Spring
2023

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: Wed 3:30 - 5:30 PM

Note: when emailing the instructor, lab engineer or the teaching assistants, please

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

Lecture time/location: Thursday 10:15 - 11:55/Zone 4-204

Laboratory location: Zone 3-116

Laboratory times: Session 1 Wednesday 16:45-18:25
Session 2 Wednesday 19:20-21:00
Session 3 Thursday 13:50-15:30

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.

Preferred Prerequisites:

ME 1014 Dynamic Systems, ME 1041 Mechanical Measurements 1, ME 1045 Automatic Controls

Reference Book:

The Mechatronics Handbook-2 Volume Set. Bishop, Robert H. CRC Press, 2002.

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

Topics Covered:

Topic 1: Graphical Programming Tools
Graphical Programming Tools Environment
Application Programming
Using Loops
Data Structure
Modularity

Topic 2: Sensors
Angular Displacement
Distance and Proximity
Pressure
Contact
Inertial Measurement

Topic 3: Actuators
DC Motor Modelling
DC Motor Position Control

Topic 4: Control System
Inverted Pendulum Modelling
Pole Placement
Optimal Control-Linear Quadratic Regulator
Swing-Up Hybrid Control

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Course Schedule:

Week	Lecture	Lab
1	Feb 23 Course Introduction	Mar 1, 2 Lab Safety
2	Mar 2 Graphical Programming Tools	Mar 8, 9 No Lab
3	Mar 9 Graphical Programming Tools	Mar 15, 16 No Lab
4	Mar 16 Graphical Programming Tools	Mar 23, 24 No Lab
5	Mar 23 Angular Displacement	Mar 29, 30 Lab 1
6	Mar 30 Distance and Proximity	Apr 5, 6 Lab 2
7	Apr 6 Inertial Measurement	Apr 12, 13 Lab 3
8	Apr 13 DC Motor Modelling	Apr 19, 20 Lab 4
9	Apr 20 Midterm Exam	Apr 26, 27 No Lab
10	Apr 27 DC Motor Speed Control	May 3, 4 Lab 5
11	May 4 DC Motor Speed Control	May 10, 11 Lab 5
12	May 11 DC Motor Position Control	May 17, 18 Lab 6
13	May 18 DC Motor Position Control	May 24, 25 Lab 6
14	May 25 Inverted Pendulum Control	May 31, Jun 1 Lab 7
15	Jun 1 Inverted Pendulum Control	Jun 7, 8 Lab 7
16	Jun 8 Project Introduction	Jun 14, 15 Project
17	Jun 15 Final Exam	Jun 21, 22 Project Demo

Course Gradings:

- Attendance 5%
- Studio 10%
- Lab reports 40%
- Final project 15%
- Midterm exam 15%
- Final exam 15%

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.
- 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.
- Any questions regarding the grading discrepancy should be brought up within a week of returning the homework 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**. Absence will result in a zero on that lab report. 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 to reschedule. While in the laboratory, all safety guidelines and procedures must be followed. Failure to comply with safe laboratory practices will result in removal from the course.