Syllabus

MAE 3010
Mechanical Engineering Laboratory
Fall 2006

Meets:
Lecture: Monday 1:40-2:55 p.m., UH 317
Labs: Tuesday 10:50-1:30, UH 316
Tuesday 1:40-4:20, UH 316
Wed. 10:50-1:30, UH 316

University of Colorado at Colorado Springs
Mechanical and Aerospace Engineering

Instructors: Dr. Jason Roney
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Level: Required Senior Level Mechanical and Aerospace Engineering Course

Prerequisites: MAE 3005 Engineering Measurements Laboratory; Desired Knowledge: MAE 3130 Fluid Mechanics, MAE 3201 Strength of Materials, MAE 3310 Heat and Mass Transfer.

Class Meetings: Lecture 1:15 hr per week, UH 316
Lab Sessions 2:30 hrs per week (3 times offered),
UH 301/UH 316/UH 318/UH 319

Textbooks: Figliola, and Beasley**,** *Theory and Design of Mechanical Measurements*, 4th ed., John Wiley & Sons, 2005. The third edition of the textbook is also acceptable.

Barry J. Rosenberg, *Spring into Technical Writing*, 1rst edition, Addison-Wesley, 2005.

Objectives:
This course has been designed to provide valuable experience and improvement of skills in four major areas: (a) engineering problem solving (b) planning, execution and analysis of laboratory experiments, (c) communication of technical results in oral and written form, (d) acquisition and utilization of information from scientific and engineering literature including basic concepts from previous engineering courses.

General Description:

Lectures: Start August 21, 2006
The course will consist of one hour 15 minutes per week of lecture with all three sections present. During this time lecture topics relevant to executing specific experiments will be presented as well as basic information on the following:

1. experimental design/design of experiments
2. research techniques
3. lab notebook keeping
4. uncertainty analysis in measurements
5. data acquisition/data management
6. data analysis
7. report writing
8. oral presentations
9. laboratory safety and procedures

Lab Time: Start September 12, 2006

The above general topics will be covered in the laboratories by "doing" experiments that incorporate the above concepts.

Experiments	**Time**	**Write-up**	**Present**	**Lab Protocol**	**Notebook**
1. Design of Experiment: Rockets and Trajectory	**2 weeks**	**Formal**	**No**	**No**	**Yes**
2. Engineering Challenge I	**5 weeks**	**Formal**	**Yes**	**Yes**	**Yes**
3. Engineering Challenge II	**5 weeks**	**Formal**	**Yes**	**Yes**	**Yes**

After, the initial Design of Experiment, an Engineering challenge will be posed to each laboratory group which "hopefully" can be solved with the available resources here at UCCS. Each group will be expected to formulate a laboratory protocol outlining how they plan to experimentally understand or solve the problem posed before proceeding with "costly" experiments. The protocol must be approved by the instructor before the experiments can be performed (it is estimated that up to two lab sessions per challenge can be used for formulating this protocol, and the up to 3 weeks of lab time to take the required data). There are two total challenges.

Grading:

1. DOE: Rocket Tajectory: 20% of Total Grade
Written Reports: 100%

2. Engineering Challenge I: 35% of Total Grade
Lab Protocol: 20%
Written Reports: 60%
Presentation: 20%

3. Engineering Challenge II: 35% of Total Grade
Lab Protocol: 20%
Written Reports: 60%
Presentation: 20%

4. Misc.: 10%
HW#1, Excel Uncertainty, 2.5%
HW#2, Matlab Data Analysis, 2.5%
Notebook: 5%

5. Peer Review:
All experiments will be done in groups of 4-5 students. You will be asked anonymously to rate your group members contributions throughout the semester. Consistently poor ratings from your group members may affect your final grade. For example, if the typical ratings in a peer review are A/A- for most group members and you consistently have a majority of your group members giving you lower ranking, then expect a deduction off the final grade ranging from 2% to 10% depending on how much lower your rating is compared to others.

Course Schedule:

Date	**Lecture**	**Labs**	**HW Assignment**
08/21/2006	1. Syllabus, Formal Report Guidelines, Protocol Guidelines, Notebook Guidelines	Labs Do Not Meet	Read CH 1
08/28/2006	2. Intro., and Overview of Design of Experiment	Labs Do Not Meet	
09/04/2006	Labor Day Holiday	Labs Do Not Meet	
09/11/2006	3. Design of Experiment Continued	DOE (T,W) Meet UH 316	DOE Lab Assigned
09/18/2006	4. Overview Uncertainty Analysis	DOE (T,W)	
09/25/2006	5. Discussion of Related Experimental Techniques for Challenge I	Eng. Chall. I (T,W)	Eng. Chall. I Issued, DOE Lab Write-up Due at Lab
10/02/2006	6. Uncertainty Analysis in MS Excel	Eng. Chall. I (T,W)	Read CH 8/9, HW#1

			Assigned
10/09/2006	7. Lecture Time used to Discuss Protocols in individual meetings	Eng. Chall. I (T,W)	Lab Protocol #1 due on Monday by e-mail by 12:00 p.m.
10/16/2006	8. Review Work –Matlab as Experimental Analysis Tool	Eng. Chall. I (T,W)	HW 2 Assigned, HW#1 Due,
10/23/2006	9. In-class, Matlab Exercise	Eng. Chall. I (T,W)	
10/30/2006	10. Discussion of Related Experimental Techniques for Challenge II	Eng. Chall. II (T,W)	Eng. Chall. II Issued, Lab 1 Write-up Due
11/06/2006	11. Lecture on Presentation and Poster Formats	Eng. Chall. II (T,W)	HW 2 Due
11/13/2006	12. Lecture Time used to Discuss Protocols in individual meetings	Eng. Chall. II (T,W)	Lab Protocol #2 due on Monday by e-mail by 12:00 p.m.
11/20/2006	13. Oral Presentation I	Eng. Chall. II (T)	
11/27/2006	14. Poster Presentation I	Eng. Chall. II (T,W)	
12/04/2006	15. FCQ's/ Time to Work On Labs	Eng. Chall. II (W)	
12/11/2006	Oral/Poster Presentation II		All Write-ups and notebooks due by Weds. 12/13/2006

Additional References:

Y. A. Cengel, J. M. Cimbala, Fluid Mechanics w/ Student Resources DVD (McGraw-Hill Mechanical Engineering) (Hardcover), 2006.

B. R. Munson, D. F. Young, and T. H. Okiishi, Fundamentals of Fluid Mechanics, 3rd Ed., John Wiley& Sons, 1998.
J. Roney, MAE 3010: Mechanical Engineering Laboratory, Laboratory Manual, University of Colorado at Colorado Springs, Fall 2005.

M. J. Moran and H. N. Shapiro, Fundamentals of Engineering Thermodynamics, 3rd Ed., John Wiley & Sons, 1995.

F. D. Incropera and D. P. DeWitt, Fundamental Heat and Mass Transfer, John Wiley & Sons, 1990.

R.C. Hibbler, Mechanical of Materials, 2nd Editions, Prentice Hall, 1994.

J.P. Holman, Experimental Methods for Engineers, McGraw-Hill, New York, 2001

A.Wheeler, and A,.Ganji, Introduction to Engineering Experimentation, Prentice Hall, Englewood Cliffs, NJ, 2004.

Course Outline Subject to Appending as the Semester Progresses.