UNIVERSITY of NICOSIA

Course Syllabus

Course Code	Course Title	ECTS Credits
MENG-440	Mechatronics and Robotics	6
Prerequisites	**Department**	**Semester**
MENG-252, MATH-280	Engineering	Fall, Spring
Type of Course	**Field**	**Language of Instruction**
Elective	Engineering	English
Level of Course	**Lecturer(s)**	**Year of Study**
1st Cycle	Dr Harry Iordanou	3rd or 4th
Mode of Delivery	**Work Placement**	**Corequisites**
Face-to-Face	N/A	None

Course Objectives:

The main objectives of the course are to:

- introduce robotics, the various types of robotic systems, their applications and the methodologies used for the mathematical analysis.
- describe the fundamentals of forward and inverse kinematics of robotic manipulators, velocities, static forces, singularities
- describe manipulator dynamics, trajectory generation, manipulator design (actuators, sensors, controls etc.).

Learning Outcomes:

After completion of the course students are expected to be able to:

- Identify and classify robotic systems, express relevant terminology and cite their applications.
- Understand the kinematics of robotic manipulators and be able to apply the mathematical methodologies used for kinematic analysis.
- Understand the dynamics of robotic systems and formulate relevant equations of motion.
- Demonstrate the motion control methodologies as applied in robotics.
- Differentiate robotic system's sensors and actuators; understand their principles of operation.
- Design motion trajectories for robotic manipulation tasks.
- State the specifications of a robotic system; evaluate based on specific application needs.

UNIC

Course Content:

- Introduction: history, types of robotic systems, applications (industrial, medical, mobile, etc.).
- Robotic manipulation systems: terminology, main parts, types of joints, end-effectors, and practical applications.
- Mathematical background: coordinate transformations, rotation matrices, and homogeneous transformations.
- Manipulator kinematics: forward kinematics, Denavit-Hartenberg notation/parameters.
- Inverse manipulator kinematics: analytical solution, existence of solutions, multiple solutions.
- Velocity kinematics: Jacobian matrix, inverse velocity kinematics, singularity, redundancy.
- Dynamics: modeling using the method of Newton-Euler and the method of Lagrange, equations of motion and important properties.
- Control: feedback control schemes, trajectory planning methods.
- Sensors and actuators used in robotics: position, velocity and force sensors, electric actuators, hydraulic and pneumatic actuators.

Learning Activities and Teaching Methods:

Lectures, In-class examples, exercises.

Assessment Methods:

Homework, exams, final exam.

Required Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Introduction to Robotics	J. J. Craig	Pearson	2014	1292040041

Recommended Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Modeling and Control of Robot Manipulators	L. Sciavicco, B. Siciliano	Springer	2001	1852332212
Robot Dynamics and Control	M. W. Spong, M. Vidyasagar	Wiley	1989	047161243X