MECHANICAL ENGINEERING

M.TECH (COMPUTER AIDED DESIGN)

(NON-CBCS)

REGULATIONS, CURRICULUM AND SYLLABUS

(With effect from the Academic Year 2011 – 12)

PONDICHERRY UNIVERSITY
PUDUCHERRY – 605 014.
PONDICHERRY UNIVERSITY
PUDUCHERRY -605 014.

REGULATIONS FOR POST GRADUATE (M.Tech.) PROGRAMMES IN THE
DISCIPLINE OF MECHANICAL ENGINEERING (NON-CBCS)
(WITH EFFECT FROM JULY 2011)
M.Tech (Computer aided Design)

1.0 ELIGIBILITY

Candidates for admission to the first semester of the four semester M.Tech course in Mechanical Engineering with specialisation in Computer Aided Design should have passed B.E / B.Tech in Mechanical Engineering / Metallurgy / Automobile / Production and Manufacturing Engineering through regular course of study from an AICTE approved institution or an examination of any University or authority accepted by the Pondicherry University as equivalent thereto, with at least 55% marks in the degree examination or equivalent CGPA.

Note:
1. Candidates belonging to SC/ST who have a mere pass in the qualifying examination are eligible.
2. There is no age limit for M.Tech. programmes.

2.0 ADMISSION

The admission policy for various M.Tech. programmes shall be decided by the respective institutes offering M.Tech. programmes subject to conforming to the relevant regulations of the Pondicherry University.

3.0 STRUCTURE OF M.Tech. PROGRAMME

3.1 General

3.1.1. The M.Tech. Programmes are of semester pattern with 16 weeks of instruction in a semester.

3.1.2. The programme of instruction for each stream of specialisation will consist of:

   i. Core courses (Compulsory)
   ii. Electives
   iii. Laboratory
   iv. Project work

3.1.3. The M.Tech. Programmes are of 4 semester duration.
3.1.4. Credits will be assigned to the courses based on the following general pattern:

i. One credit for each lecture period
ii. One credit for each tutorial period
iii. Two credits for practical course
iv. Twenty three credits for Project work divided into 9 credits for Phase-I and 14 credits for Phase – II.
v. Three credits for directed study

One teaching period shall be of 60 minutes duration including 10 minutes for discussion and movement.

3.1.5 Regulations, curriculum and syllabus of the M.Tech. programme shall have the approval of Board of Studies and other Boards/ Committees/ Councils, prescribed by the Pondicherry University. The curriculum should be so drawn up that the minimum number of credits and other requirements for the successful completion of the programme will be as given in Table – 1.

**Table 1: Minimum credits and other requirements**

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Description</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Number of Semesters</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Min. number of credits of the programme</td>
<td>72</td>
</tr>
<tr>
<td>3</td>
<td>Max. number of credits of the programme</td>
<td>75</td>
</tr>
<tr>
<td>4</td>
<td>Min. Cumulative Grade Point Average for pass</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Min. successful credits needed for registering in the next semester</td>
<td>Sem. I: 10 &lt;br&gt; Sem. II: 25 &lt;br&gt; Sem. III: 40</td>
</tr>
<tr>
<td>6</td>
<td>Min. period of completion of programme (consecutive semesters)</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Max. period of completion of programme (consecutive semesters)</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>Number of core and elective courses</td>
<td>13</td>
</tr>
<tr>
<td>9</td>
<td>Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Project work (semesters)</td>
<td>2</td>
</tr>
</tbody>
</table>
3.1.6 A core course is a course that a student admitted to the M.Tech. programme must successfully complete to receive the degree. A student shall register for all the core courses listed in the curriculum.

3.1.7 Elective courses are required to be chosen from the courses offered by the department(s) in that particular semester from among the approved courses. A core course of one department may be chosen as an elective by a student from other department.

3.1.8 Each student is required to make a seminar presentation on any chosen topic connected with the field of specialisation. Preparation and presentation of a seminar is intended to investigate an in-depth review of literature, prepare a critical review and develop confidence to present the material by the student. The seminar shall be evaluated by a Departmental Committee constituted for this purpose, based on a report submitted by the candidate and a viva-voce conducted at the end of the semester.

3.1.9 Project work is envisaged to train a student to analyze independently any problem posed to him/her. The work may be analytical, experimental, design or a combination of both. The project report is expected to exhibit clarity of thought and expression. The evaluation of project work will be a continuous internal assessment based on two reviews, an internal viva-voce and an external viva-voce examination.

3.1.10 The medium of instruction, examination, seminar, directed study and project work will be in English.

4.0 REQUIREMENTS TO APPEAR FOR UNIVERSITY EXAMINATION

4.1 A candidate shall be permitted to appear for university examinations at the end of any semester only if he / she secures not less than 75% overall attendance arrived at by taking into account the total number of periods in all subjects put together offered by the institution for the semester under consideration. Candidates who secure overall attendance greater than 60% and less than 75% have to pay a condonation fee as prescribed by the University along with a medical certificate obtained from a medical officer not below the rank of Assistant Director to become eligible to appear for the examinations.
4.2 A candidate to secure eligibility towards continuing the Programme, he/she must have earned the minimum number of credits at the end of each semester as given in Table – 1. If he /she fails to satisfy this criterion in any semester, he/she shall be placed on scholastic probation in the succeeding semester.

4.3 His / Her conduct shall be satisfactory as certified by the Head of the institution.

5.0 EVALUATION

5.1 Evaluation of theory courses shall be based on 40% continuous internal assessment and 60% University examination. Evaluation of laboratory course shall be based on 50% internal assessment and 50% University examination. In each course, there shall be a 3 hour University examination.

5.2 The total marks for the project work for M.Tech. programmes will be 300 marks for phase-I and 400 marks for phase-II. The allotment of marks for external valuation and internal valuation shall be as detailed below:

**Project work – (Phase – I): 300 Marks**

<table>
<thead>
<tr>
<th>Internal valuation</th>
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</thead>
<tbody>
<tr>
<td>Guide</td>
<td>50 marks</td>
</tr>
<tr>
<td>First Evaluation</td>
<td>50 marks</td>
</tr>
<tr>
<td>Second Evaluation</td>
<td>50 marks</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong> 150 marks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External valuation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation (External Examiner Only)</td>
<td>50 marks</td>
</tr>
<tr>
<td>Viva voce (50 for Ext.+ 50 for Int.)</td>
<td>100 marks</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong> 150 marks</td>
</tr>
</tbody>
</table>
Project work – (Phase – II): 400 Marks

<table>
<thead>
<tr>
<th>Internal valuation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Guide</td>
<td>100 marks</td>
</tr>
<tr>
<td>First Evaluation</td>
<td>50 marks</td>
</tr>
<tr>
<td>Second Evaluation</td>
<td>50 marks</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>200 marks</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>External valuation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation (External Examiner Only)</td>
<td>50 marks</td>
</tr>
<tr>
<td>Viva voce (75 for Ext. + 75 for Int.)</td>
<td>150 marks</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>200 marks</strong></td>
</tr>
</tbody>
</table>

Internal valuation should be done by a committee comprising of not less than 3 faculty members appointed by the Head of the Department and approved by the Head of the Institution.

5.3 The end-semester examination shall be conducted by the Pondicherry University for all the courses offered by the department. A model question paper, as approved by the Chairperson, BOS (MECH), Pondicherry University, for each course offered under the curriculum should be submitted to the University. The University examination shall cover the entire syllabus of the course.

5.4 The University shall adopt the double valuation procedure for evaluating the end-semester examinations, grading and publication of the results. Each answer script shall be evaluated by two experts. If the difference between the total marks awarded by the two examiners is not more than 15% of end-semester examination maximum marks, then the average of the total marks awarded by the two examiners will be reckoned as the mark secured by the candidate; otherwise, a third examiner is to be invited to evaluate the answer scripts and his/her assessment shall be declared final.

5.5 Continuous assessment of students for theory courses shall be based on two tests (15 marks each) and one assignment (10 marks). A laboratory course carries an internal assessment mark of 50 distributed as follows: (i) Regular laboratory exercises and records – 20 marks (ii) Internal laboratory test– 20 marks and (iii) Internal viva-voce – 10 marks.

5.6 All eligible students shall appear for the University examination.
6.0 Grading

6.1 The assessment of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying stipulated points, will be awarded as per the range of total marks (out of 100) obtained by the candidate, as detailed below in Table – 2.

**TABLE 2: Letter Grade and the Corresponding Grade Point**

<table>
<thead>
<tr>
<th>Range of Total Marks</th>
<th>Letter Grade</th>
<th>Grade Points</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 to 100</td>
<td>S</td>
<td>10</td>
<td>EXCELLENT</td>
</tr>
<tr>
<td>80 to 89</td>
<td>A</td>
<td>9</td>
<td>VERY GOOD</td>
</tr>
<tr>
<td>70 to 79</td>
<td>B</td>
<td>8</td>
<td>GOOD</td>
</tr>
<tr>
<td>60 to 69</td>
<td>C</td>
<td>7</td>
<td>ABOVE AVERAGE</td>
</tr>
<tr>
<td>55 to 59</td>
<td>D</td>
<td>6</td>
<td>AVERAGE</td>
</tr>
<tr>
<td>50 to 54</td>
<td>E</td>
<td>5</td>
<td>SATISFACTORY</td>
</tr>
<tr>
<td>0 to 49</td>
<td>F</td>
<td>0</td>
<td>FAILURE</td>
</tr>
<tr>
<td>Incomplete</td>
<td>FA</td>
<td>-</td>
<td>FAILURE DUE TO LACK OF ATTENDANCE/ FAILURE BY ABSENCE</td>
</tr>
</tbody>
</table>

6.2 A student is deemed to have completed a course successfully and earned the appropriate credit if and only if, he/she receives a grade of E and above. The student should obtain 40% of marks in the University examination in a subject to earn a successful grade.

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

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

(ii) The candidate should have attended all the university examinations.

(iii) The candidate should not have failed in more than two papers in the current university examination.

(iv) The request for revaluation must be made in the format prescribed and duly recommended by the Head of the Institution along with the revaluation fee prescribed by the University.
(v) Revaluation is not permitted for practical courses, seminar and project work.

6.4 The internal assessment marks secured by a student in a theory course shall be considered only during the first appearance. For the subsequent attempts, the marks secured by the student in the University examination shall be scaled up to the total marks. Further, the marks secured by the student in the University examination in the latest attempt shall alone remain valid in total suppression of the University examination marks secured by the student in earlier attempts.

6.0 DECLARATION OF RESULTS, RANK AND ISSUE OF GRADE CARD

7.1 The results will be declared and the grade cards will be issued to the students after completing the valuation process.

7.2 The grade cards will contain the following details:

(i) The college in which the candidate is studying/has studied.

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

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

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

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

The sum will cover all the courses the student has taken in that semester, including those in which he/she has secured F.

7.4 CGPA will be calculated in a similar manner, considering all the courses enrolled from first semester. FA grades are to be excluded for calculating GPA and CGPA. If a student has passed in a course after failing in earlier attempts, the grade secured by the student in the successful attempt only will be taken into account for computing CGPA.

7.5 To convert CGPA into percentage marks, the following formula shall be used:

\[
\% \text{ Mark} = (CGPA - 0.5) \times 10
\]
7.6 A candidate who satisfies the course requirements for all semesters and passes all the examinations prescribed for all the four semesters within a maximum period of 10 semesters reckoned from the commencement of the first semester to which the candidate was admitted, shall be declared to have qualified for the award of degree.

7.7 A candidate who qualifies for the award of the degree shall be declared to have passed the examination in **FIRST CLASS with DISTINCTION** upon fulfilling the following requirements:

(i) Should have passed all the subjects pertaining to semesters 1 to 4 in his/her first appearance in 4 consecutive semesters starting from first semester to which the candidate was admitted.

(ii) Should not have been prevented from writing examinations due to lack of attendance.

(iii) Should have secured a CGPA of 8.50 and above for the semesters 1 to 4.

7.8 A candidate who qualifies for the award of the degree by passing all the subjects relating to semesters 1 to 4 within a maximum period of 6 consecutive semesters after his/her commencement of study in the first semester and in addition secures CGPA not less than 6.5 shall be declared to have passed the examination in **FIRST CLASS**.

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

7.10 A student with CGPA less than 5.0 is not eligible for the award of degree.

7.11 For the award of University rank and gold medal, the CGPA secured from 1st to 4th semester should be considered and it is mandatory that the candidate should have passed all the subjects from 1st to 4th semester in the first appearance and he/she should not have been prevented from writing the examination due to lack of attendance and should not have withdrawn from writing the University examinations.
8.0 PROVISION FOR WITHDRAWAL

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

9.0 TEMPORARY DISCONTINUATION FROM THE PROGRAMME

If a candidate wishes to temporarily discontinue the programme for valid reasons, he/she shall apply through the Head of the Institution in advance and obtain a written order from the University permitting discontinuance. A candidate after temporary discontinuance may rejoin the programme only at the commencement of the semester at which he/she discontinued, provided he/she pays the prescribed fees to the University. The total period of completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not in any case exceed 5 years, including the period of discontinuance.

10.0 POWER TO MODIFY

10.1 Notwithstanding anything contained in the foregoing, the Pondicherry University shall have the power to issue directions/ orders to remove any difficulty.

10.2 Nothing in the foregoing may be construed as limiting the power of the Pondicherry University to amend, modify or repeal any or all of the above
**M.TECH (COMPUTER AIDED DESIGN)**

**CURRICULUM AND SCHEME OF EXAMINATION**

(Total number of credits required for the completion of the programme: 72)

### SEMESTER – I

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code</th>
<th>Subject</th>
<th>Hours / Week</th>
<th>Credits</th>
<th>Evaluation (marks)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L  T  P</td>
<td></td>
<td>Internal</td>
</tr>
<tr>
<td>1.</td>
<td>ME 911</td>
<td>Computational Methods</td>
<td>4 0 0</td>
<td>4</td>
<td>40 60 100</td>
</tr>
<tr>
<td>2.</td>
<td>ME 912</td>
<td>Computer Graphics</td>
<td>4 0 0</td>
<td>4</td>
<td>40 60 100</td>
</tr>
<tr>
<td>3.</td>
<td>ME 913</td>
<td>Integrated Mechanical Design</td>
<td>4 0 0</td>
<td>4</td>
<td>40 60 100</td>
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<tr>
<td>4.</td>
<td></td>
<td>Elective – I</td>
<td>3 0 0</td>
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<td>40 60 100</td>
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<td>5.</td>
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<td>Elective – II</td>
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<td>6.</td>
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<td>7.</td>
<td>ME 917</td>
<td>CAD Laboratory</td>
<td>0 0 3</td>
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<td>50 50 100</td>
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**Total Credits:** 23 290 410 700

### SEMESTER – II

<table>
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<tr>
<th>Sl. No.</th>
<th>Code</th>
<th>Subject</th>
<th>Hours / Week</th>
<th>Credits</th>
<th>Evaluation (marks)</th>
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<td></td>
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<td>L  T  P</td>
<td></td>
<td>Internal</td>
</tr>
<tr>
<td>1.</td>
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<td>ME 915</td>
<td>Product Design</td>
<td>4 0 0</td>
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<td>40 60 100</td>
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<tr>
<td>3.</td>
<td>ME 916</td>
<td>Integrated Product and Processes Development</td>
<td>3 1 0</td>
<td>4</td>
<td>40 60 100</td>
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<td>4.</td>
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<td>Elective – IV</td>
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<td>Elective – V</td>
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<td>40 60 100</td>
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<td>6.</td>
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<td>Elective – VI</td>
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<td>40 60 100</td>
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<tr>
<td>7.</td>
<td>ME 918</td>
<td>Analysis and Simulation Laboratory</td>
<td>- - 3</td>
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<td>50 50 100</td>
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**Total Credits:** 23 290 410 700
### SEMESTER – III

<table>
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<tr>
<th>Sl. No.</th>
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<th>Subject</th>
<th>Hours / Week</th>
<th>Credits</th>
<th>Evaluation (marks)</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td>L T P</td>
<td></td>
<td>Internal</td>
</tr>
<tr>
<td>1.</td>
<td></td>
<td>Elective VII</td>
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<td>3</td>
<td>40</td>
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<tr>
<td>2.</td>
<td>ME 919</td>
<td>Project Phase-I</td>
<td>- - 16</td>
<td>9</td>
<td>150</td>
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### SEMESTER – IV

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<th>Code</th>
<th>Subject</th>
<th>Hours / Week</th>
<th>Credits</th>
<th>Evaluation (marks)</th>
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<td></td>
<td></td>
<td></td>
<td>L T P</td>
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<td>Internal</td>
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<tr>
<td>1.</td>
<td>ME 920</td>
<td>Project Phase II</td>
<td>- - 24</td>
<td>14</td>
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12
<table>
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<th>Code</th>
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<tbody>
<tr>
<td>1</td>
<td>ME 941</td>
<td>Advanced Materials and Processing</td>
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<tr>
<td>2</td>
<td>ME 942</td>
<td>Advanced Mechanism Design And Simulation</td>
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<tr>
<td>3</td>
<td>ME 943</td>
<td>Advanced Strength Of Materials</td>
</tr>
<tr>
<td>4</td>
<td>ME 944</td>
<td>Advanced Tool Design</td>
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<tr>
<td>5</td>
<td>ME 945</td>
<td>Bearing Design and Rotor Dynamics</td>
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<td>6</td>
<td>ME 946</td>
<td>Composite Materials And Mechanics</td>
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<td>7</td>
<td>ME 947</td>
<td>Computational Fluid Dynamics</td>
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<td>8</td>
<td>ME 948</td>
<td>Design Of Hydraulic And Pneumatic Systems</td>
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<tr>
<td>9</td>
<td>ME 949</td>
<td>Design Of Material Handling Equipment</td>
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<td>10</td>
<td>ME 950</td>
<td>Design Of Plastic Parts</td>
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<tr>
<td>11</td>
<td>ME 951</td>
<td>Design Paradigm</td>
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<tr>
<td>12</td>
<td>ME 952</td>
<td>Engineering System Dynamics</td>
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<tr>
<td>13</td>
<td>ME 953</td>
<td>Enterprise Resource Planning</td>
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<tr>
<td>14</td>
<td>ME 954</td>
<td>Flexible Competitive Manufacturing System</td>
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<tr>
<td>15</td>
<td>ME 955</td>
<td>Industrial Design And Ergonomics</td>
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<tr>
<td>16</td>
<td>ME 956</td>
<td>Industrial Robotics And Expert Systems</td>
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<td>17</td>
<td>ME 957</td>
<td>Mechanical Vibrations</td>
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<tr>
<td>18</td>
<td>ME 958</td>
<td>Mechatronics In Manufacturing</td>
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<tr>
<td>19</td>
<td>ME 959</td>
<td>Metallic Materials And Manufacturing Processes</td>
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<tr>
<td>20</td>
<td>ME 960</td>
<td>Optimization Techniques In Design</td>
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<tr>
<td>21</td>
<td>ME 961</td>
<td>Plasticity And Metal Forming</td>
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<tr>
<td>22</td>
<td>ME 962</td>
<td>Rapid Prototyping And Tooling</td>
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<td>23</td>
<td>ME 963</td>
<td>Total Quality Management</td>
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<tr>
<td>24</td>
<td>ME 964</td>
<td>Tribology In Design</td>
</tr>
</tbody>
</table>
ME 911  COMPUTATIONAL METHODS

Unit - I


Unit - II

Classification of PDE’s, one dimensional, Finite Difference Method for Laplace, Poisson’s and elliptical equations.

Unit - III

Curve fitting – Method of least squares, fitting straight line, parabola and exponential, polynomial of degree N, applications.
Statistical methods - Statistical Inference- sampling distribution of statistics, standard error, point and internal estimation for population, mean, variance and least square estimate.

Unit - IV

Test of Hypothesis, Inference concerning means, variances and proportions for small and large samples, t, F, chi square tests, goodness of fitness, and test of independence.

Unit - V

Design of experiment – Analysis of variance, one way and two way classification, latin square design, factorial design, test of significance of main and interaction effects.

REFERENCE BOOKS:

ME 912 COMPUTER GRAPHICS

Unit - I

Unit - II

Unit - III
Viewing transformations – perspective projection – techniques for visual realism – hidden line – Surface - solid and curve removal algorithm - Algorithms for shading and Rendering. Introduction to parametric and variational geometry based software’s and their principles creation of prismatic and lofted parts using these packages.

Unit - IV
Graphics standard & Data storage - Standards for computer graphics GKS, Data exchange standards – IGES, STEP - Manipulation of the model - Model storage - Data structures - Data base considerations - Object oriented representations - Organizing data for CIM applications - Design information system.

Unit - V
REFERENCES


ME 913 INTEGRATED MECHANICAL DESIGN  
(Use of Approved Data Book Is Permitted)

UNIT I

Phases of design – Standardization and interchangeability of machine elements - Tolerances from process and function – Individual and group tolerances – Selection of fits for different design situations – Design for assembly and modular constructions – Concepts of integration.

UNIT II

Analysis and Design of shafts for different applications – detailed design – preparation of production drawings – integrated design of shaft, bearing and casing – design for rigidity.

UNIT III


UNIT IV

Introduction-design diagrams of clutch, calculation of critical parameters of clutches, design calculation of standard elements of friction clutches, torsional vibration dampers, clutch control drives.

UNIT V

Dynamics and thermal aspects of vehicle braking – Integrated design of brakes for machine tools – automobiles and mechanical handling equipments

REFERENCES

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

REFERENCES


ME 915 PRODUCT DESIGN

Unit – I

Definition - Design by Evolution and by Innovation - factors to be considered for product design - Production-Consumption cycle - The morphology of design - Primary design Phases and flow charting. Role of Allowance, Process Capability, and Tolerance in Detailed Design and Assembly.

Product strategies, Market research - identifying customer needs - Analysis of product - locating ideas for new products, Selecting the right product, creative thinking, curiosity, imagination and brain storming - product specification- Establishing Target Specifications - Setting the Final Specifications

Unit - II

Task - Structured approaches - clarification - search - external and internal -systematic exploration - concept selection - methodology and benefits.


Unit – III

Modeling and simulation - the role of models in product design, mathematical modeling similitude relations - weighted property index.


Unit - IV

Strength Consideration: Principal Stress Trajectories - Balanced Design - Criteria and Objectives of Design - Designing for Uniform Strength - Tension vis-a-vis Compression.


Unit - V

Case studies – based on materials and manufacturing of Automobiles Components and Home appliances.

Classes of exclusive rights - Patents - Combination versus aggregation - Novelty and Utility - Design patents - Paten disclosure - Patent application steps-Patent Office prosecution-Sales of paten rights- Trade marks-Copy rights.

REFERENCE BOOKS:

UNIT I


UNIT II


UNIT III


UNIT IV


UNIT V


REFERENCES


• **CAD Introduction.**

• **Sketcher**

• **Solid modeling** - Extrude, Revolve, Sweep, etc and Variational sweep, Loft etc

• **Surface modeling** - Extrude, Sweep, Trim, etc and Mesh of curves, Free form etc

• **Feature manipulation** - Copy, Edit, Pattern, Suppress, History operations etc.

• **Assembly** - Constraints, Exploded Views, Interference check

• **Drafting** - Layouts, Standard & Sectional Views, Detailing & Plotting.

Exercises in Modeling and drafting of Mechanical Components - Assembly using Parametric and feature based Packages like PRO-E / SOLID WORKS / CATIA / NX etc
Analysis of Mechanical Components – Use of FEA packages, like ANSYS NASTRAN etc., Excesses shell include FEA analysis of
i) Machine elements under static loads
ii) Heat transfer in mechanical systems
iii) Determination of natural frequency
iv) Axi-Symmetric
v) Non-linear systems

EQUIPMENTS REQUIRED

CAD work station / Pentium 4: 10 Nos
ANSYS / NASTRAN / ABACUS: 10 Licenses
ELECTIVES
Unit – I

Introduction: Conventional materials, limitation, need for composites, classification and characteristics of composites, reinforcements, Polymer, ceramics and metal matrix composites - manufacturing of metal matrix composites, solid and liquid state processing-testing of composites- applications

Unit – II

Introduction to powder metallurgy (P/M) Processes – Design considerations for P/M tooling – Types of compaction – Sintering at different atmospheres – Liquid Phase sintering – Secondary processes – P/M applications specifically to cutting tool, bearing and friction materials – Nano materials and their applications.

Unit – III


Unit – IV


Unit – V

Surface Structure and properties – Surface coatings, Hard facing, Thermal spraying, Vapor deposition, Ion implantation, Hot dipping – Coating of Cutting and forming tools.

REFERENCE BOOKS:

UNIT I

UNIT II
Position Analysis – Vector loop equations for four bar, slider crank, inverted slider crank, geared five bar and six bar linkages – Analytical methods for velocity and acceleration Analysis – four bar linkage jerk analysis – Plane complex mechanisms.

UNIT III
Fixed and moving centrodes – Inflection points and Inflection circle – Euler Savary equation – graphical constructions – cubic of stationary curvature.

UNIT IV

UNIT V

REFERENCES
UNIT I


Shear Centre: Location of shear centre for various sections – shear flow.

UNIT II

Stresses and deflection in beams subjected to unsymmetrical loading – Kern of a section. Curved flexural members - circumferential and radial stresses – deflection and radial curved beam with re-strained ends – closed ring subjected to concentrated load and uniform load – chain link and crane hooks.

UNIT III

Thick walled cylinder subjected to internal and external pressures – Shrink fit joints – Stresses due to rotation – Radial and tangential stresses in solid disc and ring of uniform thickness and varying thickness – allowable speed. – Rotating shafts and cylinders.

UNIT IV


UNIT V

Stresses in circular and rectangular plates due to various types of loading and end conditions – Buckling of plates. Theory of contact stresses – methods of computing contact stresses – deflection of bodies in point and line contact – applications.

REFERENCES

UNIT I


UNIT II


UNIT III


UNIT IV


UNIT V


REFERENCES:


UNIT I

Selection criteria-Dry and Boundary Lubrication Bearings-Hydrodynamic and Hydrostatic bearings- Electro Magnetic bearings-Dry bearings-Rolling Element bearings- Bearings for Precision Applications-Foil Bearings-Special bearings- Selection of plain Bearing materials – Metallic and Non metallic bearings

UNIT II


UNIT III

Contact Stresses in Rolling bearings- Centrifugal stresses-Elasto hydrodynamic lubrication- Fatigue life calculations- Bearing operating temperature- Lubrication- Selection of lubricants- Internal clearance – Shaft and housing fit- Mounting arrangements-Materials for rolling bearings- Manufacturing methods- Ceramic bearings-Rolling bearing cages-bearing seals selection

UNIT IV

Hydrodynamic Lubrication equation for dynamic loadings-Squeeze film effects in journal bearings and thrust bearings -Rotating loads , alternating and impulse loads in journal bearings – Journal centre Trajectory- Analysis of short bearings under dynamic conditions- Finite difference solution for dynamic conditions

UNIT V

Rotor vibration and Rotor critical speeds- support stiffness on critical speeds- Stiffness and damping coefficients of journal bearings-computation and measurements of journal bearing coefficients -Mechanics of Hydro dynamic Instability- Half frequency whirl and Resonance whip- Design configurations of stable journal bearings

REFERENCES:

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V
Failure Predictions – Laminate Design Consideration – Bolted and Bonded Joints Design Examples.

REFERENCES
UNIT I
Classification, Initial and Boundary conditions, Initial and Boundary value problems. Finite difference method, Central, Forward, Backward difference, Uniform and non-uniform Grids, Numerical Errors, Grid Independence Test.

UNIT II
Steady one-dimensional conduction, Two and Three-dimensional steady state problems, Transient one-dimensional problem, Two-dimensional Transient Problems.

UNIT III

UNIT IV

UNIT V
Algebraic Models – One equation model, K – € Models, Standard and High and Low Reynolds number models, Prediction of fluid flow and heat transfer using standard codes.

REFERENCES


UNIT I

Hydraulic Power Generators – Selection and specification of pumps, pump characteristics-Determination of volumetric, mechanical and overall efficiencies of positive displacement pumps. Linear and Rotary Actuators – selection, specification and characteristics.

UNIT II

Pressure - direction and flow control valves - relief valves, non-return and safety valves - actuation systems. Electrical control solenoid valves, relays, Electro hydraulic servo valves.

UNIT III


UNIT IV

Pneumatic fundamentals - control elements, position and pressure sensing - logic circuits - switching circuits - fringe conditions modules and these integration - sequential circuits - cascade methods - mapping methods - step counter method - compound circuit design - combination circuit design.

UNIT V

Pneumatic equipments- selection of components - design calculations – application -fault finding - hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low cost automation - Robotic circuits.

REFERENCES:


UNIT I

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


REFERENCES

UNIT I


UNIT II

Manufacturing Considerations - Mold Filling Considerations - Weld line - Shrinkage and Warpage - Cooling and Solidification - Structural design Considerations - Structural Members - Design for Stiffness - Processing Limitations in Product Design.

UNIT III


UNIT IV

Basics of mould construction - Mould design - Positive moulds - Positive moulds with Lands- Multi cavity moulds with individual, common Loading Chamber - Moulds with a slide core - Split cavity moulds, Heat losses and energy requirement.

UNIT V


REFERENCES

UNIT I


UNIT II

Redesign of castings based on parting line considerations - Minimizing core requirements - Redesigning a cast members using weldments-factors influencing form design-Working principle, Material, Manufacture, Design - Possible solutions - Materials choice - Influence of materials-on from design - form design of welded members, forgings and castings.

UNIT III

Assembly processes-Handling and insertion process-Manual, automatic and robotic assembly-Cost of Assembly-Number of Parts-DFA guidelines

UNIT IV


UNIT V

Elements of Economics analysis-Quantitative and qualitative analysis-Economic Analysis process-Estimating magnitude and time of future cash inflows and out flows-Sensitivity analysis-Project trade-offs-Trade-offs rules-Limitation of quantitative analysis-Influence of qualitative factors on project success

REFERENCES:

UNIT I


UNIT II

Introduction – Control systems – Control system configurations – Control system Terminology – Control system classes – Feedback systems – Analysis of Feedback – Historical Developments of control systems – Control system analysis and Design Objectives.

UNIT III


UNIT IV


UNIT V


REFERENCES


UNIT I


UNIT II


UNIT III

SAP – People soft, Baan and Oracle – Comparison – Integration of different ERP applications – ERP as sales force automation – Integration of ERP and Internet – ERP Implementation strategies – Organizational and social issues.

UNIT IV


UNIT V


REFERENCES


UNIT I


UNIT II


UNIT III


UNIT IV


UNIT V


REFERENCES


UNIT I

Introduction - general approach to the man - machine relationship - work station design - working position - An approach to industrial design - elements of design - structure for industrial design in engineering application in modern manufacturing systems.

UNIT II

Ergonomics and product design - ergonomics in automated systems - expert systems for ergonomic design. Anthropomorphic data and its applications in ergonomic design - limitations of anthropomorphic data - use of computerized data base. Shapes and sizes of various controls and displays – multiple display and control situations - design of major controls in automobiles, machine tools etc., and - design of office furniture - redesign of instruments.

UNIT III

The mechanics of seeing - psychology of seeing - general influences of line and form. Colour and light - colour and objects - colour and the eye - colour consistency - colour terms - reactions to colour and colour continuation - colour on engineering equipments.

UNIT IV

Concept of unity - concept of order with variety - concept of purpose - style and environment - Aesthetic expressions. Style - components of style - house style, observing style in capital goods.

UNIT V

General design situation - specifying design requirements - rating the importance of industrial design - industrial design in the design process.

REFERENCES:


UNIT I


UNIT II


UNIT III


UNIT IV


UNIT V


REFERENCES:

UNIT I


UNIT II


UNIT III


UNIT IV


UNIT V


REFERENCES:

ME 958    MECHATRONICS IN MANUFACTURING

UNIT I


UNIT II


UNIT III

Actuators – Mechanical - Electrical - Fluid Power - Piezoelectric – Magnetostrictive - Shape memory alloy - applications - selection of actuators.

UNIT IV

Introduction - Basic structure - Input and output processing - Programming - Mnemonics-Timers, counters and internal relays - Data handling - Selection of PLC.

UNIT V

Designing - Possible design solutions-Traditional and Mechatronics design concepts - Case studies of Mechatronics systems - Pick and place Robot - Conveyor based material handling system - PC based CNC drilling machine - Engine Management system - Automatic car park barrier - Data acquisition Case studies.

REFERENCES

UNIT I
Factors for design based on mechanical, electrical and thermal properties – Dimensional geometrical tolerances – Factors considered for selection of materials.

UNIT II
Ferrous metals and alloys – Steel, Stainless steel – Non-ferrous metals and alloys – Aluminium – Brass – Gun Metal

UNIT III
Design consideration in methods of manufacturing such as Casting – Sand casting, die casting, investment casting – Machining: Turning, drilling, milling and grinding – Unconventional – EDM, ECM – Forming techniques – Forging, extrusion, sheet metal forming – Powder metallurgy.

UNIT IV

UNIT V
Case studies on optimization of design for cost – material – methods – Economics of machining.

REFERENCES
UNIT I

General Characteristics of mechanical elements, adequate and optimum design, principles of optimization, formulation of objective function, design constraints – Classification of optimization problem.

UNIT II


UNIT III

Optimization with equality and inequality constraints - Indirect methods using penalty functions, Lagrange multipliers; Geometric programming- Constrained, mixed inequality and unconstrained minimization; Genetic algorithms.

UNIT IV


UNIT V

Dynamic Applications – Optimum design of single, two degree of freedom systems, vibration absorbers. Application in Mechanisms – Optimum design of simple linkage mechanisms.

REFERENCES


UNIT I


UNIT II

Uniaxial tension test – Mechanical properties – Work hardening – Compression test – bulge test – plane strain compression stress – plastic instability in uniaxial tension stress – plastic instability in biaxial tension stress

UNIT III


UNIT IV


UNIT V


REFERENCES


UNIT I


UNIT II


UNIT III


UNIT IV


UNIT V


REFERENCES

ME 963  TOTAL QUALITY MANAGEMENT

UNIT I

Need for TQM, evolution of quality, Definition of quality, TQM philosophy - CONTRIBUTIONS OF Deming Juran, Crosby and Ishikawa, TQM models.

UNIT II

Vision, Mission, Quality policy and objective Planning and Organization for quality, Quality policy Deployment, Quality function deployment, introduction to BPR and analysis of Quality Costs.

UNIT III

Customer focus, Leadership and Top management commitment, Employee involvement - Empowerment and Team work, Supplier Quality Management, Continuous process improvement, Training, performance Measurement and customer satisfaction.

UNIT IV

PDSA, The Seven Tools of Quality, New Seven management tools, Concept of six sigma, FMEA, Bench Marking, JIT, POKA YOKE, 5S, KAIZEN, Quality circles.

UNIT V


REFERENCES:

ME 964 TRIBOLOGY IN DESIGN

UNIT I


UNIT II

Lubricants – selection criteria – lubrication regimes – Hydrodynamic, elasto and plasto hydrodynamic lubrication, basic equations, Reynolds’ equation, energy equation, boundary lubrication, boundary lubricating films and its properties. Hydrostatic lubrication – Gas lubrication

UNIT III

Dynamic analysis of hydrodynamic bearing performance, trust and journal bearings– full, partial, fixed and pivoted – mass flow rate, friction, power loss, heat and temperature difference, dynamic loads, oil film thickness, stiffness of squeeze film and dynamic co-efficient – hydrostatic bearing design.

UNIT IV

Slider bearings – self acting finite bearings, failure modes, materials rolling element bearings – Types, contact mechanics, bearing internal load distribution, lubrication – Bearing geometry and kinematics, load ratings and life prediction, torque calculation, temperature analysis, endurance testing and failure analysis.

UNIT V


REFERENCES