



## SYLLABUS

### EENG 3283: Electrical Systems Design (Required Course - Spring 2025)

#### COURSE INSTRUCTOR

Dr. Yuyao Wang (yuyao.wang@msutexas.edu)

#### COURSE & LAB SCHEDULE

<i>Days</i>	<i>Time</i>	<i>Location</i>
Monday	10:00 am – 10:50 am	MY 131
Tuesday		
Wednesday	10:00 am – 10:50 am	MY 131
Thursday		
Friday	10:00 am – 10:50 am	MY 131

#### OFFICE HOURS

<i>Days</i>	<i>Time</i>	<i>Location</i>
Monday	3:00 pm – 5:00 pm	MY 127
Tuesday	3:00 pm – 5:00 pm	MY 127
Wednesday	3:00 pm – 5:00 pm	MY 127
Thursday		
Friday		

#### MSU CATALOG DESCRIPTION

Introduction to robotics, kinematics and dynamics of robotic arms, rigid motions and homogeneous transformation, motion planning, computer vision, and control, as well as current trends in the robotics industry and their practical applications.

#### COURSE PRE-REQUISITES

EENG 2104 Electric Circuits, EENG 2212 Engineering Computation

#### OTHER PREREQUISITES

Basic computer skills, MATLAB

#### TEXTBOOK

“Introduction to Robotics: Mechanics and Control, 4<sup>th</sup> edition”, *John J. Craig*, Pearson.

#### SUPPLEMENTAL MATERIAL

Robot Modeling and Control, *Mark W. Spong, Seth Hutchinson, M. Vidyasagar*, Wiley.

#### LIST OF TOPICS COVERED

<ul style="list-style-type: none"><li>• Coordinate systems</li></ul>	<ul style="list-style-type: none"><li>• Equations of motion for robotic arms</li></ul>
<ul style="list-style-type: none"><li>• Forward and inverse kinematics</li></ul>	<ul style="list-style-type: none"><li>• Dynamics analysis</li></ul>
<ul style="list-style-type: none"><li>• Rigid motions</li></ul>	<ul style="list-style-type: none"><li>• Actuators</li></ul>
<ul style="list-style-type: none"><li>• Homogeneous transformation matrices</li></ul>	<ul style="list-style-type: none"><li>• Path planning algorithms</li></ul>
<ul style="list-style-type: none"><li>• D-H parameters and Jacobian Matrix</li></ul>	<ul style="list-style-type: none"><li>• Control strategies</li></ul>

*Additional material may be covered as time permits.*

#### SPECIFIC GOALS OF INSTRUCTION

**Table 1:** A detailed list of course objectives matched with the ABET outcomes (1-7).

COURSE OBJECTIVES	ABET OUTCOMES*						
	1	2	3	4	5	6	7
Ability to understand different types of coordinate systems and how they are used to describe the configuration of a robotic system.	X					X	X
Ability to analyze and compute forward kinematics for robotic manipulators (hw, exam).	X					X	X
Ability to analyze and compute inverse kinematics for robotic manipulators (hw, exam).	X					X	X
Ability to understand and apply the concepts of dynamics in robotic systems (hw, exam).	X					X	X
Ability to understand and apply the concepts of rigid motions in robotic systems (hw, exam).	X					X	X
Ability to understand and apply Homogeneous Transformation Matrix in robotic systems (hw, exam).	X					X	X
Ability to understand and derive the Jacobian Matrix to analyze robotic systems (hw, exam).	X					X	X
Ability to understand and apply D-H parameters to derive the Jacobian for a given manipulator configuration.	X					X	X
Ability to understand and apply path and trajectory planning algorithms for robotic motion (hw, exam).	X					X	X
Ability to understand and design control strategies for independent joint control in robotic manipulators (hw, exam).	X					X	X

\***Table 2:** Detailed descriptions of the ABET outcomes (1-7) listed in Table 1.

ABET Outcome	DESCRIPTION
1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2	an ability to apply engineering design to produce solutions that meets specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3	an ability to communicate effectively with a range of audiences.
4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5	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.
6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

## COURSE ORGANIZATION AND STUDENT PERFORMANCES ASSESSMENT

- Lecture Format

This course consists of three 50-minute sessions per week. The class will be spent mostly explaining and discussing concepts, and solving relevant case problems. Lectures will not be used to communicate the entire textbook course content and thus, students will have to study a set of course paragraphs specified by the instructor on their own to further their understanding. Student participation in class discussions is highly recommended.

- Attendance

Attendance is required for each student. Absences of more than five lectures without proofs of legitimate excuses will result in a failing grade. **For each absence without proofs of acceptable excuses there will be 1 point off from Attendance & Class performance. If you are over 30 minutes late for the class, you are still allowed to sit in the class, but 1 absence will be counted.**

- Student Attitude

Once class starts, the use of cell phones, reading of newspapers, conducting private discussions, using the computer (unless requested by the instructor), working on anything that is not directly related to the course, and making derogatory remarks about your classmates or instructor will not be accepted and may result in your dismissal from the class. **Each time you are caught will result in 1 point off from Attendance & Class performance. Total grade for Attendance & Class performance is 5 points at beginning and it could become negative.**

- Homework

Homework will be assigned from a set of chosen chapters. It will be turned in each week, unless specified by the instructor. **Homework must be turned in at the beginning of class. Once class starts, late homework will be graded 80% of the full grade. If you arrived late, your homework will also be counted as late. Late homework will only be accepted until the end of the due day.** If you copied from a solution manual or from your classmates, you will receive zero points.

- Exams

There will be two midterm exams plus one final exam at the end of the semester. Exam will be closed book and cheat sheet is not allowed. **Each exam is based on the course materials developed between two consecutive exams and possibly lab material if exist.** Students are expected to take the exam on the scheduled date and time it is given. However, if for some acceptable reason the student is not able to do so, then the student must inform the instructor in advance with valid reasons. The instructor will then decide whether he/she will be allowed to take a makeup exam, depending on the validity of the excuse. There is only one chance for a makeup exam no matter what.

- Evaluation Method

Your performance will be tested regularly throughout the semester by in-class exams and homework assignments. There will be three exams.

- Midterm Progress Report

In order to help students keep track of their progress, a Midterm Progress Report will be provided for each at-risk student through WebWorld. The grades reported will not be reflected on the students' transcript; nor will they be calculated in the cumulative GPA. However, at-risk students should put more effort and seek out tutoring.

- Course Grade

Midterm 1		25%
Midterm 2		25%
Homework		20%
Attendance & Class performance		5%
Final Exam		25%

**\*Bonus point in any case will only apply to those with a final grade lower than C.**

## **GENERAL GUIDELINES**

- Plan on spending at least 6 hours outside of class to study the material and to work on homework assignments, and lab experiments. Do not wait until the last day to start working on your assignment, or prepare for the exam.
- Read the course material before coming to class.
- Utilize the office hours throughout the semester to seek explanations from the instructor.
- In engineering, neatness is a must, not a luxury. Be advised that you will be penalized for lack of neatness.
- You are strongly encouraged to study in group.
- Generative AI can assist with understanding theories but approach its answers with caution. Do not rely on AI for hardware design or homework, as it may provide incorrect information, and you will be responsible for any resulting penalties.

## **CONFLICT RESOLUTION**

- a. The student should contact the instructor face to face or via e-mail if there is an issue with the course or the instructor. The faculty and the student will discuss this face to face or via email. Hopefully, a resolution is reached on the issue.
- b. The student should notify the faculty via email again if the issue still did not get resolved after the first encounter or communication.
- c. The student can then contact the Chair of the McCoy School of Engineering, Dr. Desai, face to face or via email, ([raj.desai@msutexas.edu](mailto:raj.desai@msutexas.edu)), and discuss this issue. Dr. Desai will discuss the issue at hand with the faculty member. Dr. Desai will discuss the result of this discussion with the student. Hopefully, a resolution is reached on the issue after this.
- d. The student should notify the Chair via email if the issue still did not get resolved.
- e. The Chair will contact the Dean and try to resolve the conflict. In case the conflict deals with the student grade, she will forward the case to the Grade Appeals Committee if necessary.

## **GENERAL EDUCATION STATEMENT**

Students in this course must demonstrate their competency in oral and written communication through written project tasks assignments. They must also demonstrate their ability to use the English language.

## **ACADEMIC INTEGRITY POLICY**

Scholastic dishonesty will not be tolerated and will be prosecuted to the fullest extent. You are expected to have read and understood the current issue of the student handbook regarding student responsibilities & rights, and the intellectual property policy information about procedures and what constitutes acceptable on-campus behavior. Any form of plagiarism will not be accepted, and will be heavily reprimanded.

## **DISABILITY SUPPORT SERVICES**

Students registered with Disability Support Services should have a letter verifying their disability and the appropriate accommodations.

## **DISCLAIMER STATEMENT**

Information contained in this syllabus, other than grading, late assignments, and attendance policies, may be subject to change with advance notice, as deemed appropriate by the instructor.