. Low, medium and high head plants and pump storage plants. Types of Spillways and Dams.

UNIT IV  
**Fuel cell:** Principle of operation of an acidic fuel cell, Reusable cells, Ideal fuel cells, Other types of fuel cells, Comparison between acidic and alkaline hydrogen-oxygen fuel cells, Efficiency and EMF of fuel cells, Operating characteristics of fuel cells, Advantages of fuel cell power plants, Future potential of fuel cells.

UNIT V  
**Power Plant Economics:** Capacity factor, Load factor, Diversity factor, Peak load consideration, Factors governing capacity of plants. Cost of power plant, Cost of erection. Operating and maintenance expenses, Cost of production, distribution of power and determination of rates.
Text Books:
1. Power plant engineering by P.K. NAG
5. Non-Conventional energy resources by G.D. RAI, Khanna publishers.

References:
Five Year Dual degree (B. Tech + M.Tech)  
Mechanical Engineering- Fifth Semester  
EIRME504: MACHINE DESIGN

Hours per week: 4  
Credits: 4  
End Examination: 60 Marks  
Sessionals: 40 Marks

UNIT I  
Design against static loads: Modes of failure, Factory of safety, Axial, bending and torsional stresses. Theories of failures - Rankines theory, Trescas theory, Hekys theory, Vonmises theory  
Fluctuating and fatigue stresses - Stress concentration factors, endurance limit, notch sensitivity. Soderberg, Goodman and modified Goodman diagrams, fatigue design under combined loading.

UNIT II  
Keys and Couplings: design of Keys, square keys, rectangular keys, kenedy key and woodruff key  
Couplings - Rigid couplings - muff couplings, flange coupling, flexible coupling - bushed pin coupling, Universal coupling  
Design of shafts: Strength basis and rigidity bases, Equivalent bending and twisting.

UNIT III  
Design of Sliding contact bearings: Lubrication modes, Temperature effect on viscosity, Journal bearing design, Bearing modulus, McKee equations, Heating of bearings,  
Design of Rolling contact bearings - Static and dynamic load capacity, Equivalent bearing load, Load-life relationships, Load factor, Selection of bearings from manufacturers catalogue.

UNIT IV  
Design of clutches - uniform pressure theory, uniform wear theory, design of friction clutches - single plate multi-plate clutches.  
Brakes - Block brakes - external, internally expanded, Band brakes, Band and block brake

UNIT V  
Design of Gears; Classification of gears Standard tooth systems, Spur, Helical, Bevel and Worm gears, Terminology of each, Tooth failure, Face width an beam strength, Lewis equation, Design for dynamic and wear loads, Force analysis of Bevel and Worm gears, Thermal design considerations of worm gears.

Text Book:  
References:  
Five Year Dual degree (B. Tech + M.Tech)  
Mechanical Engineering- Fifth Semester  
EIRME505: INSTRUMENTATION AND CONTROL SYSTEMS

Hours per week: 3  End Examination: 60 Marks  
Credits: 3  Sessionals: 40 Marks

UNIT I  
**Introduction to Instrumentation**: Process of measurement, Static performance characteristics, Dynamic performance characteristics, Transducer elements, Intermediate elements, and Indicating and recording elements.  
**Motion measurement**: Relative motion measurement, absolute motion measurement, calibration of motion measuring devices.

UNIT II  
**Force measurement**: Hydraulic load cell, Pneumatic load cell, Elastic force devices, calibration.  
**Torque and power measurement**: Transmission dynamometers, Driving type dynamometers, Absorption dynamometers.  
**Temperature measurement**: Non-electrical methods, electrical methods, Radiation methods.  
**Vibration measurement**: Velocity & acceleration measurement. Vibration transducers, signal conditioning elements. Display and recording elements. Vibration meters and analyzers

UNIT III  
**Control systems**: Introduction, Open loop and closed loop systems, feed back and its effects. Transfer function, block diagram and signal flow graph: Impulse response and transfer functions of linear systems, block diagrams.

UNIT IV  
**Mathematical modeling of Physical systems**: Equations of electrical networks, modeling of mechanical system elements, equation of mechanical systems. State- variable analysis of linear dynamic systems; Matrix representation of state equations, state transition matrix, state transition equation, relationship between state equations and high- order differential equations, relationship between state equations and transfer functions, Characteristic equation, eigen values, and eigen vectors.

UNIT V  
Text Books:
1. Mechanical Measurements by Sirohi and Radha Krishnan.
2. Modern Control systems by Benjamin C. Kuo

References:
2. Instrumentation by Dobelion.
3. Mechanical and Industrial measurements by R.K. Jain
5. Automatic Control by Droff.
6. Control systems Engineering by Nagrath and Gopal
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Fifth Semester
EIRME506: OPERATIONS RESEARCH

Hours per week: 3
Credits: 3
End Examination: 60 Marks
Sessionals: 40 Marks

UNIT I
Linear Programming: Introduction to LP- Formulation of Linear Programming Problems, Graphical Method; Simplex Method, Artificial variable technique, Duality, Dual Simplex method.

UNIT II
Assignment: Formulation optimal solution, Traveling salesman problem.

UNIT III
Queuing Theory: Introduction, Queuing systems; Characteristics of Queing models, Different queuing models
Sequencing: Introduction, Terminology, problems with n-jobs and two machines, problems with n-jobs and three machines, problems with n-jobs and m-machines, graphic solution.

UNIT IV
Replacement and Maintenance: Introduction, Replacement of items that deteriorate with time - value of money unchanging and changing, Replacement of items that fail completely.

UNIT V
Inventory: Introduction, Inventory costs, Economic order quantity (EOQ) EOQ Models, Production inventory model; Inventory models with shortages quantity discounts
Project Management: Introduction, Project scheduling by CPM and PERT; Steps involved in the application of CPM and PERT.

Text Books:
2. Operations Research, by V.K.Kapoor

References:
1. To study the general behavior of reciprocating pump and to compute percentage of slip, overall efficiency and coefficient of discharge of the pump working under constant speed.
2. To study the procedure for conducting load test on Pelton wheel
4. Calibration of Orifice meter
5. To study the general method of calibration of venturimeter.
6. To study the Calibration procedure of the given Triangular notch (V - Notch)
7. Determine the coefficient of discharge of a small orifice
8. Determine the coefficient of discharge of a mouth piece
9. Conduct a load test on a Francis turbine and draw various characteristic curves.
10. Determine the overall efficiency of a centrifugal pump and draw various performance curves.
11. Performance characteristics of hydraulic ram
12. Performance characteristics of Kaplan turbine
13. Resistance characteristics of pipes.
14. Pressure distribution and drag characteristics of a cylinder and aerofoil in a wind tunnel.
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Fifth Semester
EIRME512: MANUFACTURING TECHNOLOGY -II LAB

Hours per week: 3
Credits: 2
Continuous Evaluation: 100 Marks

1. Lathe-Step turning, Chamfering, Knurling.
2. Lathe-Taper turning, Chamfering, Knurling.
3. Lathe-Thread cutting, Parting off, Chamfering, Knurling.
4. Lathe-Eccentric turning.
5. Lathe-Off set turning.
10. Shaping- Round to square cutting, V-groove cutting.
11. Shaping- Round to square cutting, Semi hexagonal cutting.
13. Force measurement using dynamometers on milling, drilling, lathe machines.
14. Grinding: Grinding a single point cutting tool as per given signature.
15. Effect of speed and feed on surface grinding.
Hours per week: 3
Credits: 2
Continuous Evaluation: 100 Marks

   a. Group Discussion.
   b. Interviews
   c. Conducting a meeting.
   d. Telephone Etiquette.

Text Books:
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Sixth Semester
EIRME601: COMPUTATIONAL METHODS IN ENGINEERING

Hours per week: 4
Credits: 4
End Examination: 60 Marks
Sessionals: 40 Marks

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V
Text Book:

References:
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Sixth Semester
EIRME602: HEAT AND MASS TRANSFER

Hours per week: 3  End Examination: 60 Marks
Credits: 3  Sessionals: 40 Marks

UNIT I

Unsteady state Heat Transfer conduction: Transient heat conduction- Lumped system analysis, and use of Heisler charts.

UNIT II
Convection: Free and Forced convection- Continuity, momentum equations, Boundary layer theory concepts-energy equations- Dimensional analysis-Approximate solution of the boundary layer equations- Laminar and turbulent heat transfer correlation- Momentum equation and velocity profiles in turbulent boundary layers- Application of dimensional analysis to free and forced convection problems- Empirical correlation.

UNIT III

UNIT IV

UNIT V
Boiling and Condensation: Different regimes of boiling- Nucleate, Transition and Film boiling. Condensation: Laminar film condensation- Nusselt's theory- Condensation on vertical flat plate and horizontal tubes- Drop wise condensation.

Text Books:
2. Fundamentals of Heat and Mass Transfer- Incropera and Dewitt

References:
1. Heat and Mass Transfer- Arora and Domkundwar
3. Essential of Heat Transfer by Christopher A. Long
4. Heat transfer by Sukhatme
5. Heat transfer by Yunus A Cengel
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Sixth Semester
EIRME603: PRODUCTION PLANNING AND CONTROL

Hours per week: 3
Credits: 3
End Examination: 60 Marks
Sessionals: 40 Marks

UNIT I
Introduction: Objectives of production planning and control, definitions, functions of production planning and control, organization of production planning and control department, internal organization of department.
Forecasting: Forecasting models, Aggregate production planning, master production scheduling, materials requirements planning.

UNIT II
Inventory Control: Objectives, scope of the problem, economic and social complications of inventory management, control systems approach, limitations of inventory control. Functions of inventory, demand and production characteristics. Measures of inventory performance.
Systematic control of inventory: Fixed order quantity systems, fixed interval systems, (s, S) systems, classification of items in inventory. Computer based inventory control systems.

UNIT III
Cost factor: The importance of costs, elements of costs, principles of cost determination and accounting systems, production and inventory cost factors, other costs to the firm.
Economic quantities of manufacture or purchase: Lot size problems, finite production rates in manufacturing, quantity discounts.
Uncertainty: Effects of uncertainty, demand and supply, safety stock, role of forecasting in production and inventory control. uncertainty in production cycling

UNIT IV
Production planning: Scope of planning, types of production planning, demand analysis, seasonal and non-seasonal demand. Planning procedures. Setting the production rate. Short term and long term planning - make and buy decisions, product design and process selection, manufacturing planning.

UNIT V
Production control: Control objectives, problems in production control, types of production and production control systems, controlling production, routing, scheduling and dispatching.
Lay out of the physical system, design of a production planning and control systems. Application of computers in production planning and control.
Text Book:
1. Production planning and inventory control - Magee and Boodman.

References:
1. Production control - John E Biegal.
2. Production forecasting, planning and control - EH Mac Niece.
3. Elements of production planning and control - Samuel Eilon.
4. Production Planning and Inventory Control – Seetharama L Narasimhan, Dennis W, McLeavey, Peter J Billington.
5. Industrial Engineering and Management – O P Khanna.
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Sixth Semester
EIRME604: CAD/CAM

Hours per week: 4  
Credits: 4  
End Examination: 60 Marks  
Sessionals: 40 Marks

UNIT I

UNIT II
Geometric Modeling: Wire frame models - Types and Mathematical parametric representation of analytic and synthetic curves; Surface models - Types and Mathematical parametric representation of analytic and synthetic surfaces; Solid models – solid entities, solid representation; fundamentals of solid modeling, Introduction to Boundary representation and Constructive solid geometry.

UNIT III
Two and Three dimensional Graphics concepts: Geometric Transformations – Transformations of geometric models, Mappings of geometric models, Inverse transformations and mapping, projections of geometric models.
NC Part Programming: Introduction to NC part programming, methods- manual part programming, computer assisted part programming, advantages and limitations of programming methods. NC tooling and Automatic Tool Changers. NC, CNC & DNC machines.

UNIT IV
Introduction to Robotics: Types of robots, specifications and applications, advantages and limitations.
Group technology and flexible manufacturing system: Part families, parts classification and coding, production flow analysis, machine cell design, FMS workstations, Material handling and storage system, Computer control system, planning the FMS, analysis methods for flexible manufacturing system, Application & benefits of Group technology and FMS.

UNIT V
Computer integrated planning system: CIM, CAPP, MPS, MRP-I, MRP-II, Capacity planning, shop floor control, Problems with conventional production system, Applications of computers in manufacturing, Planning and control.

Text Book:

Reference:
1. CAD/CAM Principles and Integration by P.N.Rao, Tata McGraw hill publishers.
EIRME 605: AUTOMOBILE ENGINEERING

UNIT I
Introduction: Classification of vehicles - options of prime movers, transmission and arrangements.

Engine: Engine classifications - number of strokes, cylinders, types of combustion chambers for petrol and diesel engines, valves, valve arrangements and operating mechanisms, piston - design basis, types, piston rings, firing order, fly wheel.

UNIT II
Fuel supply systems for petrol and diesel engines, fuel pumps - Mechanical and electrical diaphragm pumps, air and fuel filters, carburetors, fuel injection systems for diesel and petrol engines, electronic fuel injection, super chargers, mufflers.

UNIT III
Cooling system for I.C. engines: - Necessity, methods of cooling, air cooling, water cooling, components of water cooling systems.

Lubrication systems: - Objective of lubrication, requirements of lubricant, types of lubricant, various systems of engine lubrication.

Electrical systems: - Ignition system, distributor, electronic ignition, magneto, dynamo, alternator, regulator, starting motor, introduction to various accessories, typical wiring diagram.

UNIT IV
Chassis systems: Introduction of chassis, classification, conventional construction, frameless construction, introduction to vehicle dimensions.

Transmission systems: Introduction to single plate clutch, wet and dry type, clutch actuating mechanisms, study of clutch components, fluid fly wheel. Gear box - Theory, four speed and five speed sliding mesh, constant mesh and synchronesh type, selector mechanism, automatic transmission, overdrive, transfer box four wheel drive, torque converter, propeller shaft.

UNIT V
Suspension and steering system: Suspension: Systems, springs, shock absorbers, axles - front and rear, different methods of floating rear axle, front axle and wheel alignment, types of rims and tyres. Steering mechanisms, types of brakes and brake actuation mechanisms.

Text Books:

References:
2. Automobile Electrical System by Judge, A.W.
3. Automobile engineering by K.K.Ramalingam, Scitech publications
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Sixth Semester
EIRME611: PRODUCTION DRAWING LAB

Hours per week: 3
Credits: 2
Continuous Evaluation: 100 Marks

1. Representation of limits, fits, tolerances, surface roughness & Geometric tolerance on production drawing as per IS 8000, IS 696
2. Part drawings and assembly drawings.
3. Location theory 3-2-1 principle, types of jigs and fixtures, production drawing of jigs and fixtures
5. Production drawings of single point cutting tool, milling cutter, broaching tool and adopters (CNC Tooling)
6. CAD packages like AutoCAD/CATIA can be used for drawing practice

Text Books:
1. Production Drawing by K.L.Narayana, New age publishers
2. Jigs & Fixtures by Joshi, Khanna Publishers
3. Press Tool Design by Joshi, Khanna Publishers

References:
1. Production Technology Hand Book- HMT,
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Sixth Semester
EIRME612: METROLOGY LAB

Hours per week: 3
Credits: 2
Continuous Evaluation: 100 Marks

1. Calibration of micrometer and dial gauge by using slip gauges.
5. Gear metrology-to find module, addendum, dedendum, pitch circle diameter, tooth width, pressure angle of a given spur gear.
6. To check roundness and concentricity of spigot
7. To check straightness of surface plate by using spirit level and autocollimeter.
8. Study of flatness of slip gauges by using monochromatic check light.
9. Tool maker’s microscope-To study screw thread profile (Major dia, minor dia, pitch, thread angle) and tool angles.
1. To draw two handed process charts for Bolt, Washer and nut assembly
2. To draw Multiple activity chart using an electric toaster.
3. To Conduct stop watch time study for the assembly of electric plug and determine observed time, normal time and standard time.
4. To determine the cycle time using PMTS.
5. Time study using pin board apparatus
6. To conduct physiological test on bicycle ergometer and to identify the changes in heart beat rate, oxygen consumption rate during working and recovery method
7. To conduct physiological test on bicycle treadmill and to identify the changes in heart beat rate, oxygen consumption rate and energies expenditure during working and recovery method
8. To show that the sample means from a normal universe follow a normal distribution.
9. To draw the control chart for fraction defective for a given lot of Plastic Balls.
10. To draw X & R Chart to determine the process capability for the measurement of smaller diameter of a given set of stepped pins.
11. To draw C- Chart for number of defects.
12. To plot operating characteristic curves for a single sample attributes plan of a given lot of plastic balls sand to compare the actual O.C curve with theoretical O.C curve
UNIT I

UNIT II
One-dimensional Problems: Introduction, Finite element modeling, coordinates and Shape functions. The potential energy approach. The Galerkin approach, Assembly of the global stiffness matrix- mass matrix and load vector, Treatment of boundary conditions, Quadratic shape functions, Temperature effects.

UNIT III
Two-dimensional Problems Using Constant Strain Triangles: Introduction, Finite element modeling, Constant strain triangle, in plane and Bending, problem modeling and boundary conditions.

UNIT IV
Beams and Frames: Introduction, Finite element formulation, Load vector, Boundary considerations, Shear force and bending moment, Beams on elastic supports, Plane frames.

UNIT V
Introduction to FEA packages: ANSYS, MS –NASTRAN, NISA-II
Text Book:

References:
5. Finite element method by JN Reddy, Mc/Graw-Hil
UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

Text Book:

References:
Five Year Dual degree (B. Tech + M.Tech)  
Mechanical Engineering- Seventh Semester  
EIRME702T: COMPUTATIONAL FLUID DYNAMICS

Hours per week: 4  
End Examination: 60 Marks  
Credits: 4  
Sessionals:40 Marks

UNIT I  

UNIT II  
**Finite Volume Method:** Formation of Basic rules for control volume approach using 1D steady heat conduction equation – Interface Thermal Conductivity - Extension of General Nodal Equation to 2D and 3D Steady heat conduction and unsteady heat conduction

UNIT III  
**Incompressible Fluid Flow:** Governing Equations, Stream Function - Vorticity method, Determination of pressure for viscous flow, SIMPLE Procedure of Patankar and Spalding, Computation of Boundary layer flow, Finite difference approach

UNIT IV  
**Convection Heat Transfer:** Solution of one dimensional and two dimensional steady/unsteady convection – Diffusion, Discretization Schemes and their assessment Treatment of Boundary Conditions- Diffusion problems, Convection problems, Convection-diffusion problems

UNIT V  

**Text Books:**

**References:**
EIRME703M: FLEXIBLE MANUFACTURING SYSTEMS

Hours per week: 4  
Credits: 4  
End Examination: 60 Marks  
Sessionals: 40 Marks

UNIT I
Introduction: The economic justification of FMS, The basic components of FMS and their integration in the data processing system, The concept of the 'total system'. The FMS relational: Economic and technological justification for FMS Management decisions during FMS project planning, design and implementation: Designing the FMS, Data processing design, FMS project and software documentation.

UNIT II
Design and Planning of FMS: the role of associated technologies such as GT, JIT and simulation - Installation, Operation and evaluation - Scheduling problems. Control aspects of FMS-DNC of machine tools, cutting tools, robots, quality control and inventories.

UNIT III
Distributed processing in FMS: Introduction to database management systems (DBMS) and their application in CAD/CAM and FMS, Distributed systems in FMS. Distributed tool data bases in FMS: The distributed tool data structure with a general purpose tool description facility, Implementation of the FMS tool data base, Application possibilities of the FMS tool data base.

UNIT IV
FMS database for clamping devices and fixtures: The FMS clamping device and fixture data base, The analysis and calculation of pallet alignment and work mounting errors, Mating surface description methods for automated design and robotised assembly, Application of industrial robots in FMS, The application of automated guided vehicle (AGV) systems.

UNIT V

Text Books:
Five Year Dual degree (B. Tech + M.Tech)  
Mechanical Engineering- Seventh Semester  
EIRME703T: ADVANCED FLUID MECHANICS

Hours per week: 4  
End Examination: 60 Marks  
Credits: 4  
Sessionals:40 Marks

UNIT I  
Inviscid Flows: Complex potentials for simple flows, uniform flow, source, sink and vortex, combination of simple flows, Rankine half body, Rankine oval, doublet, flow past cylinder, calculation of lift, Magnus effect; Conformal transformation, transformations of the circle, Jowkowski transformation, flow over an ellipse, flow past a flat plate, aerofoil, lift calculation, Kutta condition, Stokes stream function for axi-symmetric flows, Irrotational flow equations, flow past a stream-lined body.

UNIT II  
Viscous flow: Exact solution of incompressible Navier-Stokes equations – Couette flow, flow between rotating cylinders, Stokes problems, stagnation point flow, flow near a rotating disk, fully developed flow through ducts; Low Reynolds number flows, use of vorticity and stream function, creeping flow past a sphere, hydrodynamic theory of lubrication

UNIT III  

UNIT IV  

UNIT V  
Text Books:
2. Fundamentals of Fluid Mechanics, Schlitching
3. Advanced Fluid Mechanics by Muralidhar & Biswas

References:
1. Introduction to Fluid Mechanics, Shaughnessy, Oxford University Press
2. Viscous Fluid Flow by F.M. White
Five Year Dual degree (B. Tech + M.Tech)  
Mechanical Engineering- Seventh Semester  
EIRME711: CAD/CAM LAB

Hours per week: 3  
Credits: 2  
Continuous evaluation : 100 Marks

1. Introduction to Modeling packages - ProEngineer, Ideas, Catia, Uni Graphics, Solid Works.
2. 2D-Modeling of simple objects
3. 3D-Modeling of simple objects
4. Preparation of manual part programme for turning, drilling and milling

5. To Generate NC programme using Master CAM / Edge CAM simulation software for a turning Job using Lathe Version.  
   a. Step turning, taper turning, drilling  
   b. Thread cutting, grooving,

   a. Face milling, pocketing, drilling, contouring  
   b. Gear cutting.

7. Machining of one job on CNC Lathe.  
8. Machining of one job on CNC Drilling.
EIRME 712: HEAT AND MASS TRANSFER LAB

Hours per week: 3
Credits: 2

Continuous evaluation: 100 Marks

1. Determine the Temperature Distribution and overall thermal conductance across the width of composite wall.
2. Determine the thermal conductivity of a metal rod.
3. Determine the heat transfer coefficient for a vertical cylinder in natural convection
4. Determine the heat transfer coefficient in forced convection of air in a horizontal tube.
5. Determine the emissivity of the test plate surface.
6. Determine the efficiency of a pin fin in natural convection.
7. Determine the efficiency of a pin fin in forced convection.
8. Determine the effectiveness of a parallel flow heat exchanger.
9. Determine the effectiveness of a counter flow heat exchanger.
10. Determine the heat transfer coefficients on Film and Drop wise condensation apparatus.
11. Determine the heat transfer rate and effectiveness of computer-controlled heat exchanger in parallel and counter flow.

EIRME 713: INTERNSHIP

Duration: 3 months
Credits: 8

Continuous evaluation: 100 Marks
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Eighth Semester
EIRME801M: METAL FORMING TECHNIQUES

Hours per week: 4  End Examination: 60 Marks
Credits: 4  Sessionals: 40 Marks

UNIT I
Introduction of metal forming as a manufacturing process, and its relation with other processes,
Metal Forming from systems point of view, Advantages of metal forming as a manufacturing
process, Classifications of metal forming processes, Forming equipments, Presses (mechanical, hydualic).

UNIT II
Theoretical analysis (theory of plasticity): Stress-strain relationship, Strain hardening, Material
incompressibility, Work of plastic deformation, Work hardening, Yield criteria, Flow rule, Yield
criterion and flow rule for Anisotropic material, Initiation and extent of plastic flow
(microstructural point of view). Formability of sheet, Formability tests, Forming limit diagrams.

UNIT III
Analysis of forming processes, Slab analysis : Open-die forging, Plate drawing, Flat rolling,
Deep drawing of sheet, Other methods of analysis like FEM, upper bound, slip line field. Process
simulation for deep drawing and numerical approaches.

UNIT IV
Overview of various metal forming operations: Forging; open-die forging, closed-die forging,
coining, nosing, upsetting, heading, extrusion and tooling, Rod, wire and tube drawing, Rolling;
flat rolling, shape rolling and tooling.

UNIT V
Sheet forming: blanking, piercing, press bending, deep drawing, stretch forming, spinning.
Hydroforming, rubber-pad forming, explosive forming, Hot and cold pressing (HIP, CIP), High
Energy Rate Forming (HERF), electroforming.

Text Book:
Hall,1983.

References:
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Eighth Semester
EIRME801T: ADVANCED HEAT & MASS TRANSFER

Hours per week: 4  End Examination: 60 Marks
Credits: 4  Sessionals:40  Marks

UNIT I
Conduction Heat Transfer: One dimensional steady state heat conduction with heat source - extended surface heat transfer- Fins of non uniform cross section- unsteady state conduction with moving source.

UNIT II
Turbulent Forced Convective Heat Transfer: Von- Karman and Van Driest expressions for diffusivity - mixing length concept, friction factor ,turbulence model – k -C model - analogy between heat and momentum transfer– Reynolds, Colburn, Prandtl analogies - turbulent flow in a tube-.Shear velocity and heat transfer for various boundary conditions. Heat transfer at high velocities for constant and variable fluid property.

UNIT III

UNIT IV

UNIT V

Text Books:
2. Heat and mass Transfer by N. Ozisik

References:
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Eighth Semester
EIRME802M: ADVANCED MANUFACTURING PROCESSES

Hours per week: 4                      End Examination: 60 Marks
Credits: 4                              Sessionals:40 Marks

UNIT I

UNIT II

UNIT III
Rapid Prototyping: Definition- basic steps in rapid prototyping- various techniques in Rapid prototyping, applications of rapid prototyping. Nano Manufacturing: Introduction, Definition, history of nano technology, approaches for synthesis of nano materials, Characteristics of Nano particles, applications of Nano technology

UNIT IV

UNIT V
Manufacturing system Simulation: Introduction, Some definitions for simulation, types of simulation, need for simulation, Simulation structure and elements of simulation, simulation methodology, cycle diagrams.

Text Books:
2. Computer aided design and manufacturing by Betworth, Tata Mc. Grawhill

References:
2. CAD/CAM principles and applications by PN.RAO-TMH
EIRME802T: DESIGN OF THERMAL EQUIPMENTS

Hours per week: 4
Credits: 4
End Examination: 60 Marks
Sessionals: 40 Marks

UNIT I
**Mathematical Modelling:** Equation Fitting, Nomography, Empirical Equation, Regression Analysis, Different Modes of Mathematical Models, Selection, Computer Programmes for Models.

**Design Aspects:** Heat transfer and pressure loss – flow configuration – effect of baffles – effect of deviations from ideality

UNIT II

UNIT III

UNIT IV
**Condensers and Cooling Towers:** Direct contact heat transfer – Design of surface and evaporative condensers – cooling tower – performance Characteristics. Boiler furnace and super heaters design: principles of boiler design, codes for mechanical design of he, fouling of he, testing, evaluation and maintenance of HE

UNIT V
**Heat Transfer Enhancement:** Augmentation techniques – active techniques such as providing suction, vibration, rotation etc. And passive techniques such as providing fins, turbulent promoters, rough surfaces etc. Design of heat exchangers for automotive, refrigeration, cryogenic and chemical process plants.

**Text Books:**
References:
UNIT I
Introduction: NC, CNC, DNC, Programmed Automations, Machine Control Unit, Part program, NC tooling. NC Machine tools: Nomenclature of NC machine axes, Types of NC machine tools, Machining centers, Automatic tool changers(ATC), Turning centers.

UNIT II
Machine Control Unit & Tooling: Functions of MCU, NC actuation systems(NCAS), Part program to command signal, MCU Organization, Computerized Numerical Control, Transducers for NC machine tools, Tooling for NC machining centers and NC turning machines, Tool presetting.

UNIT III

UNIT IV
Computer aided part programming: NC languages: APT, NELAPT, EXAPT, GNC, VNC, pre-processor, post-processor.

UNIT V

Text Books:
1. Automation, Production systems & Computer integrated manufacturing” by M.P.Groover, PHI Publications,

References:
2. Numerical control of Machines Tools by Yoram Koren and Joseph BenUri, Khanna publications.
Five Year Dual degree (B. Tech + M.Tech)  
Mechanical Engineering- Eighth Semester  
EIRME803T: MODERN ENERGY SYSTEMS

Hours per week: 4  
Credits: 4  
End Examination: 60 Marks  
Sessionals: 40 Marks

UNIT I  

UNIT II  

UNIT III  
Tidal & Otec Energy Systems: power generation schemes-Wave Energy-Introduction-basic theory-wave power devices- Open and Closed OTEC cycles-biophotolysis-Ocean Currents-Salinity Gradient Devices-Environmental Aspects

UNIT IV  
Hydrogen: Hydrogen – Properties – generation-Storage and handling, performance and safety aspects

UNIT V  

Text Books:  
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Eighth Semester
EIRME 804A: DATA BASE MANAGEMENT SYSTEMS
(Common with EURME852)

Hours per week: 4
Credits: 4
End Examination: 60 Marks
Sessionals: 40 Marks

UNIT I
Introduction to DBMS, Overview, File system vs DBMS, Advantages of DBMS, Storage data, queries, Transaction Management, DBMS Structure

UNIT II
E-R model Entities, Attributes and Entity sets, Relationship and Relationship sets, Features of ER model, Conceptual database design with ER model.

UNIT III
Relational model – integrity constraints over relations and enforcement, Querying relation data, Logical database design, views, destroying/altering tables and views. Relational algebra and calculus

UNIT IV
SQL – Basic SQL, Query, union, interest, except, Nested Queries, Aggregated Operation, Null values, Embedded SQL, cursors, ODBC and JDBC, Triggers and Active database, designing active databases

UNIT V
Transaction management, concurrency control & crash recovery – Transaction concept, transactions and schedules, concurrent execution of transactions, lock – based concurrency control, crash recovery. Case Study: Oracle0i (SQL, PL/SQL & Triggers)

Text Books:

Reference:
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Eighth Semester
EIRME804B: ARTIFICIAL INTELLIGENCE IN MANUFACTURING

Hours per week: 4
Credits: 4
End Examination: 60 Marks
Sessionals: 40 Marks

UNIT I
Artificial Intelligence - Definition - Components - Scope - Application Areas; Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques

UNIT II
Knowledge-Based Systems (Expert Systems) - Definition - Justification - Structure – Characterization

UNIT II
Knowledge Sources – Expert - Knowledge Acquisition- Knowledge Representation - Knowledge Base - Inference Strategies - Forward and Backward Chaining; Expert System Languages - ES Building Tools or Shells; Typical examples of shells.

UNIT III
Expert Systems Software for Manufacturing applications in CAD, CAPP, MRP, Adaptive Control, Robotics, Process Control, Fault Diagnosis, Failure Analysis; Process Selection, GT etc. Linking Expert Systems to other software such as DBMS, MIS, MDB; Process Control and Office Automation.

UNIT V
Case studies of typical applications in Tool selection, Process selection, Part classification, Inventory control, Process Planning etc.

Text Books:
EIRME 804C: WEB TECHNOLOGY
(Common with EURME863)

Hours per week: 4
Credits: 4
End Examination: 60 Marks
Sessionals: 40 Marks

UNIT I
Introduction to Web Technology: Internet, WWW, Web Browsers, Web Servers, URL.

UNIT II
Introduction to HTML & DHTML: Syntax, Forms, Cascade Style Sheets.

UNIT III

UNIT IV
Introduction to Java Servelets Programming., Introduction to Applet Programming.

UNIT V
Structure of Web Application, Deploying Web Application.

Text Books:
1. Programming the World Wide Web by Robert W Sebesta
2. Professional Java Servelets 2.3 by John Bell Wrox Publical
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Eighth Semester
EIRME 804D: DATA STRUCTURES
(Common with EURME8518)

Hours per week: 4  
End Examination: 60 Marks
Credits: 4  
Sessionals: 40 Marks

UNIT I
Introduction to data types, Data structures and abstract data type (ADT), Complexity analysis of algorithms; List, Stack, Queue and Recursion.

UNIT II
Tree – Terminology, tree as ADT and data structure, Binary tree, BST, AVL trees, B Trees, Bit vector and link list implementation of a set, sets with MERGE and FIND operation, Implementation of dictionary, hash table, priority queue.

UNIT III
Graph – Definition and representation, directed graph, single source shortest path, all pair shortest path, directed acyclic graph (DAG), minimum cost spanning tree, traversal, articulation point and bi connected components.

UNIT IV
Sorting and searching – Bubble sort, Insertion sort, Quick sort, merge sort, heap sort, binary search.

UNIT V: Issues in memory management, storage allocation, garbage collection, compaction.

Text Books:
2. Data structures using C/C++ by Tanenbaum, A.S., Langsam, Y and Augenstein, M.J., PHI

References:
3. Algorithms , Data Structures, Programs by N. Wirth, Prentice Hall India

Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Eighth Semester
EIRME811: PROJECT -1

Hours per week: 8  
End Examination: 50 Marks
Credits: 8  
Sessionals:50 Marks
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering - Ninth Semester
EIRME901M: ADVANCED OPTIMIZATION TECHNIQUES

Hours per week: 4  
Credits: 4  
End Examination: 60 Marks  
Sessionals: 40 Marks

UNIT I

UNIT II
**Dynamic programming (D.P):** Multistage decision processes. Concepts of sub optimisation, computational procedure in dynamic programming calculus method and tabular methods. Linear programming as a case of D.P and Continuous D.P.

UNIT III

UNIT IV
**Stochastic Programming (S.P):** Basic Concepts of Probability Theory, Stochastic linear programming

UNIT V
**Unconventional optimization techniques:** Multi-objective optimization - Lexicographic method, Goal programming method, Genetic algorithms, Simulated Annealing, Neural Networks based Optimization.

**Text Book:**

**References:**
1. Operations Research - Principles and Practice, Ravindran, Phillips and Solberg, John Wiely
UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V
**Energy Economics**: Importance of Energy Management, Energy Economics - Discount Rate, Payback Period, Internal Rate of Return, Life Cycle Costing

**Text Books:**

**References:**
2. V. Kadambi, and M. Prasad, Introduction to energy conversion turbo machinery: Energy conversion cycle- Wiley Eastern, New Delhi, 1974,
UNIT I
Introduction: Computer aided testing (CAT) and computer aided inspection (CAI), computer aided quality control (CAQC), on-line inspection and quality control, technology of automation Gauging, automatic inspection machines, in-process gauging,

UNIT II
Co-Ordinate Measuring Machines: Basic Types of Measuring Machines, probe types, operating modes, programming software's, accessories, measurement and inspection capabilities, flexible inspection systems, inspection problems.

UNIT III
Machine Vision: Functions of machine vision system, evaluating the performance of machine vision system, machine vision applications.

UNIT IV
Proximity Sensing: Photoelectric Transducers, Image processing for vision sensor, 3-dimensional object recognition.

UNIT V

Text Book:

References:
1. Robot Sensors -Pugh, IFS Publication, 1986
2. Transducers and Interfacing -Bannister and Whitehead~ Von Nostrand. 1986
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Ninth Semester
EIRME902T: HEATING, VENTILATION AND AIR CONDITIONING & CRYOGENICS

Hours per week: 4
Credits: 4
End Examination: 60 Marks
Sessionals: 40 Marks

UNIT-I
Psychometric Air Conditioning Processes, Dehumidification Processes, Comfort Air Conditioning, Parameters Affecting Comfort Conditions, Cooling Load Calculations, Design Of Air Delivery System To Hospital, Auditorium, Hotels Etc., Noise And Vibration Control In Air Conditioning Hall.

UNIT II
Air Conditioning Equipments: Spray systems, chilled water and DE Coils, absorption and adsorption systems, Air filtration, ducts, Design and constructional details of Unitary air conditioning equipment.

UNIT III

UNIT-IV
Cryogenic Systems: Introduction: Insight on Cryogenics, Properties of Cryogenic fluids, Material properties at Cryogenic Temperatures. Applications of Cryogenics in Space Programs, Superconductivity, Cryo Metallurgy, Medical applications.

UNIT-V
Text Books:

References:
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Ninth Semester

EIRME903MA: RAPID PROTOTYPING AND VIRTUAL PROTOTYPING

Hours per week: 4
Credits: 4
End Examination: 60 Marks
Sessionals: 40 Marks

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V
Introduction to Virtual prototyping: End to end prototyping-simulation- components of virtual prototyping- effects- economics of virtual prototyping.

Text Books:

References:
2. Joe Cecil, Virtual Engineering, Momentum Press, 2010
EIRME903MB: JOINING PROCESSES

UNIT I
Weldability of plain carbon steels, alloy steels, cast irons, aluminium alloys. Pre and post welding treatments, oxygen cutting, powder cutting arc and plasma cutting.

UNIT II
Fundamental principles of friction, friction stir and induction pressure welding, process characteristics and applications

UNIT III
Explosive, diffusion and ultrasonic welding, principles of operation, process characteristics and applications

UNIT IV
EBW: Heat generation and regulation, equipment details in typical set up, electron beam welding in different degrees of vacuum,
LBW: Physics of lasers, types of lasers, operation of laser welding setup, advantages and limitations, applications

UNIT V
Brazing: Wetting and spreading characteristics, surface tension and contact angle concepts, brazing fillers, role of flux and characteristics, atmospheres for brazing,
Soldering: Techniques of soldering, solders, phase diagram, composition, applications, adhesive bonding.

Text Book:

References:
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering - Ninth Semester
EIRME903MC: ADVANCED MATERIALS AND PROCESSING

Hours per week: 4
Credits: 4
End Examination: 60 Marks
Sessionals: 40 Marks

UNIT I

UNIT II
Hardening in steels-TTT diagrams-other heat treatment processes - formation of alloys in steel and cast irons- non ferrous alloys and their applications special alloys.

UNIT III
Polymers and polymerization- structure and properties of thermoplastics and thermosets- engineering applications -property modifications- mechanical, thermal behaviour-composites with polymer matrix

UNIT IV
Ceramics- glasses- glass ceramics- fabrication methods- metal matrix and ceramic matrix composites.

UNIT V
Processing of polymers- fabrication of composites- processing of ceramics-thermal spraying-ion beam machining-laser and electron beam processing- superplastic forming- thin films and their deposition- diamond coating techniques- tribological applications.

Textbooks:

References:
Five Year Dual degree (B. Tech + M.Tech)  
Mechanical Engineering- Ninth Semester 
EIRME903TA: FUEL CELL TECHNOLOGY

Hours per week: 4 End Examination: 60 Marks  
Credits: 4 Sessionals: 40 Marks

UNIT I  
Introduction: Basic Principles – Classification – Alkaline, Proton Exchange Membrane, Direct Methanol, Phosphoric Acid & Molten Carbonate – Parts – Fuel cell poisoning

UNIT II  
Thermodynamics: Basic Reactions, Heat of reaction, Enthalpy of formation of substances – Enthalpy change of a reacting system – Gibbs free energy of substances – Gibbs free energy change of reacting system – Efficiency – Power, heat due to entropy change, and internal ohmic heating

UNIT III  

UNIT IV  

UNIT V  
Applications: Automotive applications & issues – Micro fuel cells & Portable power – Distributed & Stationary power.

Text Books:  
UNIT I

UNIT II
Heat Transfer: Different modes of heat transfer in fluidized bed, to wall heat transfer, gas to solid heat Transfer, radiant heat transfer, heat transfer to immersed surfaces. Methods for improvement, external heat exchangers, heat transfer and part load operations.

UNIT III

UNIT IV
Design Considerations: Design of distributors, stoichiometric calculations, heat and mass balance, furnace design, design of heating surfaces, gas solid separators.

UNIT V
Industrial Applications: Physical operations like transportation, mixing of fine powders, heat exchange, coating, drying and sizing. Cracking and reforming of hydrocarbons, carbonization, combustion and gasification. Sulphur retention and oxides of nitrogen emission Control.

Text Books:

References:
1. Kunii, D and Levespiel, O., Fluidization Engineering, John Wiley and Son
UNIT I


UNIT II


UNIT III

**Chemical Thermodynamics and Equilibrium:** Thermo chemistry, First Law analysis of reacting systems, Adiabatic Flame temperature, Entropy Change of reacting systems, Second Law analysis of reacting systems, Criterion for reaction Equilibrium composition, Chemical availability, Availability of reacting systems.

UNIT IV

**Statistical Thermodynamics:** Microstates and Macro states, Thermodynamic probability, Degeneracy of energy levels, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein Statistics, Microscopic Interpretation of heat and work, Evaluation of entropy, Partition function, Calculation of the Macroscopic properties From partition functions, Equilibrium constant statistical thermodynamic approach.

UNIT V

**Irreversible Thermodynamics:** Conjugate Fluxes and Forces, Entropy Production, Onsager's Reciprocity relations, Thermoelectric Phenomena, formulations, Power Generation, Refrigeration.
Text Books:

References:
Rao, Y.V.C., Postulational and Statistical Thermodynamics, Allied Publisher Limited, New Delhi, 1994.
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Ninth Semester
EIRME904MA: PRODUCTION MANAGEMENT

Hours per week: 4  End Examination: 60 Marks
Credits: 4  Sessionals:40  Marks

UNIT I
INTRODUCTION: History and overview of production management - Capacity planning, Location planning - Types of production processes. Layout planning - Productivity management.

UNIT II
INVENTORY MANAGEMENT: Deterministic and Probabilistic inventory management models - Purchasing and warehousing, Methods study, Motion study and Work measurement - Simple problems.

UNIT III
SCHEDULING: Job Evaluation - Wage incentive schemes - Value analysis - Forecasting - Aggregate planning - Scheduling: Gantt charts and Sequencing - Simple problems.

UNIT IV
MRP: Project Management with PERT/CPM - Material requirements - Planning (MRP) - Manufacturing - Resources planning (MRP II) - Enterprise resource planning (ERP)

UNIT V
TQM: Total Quality Management - Quality management systems - Statistical process control (SPC) - Maintenance management - Reliability and maintenance, Replacement techniques, Logistics and supply chain management.

Text Books:
1. Ahuja, K. K., Production Management, CBS Publishers, New Delhi, 1993
2. Goel, B. S., Production management, Pragathi & prakasam publishers, Meerut, 1984

References:
2. Narang, G. B. S. and Kumar, V., Production management, Khanna publishers, New Delhi, 1989
3. Agarwal and Jain, Production management, Khanna publishers, New Delhi, 1998
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Ninth Semester
EIRME904MB: MANAGEMENT INFORMATION SYSTEMS

Hours per week: 4
Credits: 4
End Examination: 60 Marks
Sessionals: 40 Marks

UNIT I
Organizations, Management and the Networked Enterprise Managing the Digital Firm:
Necessity of Information Systems (IS) - The New Role of IS in Organizations - New Opportunities with Technology for IS. IS in the Enterprise: Major types, functional perspective and enterprise applications. IS, organizations, management and strategy.

UNIT II
Information Technology Infrastructure Managing hardware and software assets:
Categories of computer systems, types of software, managing hardware and software assets. Managing data resources: Telecommunications and Networks.

UNIT III

UNIT IV
Building Information Systems in the Digital Firm Redesigning the organization with IS:
Systems as planned organizational change – Business Process Reengineering (BPR) and process improvement. Understanding the business value of systems.

UNIT V
Managing Change Importance of change management in IS success and failure – Managing implementation.

Text Book:

References:
UNIT I

UNIT II

UNIT III
Latin Square And Related Designs: Latin squares and two-way restrictions on randomization. The linear model and assumptions for a one-factor experiment fitted in a Latin square design. ANOVA table.

UNIT IV
Factorial Experiments: Complete factorial experiments in CRD's. Main effects and interactions. One observation per treatment combination. Linear model and analysis. The error term and pooling. The meaning of a significant interaction. The case of n observations per treatment combination. Complete 2f factorial experiments in CRD's. Special notation. Average effect of main effects and interaction. Orthogonal contrasts and sum of squares. Yates's algorithm.

UNIT V

Text Books:

Reference:
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering - Ninth Semester
EIRME904TA: NUCLEAR ENGINEERING

Hours per week: 4  
End Examination: 60 Marks
Credits: 4  
Sessionals: 40 Marks

UNIT I

UNIT II
**Nuclear Reactors:** Introduction, General Components of Nuclear Reactor, General Problems of Reactor Operation, Different Types of Reactors, Pressurised Water Reactors (PWR), Boiling Water Reactors (BWR), Heavy Water – cooled and Moderated CANDU (Canadian Deuterium Uranium) Type Reactors, Gas-cooled Reactors, Breeder Reactors, Reactor Containment Design, Location of Nuclear Power Plant, Nuclear Power Station in India, India’s 3-stage Programme for Nuclear Power Development, Comparison Nuclear Plants with Thermal Plants.

UNIT III
**Nuclear Materials:** Introduction, Fuels, Uranium - production and purification of Uranium - conversion to UF4 and UF6 - other fuels like Zirconium, Thorium - Beryllium. Cladding and Structural Materials Coolants, Moderating and Reflecting Materials, Control Rod Materials, Shielding Materials

UNIT IV

UNIT V
**Safety Rules:** Personal Monitoring, Radiation Protection (Radiation Workers, Non-Radiation Workers, Public at large), Radiation Dose (Early effect, late effect, hereditary effect)
Text Books:

References:
UNIT I
Source of radiation, solar constant, solar charts, Measurement of diffuse, global and direct solar radiation: pyrheliometer, pyranometer, pyrgeometer, net pyradiometer, sunshine recorder.

UNIT II
Solar Non-Concentrating Collectors, Design considerations, Classification, air, liquid heating collectors, Derivation of efficiency and testing of flat plate collectors, Analysis of concentric tube collector, Solar greenhouse.

UNIT III

UNIT IV
Photo-voltaic cell, characteristics, cell arrays, power electric circuits for output of solar panels, choppers, inverters, batteries, charge regulators, Construction concepts.

UNIT V
Energy Storage, Sensible, latent heat and thermo-chemical storage, pebble bed etc. materials for phase change-Glauber’s salt-organic compounds. Solar ponds.

Text Books:

References:
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Ninth Semester
EIRME904TC: THERMAL MEASUREMENTS

Hours per week: 4  End Examination: 60 Marks
Credits: 4  Sessionals: 40 Marks

UNIT I
Analysis of experimental data: Types of Experimental Errors , Error Analysis on a Commonsense Basis , Uncertainty Analysis , Complicated Data Reduction , Statistical Analysis of Experimental Data , Probability Distributions, The Gaussian or Normal Error Distribution , Comparison of Data with Normal Distribution The Chi-Square Test of Goodness of Fit, Method of Least Squares , The Correlation Coefficient , Multivariable Regression , Standard Deviation of the Mean , Student’s t-Distribution , Graphical Analysis and Curve Fitting.

UNIT II

UNIT III

UNIT IV

UNIT V
Measurements of Non-Newtonion Fluids: General viscous fluid; power law model, Ellis model; Linear viscoelasticity; Nonlinear viscoelasticity, Rheometry: Shear rheometers, Concentric cylinder rheometers, Cone & plate rheometer, Parallel plate rheometer, capillary rheometer, slit rheometer; Extensional rheometry. Measurement in Complex flow, Pressure measurement; Velocity measurement; Flow birefringence.

Text Books:
1. Thermal Measurements by J.P.Hollman
UNIT I

Introduction: Scope of computer integrated manufacturing, Product cycle, Production automation.

Group technology: Role of group technology in CAD/CAM integration, Methods for developing part families, Classification and coding, Examples of coding systems, Facility design using group technology, Economics of group technology.

UNIT II:


UNIT III:

Integrative manufacturing planning and control: Role of integrative manufacturing in CAD/CAM integration, Over view of production control - Forecasting, Master production schedule, Capacity planning, M.R.P., Order release, Shop-floor control, Quality assurance, Planning and control systems, Cellular manufacturing, JIT manufacturing philosophy.

UNIT IV:

Computer Aided Quality Control: Terminology in quality control, Contact inspection methods, Noncontact inspection methods, Computer aided testing, Integration of CAQC with CAD/CAM.

UNIT V:


Text Books:

Reference:
UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

Text Books:

References:
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Ninth Semester
EIRME905MC: DESIGN OF MATERIAL HANDLING SYSTEMS

Hours per week: 4
Credits: 4

End Examination: 60 Marks
Sessionals: 40 Marks

UNIT I
Flexible Hoisting Appliances: Type, selection and applications of material handling equipments, choice of material handling equipment – hoisting equipment – components and theory of hoisting equipment – chain and ropes – selection of ropes, pulleys, pulley systems, sprockets and drums.

UNIT II

UNIT III

UNIT IV

UNIT V

Text Books:

References:
Five Year Dual degree (B. Tech + M.Tech)  
Mechanical Engineering- Ninth Semester  
EIRME905TA: THERMAL TURBO MACHINERY

Hours per week: 4  End Examination: 60 Marks  
Credits: 4  Sessionals: 40 Marks

UNIT I  
**General Concepts Related to Turbo Machinery**: Classification; Euler's Equation for Turbo machinery; Velocity triangle; Cascade analysis & nomenclature. Shaft Power & Aircraft Propulsion Cycles

UNIT II  
**Centrifugal Compressors**: Work done and pressure rise; Slip; Compressibility effects; Compressor characteristics. Axial Flow Compressors: Stage pressure rise; Blockage in compressor annulus; Degree of reaction; 3- D flow; Stage performance; h-s diagram & efficiency; off design performance; Performance characteristics; Design process. Combustion System.

UNIT III  

UNIT IV  
**Analysis of Centrifugal Blowers and Fans**: Centrifugal Blowers: Theoretical characteristic curves, Euler's characteristics and Euler’s velocity triangles, losses and hydraulic efficiency, flow through impeller inlet volute, diffusers, leakage disc friction mechanical losses multi vane impellers of impulse type, cross flow fans.

UNIT V  
**Testing and Control of Fans**: Fan testing, noise control, materials and components blower regulation, speed control, throttling, control at discharge and inlet.

Text Books:  

References:  
1. Austin H. Church, Centrifugal pumps and blowers, John Wiley and Sons, 1980  
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Ninth Semester
EIRME905TB: MULTIPHASE FLOW

Hours per week: 4  End Examination: 60 Marks
Credits: 4  Sessionals: 40 Marks

UNIT I
Introduction- multi phase and multi-component flow, practical examples; method of analysis of multi phase and multi-component flow problems; basic definitions; two phase, one-dimensional conservation equations; pressure gradient components; flow patterns.

UNIT II
Basic flow models – homogeneous flow model, pressure gradient, two phase friction factor for laminar flow and turbulent flow, two phase viscosity, friction multiplier; separated flow model – pressure gradient, Lokhart Martinelli correlation.

UNIT III
Drift flux model – gravity dominated flow regime, corrections for void fraction and velocity distribution in different flow regimes, pressure loss due to multi phase flow in pipe fittings, velocity and concentration profiles in multi phase flow; one-dimensional waves in two component flow.

UNIT IV
Boiling– evaporation, nucleate boiling, convective boiling; bubble formation and limiting volume; boiling map; DNB; critical boiling conditions.

UNIT V
Condensation process – types of condensation, Nusselt theory, deviations from Nusselt theory, practical equations, condensation of flowing vapors.

Text Books:

References:
UNIT I

UNIT II

UNIT III
Theory of combustion: Spray formation and droplet behavior, direct and indirect Injection combustion in IC engines premixed charge engine combustion, Stages of combustion for IC Engines- rate of pressure rise- p-θ diagram, heat release rates calculations- S.I. engine cycle calculations, combustion chambers for MPFI, Design Considerations for Combustion Chambers of IC engines.

UNIT IV
Engine performance and Emissions: Methods of performance improvement, Engine dynamics and torque analysis, Use of Combustion chart, Analytical method of performance estimation, supercharging, emission norms, emissions control by engine modifications, emission after treatment, exhaust system devices, catalytic converters, thermal reactors, Emissions from engines operating on Alternative fuels

UNIT V
**Text Books:**

**References:**
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Ninth Semester
EIRME911M: FINITE ELEMENT METHODS LAB

Hours per week: 3
Credits: 2
Continuous evaluation: 100 Marks

1. Introduction to Finite Element Analysis software – ANSYS / NISA / Nastran
2. Static Structural Analysis of 1D problems – bars, trusses, beams and frames
3. Static Structural Analysis of 2D problems – plane stress, plane strain, axisymmetric
4. Static Structural Analysis of 3D problems – various brackets
5. Dynamic Structural Analysis of 1D problems – beams and frames
6. Steady State Thermal Analysis of 1D and 2D models
7. Transient Thermal Analysis of 1D and 2D models
8. Couple Field (Thermal/Structural) Analysis
Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Ninth Semester
EIRME911T: COMPUTATIONAL FLUID DYNAMICS LAB

Hours per week: 3
Credits: 2
Continuous evaluation: 100 Marks

2. Incompressible Laminar viscous flow with and without heat transfer
3. 2-D incompressible laminar Boundary Layer without heat transfer.
4. 2-D incompressible turbulent Boundary Layer with and without heat transfer.
5. Steady and unsteady heat conduction in 2-D, using available packages such as TK Solver, ANSYS, CFX, STARCD, FLUENT etc…

Five Year Dual degree (B. Tech + M.Tech)
Mechanical Engineering- Tenth Semester
EIRME-1011: PROJECT-2

Hours per week: 24
Credits: 16
End Examination: 50 Marks
Sessionals: 50 Marks