INDUSTRIAL ROBOTICS

Course Code: 15ME2113

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Course Outcomes: At the end of the course, the student will be able to

CO1: Analyze the manipulator design including actuator and sensor issues

CO2: Calculate the problems based on manipulator kinematics for serial and parallel robots

CO3: Identify different types of end effectors and sensors required for specific applications

CO4: Develop programming principles and languages for a robot control system

CO5: Discuss various applications for industrial and non-industrial robot systems

UNIT–I (10-Lectures)

Introduction: Automation and robotics, robot anatomy, robot configurations, work volume, robot drive systems, control systems and precision of movement

Control systems and components: Basic control system concepts and models, controllers, control system analysis, feedback components – position sensors, velocity sensors, actuators and power transmission systems

UNIT–II (10-Lectures)

Robot motion analysis and control: Introduction to manipulator kinematics, homogenous transformations, manipulator path control, dynamic model for 2 DOF manipulator, Lagrange – Euler formulation, Newton – Euler formulation, trajectory planning – joint space techniques and cartesian space techniques, configuration of a robot controller

UNIT–III (10-Lectures)

Robot end effectors: Grippers-types, operation, mechanism, force analysis, tools as end effectors and considerations in gripper selection and design

Robotic sensors**:** Desirable features of tactile, proximity and range sensors, uses of sensors in robotics

UNIT–IV (10-Lectures)

Robotic vision: Process of imaging, architecture of robotic vision system, image acquisition, image representation, image processing

Robot programming and languages: Lead through programming, robot programming as a path in space, motion interpolation, WAIT, SIGNAL and DELAY commands, branching, capabilities and limitations of lead through methods, textual robot languages, generations, robot language structure and motion commands

UNIT-V (10-Lectures)

Robot cell design and control: Robot cell layouts-robot centered cell, inline robot cell, mobile robot cell, considerations in work design, work cell control, inter locks, errors detection, work cell controller

Robot applications: Industrial applications – material handling, processing applications, assembly and inspection applications, non-industrial applications

TEXT BOOK:

1. M.P Groover, M Weiss, R M Gnagel and N G Ordrey, "*Industrial Robotics*", Tata McGraw-Hill, New Delhi, 2012

REFERENCES:

1. Nagrath and Mittal, "*Robotics and Control*", Tata McGraw-Hill, 2003, 24th Reprint, New Delhi, 2015
2. S. K. Saha, "*Introduction to Robotics*", McGraw-Hill Education India, New Delhi, 2008
3. Saeed B. Niku, "*Introduction to Robotics: Analysis, Systems, Application*", Pearson Education, New Delhi, 2011