Fall
2022

SCUPI
Sichuan University - Pittsburgh Institute

MEMS 1045 Automatic Controls

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

Instructor:	Qi (Michael) Lu, Ph.D. (qi.lu@scupi.cn), Zone 4-218
Lecture time/room:	Tue 1:50 - 4:25 PM/Zone 4-204
Office hours:	Wed 1:50 - 5:30 PM
Teaching assistant (TA):	Yilong Li (925198989@qq.com)

Note: when emailing the instructor or the teaching assistant, please

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

Catalog Description:

Introduction to analysis and design of control systems, including applications to electromechanical systems. Students learn how characteristics such as stability, transient response, and steady-state error may be changed through dynamic compensation. Students become familiar with classical analysis and design tools in the context of single-input, single-output, linear time-invariant systems. (3 credit hours)

Course Objective:

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

- Understand the benefits of feedback
- Obtain and use transfer function to model dynamical systems
- Assemble complex systems using block diagrams
- Analyze stability of dynamical system
- Quantify system performance
- Design control systems for closed-loop stability and performance
- Understand PID control

Prerequisites:

MEMS-1015 Rigid-Body Dynamics, MEMS-1014 Dynamic Systems, or the permission from instructor.

Textbook:

Norman S. Nise, Control System Engineering, 8th edition, Wiley, 2019. ISBN – 978-1-119-59435-2

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Course Schedule:

Week	Textbook	Topic
2	1.1, 1.3-1.5; 2.1-2.2	Introduction Review of Laplace Transform
3	2.3-2.7	Differential Equations Dynamic Models
4	2.8-2.9; 3.1-3.7	Transfer Functions State Space Model
5	5.1-5.5	Block Diagrams Block Reduction
6	National Holiday (TBD)	
7	6.1-6.4	Stability of Linear Dynamic Models Routh-Hurwitz Criterion
8	Midterm Exam I	
9	4.1-4.4	Time Response First Order System
10	4.5-4.8	Second Order System Rise, Settling, Peak and Overshoot
11	7.1-7.5	Steady-State Error Analysis System Type
12	8.1-8.6	Root Locus Techniques
13	Midterm Exam II	
14	9.1-9.5	Design via Root Locus
15	10.1-10.3	Frequency Response Analysis Bode Plot Nyquist Plot
16	10.3-10.5	Nyquist Plot Nyquist Stability Criterion Gain Margin, Phase Margin
17	11.1-11.5	Design via Frequency Response
18	12.1-12.8	Pole Placement Design
19	Final Exam	

Course Gradings:

- Studio & homework 30 %
- Midterm exam I 20 %
- Midterm exam II 20 %
- Final exam 30 %

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.
- No 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 submission for studio or homework is 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 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.