### SEMESTER I

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>ED8151</td>
<td>Advanced Mechanics of Materials</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>ED8152</td>
<td>Computer Applications in Design</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>ED8153</td>
<td>Quality Concepts in Design</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>ED8154</td>
<td>Vibration Analysis and Control</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>MA8155</td>
<td>Advanced Numerical Methods</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>Elective I</td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>ED8161</td>
<td>CAD Lab</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>18</td>
<td>1</td>
<td>6</td>
<td>22</td>
</tr>
</tbody>
</table>

### SEMESTER II

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>ED8201</td>
<td>Behavior of Engineering Materials</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>ED8251</td>
<td>Finite Element Methods in Mechanical Design</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>ED8252</td>
<td>Integrated Mechanical Design</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>ED8253</td>
<td>Mechanisms Design and Simulation</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Elective II</td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>Elective III</td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>ED8211</td>
<td>Design Project</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>ED8261</td>
<td>Analysis and Simulation Lab</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>18</td>
<td>2</td>
<td>7</td>
<td>24</td>
</tr>
</tbody>
</table>

### SEMESTER III

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td></td>
<td>Elective IV</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>Elective V</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>Elective VI</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>ED8311</td>
<td>Project Work Phase I</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>9</td>
<td>0</td>
<td>12</td>
<td>15</td>
</tr>
</tbody>
</table>

1
### SEMESTER IV

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ED8411</td>
<td>Project Work Phase II</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>12</td>
</tr>
</tbody>
</table>

* a Term Project must be given for Assessment – 3 (Compulsory)

(Total number of credits: 22 + 24 + 15 + 12 = 73)

---

### ELECTIVES FOR M.E. ENGINEERING DESIGN FOR REGULATIONS 2013

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ED8001</td>
<td>Advanced Metal Forming Techniques</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>ED8002</td>
<td>Plates and Shells</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>ED8003</td>
<td>Surface Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>ED8071</td>
<td>Advanced Finite Element Analysis</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>ED8072</td>
<td>Bearing Design and Rotor Dynamics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>ED8073</td>
<td>Composite Materials and Mechanics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>ED8074</td>
<td>Design for Manufacture Assembly and Environments</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>ED8075</td>
<td>Design Of Hydraulic And Pneumatic Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>ED8076</td>
<td>Design of Material Handling Equipments</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>ED8077</td>
<td>Design of Pressure Vessel and Piping</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>ED8078</td>
<td>Engineering Fracture Mechanics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>12.</td>
<td>ED8079</td>
<td>Modal Analysis of Mechanical Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>13.</td>
<td>ED8080</td>
<td>Optimization Techniques In Design</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>14.</td>
<td>ED8081</td>
<td>Tribology in Design</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>15.</td>
<td>RA8071</td>
<td>Computational Fluid Dynamics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
### SEMESTER I

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>MA8155</td>
<td>Advanced Numerical Methods</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>ED8151</td>
<td>Advanced Mechanics of Materials</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>ED8152</td>
<td>Computer Applications in Design</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>ED8161</td>
<td>CAD Lab</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>9</td>
<td>1</td>
<td>4</td>
<td>12</td>
</tr>
</tbody>
</table>

### SEMESTER II

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>ED8251</td>
<td>Finite Element Methods in Mechanical Design</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>ED8253</td>
<td>Mechanisms Design and Simulation</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>ED8201</td>
<td>Behavior of Engineering Materials</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>ED8261</td>
<td>Analysis and Simulation Lab</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>9</td>
<td>1</td>
<td>4</td>
<td>12</td>
</tr>
</tbody>
</table>

### SEMESTER III

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ED8153</td>
<td>Quality Concepts in Design</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>ED8154</td>
<td>Vibration Analysis and Control</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>Elective I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>9</td>
<td>0</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>

### SEMESTER IV

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ED8252</td>
<td>Integrated Mechanical Design</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>Elective II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>Elective III</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>ED8211</td>
<td>Design Project</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>9</td>
<td>1</td>
<td>3</td>
<td>12</td>
</tr>
</tbody>
</table>
## SEMESTER V

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Elective IV</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Elective V</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Elective VI</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>ED8311</td>
<td>Project Work Phase I</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>9</td>
<td>0</td>
<td>12</td>
<td>15</td>
</tr>
</tbody>
</table>

## SEMESTER VI

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ED8411</td>
<td>Project Work Phase II</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>12</td>
</tr>
</tbody>
</table>

* a Term Project must be given for Assessment – 3 (Compulsory)

(Total number of credits: 12+12+10+12+ 15 + 12 = 73)

## ELECTIVES FOR M.E. ENGINEERING DESIGN FOR REGULATIONS 2013

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ED8001</td>
<td>Advanced Metal Forming Techniques</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>ED8002</td>
<td>Plates and Shells</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>ED8003</td>
<td>Surface Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>ED8071</td>
<td>Advanced Finite Element Analysis</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>ED8072</td>
<td>Bearing Design and Rotor Dynamics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>ED8073</td>
<td>Composite Materials and Mechanics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>ED8074</td>
<td>Design for Manufacture Assembly and Environments</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>ED8075</td>
<td>Design of Hydraulic and Pneumatic systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>ED8076</td>
<td>Design of Material Handling Equipments</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>ED8077</td>
<td>Design of Pressure Vessel and Piping</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>ED8078</td>
<td>Engineering Fracture Mechanics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>12.</td>
<td>ED8079</td>
<td>Modal Analysis of Mechanical Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>13.</td>
<td>ED8080</td>
<td>Optimization Techniques In Design</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>14.</td>
<td>ED8081</td>
<td>Tribology in Design</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>15.</td>
<td>RA8071</td>
<td>Computational Fluid Dynamics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
OBJECTIVE:
- To know the fundamentals of mechanics of materials under various loading conditions.

OUTCOME:
- It helps the students to be familiarized with the stresses under different loading conditions.

UNIT I ELASTICITY

UNIT II SHEAR CENTER AND UNSYMMETRICAL BENDING
Location of shear center for various thin sections - shear flows. Stresses and Deflections in beams subjected to unsymmetrical loading-kern of a section.

UNIT III STRESSES IN FLAT PLATES AND CURVED MEMBERS

UNIT IV TORSION OF NON-CIRCULAR SECTIONS
Torsion of rectangular cross section - St.Venants theory - elastic membrane analogy - Prandtl’s stress function - torsional stress in hollow thin walled tubes.

UNIT V STRESSES IN ROTATING MEMBERS AND CONTACT STRESSES
Radial and tangential stresses in solid disc and ring of uniform thickness and varying thickness allowable speeds. Methods of computing contact stress-deflection of bodies in point and line contact applications.

REFERENCES:

TOTAL : 45 PERIODS
OUTCOME:
• With laboratory classes in conjunction, it helps the students to get familiarized with the
  computer graphics application in design. This understanding reinforces the knowledge being
  learned and shortens the overall learning curves which are necessary to solve CAE problems
  that arise in engineering.

UNIT I INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS 8
Output primitives (points, lines, curves etc.), 2-D & 3-D transformation (Translation, scaling,
rotators) windowing - viewports - clipping transformation.

UNIT II CURVES AND SURFACES MODELLING 10
Introduction to curves - Analytical curves: line, circle and conics – synthetic curves: Hermite cubic
spline- Bezier curve and B-Spline curve – curve manipulations.

Introduction to surfaces - Analytical surfaces: Plane surface, ruled surface, surface of revolution
and tabulated cylinder – synthetic surfaces: Hermite bicubic surface- Bezier surface and B-Spline
surface- surface manipulations.

UNIT III NURBS AND SOLID MODELING 9
NURBS- Basics- curves, lines, arcs, circle and bi linear surface. Regularized Boolean set
operations - primitive instancing - sweep representations - boundary representations - constructive
solid Geometry - comparison of representations - user interface for solid modeling.

UNIT IV VISUAL REALISM 9
Hidden – Line – Surface – solid removal algorithms shading – coloring. Introduction to parametric
and variational geometry based software’s and their principles creation of prismatic and lofted
parts using these packages.

UNIT V ASSEMBLY OF PARTS AND PRODUCT DATA EXCHANGE 9
Assembly modeling - interferences of positions and orientation - tolerances analysis - mass
property calculations - mechanism simulation.
Graphics and computing standards– Open GL Data Exchange standards – IGES, STEP etc–
Communication standards.

NOTE: LAB PRACTICE OF 30 HRS. TOTAL 45 + 30 = 75 HOURS
Laboratory session: Writing interactive programs generate graphics and to solve design problems -
using any languages like Auto LISP/ C / FORTRAN etc. Each assessment should contain a
component of Laboratory session.

REFERENCES:
4. Foley, Wan Dam, Feiner and Hughes – Computer graphics principles & practices, Pearson
5. David F. Rogers, James Alan Adams “Mathematical elements for computer graphics” second
OBJECTIVE:

- To impart knowledge on various concepts in engineering design and principles of implementing quality in a product or service through tools such as quality houses, control charts, statistical process control method, failure mode effect analysis and various strategies of designing experiments, methods to uphold the status of six sigma and improve the reliability of a product.

OUTCOME:

- It helps the design cum quality engineer to get familiarized with various concepts in design, quality and reliability principles in the design of an engineering product or a service.

UNIT I DESIGN FUNDAMENTALS, METHODS AND MATERIAL SELECTION


UNIT II DESIGN FOR QUALITY

Quality Function Deployment -House of Quality-Objectives and functions-Targets-Stakeholders- Measures and Matrices-Design of Experiments –design process-Identification of control factors, noise factors, and performance metrics - developing the experimental plan- experimental design – testing noise factors- Running the experiments –Conducting the analysis-Selecting and conforming factor-Set points-reflecting and repeating.

UNIT III FAILURE MODE EFFECT ANALYSIS AND DESIGN FOR SIX SIGMA

Basic methods: Refining geometry and layout, general process of product embodiment - Embodiment checklist- Advanced methods: systems modeling, mechanical embodiment principles-FMEA method- linking fault states to systems modeling - Basis of SIX SIGMA –Project selection for SIX SIGMA- SIX SIGMA problem solving- SIX SIGMA in service and small organizations - SIX SIGMA and lean production –Lean SIX SIGMA and services

UNIT IV DESIGN OF EXPERIMENTS

Importance of Experiments, Experimental Strategies, Basic principles of Design, Terminology, ANOVA, Steps in Experimentation, Sample size, Single Factor experiments - Completely Randomized design, Randomized Block design, Statistical Analysis, Multifactor experiments - Two and three factor full Factorial experiments, $2^k$ factorial Experiments, Confounding and Blocking designs, Fractional factorial design, Taguchi’s approach - Steps in experimentation, Design using Orthogonal Arrays, Data Analysis, Robust Design- Control and Noise factors, S/N ratios

UNIT V STATISTICAL CONSIDERATION AND RELIABILITY

Frequency distributions and Histograms- Run charts –stem and leaf plots- Pareto diagrams-Cause and Effect diagrams-Box plots- Probability distribution-Statistical Process control–Scatter diagrams –Multivariable charts –Matrix plots and 3-D plots.-Reliability-Survival and Failure-Series and parallel systems-Mean time between failure-Weibull distribution

REFERENCES:

ED8154 VIBRATION ANALYSIS AND CONTROL

OBJECTIVE:
- To understand the Fundamentals of Vibration and its practical applications
- To understand the working principle and operations of various vibration measuring instruments
- To understand the various Vibration control strategies

OUTCOME:
- To make the students understand the basics of vibration, its importance in engineering field.
  Since vibration is a critical problem today in engineering industries, the students are equipped with
  the working operations of various vibration measuring instruments, vibration control and
  analysis techniques in the engineering field.

UNIT I  FUNDAMENTALS OF VIBRATION

UNIT II  TWO DEGREE FREEDOM SYSTEM
Introduction-Free Vibration Of Undamped And Damped - Forced Vibration With Harmonic Excitation System –Coordinate Couplings And Principal Coordinates

UNIT III  MULTI-DEGREE FREEDOM SYSTEM AND CONTINUOUS SYSTEM
Multi Degree Freedom System –Influence Coefficients and stiffness coefficients- Flexibility Matrix and Stiffness Matrix – Eigen Values and Eigen Vectors-Matrix Iteration Method –Approximate Methods: Dunkerley, Rayleigh’s, and Holzer Method -Geared Systems-Eigen Values & Eigen vectors for large system of equations using sub space, Lanczos method - Continuous System: Vibration of String, Shafts and Beams

UNIT IV  VIBRATION CONTROL

UNIT V  EXPERIMENTAL METHODS IN VIBRATION ANALYSIS

TOTAL 45 + 30 = 75 PERIODS
" a Term Project must be given for Assessment – 3 (Compulsory)
MA8155 ADVANCED NUMERICAL METHODS

OBJECTIVE:
- To impart knowledge on numerical methods that will come in handy to solve numerically the problems that arise in engineering and technology. This will also serve as a precursor for future research.

OUTCOME:
- It helps the students to get familiarized with the numerical methods which are necessary to solve numerically the problems that arise in engineering.

UNIT I ALGEBRAIC EQUATIONS (9+3)

UNIT II ORDINARY DIFFERENTIAL EQUATIONS (9+3)
Runge Kutta Methods for system of IVPs, numerical stability, Adams-Bashforth multistep method, solution of stiff ODEs, shooting method, BVP: Finite difference method, orthogonal collocation method, orthogonal collocation with finite element method, Galerkin finite element method.

UNIT III FINITE DIFFERENCE METHOD FOR TIME DEPENDENT PARTIAL DIFFERENTIAL EQUATION (9+3)

UNIT IV FINITE DIFFERENCE METHODS FOR ELLIPTIC EQUATIONS (9+3)
Laplace and Poisson’s equations in a rectangular region: Five point finite difference schemes, Leibmann’s iterative methods, Dirichlet and Neumann conditions – Laplace equation in polar coordinates: finite difference schemes – approximation of derivatives near a curved boundary while using a square mesh.

UNIT V FINITE ELEMENT METHOD (9+3)

REFERENCES

ED8161 CAD LAB

OBJECTIVE:
- To impart knowledge on how to prepare drawings for various mechanical components using any commercially available 3D modeling software’s

OUTCOME:
- With laboratory classes, it helps the students to get familiarized with the computer applications in design and preparing drawings for various mechanical components.

- 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

Exercises in Modeling and drafting of Mechanical Components - Assembly using Parametric and feature based Packages like PRO-E / SOLID WORKS /CATIA / NX etc

TOTAL : 30 PERIODS

ED8201 BEHAVIOR OF ENGINEERING MATERIALS

OBJECTIVE:
- To know the mechanical behaviour of both metallic and non-metallic materials under different loading and temperature conditions.

OUTCOME:
- To familiarize the researchers in the area of material behaviour under different loading and selection of materials for the design of engineering structures.

UNIT I BASIC CONCEPTS OF MATERIAL BEHAVIOR


UNIT II BEHAVIOUR UNDER DYNAMIC LOADS AND DESIGN APPROACHES

Stress intensity factor and fracture toughness – Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law.- Safe life, Stress-life, strain-life and fail - safe design approaches -Effect of surface and metallurgical parameters on fatigue – Fracture of non metallic materials – Failure analysis, sources of failure, procedure of failure analysis.
UNIT III  SELECTION OF MATERIALS  8
Motivation for selection, cost basis and service requirements – Selection for mechanical properties, strength, toughness, fatigue and creep – Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing – Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications – Computer aided materials selection.

UNIT IV  MODERN METALLIC MATERIALS  8

UNIT V  NON METALLIC MATERIALS  7
Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TiC, TaC, Al₂O₃, SiC, Si₃N₄ CBN and diamond – properties, processing and applications.

REFERENCES:

ED8251  FINITE ELEMENT METHODS IN MECHANICAL DESIGN  3 1 0 4
OBJECTIVE:
• To develop a thorough understanding of the basic principles of the finite element analysis techniques with an ability to effectively use the tools of the analysis for solving practical problems arising in engineering design

OUTCOMES:
Upon understanding this course the students will be able to
• Understand how to mathematically model physical systems and solve using numerical techniques.
• Select appropriate element and boundary conditions for various 1D, 2D Boundary problems.
• Apply various solution techniques to solve Boundary value problems and Eigen value problems

UNIT I  FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL PROBLEMS  11+3
UNIT II  FINITE ELEMENT ANALYSIS OF TWO DIMENSIONAL PROBLEMS  10+3  

UNIT III  ISO-PARAMETRIC FORMULATION  8+3  

UNIT IV  SOLUTION TECHNIQUES  8+3  

UNIT V  SPECIAL TOPICS  8+3  

TOTAL  45 + 15 = 60 HOURS

NOTE
At the post-graduate level of instruction the contact hours are to be supplemented by self study by students. As for the examination, modelling considerations, choice of elements, boundary conditions, loading conditions, and basic procedures only need to be emphasized without expecting a complete numerical solution to practical problems.

REFERENCES:
OBJECTIVE:
- To know the integrated design procedure of different machine elements for mechanical applications.

OUTCOME:
- This will familiarize the students with the concepts of integration of design of machines and structures.

UNIT I FUNDAMENTALS AND DESIGN OF SHAFTS 8
Oblique stresses – Transformation Matrix – Principal stresses – Maximum shear stress - Theories of Failure – Ductile vs. brittle component design - Analysis and Design of shafts for different applications – integrated design of shaft, bearing and casing – Design for rigidity

UNIT II DESIGN OF GEARS AND GEAR BOXES 12

UNIT III BRAKES & CLUTCHES 7
Dynamics and thermal aspects of brakes and clutches – Integrated design of brakes and clutches for machine tools, automobiles and mechanical handling equipments.

UNIT IV INTEGRATED DESIGN 18
Integrated Design of systems consisting of shaft, bearings, springs, motor, gears, belt, rope, chain, pulleys, Cam & Follower, flywheel etc. Example - Design of Elevators, Escalators, Gear Box, Valve gear Mechanisms, Machine Tools

TOTAL: 45+15=60 PERIODS
The Pattern of Question Paper will consist one Question from Unit – 4 for 50% of total marks.
"a Term Project must be given for Assessment – 3 (Compulsory)

REFERENCES:

APPROVED DATA BOOKS
OBJECTIVE:
- To develop a thorough understanding of the various mechanisms and its design and simulation with an ability to effectively use the various mechanisms in real life problems.

OUTCOME:
- It helps the students to get familiarized with the advanced mechanisms which are necessary to design and simulate mechanisms.

UNIT I  INTRODUCTION

UNIT II  KINEMATIC ANALYSIS

UNIT III  PATH CURVATURE THEORY, COUPLER CURVE
Fixed and moving centrodes, inflection points and inflection circle. Euler Savary equation, graphical constructions – cubic of stationary curvature. Four bar coupler curve-cusp-crunode-coupler driven six-bar mechanisms-straight line mechanisms

UNIT IV  SYNTHESIS OF FOUR BAR MECHANISMS

UNIT V  SYNTHESIS OF COUPLER CURVE BASED MECHANISMS & CAM MECHANISMS
Study and use of Mechanism using Simulation Soft-ware packages. Students should design and fabricate a mechanism model as term project.

Note: Tutorial/Practice: 30 Hrs TOTAL 45 + 30 = 75 PERIODS
" a Term Project must be given for Assessment – 3 (Compulsory)

REFERENCES:
ED8211 DESIGN PROJECT

OBJECTIVE:
- It is proposed to carry out detailed design calculations and analysis of any mechanical component or mechanical system. This helps the students to get familiar with respect to the design methodologies applied to any component or mechanical system subjected to static, dynamic and thermo-mechanical loads.

OUTCOME:
- It helps the students to get familiarized with respect to design standards, design calculations and analysis in designing any mechanical component or system.

Each student is required to select any new component or an integrated mechanical system that involves various sub components which are to be designed as per design standards and further required to be analyzed for optimum dimensions with respect to the strength and stiffness.

TOTAL: 45 PERIODS

ED8261 ANALYSIS AND SIMULATION LAB

OBJECTIVE:
- At the end of this course the students would have developed a thorough understanding of the Computer Aided Finite Element Analysis packages with an ability to effectively use the tools of the analysis for solving practical problems arising in engineering design

OUTCOME:
- It helps the students to get familiarized with the Computer Aided Finite Element Analysis packages which are necessary to solve the engineering problems numerically.

Analysis of Mechanical Components – Use of FEA Packages like ANSYS/ NASTRAN etc., Exercises shall include analysis of

i) Machine elements under Static loads
ii) Thermal Analysis of mechanical systems
iii) Modal Analysis
iv) Machine elements under Dynamic loads
v) Non-linear systems

Use of kinematics and dynamics simulation software like ADAMS, MATLAB. Analysis of velocity and acceleration for mechanical linkages of different mechanisms.

TOTAL: 30 PERIODS

ED8001 ADVANCED METAL FORMING TECHNIQUES

OBJECTIVES:
- To study the concepts of latest metal forming techniques and their applications in metal forming industry.
- To study the thermo mechanical regimes and its requirements of metal forming

OUTCOME:
- The course would familiarize the students on the latest metal forming techniques and help them decide on the suitable method to form the metals for various industrial applications.

UNIT II THEORY AND PRACTICE OF BULK FORMING PROCESSES Analysis of plastic deformation in Forging, Rolling, Extrusion, rod/wire drawing and tube drawing – Effect of friction – calculation of forces, work done – Process parameters, equipment used – Defects – applications – Recent advances in Forging, Rolling, Extrusion and Drawing processes – Design consideration in forming - Formability of laminated sheet - Overview of FEM applications in Metal Forming analysis.

UNIT III SHEET METAL FORMING Formability studies – Conventional processes – H E R F techniques – Superplastic forming techniques – Hydro forming – Stretch forming – Water hammer forming – Principles and process parameters – Advantage, Limitations and application


TOTAL: 45 PERIODS

REFERENCES:
2. Proceedings of International Workshop on EMFT 2010, Anna University

ED8002 PLATES AND SHELLS

OBJECTIVE:
- To impart knowledge on the behavior of plates and shell elements, their places of utility and of course the design procedure of such elements in practical applications.

OUTCOME:
- After undergoing this course, the students would be in a position to understand the behaviour of these commonly occurring structural elements in engineering design and would have developed the capability to design and analyse them in their normal design practice.
UNIT I  GENERAL INTRODUCTION
Review of equations of elasticity- kinematics, compatibility equations, stress measures- equations of motions- constitutive relations- transformation of stresses, strains and stiffness-energy principles and variational methods in elasticity- virtual work-external and internal virtual work-variational operator- functionals- Euler Lagrange equations- energy principles- Hamilton's principle- principle of minimum total potential- applications

UNIT II  CLASSICAL THEORY OF PLATES
Plates as structural elements- stress and moment resultants- assumptions made in the classical theory- displacement fields and strains- equations of equilibrium in Cartesian coordinates and in polar coordinates- boundary conditions- bending of rectangular plates with various boundary conditions and loading- symmetrical and asymmetrical bending of circular plates-limitations of classical theory- finite element analysis(elementary treatment only; discussion of various elements used and their capabilities- not for examination)

UNIT III  BUCKLING ANALYSIS OF RECTANGULAR PLATES
Buckling of simply supported plates under compressive forces- governing equations- the Navier solution- biaxial compression of a plate- uniaxial compression of a plate- buckling of plates simply supported on two opposite edges- Levy’s solution- buckling of plates with various boundary conditions- general formulation- finite element analysis(elementary treatment only; discussion of various elements used and their capabilities- not for examination)

UNIT IV  VIBRATION OF PLATES
Governing equations for natural flexural vibrations of rectangular plates- natural vibrations of plates simply supported on all edges- vibration of plates with two parallel sides simply supported- Levy’s solution- vibration of plates with different boundary conditions- Rayleigh-Ritz method-Natural vibration of plates with general boundary conditions- transient analysis of rectangular plates- finite element analysis(elementary treatment only; discussion of various elements used and their capabilities- not for examination)

UNIT V  ANALYSIS OF THIN ELASTIC SHELLS OF REVOLUTION
Classification of shell surfaces- geometric properties of shells of revolution- general strain displacement relations for shells of revolution- stress resultants- equations of motion of thin shells-analytical solution for thin cylindrical shells- membrane theory- flexure under axisymmetric loads-shells with double curvature- geometric considerations- equations of equilibrium- bending of spherical shells- vibration of cylindrical shells- finite element analysis(elementary treatment only; discussion of various elements used and their capabilities- not for examination)

TOTAL: 45 PERIODS

REFERENCES:
4. Wilhelm Flügge, stresses in shells, Springer - Verlag
7. Dr.N.Subramanian, Principles of Space Structures, Wheeler Publishing Co. 1999
OBJECTIVE:
- To impart knowledge on surface engineering and surface modification methods that will come in handy to solve the industrial problems. This will also serve as a precursor for future research in the same field.

OUTCOME:
- It helps the students to get familiarized with the various theories and practice on surface engineering and surface modification methods which are necessary to solve the industrial practical problems that arise and also for the research.

UNIT I  FRICTION  7
Topography of Surfaces – Surface features – Properties and measurement – Surface interaction – Adhesive Theory of Sliding Friction – Rolling Friction – Friction properties of metallic and non-metallic materials – Friction in extreme conditions – Thermal considerations in sliding contact

UNIT II  WEAR  6

UNIT III  CORROSION  10

UNIT IV  SURFACE TREATMENTS  12

UNIT V  ENGINEERING MATERIALS  10

TOTAL: 45 PERIODS

REFERENCES
ED8071 ADVANCED FINITE ELEMENT ANALYSIS

OBJECTIVE:
- To develop a thorough understanding of the advanced finite element analysis techniques with an ability to effectively use the tools of the analysis for solving practical problems arising in engineering design.

OUTCOME:
- It helps the students to get familiarized with the advanced finite element analysis techniques which are necessary to solve the engineering problems.

UNIT I BENDING OF PLATES AND SHELLS
Review of Elasticity Equations – Bending of Plates and Shells – Finite Element Formulation of Plate and Shell Elements - Conforming and Non Conforming Elements – \( C_0 \) and \( C_1 \) Continuity Elements – Degenerated shell elements – Application and Examples.

UNIT II NON-LINEAR PROBLEMS

UNIT III DYNAMIC PROBLEM

UNIT IV FLUID MECHANICS AND HEAT TRANSFER

UNIT V ERROR ESTIMATES AND ADAPTIVE REFINEMENT
Error norms and Convergence rates – \( h \)-refinement with adaptivity – Adaptive refinement.

TOTAL: 45 PERIODS

REFERENCES:

ED8072 BEARING DESIGN AND ROTOR DYNAMICS

OBJECTIVE:
- To know about different types of bearings available for machine design and their operating principles.
- To design hydrodynamic/ hydrostatic / rolling bearing for given specifications and analyze the bearings for their performance.
- To understand the bearing behavior under dynamic conditions.

OUTCOME:
- Acquisition of knowledge in the analysis of all types of bearings.
- Ability to make specifications of all types of bearings.
- Skill for conducting dynamic / vibration analysis and trouble shooting of bearings.
UNIT I  CLASSIFICATION AND SELECTION OF BEARINGS  6
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  DESIGN OF FLUID FILM BEARINGS  10
Design and performance analysis of Thrust and Journal bearings – Full, partial, fixed and pivoted
journal bearings design procedure-Minimum film thickness – lubricant flow and delivery – power
loss, Heat and temperature distribution calculations- Design based on Charts & Tables and
Experimental curves-Design of Foil bearings-Air Bearings- Design of Hydrostatic bearings-Thrust
and Journal bearings- Stiffness consideration - flow regulators and pump design

UNIT III  SELECTION AND DESIGN OF ROLLING BEARINGS  10
Contact Stresses in Rolling bearings- Centrifugal stresses-Elasto hydrodynamic lubrication-
Fatique 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  DYNAMICS OF HYDRODYNAMIC BEARINGS  10
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 DYNAMICS  9
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

TOTAL:  45 PERIODS

REFERENCES:
   Ltd , New Delhi, 2005

ED8073  COMPOSITE MATERIALS AND MECHANICS  L T P C
                                      3 0 0 3

OBJECTIVE
• To understand the fundamentals of composite material strength and its mechanical behavior
• Understanding the analysis of fiber reinforced Laminate design for different combinations of
  plies with different orientations of the fiber.
• Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
• Implementation of Classical Laminate Theory (CLT) to study and analysis for residual
  stresses in an isotropic layered structure such as electronic chips.

OUTCOME
• At the end of the course the students will be in position to understand the mechanics and
design related to layered components such as fiber reinforced polymer composites, isotropic
layered structures (example electronic chips) etc and its manufacturing methodologies.
UNIT I  INTRODUCTION TO COMPOSITE MATERIALS  10

UNIT II  MANUFACTURING OF COMPOSITES  10
Manufacturing of Polymer Matrix Composites (PMCs)-handlay-up, spray technique, filament winding, Pultrusion, Resin Transfer Moulding (RTM)-, bag moulding, injection moulding, Sandwich Mould Composites (SMC) - Manufacturing of Metal Matrix Composites (MMCs) - Solid state, liquid state, vapour state processing, Manufacturing of Ceramic Matrix Composites (CMCs) –hot pressing-reaction bonding process-infiltration technique, direct oxidation- interfaces

UNIT III  INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS  12

UNIT IV  LAMINA STRENGTH ANALYSIS AND ANALYSIS OF LAMINATED FLAT PLATES  8

UNIT V  THERMAL ANALYSIS  5

TOTAL: 45 PERIODS

REFERENCES:
OBJECTIVE:
• To know the concept of design for manufacturing, assembly and environment.
• To know the computer application in design for manufacturing and assembly.

OUTCOME:
• To make the students get acquainted with the design for manufacturing, assembly and environment.

UNIT I INTRODUCTION 5
General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances Geometric tolerances - Assembly limits -Datum features - Tolerance stacks.

UNIT II FACTORS INFLUENCING FORM DESIGN 13
Working principle, Material, Manufacture, Design- Possible solutions - Materials choice - Influence of materials on form design - form design of welded members, forgings and castings.

UNIT III COMPONENT DESIGN - MACHINING CONSIDERATION 8

UNIT IV COMPONENT DESIGN – CASTING CONSIDERATION 10
Redesign of castings based on Parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores. Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA

UNIT V DESIGN FOR THE ENVIRONMENT 9

TOTAL: 45 PERIODS

REFERENCES:
OBJECTIVE:
• To impart students on the science, use and application of hydraulics and pneumatics as fluid power in Industry. Also to impart knowledge on the methodology of basic and advanced design of pneumatics and hydraulics systems.

OUTCOME:
• It helps students to get knowledge on the need, use and application of fluid power and make them familiar to industrial design that lead to automation.

UNIT I  OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS  5
Hydraulic Power Generators – Selection and specification of pumps, pump characteristics. Linear and Rotary Actuators – selection, specification and characteristics.

UNIT II  CONTROL AND REGULATION ELEMENTS  12
Pressure - direction and flow control valves - relief valves, non-return and safety valves - actuation systems.

UNIT III  HYDRAULIC CIRCUITS  5

UNIT IV  PNEUMATIC SYSTEMS AND CIRCUITS  16
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  INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS  7
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  
MATERIALS HANDLING EQUIPMENT  
Types, selection and applications  

UNIT II  
DESIGN OF HOISTS  

UNIT III  
DRIVES OF HOisting GEAR  
Hand and power drives - Traveling gear - Rail traveling mechanism - cantilever and monorail cranes - slewing, jib and luffing gear - cogwheel drive - selecting the motor ratings.  

UNIT IV  
CONVEYORS  
Types - description - design and applications of Belt conveyors, apron conveyors and escalators - Pneumatic conveyors, Screw conveyors and vibratory conveyors.  

UNIT V  
ELEVATORS  
Bucket elevators: design - loading and bucket arrangements - Cage elevators - shaft way, guides, counter weights, hoisting machine, safety devices - Design of fork lift trucks.  

TOTAL: 45 PERIODS  

REFERENCES  

ED8077  
DESIGN OF PRESSURE VESSELS AND PIPING  
L T P C  
3 0 0 3  

OBJECTIVE  
• The main objective is to present the industrial related problems, procedures and design principles for pressure vessels and enhance the understanding of design procedure of pressure vessel and Design of piping layout.  

OUTCOME  
• It helps the student to get familiarized with the various theories and practice on pressure vessel and piping design and procedures which are necessary to solve the industrial practical problems that arise and also for the research in the field of pressure vessel design.  

UNIT I  
INTRODUCTION  

UNIT II  
STRESSES IN PRESSURE VESSELS  
UNIT III DESIGN OF VESSELS
Design of Tall cylindrical self supporting process columns – Supports for short, vertical and horizontal vessels – stress concentration – at a variable Thickness transition section in a cylindrical vessel, about a circular hole, elliptical openings. Theory of Reinforcement – pressure vessel Design. Introduction to ASME pressure vessel codes

UNIT IV BUCKLING OF VESSELS
Buckling phenomenon – Elastic Buckling of circular ring and cylinders under external pressure – collapse of thick walled cylinders or tubes under external pressure – Effect of supports on Elastic Buckling of Cylinders – Buckling under combined External pressure and axial loading.

UNIT V PIPING

TOTAL: 45 PERIODS

REFERENCES

ED8078 ENGINEERING FRACTURE MECHANICS
L T P C 3 0 0 3

OBJECTIVE:
- To impart knowledge on mechanics of cracked components of different modes by which these components fail under static load conditions.
- To impart knowledge on mechanics of cracked components of different modes by which these components fail under fatigue load conditions.

OUTCOME:
- It helps the engineers to get familiarized with the design of components that contain crack under static load condition.
- It helps the engineers to get familiarized with the design of components that contain crack and its growth under fatigue load condition.

UNIT I ELEMENTS OF SOLID MECHANICS
The geometry of stress and strain, elastic deformation, plastic and elasto-plastic deformation - limit analysis – Airy’s function – field equation for stress intensity factor.

UNIT II STATIONARY CRACK UNDER STATIC LOADING

UNIT III ENERGY BALANCE AND CRACK GROWTH
UNIT IV  FATIGUE CRACK GROWTH CURVE  9
Empirical relation describing crack growth law – life calculations for a given load amplitude – effects of changing the load spectrum -- rain flow method– external factors affecting the K1c values.- leak before break analysis.

UNIT V  APPLICATIONS OF FRACTURE MECHANICS  9
Crack Initiation under large scale yielding – thickness as a design parameter – mixed mode fractures - crack instability in thermal and residual stress fields - numerical methods

REFERENCES:

ED8079  MODAL ANALYSIS OF MECHANICAL SYSTEMS  L T P C  3 0 0 3

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

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

UNIT I  OVERVIEW  6

UNIT II  THEORETICAL BASIS  12

UNIT III  MOBILITY MEASUREMENT TECHNIQUES  10

UNIT IV  MODAL PARAMETER EXTRACTION METHODS  11
UNIT V DERIVATION OF MATHEMATICAL MODELS

REFERENCES:

TOTAL: 45 PERIODS

ED8080 OPTIMIZATION TECHNIQUES IN DESIGN

OBJECTIVE:
• To impart knowledge on various categories of existing engineering problems and solutions to such problems through different optimization techniques and approaches.

OUTCOME:
• It helps the engineers to get familiarized with the different approaches of optimizing (maximizing or minimizing) an engineering problem or a function which is essentially required in industries today.

UNIT I UNCONSTRAINED OPTIMIZATION TECHNIQUES
Introduction to optimum design - General principles of optimization – Problem formulation & their classifications - Single variable and multivariable optimization, Techniques of unconstrained minimization – Golden section, Random, pattern and gradient search methods – Interpolation methods.

UNIT II CONSTRAINED OPTIMIZATION TECHNIQUES
Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions, Lagrange multipliers - Geometric programming

UNIT III ADVANCED OPTIMIZATION TECHNIQUES
Multi stage optimization – dynamic programming; stochastic programming; Multi objective optimization, Genetic algorithms and Simulated Annealing techniques; Neural network & Fuzzy logic principles in optimization.

UNIT IV STATIC APPLICATIONS

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

TOTAL: 45 PERIODS

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

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

UNIT I  SURFACE INTERACTION AND FRICTION  7

UNIT II  WEAR AND SURFACE TREATMENT  8

UNIT III  LUBRICANTS AND LUBRICATION REGIMES  8

UNIT IV  THEORY OF HYDRODYNAMIC AND HYDROSTATIC LUBRICATION  12
Reynolds Equation, - Assumptions and limitations-One and two dimensional Reynolds Equation-Reynolds and Sommerfeld boundary conditions - Pressure wave, flow, load capacity and friction calculations in Hydrodynamic bearings - Long and short bearings - Pad bearings and Journal bearings - Squeeze film effects - Thermal considerations- Hydrostatic lubrication of Pad bearing - Pressure, flow, load and friction calculations - Stiffness considerations - Various types of flow restrictors in hydrostatic bearings.

UNIT V  HIGH PRESSURE CONTACTS AND ELASTO HYDRODYNAMIC LUBRICATION  10
Rolling contacts of Elastic solids- contact stresses – Hertzian stress equation – Spherical and cylindrical contacts- Contact Fatigue life – Oil film effects – Elasto Hydrodynamic lubrication Theory- Soft and hard EHL-Reynolds equation for elasto hydrodynamic lubrication - Film shape within and outside contact zones - Film thickness and friction calculation- Rolling bearings - Stresses and deflections - Traction drives.

TOTAL: 45 PERIODS

REFERENCES:
OBJECTIVES

- To develop finite difference and finite volume discretized forms of the CFD equations.
- To formulate explicit & implicit algorithms for solving the Euler Equations & Navier Strokes Equations.

OUTCOME

- On successful completion of this course the student will be able to apply concept of CFD to analyse flow in thermal systems.

UNIT I GOVERNING DIFFERENTIAL EQUATIONS AND FINITE DIFFERENCE METHOD

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 CONDUCTION HEAT TRANSFER BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD

Steady one-dimensional conduction, Two and three dimensional steady state problems, Transient one-dimensional problem, Two-dimensional Transient Problems.

UNIT III CONVECTION HEAT TRANSFER BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD


UNIT IV INCOMPRESSIBLE FLUID FLOW BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD

Governing Equations, Stream Function – Vorticity method, Determination of pressure for viscous flow, SIMPLE, Computation of Boundary layer flow - Finite difference approach.

UNIT V FINITE ELEMENT METHOD AND TURBULENCE MODELS


REFERENCES