

ME 406: Experimental Design

<i>Course description:</i>	Designing, conducting, and reporting of experimental investigations involving mechanical equipment.
<i>Number of credits:</i>	3 (1-6)
<i>Course Coordinator:</i>	C. Richards
<i>Prerequisites by course:</i>	ME 220; ME 304; ME 306; ME 316
<i>Prerequisites by topic:</i>	<ol style="list-style-type: none">1. Fluid Dynamics2. Thermodynamics3. Dynamics4. Materials Science5. Computer Aided Data Acquisition6. Instrumentation7. Electronic Instruments8. Uncertainty analysis
<i>Textbooks/other required materials:</i>	<ol style="list-style-type: none">1. A. Wheeler and A. Ganji, <i>Introduction to Engineering Experimentation.</i>, Prentice Hall, 2009, 3/e.
<i>Course objectives:</i>	Learn how to design, conduct, and report experimental investigations involving mechanical equipment and systems.
<i>Topics covered:</i>	<ol style="list-style-type: none">1. Experiments involving<ol style="list-style-type: none">a. thermal fluid scienceb. dynamicsc. materials characterization2. Professional communication skills<ol style="list-style-type: none">a. memorandum writingb. progress report writingc. proposal writingd. report writinge. formal oral reporting3. Experimental skills<ol style="list-style-type: none">a. design of experimentsb. uncertainty analysisc. computer aided data acquisition4. Professional conduct<ol style="list-style-type: none">a. ethicsb. professionalismc. intellectual property and patentsd. ABET and registration
<i>Expected student outcomes:</i>	<p>Outcomes for the Lecture Component:</p> <ol style="list-style-type: none">a. Increased understanding of professionalism and continuation educationb. Increased understanding of intellectual property and patentsc. Increased understanding of ethicsd. Increased understanding of statistical design of experiments <p>Outcomes for the Laboratory Component:</p> <ol style="list-style-type: none">a. Increased understanding of the ideas of experimentation and design of experiments including:<ol style="list-style-type: none">1. Designing experimental projects

2. Verifying the trends of the raw data
 3. Reducing and presenting experimental data
 4. Estimating uncertainty of the final results
 5. Comparing results with other available information
- b. Increased communication skills including:
 1. Being able to write memoranda to supervisors.
 2. Report results in the form of (1) short reports, (2) complete reports, (3) letters, and (4) progress reports
 3. Being able to give oral reports using PowerPoint and an LCD projector
 4. Being able to communicate on a one-to-one basis with (1) laboratory assistants, (2) engineers, and (3) supervisors
 - c. Be able to use codes and handbooks
 - d. Be able to apply the material from coursework to actual problems
 - e. Be able to expand understanding of a subject by reading reference books and textbooks

Class schedule: One 50-minute lecture session per week, for one semester.

Laboratory schedule: Two 3-hour laboratory sessions per week, for one semester.

Contribution to meeting the professional component: Engineering Topics

Relationship of course to program objectives: Meets:
 School of MME ME educational objectives: 1, 2, 3 2.
 School of MME ME program outcomes: 1, 3, 4, 6, 7 3.
 ABET EC2019, Criterion 3 program outcomes: 1, 3, 4, 6, 7.

Prepared by: C.D. Richards

Date: May 30, 2018

- A. **Reasonable Accommodation** Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; 509-335-3417) to schedule an appointment with an Access Advisor. All accommodations **MUST** be approved through the Access Center.
- B. **Academic Integrity** WSU expects all students to behave in a manner consistent with its high standards of scholarship and conduct. Students are expected to uphold these standards both on and off campus and acknowledge the university's authority to take disciplinary action. The Standards of Conduct for Students can be found at <http://conduct.wsu.edu>.
- C. **WSU Safety** WSU is committed to maintaining a safe environment for its faculty, staff, and students. Safety is the responsibility of every member of the campus community and individuals should know the appropriate actions to take when an emergency arises. In support of our commitment to the safety of the campus community the University has developed a **Campus Safety Plan** (<http://safetyplan.wsu.edu>). It is highly recommended that you visit this web site as well as the University emergency management web site at <http://oem.wsu.edu/> to become familiar with the information provided.
- D. **Classroom Safety** Classroom and campus safety are of paramount importance at Washington State University, and are the shared responsibility of the entire campus population. WSU urges students to follow the "Alert, Assess, Act" protocol for all types of emergencies. Remain **ALERT** (through direct observation or emergency notification), **ASSESS** your specific situation, and **ACT** in the most appropriate way to assure your own safety (and the safety of others if you are able).

Please sign up for emergency alerts on your account at MyWSU. For more information on this subject, campus safety, and related topics, visit the [WSU safety portal \(https://faculty.wsu.edu/classroom-safety/\)](https://faculty.wsu.edu/classroom-safety/).

Specifics for Spring 2018

MEETING TIME AND LOCATION: Lab Section 3: ETRL M7 & 1, Tuesday & Thursday 10:35 AM-1:25 PM

INSTRUCTOR: Dr. Jacob Leachman, Office: Sloan 217, Phone: 335-7711, e-mail: jacob.leachman@wsu.edu

TEACHING ASSISTANT(s): Kellen Traxel e-mail: kellen.traxel@wsu.edu

ADDITIONAL COURSE RESOURCES:

Website: All course materials will be posted to <http://hydrogen.wsu.edu/>

GRADING:

Participation & Safety Reviews	10 %
Written Proposals (5 % each)	15 %
Oral Presentations (10 % each)	30 %
Written Reports (15 % each)*	45 %

A Project: The A projects are defined and setup for operation in the laboratory. A prompt for the projects is provided detailing the scope of work that should be completed. You can select your lab partner and a project will be assigned.

B Project: The B projects consist of similar experiments as the A set including some alternative projects. You get to propose the project you want to pursue as well as the purpose and they will be assigned considering your proposal.

C Project: The C projects are student motivated and not typically setup prior to operation. Students self-organize into teams and must design-build-test the experiment.

Distribution: 100–93 (A), 93–90 (A-), 90–87 (B+), 87–83 (B), 83–80 (B-), 80–77 (C+), 77–73 (C), 73–70 (C-), 70–60 (D), 60–0 (F), incomplete (I), integrity violation (X).

SCHEDULE: ** The schedule topics may change throughout the course.

Day		Lecture Topic	Due by end of Lab
Jan 8	Experimental Design	1. Introduction & Experimental Safety	
Jan 10		2. Literature Reviews & Use of Testing Standards	
Jan 15		3. Using Theory to Guide Experiments	
Jan 17		4. Experimental Setup and Test Plans/Procedure	
Jan 22		5. Instrument Traceability & Calibration	A Proposals
Jan 24		6. Uncertainties and Propagation of Error	
Jan 29		7. 'Fool-Proof' Presentation of Data	
Jan 31		8. Conclusions & Recommendations	
Feb 5	Communication	9. A Review & Rehearsal	
Feb 7		10. A Oral Presentations	A Orals & Reports
Feb 12		11. Rules for Engineering Communication	
Feb 14		12. Resumes & Work Portfolios	
Feb 19		13. Interviews & Negotiations	
Feb 21		14. White Paper Proposals	
Feb 26		15. How to Hold a Meeting	B Proposals
Feb 28		16. Conflict Management	
Mar 5		17. Reports with Rapport	
Mar 7		18. Show-stopping Presentations	
Mar 19	Engineering Practice	19. B Review & Rehearsal	
Mar 21		20. B Oral Presentations	B Orals & Reports
Mar 26		21. Engineering Practice and Professionalism	C Proposals
Mar 28		22. Building your new Team/Tribe	
Apr 2		23. Authoritarians & the need for Ethical Standards	
Apr 4		24. FE Ethics review	
Apr 9		25. Patents & Trademarks	
Apr 11		26. Creativity, Innovation, & Entrepreneurs	
Apr 16		27. Engineering Sustaining Communities	
Apr 18		28. Systems thinking in Experimental Design	
Apr 23		29. C Review & Rehearsal	
Apr 25		30. C Project Oral Presentations	C Orals & Reports