ME EN 4005/6005
Complex Continuum Systems
Fall 2004

Instructor: Eric Pardyjak
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Class Meetings: M W 9:40am – 10:30am

Lab Sections: 1) F 10:00am to 12:00am

Text: None

References: Holman, J.P., *Experimental Methods for Engineers*, McGraw Hill, Boston, MA, 2001.
Otto, K. & Wood, K., *Product Design*, Prentice Hall, Upper Saddle River, NJ, 2001.

Scope of the Course:

- Development of project management, technical writing, and presentation skills
- Elements of experiment design and experimental technique
- Statistical considerations and basic statistical analysis techniques
- Error analysis and uncertainty analysis
- Review of solid mechanics fundamentals and experimental techniques
- Review of fluid mechanics fundamentals and experimental techniques
- Introduction to solid and fluid numerical simulation techniques
- Elements of continuum mechanics
- Integration of experimental and computational techniques to obtain convergent validity relative to design/research objectives

Laboratory: Both experimental and computational laboratory experiences will be used to reinforce concepts discussed in lecture. Specifically, two "mini-design projects" (one solids-oriented and one fluids-oriented) will be investigated by teams from both an experimental approach and a computational approach. These projects will serve as a "model" to introduce concepts which will be more fully explored in students' chosen design projects. Lab notebooks should be maintained for both the mini-design projects and Senior / Graduate Design projects.

Grading:

• Lab notebooks	10%	(individual)
• Mini-design projects	15% each	(group)
• Design project presentations/progress reports	20%	(individual)
• Preliminary report	5%	(group)
• Final presentation	10%	(group)
• Final report	25%	(group)

Lab notebooks. The laboratory notebooks are to be used to document lab activities (experimental configuration, apparatus, methodology, etc) and record lab data. They should also be used to construct data flow charts for upcoming labs, as described in lecture. Any data analysis algorithms should also be recorded here. Notebooks should also be used to record observations relative to experimental problems encountered, assumptions made, equipment sensitivity limitations, etc. Documentation and analysis should be sufficiently thorough and clear that the given experimental / computational technique could be repeated in the future (months to years in the future) using the notebook alone. Record why you are doing what you are doing relative to both the mini-design projects and course projects; these notes will prove invaluable when the time comes to write reports and make presentations.

Mini-design projects. Separate handouts will describe the scope of the two mini design projects. In brief, these projects will describe a design problem (one solids, one fluids) to be solved by the lab group. A variety of experimental and computational tools (including FLUENT and ANSYSIS) will be available to the group to solve each problem over the course of several lab sections.

Senior design / Master's theses projects. The single largest contribution to the overall grade is the final design report. This report, in many respects, represents the focus of the other course activities and the culmination of the undergraduate program of study. Associated with the final report is a final presentation, in which all group members need to take part. Additionally, throughout the semester all students will be required to make progress presentations accompanied by written progress reports. Reports should reflect progress made and problems encountered since the last presentation. Each student should expect to talk for 5 to 10 minutes, adopting a professional presentation style for each presentation. The purpose of these reports is to keep design projects moving forward, obtain feedback from others, and give students more opportunity to improve presentation and technical writing skills. A relatively small class size will facilitate this process.

ME4005/6005 Lecture, Lab, & Presentation Schedule

Date	Activity	Topic	Speaker
8/27	Lecture	Course Introduction	Pardyjak
8/30	Lecture	Exper & Comp Research	Pardyjak
9/1	Lecture	Project Planning & Management	Pardyjak
9/3	No class	Work on projects	
9/6	No Class	Labor Day	
9/8	Lecture	Intro to Solids Design Project	Pardyjak
9/10	Lab	Strain Gauge Experimentation	Kirkman
9/13	Lecture	Statistical Analysis	Pardyjak
9/15	Lecture	Intro to FE, FD, & FV	Kirkman
9/17	Lab	ANSYS Simulation	Kirkman
9/20	No class	Work on projects	
9/22	Lecture	Technical Writing / Presenting	Pardyjak
9/24	Lab	ANSYS Simulation	Kirkman
9/27	Presentations	Progress Report #1	Students
9/29	Presentations	Progress Report #1	Students
9/29	***** Written Progress Report #1 Due*****		
10/1	Lab	Surface Streaking	Kirkman
10/4	No Class	Work on Projects	
10/6	No Class	Work on Projects	
10/6	***** Solids Design Project Due *****		
10/8	No Class	Fall Break	
10/11	Lecture	Intro to Fluids Design Project	Pardyjak
10/13	No class	Work on projects	
10/15	No class	Work on projects	
10/18	Lecture	Turbulence	Pardyjak
10/20	Lecture	Turb model / FV Fundamentals	Pardyjak
10/22	Lab	Fluent Simulation	Kirkman
10/25	Presentations	Progress Report #2	Students
10/27	Presentations	Progress Report #2	Students
10/27	***** Written Progress Report #2 Due *****		
10/29	Lab	Fluent Simulation	Kirkman

Date	Activity	Topic	Speaker
11/1	Lecture	Continuum Mechanics	Pardyjak
11/3	Lecture	Integrating Exper & Comp Research	Pardyjak
11/5	Lab	Drag Balance / Pitot Tube	Kirkman
11/8	Lecture	Moire Interferometry	Adams
11/10	Demonstration	Moire Interferometry	Adams
11/12	Lab	Hot Wire Anemometry	Kirkman
11/15	Presentations	Progress Report #3	Students
11/17	Presentations	Progress Report #3	Students
11/17	***** Written Progress Report #3 Due *****		
11/19	No Class	Work on projects	
11/22	Lecture	Flow Visualization/PIV	Pardyjak
11/24	***** Fluids Design Project Due *****		
11/24	Demonstration	Flow Visualization/PIV	Pardyjak
11/26	No Class	Thanksgiving	
11/29	No Class	Work On Projects	
12/1	No Class	Work On Projects	
12/1	***** Preliminary Report Due *****		
12/3	No Class	Thanksgiving	
12/6	Presentations	Final Presentations	Students
12/8	Presentations	Final Presentations	Students
12/13	***** Lab Notebooks Due *****		
12/16	***** Written Projects Due – No Late Projects Accepted *****		