# INDUSTRIAL ROBOTICS

**Subject Code: 13ME2114**

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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, drive and sensor issues

CO2: Calculate the forward kinematics, inverse kinematics and Jacobian 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 of industrial robot systems

## UNIT–I

Introduction: Automation and robotics. robot anatomy, robot configuration motions, joint notation, work volume, robot drive systems, control systems and dynamic performance, precision of movement Control systems and components: Basic concepts and models, controllers, control system analysis, robot activation and feedback components, position sensors, velocity sensors, actuators, power transmission systems

## UNIT–II

Motion analysis and control: Manipulator kinematics, position representation forward transformation, homogenous transformations, manipulator path control robot dynamics, configuration of a robot controller

## UNIT–III

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

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

**UNIT–IV**

Machine vision: Functions, sensing and digitizing-imaging, devices, lighting techniques, analog to digital signal conversion, image storage, image processing and analysis-image data reduction, segmentation, feature, extraction, object recognition, training the vision system, robotics applications

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. Textual robot languages, generations, robot language structures, elements in functions.

**UNIT-V**

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**:** material transfer, machine loading/unloading, processing operations, assembly and inspections

**TEXT BOOK:**

1. M.P Groover, M Weiss, R M gnagel and N G Ordrey, "*Industrial Robotics*", Tata McGraw-Hill, New Delhi, 2008.

**REFERENCES:**

1. R.K. Mittal, I J Nagrath, " *Robotics and Control*", Tata McGraw Hill, 2003, 6th Reprint, 2007, New Delhi.
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, 2011.