Course name	**ECE 56900 Introduction To Robotic Systems**
Credit and contact hours	(3 cr.) Class 3
Course coordinator's name	Sarah Koskie
Textbook	M. Spong, S. Hutchinson, M. Vidyasagar, *Robot Modeling and Control,* Wiley 2005. ISBN: 9780471649908
Course information	**2020-21 IUPUI Campus Bulletin description:** ECE 56900 Introduction to Robotic Systems (3 cr.) P: ECE 38200 or Graduate Standing. Class 3. Basic components of robotic systems; selection of coordinate frames; homogeneous transformations; solutions to kinematics of manipulator arms; velocity and force/torque relations; dynamic equations using Euler-Lagrange formulation; digital simulation of manipulator motion; motion planning; obstacle avoidance; controller design using torque method; and classical controllers for manipulators. Lab experiments and final project required. **Prerequisites/ Co-Requisite** P or C: ECE 38200 or equivalent, and any high-level programming languages or graduate standing **Required, Elective, or Selected Elective:** EE Elective, CE Elective
Goals for the course	Upon successful completion of the course, students should be able to 1. Define the coordinates and the corresponding kinematic parameters for robotic manipulators. [1] 2. Solve forward and inverse kinematic equations. [1] 3. Analyze robotic motion using the concepts of Jacobian matrix. [1] 4. Drive robot dynamic model using Lagrange's equations of motion. [1] 5. Design robot motion trajectories to meet the design specifications and requirements. [1, 2] 6. Analyze and design simple robot control systems using classical control design methods. [1] 7. Evaluate and test the system performance using computer-aided tools. [6] 8. Program industrial robots to perform pre-specified tasks. [6]
List of topics to be covered	1. Introduction: robotics and automation, mechatronics, and applications. (1 class) 0.5 2. Fundamentals of robot technology. (2 classes) 1.0 (Components of industrial robots, work volume, drive systems, control systems, end effector, performance specifications, etc.) 3. Kinematics: spatial description, homogeneous transformations. (2 classes) 1.0 4. Kinematics: D-H representation and transformation matrices. (2 classes) 1.0 5. Inverse kinematics: solvability and solutions. (2 classes) 1.0

	6. Differential motions and robot Jacobian. (2 classes)	1.0
	7. Robot programming languages. (1 classes)	0.5
	8. Path/Trajectory planning. (2 classes)	1.0
	9. Robot dynamics: Euler-Lagrange formulation. (3 classes)	1.5
	10. Robot actuators. (2 classes)	1.0
	11. Sensors and instrumentation. (2 classes)	1.0
	12. Robot control: concepts, classical control design techniques. (3 classes)	1.5
	13. Robot control: computed torque technique. (1 classes)	0.5
	14. Machine vision: introduction. (3 classes)	1.5
	Exams (2.0 classes and final exam period)	
Syllabi approved by	Sarah Koskie	
Date of approval	08/20/2019	