The University of Jordan
School of Engineering

Department	Course Name	Course Number	Semester
Mechanical Engineering	Robotics	0904521	

2019 Course Catalog Description

In this course students are familiarized with the basics of robotics. It covers: applications of robots, spatial descriptions and transformations, forward and inverse kinematics, velocities and static forces, Lagrange formulation, Newton-Euler Method, manipulator dynamics, trajectory generation and methods of controlling a robotic arm.

Instructors

Name	E-mail	Sec	Office Hours	Lecture Time

Text Books

	Text book 1	Text book 2
Title	Lecture notes	
Author(s)		
Publisher, Year, Edition		

References

Books	1. Robot Modeling and Control, by M.W. Spong, S. Hutchinson, and M. Vidyasagar, 2nd edition, John Wiley& Sons, 2006. 2. Introduction to Robotics: Mechanics and Control, by John J. Craig, 3rd Edition, Addison Wesley Publishing Company, 2003.
Journals	
Internet links	

Prerequisites

Prerequisites by topic	-
Prerequisites by course	Mechanics of Machines 0944331+ System Dynamics and Control 0904418
Co-requisites by course	-
Prerequisite for	-

Topics Covered

Week	Topics	Chapter in Text	Sections
1	Kinematics of Particles		
2-3	Spatial descriptions Design Concepts		
4-5	Forward Kinematics		
6-7	Inverse Kinematics		
8-9	Jacobians: Velocities and Singularities		
10-11	Jacobians: Static Forces		
12-13	Building robots with MATLAB		
14-16	Trajectory planning (Joint space and Cartesian space)		

Mapping of Course Outcomes to ABET Student Outcomes

SOs	Course Outcomes
1	1. Ability to derive the Forward & Inverse Kinematics of a simple robotic arm.
2	2. Ability to relate the joint velocities to the Cartesian ones and vice versa of a simple 2 degrees of freedom manipulator arm. 3. Ability to use the concepts of Forward Kinematics, Inverse Kinematics, velocity propagation, singularities, static torques, and workspace to design a 3 (or 3+) degrees of freedom robotic arm. 4. Ability, as a team, to design a 3 (or 3+) degrees of freedom robotic arm and show the details in a report.
3	5. Ability, as a team, to deliver an oral presentation.

Evaluation

Assessment Tools	Expected Due Date	Weight
Midterm		30%
Quizzes/HWs/Project		20%
Final Exam		50%

Contribution of Course to Meet the Professional Components

Forward kinematic equations of rigid manipulators and inverse kinematics are derived. Velocity relationships are determined with the use of the Jacobian matrix. Path planning and trajectory of motion are also discussed in this course. The course incorporates a semester project.

Relationship to Student Outcomes

SOs	1	2	3	4	5	6	7
Availability	X	X	X				

Relationship to Mechanical Engineering Program Objectives (MEPOs)

MEPO1	MEPO2	MEPO3	MEPO4	MEPO5

ABET Student Outcomes (SOs)

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 meet 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 judgments, 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

Updated by ABET Committee, 2024