

Course	ECE 56900 - Introduction to Robotics
Type of Course	Elective for the CmpE and EE programs
Catalog Description	The topics to be covered include: basic components of robotic systems; selection of coordinate frames; homogeneous transformations; solutions to kinematic equations; velocity and force/torque relations; manipulator dynamics in Lagrange's formulation; digital simulation of manipulator motion; motion planning; obstacle avoidance; controller design using the computed torque method; and classical controllers for manipulators.
Credits	3
Contact Hours	3
Prerequisite Courses	ECE/ME 33300, MA 35100, MA 36300
Corequisite Courses	None
Prerequisites by Topics	Students are expected to have a basic knowledge of feedback control systems, have a good understanding of vector algebra and differential equations.
Textbook	M. W. Spong and M. Vidyasagar, <i>Robot Dynamics and Control</i> , John Wiley & Sons, 1989
Course Objectives	This course provides an introduction to the basics of modeling, design, planning and control of robot systems with an emphasis on robot arms.
Course Outcomes	Students who successfully complete this course will have demonstrated: <ol style="list-style-type: none">1. an understanding of rigid motions and homogeneous transformation. (a, e)2. an ability to solve forward and inverse kinematics equations. (a, e)3. an ability to analyze robotic motion using Jacobian matrix. (a, e)

4. an ability to understand robot dynamic modeling and to derive the dynamic model using Lagrangian equations. **(a, e)**
5. an ability to design and analyze simple robot control systems using classical feedback control design methods. **(a, c, e)**
6. an ability to design robot motion trajectories to meet certain specifications and requirements. **(a, c, e, k)**

Lecture Topics

1. Introduction
2. Rigid motions and homogeneous transformations
3. Forward Kinematics: the Denavit-Hartenberg representation
4. Inverse Kinematics
5. Velocity kinematics-Jacobian
6. Dynamics
7. Control
8. Trajectory generation and interpolation

Computer Usage Medium

Laboratory Experience None

Design Experience High

Coordinator Yanfei Liu, Ph.D.

Date 03/02/2018