Course Title	**Robotics**				
Course Code	**MME 420**				
Course Type	Elective				
Level	Undergraduate				
Year / Semester	4th Year / 7th or 8th Semester				
Teacher's Name	Eftychios Christoforou				
ECTS	6	Lectures / week	3+1 hours	Laboratories / week	4 hours total
Course Purpose and Objectives	The purpose of the course is to provide an introduction to robotics with the emphasis being on robotic manipulators. Examine the various types of robotic systems, their applications and the methodologies used for their mathematical analysis, design, and control. Develop relevant problem-solving skills applied to practical engineering problems.				
Learning Outcomes	• Identify and classify robotic systems, use the relevant terminology and cite their applications. • Understand the kinematics of robotic manipulators and be able to apply the mathematical methodologies used for kinematic and workspace analysis. • Understand the dynamics of robotic systems and how the relevant equations of motion are formulated. • Apply common motion control methodologies as used in robotics. • Identify sensors and actuators used in robotic systems, understand their principles of operation and characteristics, and be able to select them. • Design motion trajectories for robotic manipulation tasks. • Interpret the specifications of a robotic system and evaluate it based on the needs of a specific application.				
Prerequisites	MME 327	Required	None		
Course Content	The course introduces the students to the field of robotics with emphasis on robotic manipulators. Applications, theoretical analysis, design, and control issues are considered. Topics covered: (a) History, types of robotic systems and applications, (b) Terminology, main parts, kinematic chain, end-effectors, (c) Coordinate transformations, rotation matrices, and homogeneous transformations, (d) Forward kinematics analysis, Denavit-Hartenberg procedure, inverse manipulator kinematics, (e) Velocity kinematics, Jacobian matrix, inverse velocity kinematics, singular configurations, (f) Dynamics modeling, the method of Newton-Euler and the method of Lagrange, equations of motion, (g) Feedback control schemes, trajectory planning, (h) Sensors and actuators used in robotics, (i) Specifications of industrial robotic systems and safety measures. **Laboratory Exercises** • Motion planning and programming of basic pick-and-place tasks • Industrial application simulation using a belt conveyor				

Teaching Methodology	• 2 weekly lectures • 1 weekly tutorial • Weekly homework problems • Laboratory demonstration/exercise • During the first week of the semester the students receive the course syllabus, which includes the course content, bibliography, learning outcomes, assessment and office hours.
Bibliography	• Craig, J., *Introduction to Robotics: Mechanics and Control*. Prentice Hall • Sciavicco, L. and B. Siciliano, *Modeling and Control of Robot Manipulators*. Springer. • Spong, M.W. and M. Vidyasagar, *Robot Dynamics and Control*. Wiley.
Assessment	• Laboratory 10% • Midterm exam 40% • Final exam (comprehensive) 50%
Language	Greek