

EAS401 Robotics Mechanics and Control

Level: 4

Credit Units: 5 Credit Units

Language: ENGLISH

Presentation Pattern: EVERY JULY

Synopsis:

This course introduces fundamental concepts in robotics and a unified set of analytical tools for the modeling and control of robotic systems. The course focuses on arm-type robotics with mobile robotics briefly introduced. Topics covered include rigid-body transformations, robot kinematics, differential motions, robot dynamics, trajectory planning, linear/non-linear control and force control methodologies, sensors and actuators as well as mechanical design aspects of robots. Computer simulations of robot applications using the Robot Operating System (ROS) platform is also introduced. The Python programming language is used in laboratory sessions and course projects to simulate the kinematics and control of robotic systems.

Topics:

- Introduction to robotic systems and applications
- Spatial descriptions and transformations
- Forward kinematics and inverse kinematics
- Velocities, static forces, and Jacobians
- Manipulator dynamics
- Trajectory planning
- Sensors and actuators
- Mechanical design of robots
- Linear control of manipulators
- Nonlinear control of manipulators
- Force control of manipulators
- Simulation of robot applications in ROS using Python programming

Textbooks:

John J. Craig: Introduction to Robotics: Mechanics and Control Third Edition Pearson
ISBN-13: 978-020154361

Learning Outcome:

- Appraise applications of robots and robotic systems
- Formulate position and velocity kinematics of robot manipulators
- Calculate path planning using algebraic techniques
- Examine working principles of robot sensors and actuators
- Analyse robot controllers using appropriate methods
- Design numerical models to simulate kinematics and control of robotic systems
- Experiment with the Python programming for development of numerical models
- Design robotic systems in a simulation environment

Assessment Strategies:

Continuous Assessment Component	Weightage (%)
TUTOR-MARKED ASSIGNMENT	15
TUTOR-MARKED ASSIGNMENT	15
Sub-Total	30

Examinable Component	Weightage (%)
ECA	70
Sub-Total	70

Weightage Total **100**