17ES018 ROBOTICS AND AUTOMATION

Hours Per Week :

L	T	P	C
3	1	-	4

Total Hours :

L	T	P
45	15	-

WA/RA	SSH/HSH	CS	SA	S	BS
15	30	-	5	5	-

Course Objectives:

Automation, control and robotics are pervasive enabling technologies found in almost every modern technical system, particularly in manufacturing and production. They combine the diverse and rapidly expanding disciplines of automation, control, mechanics, software and signal processing.

This course is ideal if you wish to develop comprehensive knowledge and understanding of • classical and modern control theory • industrial automation • systems analysis • design and simulation • robotics.

Course Outcomes:

- Understand basic concepts of robotics.
- Enhances practical applications of sensors and actuators in robotic systems.
- Design and model robotic manipulator.
- Design and develop dynamic control systems with related to robotics

SKILLS:

- Ability to design robot model
- Ability to apply principles of modelling
- Ability to distinguish classical and modern control concepts and controller design packages in various areas of industry
- Ability to design and exploit automation and robotic systems in a range of manufacturing and industrial applications.
- Familiarization with machine vision for image processing applications with robot

ACTIVITIES:

- Design dynamics of robots
- Calculation of torques and selection of motors
- Selection of sensors
- Integration of mechatronic systems
- Motion planning and control
- Design of a robot using CAD

Unit – I

Introduction: Brief History - Past, Present status and Future trends in robotics - Uses of robots – Robot Anatomy: Overview of Robot subsystems - Concept of Workspace - Mechanisms and Transmission - Types of Robots - Issues in Designing and Controlling Robots: Resolution, Repeatability, Accuracy and Compliance.

Unit – II

Effectors: Different types of Grippers and Tools - Vacuum and other methods of gripping, Actuators: Pneumatic, Hydraulic and Electric Actuators – Sensors: Internal and External sensors - Position, Velocity and Acceleration Sensors - Proximity Sensors - Force Sensors - Laser range finder - Camera. Micro-controllers, DSP, Real time operating systems.

Unit – III

Positions, Orientations and Frames - Mappings: Changing descriptions from frame to frame, Operators: Translations, Rotations and Transformations - Transformation Arithmetic - D-H Representation - Forward and Inverse Kinematics of Six DOF Robot Arm - Robot Arm dynamics.

Unit – IV

Robot Control: Independent joint control - PD and PID feedback - Actuator models - Nonlinearity of Manipulator models - Issues in nonlinear control - Force feedback - Hybrid control - Motion planning and Obstacle avoidance: Road map methods, Graph search algorithms, Potential field methods - Robot languages -.Computer Control and Robot software.

Unit –V

Robot Vision - Camera model and Perspective transformation - Image processing fundamentals for Robotic applications - Image acquisition and preprocessing - Segmentation and region characterization - object recognition by image matching and based on features - Problem of bin-picking - Futuristic topics in Robotics.

TEXT BOOKS:

1. Groover M P, “Industrial Robotics”, Pearson Publications.
2. Mittal R K &Nagrath I J, “Robotics and Control”, Tata McGraw Hill Publications.
3. Ghosal A, “Robotics: Fundamental Concepts and Analysis”, Oxford University Press

REFERENCE BOOKS:

1. Fu K S, “Robotics”, McGraw Hill Publications
2. P. Coiffet and M. Chaironze, “An Introduction to Robot Technology”, Kogam Page Ltd. London, 1983.
3. Richard D. Klafter, “Robotic Engineering”, Prentice Hall India Limited.
4. John J Craig, “Introduction to Robotics”, Pearson Education publications.
5. Mark W. Spong and M. Vidyasagar, “Robot Dynamics & Control”, John Wiley & Sons (ASIA) Pvt. Ltd.