

**III Year-II Semester
(20ME6430) Industrial Robotics & Applications**

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

Pre- Requisites: None

Course Objectives:

- To give students practice in applying their knowledge of mathematics, science, and Engineering and to expand this knowledge into the vast area of robotics.
- The students will be exposed to the concepts of robot kinematics, Dynamics, Trajectory planning.
- Mathematical approach to explain how the robotic arm motion can be described.
- The students will understand the functioning of sensors and actuators.
- They will know the application and can explore possible applications of robot in future.

UNIT-I:

INTRODUCTION: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

COMPONENTS OF THE INDUSTRIAL ROBOTICS: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors and comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

UNIT-II:

MOTION ANALYSIS: Homogeneous transformations as applicable to rotation and translation – problems.

MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.

UNIT-III:

Differential transformation and manipulators, Jacobians – problems Dynamics: Lagrange – Euler and Newton – Euler formulations – Problems.

UNIT-IV:

General considerations in path description and generation. Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion – Robot programming, languages and software packages-description of paths with a robot programming language.

UNIT-V:

ROBOT ACTUATORS AND FEED BACK COMPONENTS:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders– Velocity sensors.

ROBOT APPLICATIONS IN MANUFACTURING: Material Transfer -Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Defense, Disaster management. Applications, Micro and Nano-robots, Future Applications.- Assembly and Inspection.

Course Outcomes:

S.No	Course Outcomes	BTL
1	Identify various robot configuration and components.	
2	Select appropriate actuators and sensors for a robot based on specific application.	
3	Carry out kinematic and dynamic analysis for simple serial kinematic chains	
4	Perform trajectory planning for a manipulator by avoiding obstacles	
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Text Books:

1. Industrial Robotics / Groover M P / Pearson Edu.
2. Robotics and Control / Mittal R K & Nagrath I J / TMH.

Reference Books:

1. Robotics / Fu K S / McGraw Hill.
2. Robotic Engineering / Richard D. Klafter, Prentice Hall.
3. Robot Analysis and Intelligence / Asada and Slotnick / Wiley InterScience.
4. Introduction to Robotics / John J Craig / Pearson Edu.