EDSGN 497K  Engineering Design and Analysis with CATIA (3.0 Credits)

SPRING 2009 (January 12 – May 1)

Course instructor: Xinli Wu, P.E.
Phone number: (814)863-1537
Fax number: (814)863-7229
E-mail address: Xinli@psu.edu
Teaching Assistant: Michael A. Opdyke, Email: mao5040@psu.edu

Course Number, Class Time, and Place: EDSGN 497K: 4:40 – 7:00 PM, Thursday, 315 Hammond
Office hours & location: 1:30 – 2:20 PM Tuesday, Thursday, and/or by appointments, 213-S Hammond

Prerequisites: Junior standing or above in an engineering major with knowledge of E MCH 210 and 211 or equivalent (approved by the instructor).

Course overview and objectives:

The main objectives of this course are for students to learn how to use CATIA as a design tool to build parts and assemblies, and how to make drawings of those parts and assemblies; Students will learn the basic FEA (Finite Element Analysis) capabilities in CATIA V5 to conduct structural analysis and computer simulation of designs. Students will learn how to generate models, establish meshes, apply boundary conditions, loads, and material properties to the model for structural analysis, and then generate FEA report. CATIA is a robust application that makes creating rich and complex designs possible. This course focuses on the fundamental skills and concepts that enable students to create a solid foundation for their designs and analyses. Through various exercises, design projects with rapid prototyping model, and building design portfolios, students will be one step readier as they move into the real workforce.


## Course Calendar:

<table>
<thead>
<tr>
<th>Week</th>
<th>Day/Date</th>
<th>Course content</th>
<th>Text</th>
</tr>
</thead>
</table>
| 1    | Tuesday (1/13) | • Intro. To the course
        • Introduction to CATIA V5
        • Practice Exercises 1-5 on p. 1.16 | Cozzens, Chap. 1          |
|      | Thursday (1/15)| • Navigating the CATIA V5 Environment
        • Practice Exercises 1-5 on p. 2.40 | Cozzens, Chap. 2          |
| 2    | Tuesday (1/20) | • Sketcher
        • Practice Exercises 3 on p. 3.47 | Cozzens, Chap. 3          |
|      | Thursday (1/22)| • Part Design
        • Practice Exercises 3 on p. 4.51 | Cozzens, Chap. 4          |
| 3    | Tuesday (1/27) | • Drafting: creating sheets and views
        • Practice Exercises 3 on p. 5.40 | Cozzens, Chap. 5          |
|      | Thursday (1/29)| • Drafting: creating text and dimensions
        • Practice Exercises 3 on p. 6.36 | Cozzens, Chap. 6          |
| 4    | Tuesday (2/3) | • Complex and Multiple Sketch Parts
        • Practice Exercises 3 on p. 7.44 | Cozzens, Chap. 7          |
|      | Thursday (2/5) | • Assembly Design
        • Practice Exercises 4 on p. 8.37 | Cozzens, Chap. 8          |
| 5    | Tuesday (2/10)| • Generative Shape Design: creating surfaces
        • Practice Exercises 2 on p. 9.47 | Cozzens, Chap. 9          |
|      | Thursday (2/12)| • Generative Shape Design: creating surface geometry using the sweep tool
        • Practice Exercises 1-8 on p. 10.34-10.35 | Cozzens, Chap. 10         |
| 6    | Tuesday (2/17) | • DMU Navigator
        • Practice Exercises 1 on p. 11.28 | Cozzens, Chap. 11         |
|      | Thursday (2/19)| • Real Time Rendering
        • Practice Exercises 1 on p. 12.27 | Cozzens, Chap. 12         |
<table>
<thead>
<tr>
<th>Week</th>
<th>Tuesday (2/24)</th>
<th>Thursday (2/26)</th>
<th>Handouts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>● Parametric Design</td>
<td>● <strong>Mini Design Project</strong> (Due 3/31/09)</td>
<td>Cozzens, Chap. 13</td>
</tr>
<tr>
<td></td>
<td>● Practice Exercises 3 on p. 13.28</td>
<td>● <strong>Advanced CATIA Design Example 1</strong></td>
<td></td>
</tr>
<tr>
<td>Week 8</td>
<td>Tuesday (3/3)</td>
<td>Thursday (3/5)</td>
<td>Handouts</td>
</tr>
<tr>
<td></td>
<td>● <strong>Final Design Project</strong> (Due 4/30/09)</td>
<td>● Introduction to Finite Element Analysis</td>
<td>Zamani, Chap. 1</td>
</tr>
<tr>
<td></td>
<td>● Guidelines for online design portfolio</td>
<td>● Capabilities and limitations of the FEA in CATIA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● <strong>Advanced CATIA Design Example 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 9</td>
<td>March 9 - 13</td>
<td>Spring Break, No Classes</td>
<td></td>
</tr>
<tr>
<td>Week 10</td>
<td>Tuesday (3/17)</td>
<td>Thursday (3/19)</td>
<td>Zamani, Chap. 2</td>
</tr>
<tr>
<td></td>
<td>● Analysis of a Bent Rod with Solid Elements</td>
<td>● Axially Loaded Block with Stress Concentration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Practice Exercises 1 on p. 2-20</td>
<td>● Practice Exercises 1 on p. 3-22</td>
<td></td>
</tr>
<tr>
<td>Week 11</td>
<td>Tuesday (3/24)</td>
<td>Thursday (3/26)</td>
<td>Zamani, Chap. 3</td>
</tr>
<tr>
<td></td>
<td>● Stress Analysis of a Rotating Disk</td>
<td>● Deformation of an I-beam under Self-weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Practice Exercises 1 on p. 4-23</td>
<td>● Practice Exercises 1 on p. 5-13</td>
<td></td>
</tr>
<tr>
<td>Week 12</td>
<td>Tuesday (3/31)</td>
<td>Thursday (4/2)</td>
<td>Zamani, Chap. 4</td>
</tr>
<tr>
<td></td>
<td>● C-clamp Deformed with Enforced Displacement</td>
<td>● FEA Modeling of the Bent Rod with beam Elements</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Practice Exercises 1 on p. 6-12</td>
<td>● Practice Exercises 1 on p. 7-13</td>
<td></td>
</tr>
<tr>
<td>Week 13</td>
<td>Tuesday (4/7)</td>
<td>Thursday (4/9)</td>
<td>Zamani, Chap. 5</td>
</tr>
<tr>
<td></td>
<td>● Bending of a Notched Specimen with Smooth Virtual Part</td>
<td>● Modeling Mismatch in Shell thickness and Surface Mesh</td>
<td></td>
</tr>
<tr>
<td></td>
<td>● Practice Exercises 1 on p. 9-18</td>
<td>● Practice Exercises 1 on p. 11-18</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Zamani, Chap. 11</td>
</tr>
</tbody>
</table>
Class Policies:

The following are some ground rules to help us maintain a steady progress through the semester:

1. Punctual attendance is mandatory for all the class periods. Course grade will be dropped to the next lower grade for every class missed. All excused absences must be supported by written documentation, such as doctor's receipt, Penn State athletics travel notice, ROTC notice, etc.
2. No cell phone is permitted in the classroom.

Academic Integrity:

Senate Policy 49-20 Academic Integrity
Definition and expectations: Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts.

Academic integrity includes a commitment not to engage in or tolerate acts of falsification, misrepresentation or deception. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others.

The Penn State Principles:
1. I will respect the dignity of all individuals within the Penn State community;
2. I will practice academic integrity;
3. I will demonstrate social and personal responsibility;
4. I will be responsible for my own academic progress and agree to comply with all University policies.

Related sites:
- Academic integrity, http://www.psu.edu/ufs/policies/47-00.html - 49-20

Grading System:

• In-class exercises and homework assignments: 50%
• Mini-Design Project with Rapid Prototyping: 15%
• Design Project and Design Portfolios: 35%