Spring
2025

SCUPI
Sichuan University - Pittsburgh Institute

MEMS 1049 Mechatronics

(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 2:00-5:30 PM, Wed 9:00 - 11:30 PM

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.

Lecture/Laboratory time: Thursday 13:50 - 16:25 PM

Lecture/Laboratory location: SCUPI Building 201

Catalog Description:

3 Credits; An introduction to mechatronics, or the interfacing of mechanical and electrical systems. Focus is on embedded controllers and their programming, actuators, sensors, and integration of these components to create a complete functional automated mechatronic system. Gain hands-on experience with mechatronic system modelling, control algorithm design and implementation.

Course Objective:

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

- Develop an understanding of a laboratory environment and safe practice techniques.
- Become familiar with mechatronic systems, feedback control principle, the integration of the electronics with the mechanical system.
- Learn how to use data acquisition hardware, software and their interfacing.
- Learn how to use the high-level graphical programming tools to implement real-time computation tasks.
- Design and implement a mechatronics system.

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.

Preferred Prerequisites:

ME 1041 Mechanical Measurements 1, ME 1045 Automatic Controls

Reference Book:

The Mechatronics Handbook-2 Volume Set. Bishop, Robert H. CRC Press, 2002.
Handbook of Modern Sensors: Physics, Designs, and Applications (Vol. 3). Fraden, J., New York: Springer., 2010.

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

Tentative Course Schedule:

Week	Lecture/Lab
W.1 Feb. 27	Course Introduction/Lab Safety
W.2 Mar. 6	Graphical Programming Tools
W.3 Mar.13	Graphical Programming Tools
W.4 Mar.20	Angular Displacement
W.5 Mar.27	Inertial Measurement
W.6 Apr.3	DC Motor Modelling
W.7 Apr.10	DC Motor Speed Control
W.8 Apr.17	DC Motor Position Control
W.9 Apr.24	State-Space Modeling of the Pendulum Module
W.10 May.1	National Holiday

W.11 May.8	State Feedback Control for Inverted Pendulum
W.12 May.15	Optimal Control of an Inverted Pendulum
W.13 May.22	Swing-Up Hybrid Control
W.14 May.29	System Identification of the Inverted Pendulum & Project Introduction
W.15 Jun. 5	Project
W.16 Jun. 12	Project
W.17 Jun. 19	Project Demo & Grading

Course Gradings:

- Attendance 10%
- Studio 10%
- Lab reports 40%
- Project report 40%

Note: 3-student group for lab reports and project 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

  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.