MEMS 1014 – DYNAMIC SYSTEMS

2024-2025 Fall

(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)

Catalog Description:
This course is designed to introduce students to the modeling and analysis of dynamic systems. Topics covered include Laplace transformation; modeling and analysis of physical systems; time and frequency domain analysis; transient and steady state system responses to various excitations; transfer function formulation; and state space model representations. MATLAB and Simulink will be used in this course (3 credit hours).

Prerequisites:
- MATH 0280 Matrices & Linear Algebra or equivalent
- MATH 290 Differential Equation or equivalent
- ENGR 0012 Engineering Computing or equivalent
- MEMS 0031 Electrical Circuits or equivalent
- MEMS 1015 Rigid-Body Dynamics or equivalent

Lecture time/location: Monday 08:15 - 10:25 / zone 4 – room 201.

Textbook & References:
- Ramin S. Esfandiari and Bei Lu: Modeling and Analysis of Dynamic Systems, 3rd Edition, CRC Press, 2018.
- Additional references and supplementary materials will be posted on Blackboard.

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Office Hours: Monday 13:00 – 16:00 and Tuesday 13:00 – 16:00
For consultation outside office hours, please send an email to make an appointment. Note: please include the course name/number, your name and student number in the message. In the subject field of your email indicate the issue (and use your university email account).

Course Objectives:
- Introduce students to the modeling of dynamic systems.
- Acquaint students with the analysis of dynamic systems in the time and frequency domains.
- Develop the students' skills in the utilization of computer tools to investigate the behaviors of dynamic systems.

Course Learning Outcomes:

After the successful completion of this course students should be able to:

- Formulate equations of motions for linear mechanical, electrical, fluid, & thermal systems,
- Represent the system model in different forms,
- Solve the system model to get the responses for different inputs,
- Analyze the system response characteristics in the time and frequency domains,
- Utilize computer tools to analyze system responses.

This course contributes to the following ABET Criterion 3 outcomes:

(1) Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

(2) Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

(3) Communicate effectively with a range of audiences.

(7) Acquire and apply new knowledge as needed, using appropriate learning strategies.

Tentative Course Schedule (changes will be announced):

Week	Text	Topic
1	Ch. 1 & 3	Introduction (with revision of applied linear algebra)
2	Ch. 2	Ordinary differential equations (revision)
3	Ch. 4 makeup 14Sep	Linear systems & State-space models
4	Ch. 4	Input-output equations & Transfer function
5	Ch. 4	Block diagrams
6	Makeup 12 Oct	Midterm 1
7	Ch. 6	Electrical systems
8	Ch. 5	Mechanical systems
9	Ch. 5	Mixed mechanical systems
10	Ch. 5 & 6	Electromechanical systems
11		Midterm
12	Ch. 7	Fluid and thermal systems
13	Ch. 8	First order system responses
14	Ch. 8	Second order system time responses
15	Ch. 8	Frequency responses
16	Ch. 4	Nonlinearities & Revision
17		Final exam

The course covers the modeling and response analysis of mechanical, electrical, fluid, and thermal systems through guided learning, discussion, formative exercises, quizzes, studios, computer laboratory exercises and projects. Laboratory exercises will cover the use of computer tools for analytical and numerical investigations of systems' behaviors. Projects will enable students to apply knowledge and computer skills in the modelling and analysis of linear dynamic systems. Quizzes, studios, and formative exercises will focus on fundamentals so that students can better understand basic concepts.

Grading Policy:

ACTIVITIES	PERCENTAGES
Quizzes, studios	10%
Labs, Projects	20%
Midterms	40%
Final	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:

- Sichuan University attendance policy will be enforced. Attendance will be taken at the start and checked at the end of the class. Students who come to class more than 15 minutes late (without valid reasons) will be considered as absent. Students who leave class early (without valid reasons) will be considered absent. Students who sign the attendance for another student will be considered as absent and will be reported to the University as a misconduct. Students performing activities not associated with the course while in class (e.g., sleeping, watching video, playing games, doing other course assignments or personal work) will be considered absent.
- Students with 3 unexcused absences (including lateness or leaving class early) will receive zero for all quizzes, studios, laboratory exercises, and projects (i.e., only the midterm and final exams' marks will be considered towards their final grades).
- Students who missed more than a third of the classes (these absences included classes missed with and without approval and valid reasons) will lose the right to be assessed and will receive zero for the course.
- All quizzes, studios, laboratory exercises, projects and exams have clearly stated submission requirements. No marks will be given if the submission requirements are not met. Late submissions will not be accepted. No makeup for quizzes, studios, laboratory exercises, and projects will be allowed.
- If a student cannot attend the midterm examinations, the student must contact the instructor immediately with a valid reason. If the reason stated is consistent with University Policy, arrangements can be made for alternate assessments. Otherwise, the student will get zero for the midterm examinations.
- If a student has a valid reason and cannot attend the final exam, the student must apply to the administration for a deferred examination.
- Challenge to the grading must be made within 7 days after the returned of the graded assessment item. No challenges to the grading will be entertained after the 7-day period.

Academic misconduct and non-academic misconduct will not be tolerated. All misconduct will be reported and dealt with by SCUPI.

Academic Misconduct:

All students in attendance at the Sichuan University are expected to be honorable and to observe standards of conduct appropriate to a community of scholars. The University expects from its students a higher standard of conduct than the minimum required to avoid discipline. Academic misconduct includes all acts of dishonesty in any academically related matter and any knowing or intentional help or attempt to help, or conspiracy to help, another student. The Academic Misconduct Disciplinary Policy will be followed in the event of academic misconduct.

Non-academic Misconduct:

All cell phones, and mobile phones are to be turned off and put out of sight during lectures (mobile phones and computers can be turned on during studios). All newspapers and other materials not related to the class are to be put away once class begins. Operating these devices and reading unrelated materials while in class is disrespectful to your instructor and fellow classmates. If you fail to abide by this rule, the instructor has the right to confiscate the device or materials and mark you as absent. If you have an emergency and need to have your phone turned on during class, ask your instructor for permission.