Textbooks and Notes:

- Instructor’s Lecture Notes

Reference:

ISBN 0-07-286845-7

Course Description:

This is a course introducing basic concepts of CAD (Computer Aided Design) and structural and thermal as applied to Mechanical Engineering design problems. Topics include geometric modeling, computer graphics, projections, database, mechanism design, structure and thermal FEA (Finite Element Analysis), optimization for design models. The laboratory component involves use of current CAD software packages for mechanical design.

Prerequisites: CIS 101, Math 222

Miscellaneous:

- NJIT Academic Honor Code will be upheld, and any violations will be brought to the immediate attention of the Dean of Students – visit http://www.njit.edu/academics/honorcode.php.
- For any modifications or deviations from the syllabus throughout the course of the semester, instructor will consult with students and the students must agree to.

Course Outline1[1] : Lectures

<table>
<thead>
<tr>
<th>Session Number</th>
<th>TOPICS</th>
<th>ASSIGNMENTS</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Course Introduction, Product Life Cycle and Roles of CAD in Design Process (Synthesis and Analysis)</td>
<td>Shaft, Base Support &amp; Helical Extension Spring</td>
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<td></td>
<td>Structure of Software GUI and Basic &amp; Advanced Types of Protrusion</td>
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<td>2</td>
<td>CAD/CAM Hardware – CAD/CAM Systems – Hardware Configurations (Mainframe, Workstation and PC Configurations).</td>
<td>Hammer Handle, Tray &amp; Cam</td>
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<td></td>
<td>Graphics Displays hardware in Computer Graphics</td>
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<td>3</td>
<td>CAD/CAM Hardware – Hardware Integration and Networking.</td>
<td>Windmill, Razor Handle &amp; Ball Bearing</td>
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<td>4</td>
<td>Model Representation Schemes – Wireframe Modeling, Surface</td>
<td>Clip, Bottle &amp;</td>
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<td>No.</td>
<td>Topic</td>
<td>Details</td>
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<td>5</td>
<td>Modeling, and Solid Model Creation Techniques (Constructive Solid Geometry, Boolean Operations, and Parametric Modeling)</td>
<td>Pump Housing</td>
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<td>Dimensioning &amp; Tolerancing Techniques</td>
<td>Involute Spur Gear, Detailed Drawing of Shaft &amp; Cotter Pin Using Family Table</td>
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<td>Multi-view Projections &amp; Auxiliary View Type of Sectional Views</td>
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<td>7</td>
<td>Curves Representation – Analytical and Free Form Curves: Bezier, B-Spline &amp; NURBS</td>
<td>Bicycle Chain Assembly, Crankshaft Balancing and Optimization &amp; Eccentric Mechanism</td>
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<td>Assembly Design Modeling – Assembly Constraints</td>
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<td>Optimization</td>
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<td>Mechanism Design – Kinematics and Dynamics Analyses in CAD.</td>
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<td>8</td>
<td><strong>Mid-term Exam I</strong></td>
<td>Oscillating Cam Mechanism &amp; Exercise Machine</td>
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<td>9</td>
<td>Mechanism Design – Type of Joints and Degree of Freedom in Mechanism Design</td>
<td>Car Wheel, Plastic Advisor Analysis of Tray &amp; Bike Wrench Structural Analysis</td>
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<td>Theory of Failures – von Mises Stress etc.</td>
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<td>Introduction to Plastic Injection Machines</td>
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<td>10</td>
<td>Finite Element Analysis (FEA) – P-Method and H-Method, Steps in FEA Modeling, Convergence Techniques</td>
<td>Torsional Analysis &amp; Transient and Steady State Thermal Analysis</td>
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<tr>
<td>11</td>
<td>FEA – 2-D and 3-D Analysis, Element Types, Singularities</td>
<td>Project I – Belt Tightener</td>
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<td>12</td>
<td>Matrices of Geometric Transformation – Translation, Scaling, Reflection &amp; Rotation</td>
<td>Project I – Belt Tightener</td>
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<tr>
<td>13</td>
<td>Standards Exchange Between CAD Systems – Direct method and Neutral files (IGES, DXF, and STEP)</td>
<td>Project II – Welder Arm</td>
</tr>
<tr>
<td>14</td>
<td>Review</td>
<td>Project II – Welder Arm</td>
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</tbody>
</table>
Homework related to the lectures will be assigned, collected and graded.

The laboratory will be in MEC-219, and will have hands-on sessions to cover the basics and advanced features of Pro/ENGINEER.

**SUBMITTED ASSIGNMENT FORMAT:**

Projects / assignments should be submitted according to the following format:

Grading Scheme:

The grade will be based on the following:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Lab Works - Assignments</td>
<td>30%</td>
</tr>
<tr>
<td>Project I &amp; II</td>
<td>20%</td>
</tr>
<tr>
<td>Mid-term Exam</td>
<td>20%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>30%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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</table>

*Note: Assignments may vary as determined by your instructor.*

**Sample of Title Page:**
ME-430 Introduction to Computer Aided Design

AT NEW JERSEY INSTITUTE OF TECHNOLOGY

Name of Assignment/Project

by

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Instructor: Dr. Herli Surjanhata

May 22, 2006