

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

SPRING 2012 (January 09 – April 27)

<http://www.engr.psu.edu/xinli/EDSGN497K/>

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Course Number, Class Time, and Place: EDSGN 497K: 4:40 – 6:35 PM, Tuesday and Thursday,
315 Hammond

Office hours & location: 1:10 – 2:00 PM, Thursday, and/or by appointments,
213 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 course objectives are to understand how engineering design efforts are supported through the use of advanced Computer Aided Design (CAD). Advanced CAD makes creating rich and complex designs possible. Advanced CAD (in this offering CATIA V5) is used as a design tool to build parts and assemblies, and to create drawings of those parts and assemblies. Students will learn basic FEA (Finite Element Analysis) capabilities 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 an FEA report. Through various exercises, design projects with rapid prototyping models, and building design portfolios, students will obtain a solid foundation in the use of advanced CAD for their designs and engineering analyses.

Textbook: Richard Cozzens (2009), CATIA V5 Workbook, Release 19, SDC Publications. ISBN 978-1-58503-544-1 (Available at Penn State Bookstore or online bookstore: www.schroff.com).

Nader G. Zamani (2011), [CATIA V5 FEA Tutorials](#), Release 20, SDC Publications. ISBN: 978-1-58503-654-7 (Available at Penn State Bookstore or online bookstore: www.schroff.com).

Course Calendar:

Week	Day/Date	Course content	Text
Week 1	Tuesday (1/10)	<ul style="list-style-type: none">• Intro. to the course• Introduction to CATIA V5• Practice Exercises 1-5 on p. 1.16	Cozzens, Chap. 1
	Thursday (1/12)	<ul style="list-style-type: none">• Navigating the CATIA V5 Environment• Practice Exercises 1-5 on p. 2.40	Cozzens, Chap. 2
Week 2	Tuesday (1/17)	<ul style="list-style-type: none">• Sketcher• Practice Exercises 3 on p. 3.47	Cozzens, Chap. 3
	Thursday (1/19)	<ul style="list-style-type: none">• Part Design• Practice Exercises 3 on p. 4.51	Cozzens, Chap. 4
Week 3	Tuesday (1/24)	<ul style="list-style-type: none">• Drafting: creating sheets and views• Practice Exercises 3 on p. 5.42	Cozzens, Chap. 5
	Thursday (1/26)	<ul style="list-style-type: none">• Drafting: creating text and dimensions• Practice Exercises 3 on p. 6.31	Cozzens, Chap. 6
Week 4	Tuesday (1/31)	<ul style="list-style-type: none">• Complex and Multiple Sketch Parts• Practice Exercises 3 on p. 7.40	Cozzens, Chap. 7
	Thursday (2/2)	<ul style="list-style-type: none">• Assembly Design• Practice Exercises 4 on p. 8.38	Cozzens, Chap. 8
Week 5	Tuesday (2/7)	<ul style="list-style-type: none">• Generative Shape Design: creating surfaces• Practice Exercises 2 on p. 9.47	Cozzens, Chap. 9
	Thursday (2/9)	<ul style="list-style-type: none">• Generative Shape Design: creating surface geometry using the sweep tool• Practice Exercises 1-8 on p. 10.26-10.28	Cozzens, Chap. 10
Week 6	Tuesday (2/14)	<ul style="list-style-type: none">• DMU Navigator• Practice Exercises 1 on p. 11.29	Cozzens, Chap. 11
	Thursday (2/16)	<ul style="list-style-type: none">• Real Time Rendering• Practice Exercises 1 on p. 12.27	Cozzens, Chap. 12
	Tuesday (2/21)	<ul style="list-style-type: none">• Parametric Design• Practice Exercises 3 on p. 13.29	Cozzens, Chap. 13

Week 7	Thursday (2/23)	<ul style="list-style-type: none"> • <u>Mini Design Project (Due 3/29/2012)</u> • Advanced CATIA Design Example 1 	Handouts
Week 8	Tuesday (2/27)	<ul style="list-style-type: none"> • <u>Final Design Project (Due 4/26/2012)</u> • <u>Guidelines for online design portfolio</u> • Advanced CATIA Design Example 2 	Handouts
	Thursday (3/1)	<ul style="list-style-type: none"> • Introduction to Finite Element Analysis • Capabilities and limitations of the FEA in CATIA 	Zamani, Chap. 1
Week 9	March 4 - 10	Spring Break, No Classes	
Week 10	Tuesday (3/13)	<ul style="list-style-type: none"> • Analysis of a Bent Rod with Solid Elements • Practice Exercises 1 on p. 2-20 	Zamani, Chap. 2
	Thursday (3/16)	<ul style="list-style-type: none"> • Axially Loaded Block with Stress Concentration • Practice Exercises 2 on p. 3-23 	Zamani, Chap. 3
Week 11	Tuesday (3/20)	<ul style="list-style-type: none"> • Deformation of an I-beam under Self-weight • Practice Exercises 1 on p. 5-13 	Zamani, Chap. 5
	Thursday (3/22)	<ul style="list-style-type: none"> • C-clamp Deformed with Enforced Displacement • Practice Exercises 1 on p. 6-12 	Zamani, Chap. 6
Week 12	Tuesday (3/27)	<ul style="list-style-type: none"> • FEA Modeling of the Bent Rod with beam Elements • Practice Exercises 1 on p. 7-13 	Zamani, Chap. 7
	Thursday (3/29)	<ul style="list-style-type: none"> • Modeling Mismatch in Shell Thickness and Surface Mesh • Practice Exercises 1 on p. 11-18 	Zamani, Chap. 11
Week 13	Tuesday (4/3)	<ul style="list-style-type: none"> • FE Model of a Bearing-Shaft Assembly Using Analysis Connection • Practice Exercises 1 on p. 14-28 	Zamani, Chap. 14
	Thursday (4/5)	<ul style="list-style-type: none"> • Analysis of a Tensile Specimen as an Assembly • Practice Exercises 2 on p. 16-28 	Zamani, Chap. 16
	Tuesday (4/10)	<ul style="list-style-type: none"> • Analysis of a Fastened Assembly • Practice Exercises 1 on p. 17-28 	Zamani, Chap. 17

Week 14	Thursday (4/12)	Working on Design Project	
Week 15	Tuesday (4/17)	Working on Design Project	
	Thursday (4/19)	Working on Design Project	
Week 16	Tuesday (4/24)	Working on Design Project	
	Thursday (4/27)	<ul style="list-style-type: none"> • Design Project Due • Design portfolios (both online and hard copy) Due • Class concluded 	

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:

- Penn State Principles, <http://www.psu.edu/ur/2001/principles.html>
- Code of Conduct, <http://www.sa.psu.edu/ja/codeconduct.html>
- 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%