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| **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, *Robot Dynamics and Control*, 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:   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 |