Spring
2024

SCUPI
Sichuan University - Pittsburgh Institute

ME 1041 Mechanical Measurements 1

(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.)

Instructor: Qi (Michael) Lu, Ph.D.
Office: New building 506
Email: qi.lu@scupi.cn

Lab Engineer: Yuna Tu
Office: New building 305
Email: yuna.tu@scupi.cn

Grading Teaching Assistant:
Haojin Zhang zhj807462256@163.com

Lab Teaching Assistant:
Qi Cheng 15024639716@163.com
Yingxin Dong 3020189856@qq.com

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

Note: for email, please

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

Credit hours: 3

Lecture time/location: Wednesday 10:15-11:55 AM/ New building 212

Laboratory location: New building 206

Laboratory times: Wednesday 1:50-3:30 PM
Wednesday 3:40-5:30 PM

Course Description:

This course is the first in a sequence of courses that pertain to engineering laboratory measurements. Its primary objective is to provide fundamental knowledges of mechanical measurements. This encompasses aspects such as measurement system components, data acquisition, standards, instrument calibration, signal characteristics, measurement system behavior, signal conditioning, statistical treatment of data, uncertainty analysis, and technical report 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 common laboratory tools like power supplies, multimeters, oscilloscopes, data acquisition units, strain gages, etc.
- Learn how to effectively analyze data sets and apply statistical techniques (i.e.

uncertainty analysis and variance).
- Design and implement an experimental approach for hypothesis testing.

Learning Outcomes:

- Choose suitable measurement systems based on predefined requirements, such as range, resolution, uncertainty and etc.
- Become familiar with common laboratory tools like power supplies, multimeters, oscilloscopes, data acquisition units, strain gages, etc. And effectively acquire experimental data from measurement systems.
- Perform statistical and uncertainty analysis for acquired experimental data to derive the necessary quantities for results reporting.
- Communicate with your advisor/boss/colleagues technically in writing with good manner, formats and proper representation of results.

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:

ENGR 0145 Statics and Mechanics of Materials 2, MEMS 0031 Electric Circuits

Textbook:

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

Website: https://pibb.scu.edu.cn/

Topics Covered:

Laboratory 1: Introduction to Instrumentation and Data Acquisition
Data Acquisition (Ch. 2)
Sampling Concepts (Ch. 7)

Laboratory 2: Use of Accelerometers in the Measurements of Dynamic Systems
Measurement System Behavior (Ch. 3)
Accelerometers (Ch. 12)

Laboratory 3: Temperature Sensors and Statistical Analysis of Data
Measurement System Behavior (Ch. 3)
Finite Statistics (Ch. 4)
Uncertainty Analysis (Ch. 5)
Temperature Measurements (Ch. 8)

Laboratory 4: Use of Strain Gages to Determine the Strain in Cantilever Beams
Strain Gages, Resistance Bridges, Bridge Constants (Ch. 11)
Apparent Strain, Temperature Compensation (Ch. 11)

Laboratory 5: Characteristics of Passive & Active Filters
Filters and Amplifiers (Ch. 6)
Aliasing (Ch. 7)

Course Schedule:

Week	Lecture	Lab
1	Feb. 28 Course Introduction	Feb. 28 Lab Safety Introduction
2	Mar. 6 Ch. 1, Ch. 2	Mar. 6 No Lab
3	Mar. 13 Ch. 2, Ch. 7	Mar. 13 Lab 1
4	Mar. 20 Ch. 3	Mar. 20 No Lab
5	Mar. 27 Ch.3, Ch. 12	Mar. 27 Lab 2
6	Apr. 3 Ch. 4	Apr. 3 No Lab
7	Apr. 10 Ch. 4, Ch. 5	Apr. 10 No Lab
8	Apr. 17 Ch. 5	Apr. 17 No Lab
9	Apr. 24 Ch. 8	Apr. 24 Lab 3

10	May 1 National Holiday	May 1 National Holiday
11	May 8 Ch. 11	May 8 Lab 4
12	May 15 Midterm Exam	May 15 No Lab
13	May 22 Ch. 6	May 22 Lab 5
14	May 29 Project Introduction	May 29 Project Step 1 & 2
15	Jun. 5 Final Exam Review	Jun. 5 Project Step 3
16	Jun. 12 Project Testing	Jun. 12 Project Testing
17	Jun. 19 Final Exam	

Course Gradings:

- Attendance 10 %
- Studio 10 %
- Lab reports 30 %
- Group project 20 %
- Midterm exam 15 %
- Final exam 15 %

Note: 3-student group for studio, lab reports and project submission, every group member receive 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 not 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.