Fall
2024

SCUPI
Sichuan University - Pittsburgh Institute

# ME 1042 Mechanical Measurements 2

*(Modifications to this syllabus may be required during the semester. Any changes to the syllabus will be announced in class or posted on the course website.)*

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**Office Hours:** Tue 2:00 - 5:00 PM, Thu 9:00-11:00 AM, Thu 2:00-5:00 PM


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Note: for email, please

- Include the course number, your name and your student number in the subject field of your message;
- Use your university email account.

**Credit hours:** 3

**Lecture time/location:** Monday 8:15-9:55 AM/ SCUPI Building 210

**Laboratory location:** SCUPI Building 204

**Laboratory times:** Monday 10:15-11:55 AM
Monday 1:50-3:30 PM
Monday 3:40-5:30 PM
Wednesday 8:15-9:55 AM
Wednesday 10:15-11:55 AM

## Course Description:

This course is the second in a sequence of courses that pertain to engineering laboratory measurements. Builds on the fundamental knowledge provided in Mechanical Measurements 1, it equips students with the proficiency needed to adeptly devise and execute experiments concerning complex mechanical systems. The objective is to ascertain distinct attributes of those systems, which encompasses an in-depth grasp of statistical concepts, error analysis, computer-based data acquisition methods, and technical writing.

## Course Objective:

At the completion of this course, students will be able to

- Develop an understanding of a laboratory environment and safe practice techniques.
- Learn how to organize experimental procedure and operate laboratory equipment.
- Become familiar with advanced engineering laboratory tools and how engineering systems are tested.

- Learn how to effectively analyze data sets and apply statistical techniques (i.e. uncertainty analysis)

## Applicable ABET Learning Outcomes:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

## Prerequisites:

ME 1041 Mechanical Measurements 1

## Textbook:

Theory and Design for Mechanical Measurements, 7th Edition, Figliola and Beasley, Wiley, 2019.

## Reference Books:

- Lab equipment manuals from the vendor (Hardcopy available in the lab)
- Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines, 4th Edition, Norton, Robert L, McGraw-Hill Education, 2020.
- Mechanics of Materials, 10th Edition, Hibbeler, R. C., Pearson, 2015.
- Statics and Mechanics of Materials: An Integrated Approach, 2nd Edition, W. F. Riley, L. D. Sturges, and D. H. Morris, Wiley, 2002.
- Mechanical Vibrations, 6th Edition, Singiresu S. Rao, Pearson, 2018.
- Programmable Logic Controllers, 5th Edition, Frank D. Petruzella, McGraw-Hill Education, 2015.
- Control System Engineering, 8th edition, Norman S. Nise, Wiley, 2019.
- Modern Robotics: Mechanics, Planning, and Control, 1st Edition, Lynch, Kevin M., and Frank C. Park. University Press, 2021.
- Fluid Mechanics: Fundamentals and Applications, 1st Edition, Çengel, Yunus A., and John M. Cimbala, McGraw-Hill Education, 2006.
- Fundamentals of Heat and Mass Transfer, 8th Edition, Bergman, Theodore L. and Lavine, Adrienne S, Wiley, 2017.
- Heat And Mass Transfer: Fundamentals and Applications, 5th Edition, Çengel, Yunus A., and Afshin J. Ghajar, McGraw-Hill Education, 2020.

**Website:** https://learn.scupi.cn/

## Topics to be Covered:

**Topic 1: Solid Mechanics and Design**
Geared Systems
Forced and Free Vibrations
Uniaxial Tension Test of Materials

**Topic 2: Control System**
Automated Level Control using Programmable Logic Controllers (PLCs)
Fundamentals of Feedback Control
PD Control of Unstable Systems
Robot Manipulator Control

**Topic 3: Thermal & Fluid Labs**
Fluid Mechanics
Bench-top Heat Exchangers
Radiation Heat Transfer

## Tentative Course Schedule:

| Week | Lecture | Lab |
|---|---|---|
| 1 | Sep. 2<br>Course Introduction | Sep. 4<br>Lab Introduction and Safety |
| 2 | Sep. 9<br>Gear Systems | Sep. 9, 11<br>Gear Systems |
| 3 | Sep. 16(Sep. 14)<br>Forced and Free Vibrations | Sep. 16(Sep. 14), 18<br>Forced and Free Vibrations |
| 4 | Sep. 23<br>Uniaxial Tension Test | Sep. 23, 25<br>Uniaxial Tension Test W1 |
| 5 | Sep. 30<br>Exam Review | Sep. 30, Oct. 2 (TBD)<br>Uniaxial Tension Test W2 |
| 6 | Oct. 7(Oct. 12)<br>Midterm Exam I | Oct. 7(Oct. 12), 9<br>No Lab |
| 7 | Oct. 14<br>Programmable Logic Controllers | Oct. 14, 16<br>Programmable Logic Controller |
| 8 | Oct. 21<br>Fundamentals of Feedback Control | Oct. 21, 23<br>Fundamentals of Feedback Control |
| 9 | Oct. 28<br>Unstable Systems | Oct. 28, 30<br>Unstable Systems |
| 10 | Nov. 4<br>Robot Manipulator Control | Nov. 4, 6<br>Robot Manipulator Control |
| 11 | Nov. 11<br>Exam Review | Nov. 11, 13<br>No Lab |

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|---|---|---|
| 12 | Nov. 18<br>Midterm Exam II | Nov. 18, 20<br>No Lab |
| 13 | Nov. 25<br>Fluid Mechanics | Nov. 25, 27<br>Fluid Mechanics |
| 14 | Dec. 2<br>Heat Exchangers | Dec. 2, 4<br>Heat Exchangers |
| 15 | Dec. 9<br>Radiation | Dec. 9, 11<br>Radiation W1 |
| 16 | Dec. 16<br>Exam Review | Dec. 16, 18<br>Radiation W2 |
| 17 | Dec. 23<br>Final Exam | Dec. 23, 25<br>No Lab |

## Course Gradings:

- Attendance 10 %
- Studio 10 %
- Lab reports 50 %
- Midterm exam I 10 %
- Midterm exam II 10 %
- Final exam 10 %

Note: 4-student group for studio and lab reports submission, every group member receives the same score

## Grading Scale:

| Letter | A | A- | B+ | B | B- | C+ | C | C- | D+ | D | F |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Percentage (%) | 100~90 | 89~85 | 84~80 | 79~76 | 75~73 | 72~70 | 69~66 | 65~63 | 62~61 | 60 | <60 |

## Class Policies:

- **On-time attendance at all class activities is expected**. Student is responsible for any material that was covered, and any changes to the exam dates and homework assignments announced in class.
- **NOTE:** Students with **three unexcused absences** (including lateness or early departure) can be given a **zero** for their regular course grade. Students missing **a third of total class hours** in a semester (including all types of leaves) will lose the right to be assessed in that course, receiving a **zero** for the course grade.
- In general, no late assignment or make up exams will be accepted. If you have a serious conflict with an exam schedule, you must discuss it with the instructor and **take the exam early**. Failure to contact the instructor prior to the exam or assignment due date

will result in **a zero** on that exam/assignment. Exams missed due to a serious illness or a family emergency (these must be documented) will be dealt with on a **case-by-case** basis according to the University Policy.

- **Late submissions** for studio, lab reports or assignment are calculated based on the following equation

$$\textbf{Late submission full mark} = 100\% \times r^n$$

$r = 0.8$: discounted return coefficient; $n$ : number of late weeks and $n$ is an integer number which will be round up, e.g. $n = 1$ for the late submission within a week

- Any questions regarding the grading discrepancy should be brought up **within a week** after returning the homework, report or exam.
- Violations of academic integrity include, but are not limited to, cheating, plagiarism, or misrepresentation in oral or written form. Such violations will be dealt with severely, in accordance with University policy.

## Laboratory Policies:

- **Students must attend all scheduled labs**. Failure to attend the labs will result in **zero** for lab report grades. Exceptions will be made for a valid excuse consistent with University Policy. If you cannot attend a laboratory, you must contact the instructor prior to the lab session in order to reschedule. While in the laboratory, all safety guidelines and procedures must be followed.