

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) This course is required
<i>Course Coordinator:</i>	J. Steffens
<i>Prerequisites by course:</i>	ME 220; ME 304; ME 306; ME 348; admitted to the major in Mechanical Engineering
<i>Textbooks/other required materials:</i>	NIST/SEMATECH e-Handbook of Statistical Methods, http://www.itl.nist.gov/div898/handbook/
<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 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 projects2. Verifying the trends of the raw data3. Reducing and presenting experimental data4. Estimating uncertainty of the final results5. Comparing results with other available informationb. Increased communication skills including:<ol style="list-style-type: none">1. Writing memoranda to supervisors.2. Reporting results in the form of (1) short reports, (2) complete reports, (3) letters, and (4) progress reports.3. Giving oral reports using PowerPoint and an LCD projector.4. Communicating on a one-to-one basis with (1) laboratory assistants, (2)

- engineers, and (3) supervisors.
- c. Use of codes and handbooks
- d. Application of the material from coursework to actual problems
- e. Expanded 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:
1. ABET EC2024, Criterion 3 program outcomes: 1, 3, 4, 6, 7.

Prepared by: Teresa Fuller and J. Steffens *Date:* September 23rd, 2024

- 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:** Academic Integrity is the cornerstone of higher education. As such, all members of the University community share responsibility for maintaining and promoting the principles of integrity in all activities, including academic integrity and honest scholarship. Academic integrity will be strongly enforced in this course. Students who violate WSU’s Academic Integrity Policy (identified in Washington Administrative Code (WAC) 504-26-010(4)) will receive [insert academic sanction (e.g., fail the course, fail the assignment, etc.)], will not have the option to withdraw from the course pending an appeal, and will be reported to the Center for Community Standards. Cheating includes, but is not limited to, plagiarism and unauthorized collaboration as defined in the Standards of Conduct for Students, WAC 504-26-010(3). You need to read and understand all of the definitions of cheating. If you have any questions about what is and is not allowed in this course, you should ask course instructors before proceeding.
- 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 \(http://safetyplan.wsu.edu\)](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. **Online Classroom Safety & Etiquette:** Our on-line classroom may look different than traditional physical classrooms but the core values we use to promote a safe and welcoming physical classroom are the same as those on-line. That’s why we call them ‘core’ values – they remain the same regardless of setting or context. You need to be appropriately dressed, use appropriate language, and work to promote the professionalism of your peers. Use your WSU login to attend class. Please immediately report any actions that threaten you or the safety of our classroom.

Specifics for Spring 2026

MEETING TIME: Lab Section 3: Tuesday & Thursday 2:55 PM-5:45 PM

INSTRUCTOR: Dr. Jacob Leachman, Office: HYPER 30, Phone: 208-816-0288, e-mail: jacob.leachman@wsu.edu

** HYPER is across campus and locked – if you need to meet with me outside of class, please email me or send a zoom or Teams invite.

TEACHING ASSISTANT(s): Cole James e-mail: cole.james@wsu.edu

ADDITIONAL COURSE RESOURCES:

Website: All course materials will be posted to Canvas.

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 13	Experimental Design	1. Introduction & Experimental Safety		
Jan 15		2. Literature Reviews & Use of Testing Standards		
Jan 20		3. Using Theory to Design Experiments		
Jan 22		4. Experimental Setup and Test Plans/Procedure		
Jan 27		5. Instrument Traceability & Calibration	A Proposals	
Jan 29		6. Uncertainties and Propagation of Error		
Feb 3		7. 'Fool-Proof' Presentation of Data		
Feb 5		8. Conclusions & Recommendations		
Feb 10		9. A Review & Rehearsal		
Feb 12		10. A Oral Presentations	A Orals & Reports	
Feb 17	Communication	11. Rules for Engineering Communication		
Feb 19		12. White Paper Proposals		
Feb 24		13. E-mails, Resumes, & Work Portfolios	B Proposals	
Feb 26		14. Interviews & Negotiations		
Mar 3		14. A Story of Presentations		
Mar 5		15. Rethinking Reports		
Mar 10		16. B Review & Rehearsal		
Mar 12		17. B Oral Presentations	B Orals & Reports	
Mar 16		Engineering Practice	SPRING BREAK!	
Mar 20				
Mar 24	18. Defining Professionalism			
Mar 26	19. Entering the Profession		C Proposals	
Mar 31	20. Let's Talk About Safety			
Apr 2	21. Ethical Standards in Engineering			
Apr 7	22. The History of US R&D funding			
Apr 9	23. US R&D Agents			
Apr 14	24. Creativity, Innovation, & Entrepreneurs			
Apr 16	25. Intellectual Property: Patents and Trademarks			
Apr 21	26. Onboarding and Mentoring			
Apr 23	27. Our Land-Grant Mission			
Apr 28	28. C Review & Rehearsal			
Apr 30	29. C Project Oral Presentations	C Orals & Reports		