Course Structure

Course Code : **SM7106**

Course Title : **Robotics Modelling and Control**

Credit Hours : **3**

Course Description

Manipulator and mobile platform robots, Robot kinematics and dynamics, Homogeneous coordinate transformations, Direct and inverse kinematics of manipulators, Friction, Sensors of rotation, accelerometers, gyroscopes, Actuators, Trajectories in space and time, Path planning, control, Human-Robot Interaction.

Course Objectives

The student should become acquainted with:

- Introducing the fundamental concepts of robot manipulators and mobile robots: kinematics, dynamics, differential kinematics, path and trajectory planning, control. Presentation of the diverse sorts of sensors useful in robotics, their functioning principle and observation model. Notions of formation control. Programming languages and robot operation interfaces.

Course Topics

- Introduction: Manipulator and mobile platform robots. Applications.
- Robot kinematics and dynamics. Coordinate systems: position and orientation
- Homogeneous coordinate transformations. Denavit-Hartenberg convention
- Direct and inverse kinematics of manipulators Kinematics of mobile platforms.
- Differential kinematics. Notions of manipulator and mobile platform dynamics
- Friction. Examples of dynamics models. Newton Euler Laws. Lagrangians.
- Laboratory work on the kinematics of serial manipulators.
- Sensors of rotation, accelerometers, gyroscopes. Sonars, laser range-finder, and vision
- Actuators: motors, deflection surfaces. Movement and navigation planning:
- Trajectories in space and time. Trajectory generation
- Path planning by search on visibility graphs, and by potential fields. Path planning under holonomic and non-holonomic constraints.
- Introduction to Control. Control Linearization. Control of manipulator and mobile robots.
- Formation control of mobile robots Programming languages for robots

Course Structure

- Introduction to robot control architectures. Functional vs Behavioral. The subsumption paradigm. Hierarchical architectures. Examples
- Introduction to Human-Robot Interaction (HRI). Discussion based on known examples of HRI. The importance of emotions and anthropomorphic features. Emotional response.