MAE 3195/3196 Syllabus
Computer-Aided Engineering of Mechanical Systems
Spring 2014

Jon Torrey
jtorrey@gwu.edu
Tompkins 402
Office Hours: By appointment

The included schedule is tentative and can be changed without notice.

Course Description: This course presents major elements of computer-aided engineering systems: interactive graphics, finite element analysis and design sensitivity and optimization.

Prerequisite(s): MAE 4193; concurrent registration: MAE 3196.

Credit Hours: 3/1

Text(s):

1. Toogood, Roger, and Jack E. Zecher. Pro/ENGINEER Wildfire 5.0: Tutorial and Multimedia CD. Ingram, 2009.

2. Toogood, Roger. Pro/Engineer Wildfire 5.0 Mechanical Tutorial: Structure/Thermal. SDC publications, 2009.

3. Toogood, Roger. Pro/Engineer Wildfire 5.0 Advanced Tutorial. SDC publications, 2009.

Course Objectives:

MAE 3195 course learning objectives:

1. Learn to construct 3D geometric models using parametric, associative, solid modeling;

2. Learn to capture design intent in 3D solid models

3. Learn to use finite element analysis to calculate deformation, stress, or strain in 3D solid models

4. Learn to demonstrate convergence of finite element solutions

5. Learn to use sensitivity and optimization techniques in solid modeling and finite element analysis

MAE 3196 course learning objectives:

1. Provide design experience using feature-based, parametric associative solid modeling software

2. Provide design experience using finite element analysis techniques

Grade Distribution MAE 3195:

Credit Sheets	20%
Exam	25%
Final Project	55%

Grade Distribution MAE 3196:

Project 1	15%
Project 2	20%
Project 3	25%
Final Project	40%

Letter Grade Distribution:

>= 93.00	A	73.00 - 76.99	C	
90.00 - 92.99	A-	70.00 - 72.99	C-	
87.00 - 89.99	B+	67.00 - 69.99	D+	
83.00 - 86.99	B	63.00 - 66.99	D	
80.00 - 82.99	B-	60.00 - 62.99	D-	
77.00 - 79.99	C+	>60	F	

MAE 3195 Homework: There will be approximately 13 homework assignments to complete throughout the semester. These assignments will typically be based on lessons from lectures and the Pro/E or Pro/Mechanica textbooks. A Credit Sheet (CS) will be provided for each homework assignment that details all required information that must be submitted for credit. Except when otherwise noted on a credit sheet, it is required that students work independently on the homework assignments. In general, however, discussion among students on the homework is encouraged. Five of the assignments will be randomly selected at the beginning of a class and graded. Therefore, each assignment will be worth an equal portion of your final grade (4% each).

MAE 3196 Homework: Three Pro/E projects will be assigned that build competency in constructing 3D solid models that capture design intent. After completing these first three assigned projects, you will spend the remainder of the semester working on your term project that combines solid modeling with finite element analysis. A formal report will be required for the term project.

Projects should be turned in on the appropriate due date. As in the case of the homework, an assignment sheet will be provided for each project listing all requirements and the due date for the project.

MAE 3195 Exam: The "midterm" will be a take-home exam testing the student on materials related to the first part of the semester (primarily solid modeling and optimization).

Term Project: A final project will be assigned during the semester. It will require you to use both 3D solid modeling and finite element analysis. A formal presentation, in the form of a power-point, and report will be used to determine grades. If you are also enrolled in MAE 3196, this project will contribute to both your MAE 3195 and MAE 3196 grades.

Contesting a Grade: If a student thinks that a grade is unfair, he/she can contest it. The student has to submit a written request (e.g. email) within two weeks after the grade is re-

ceived (two days for the midterm exam and the final project). Depending on the veracity of the presented arguments, the instructor may adjust the grade by adding or removing points.

Late Submission: Assignments are due at the beginning of each period, in coordination with the due date given by the schedule. No credit will be given for assignments turned in late, unless there is good reason or previous coordination and granted permission with instructors.

Course Policies: This courses philosophy on academic honesty is best stated as "be reasonable." The course recognizes that interactions with classmates and others can facilitate mastery of the courses material. However, there remains a line between enlisting the help of another and submitting the work of another. This policy characterizes both sides of that line.

The essence of all work that you submit to this course must be your own. Collaboration on problem sets is not permitted except to the extent that you may ask classmates and others for help so long as that help does not reduce to another doing your work for you. Generally speaking, when asking for help, you may show your code to others, but you may not view theirs, so long as you and they respect this policys other constraints. Collaboration on the courses final project is permitted to the extent prescribed by its specification.

Below are rules of thumb that (inexhaustively) characterize acts that the course considers reasonable and not reasonable. If in doubt as to whether some act is reasonable, do not commit it. A detailed code of conduct can be found here: http://www.gwu.edu/ ntegrity/code.html.

- **Reasonable**

  - Communicating with classmates about problem sets' problems.
  - Discussing the course's material with others in order to understand it better.
  - Helping a classmate identify a bug in his or her model, as by viewing, compiling, or running his or her code, even on your own computer.
  - Turning to the web or elsewhere for instruction beyond the courses own, for references, and for solutions to technical difficulties, but not for outright solutions to problem set's problems or your own final project.
  - Whiteboarding solutions to problem sets with others using diagrams.
  - Working with (and even paying) a tutor to help you with the course, provided the tutor does not do your work for you.

- **Not Reasonable**

  - Accessing a solution from past students to some problem prior to (re-)submitting your own.
  - Asking a classmate to see his or her solution to a problem sets problem before (re-)submitting your own.
  - Failing to cite the origins of code or techniques that you discover outside of the course's own lessons and integrate into your own work, even while respecting this policy's other constraints.

- Paying or offering to pay an individual for work that you may submit as (part of) your own.
- Providing or making available solutions to problem sets to individuals who might take this course in the future.
- Searching for or soliciting outright solutions to problem sets online or elsewhere.
- Viewing anothers solution to a problem sets problem and basing your own solution on it.

Tentative Course Outline:

Week	Content
Week 1	• Syllabus and Course Schedule; Introduction to Parametric Solid Modeling; Creating Simple Objects; Basic Drawings • Reading assignment: WF5 Intro Ch 1, 2, 8
Week 2	• Introduction to Finite Element Method; DFMA • Reading assignment: Mechanica Ch 1, 2, 3
Week 3	• Parametric Relations and Constraints; Parent/Child Relationships; Three Dimensional Construction Tools • Reading assignment: WF5 Intro 3, 4
Week 4	• Datum Features; 3D Annotation; Symmetrical Features in Designs and 2D Drawings; Assemblies • Reading assignment: WF5 Intro 5, 6, 7
Week 5	• Assemblies; Advanced Assembly Modeling; Convergence of Finite Element Method; 3D finite element models • Reading assignment: WF Intro 9, 10; Mechanica 3, 4
Week 6	• Convergence of Finite Element Method; 3D finite element models • Reading assignment: Mechanica 3, 4
Week 7	• Advanced Modeling Tools; Pro/E Animation; Optimization • Reading assignment: WF5 Intro 11 Mechanica 4
Week 8	• Optimization; Structural optimization; • Reading assignment: Mechanica 4, 5
Week 9	• 2D finite element models; Symmetry in Finite Element Models • Reading assignment: Mechanica 5, 6
Week 10	• Shell models; Beams and frames; Modal analysis - Theory • Reading assignment: Mechanica 7, 8
Week 11	• Modal analysis by FEM; Thermal modeling • Reading assignment: Mechanical 9, 10
Week 12	• Miscellaneous topics in FEM • Reading assignment: Mechanica 9
Week 13	• Advanced Modeling Tools • Reading assignment:
Week 14	• Review • Reading assignment: