

Introduction to Industrial Robotics

Course Code	23ME2601	Year	III	Semester	II
Course Category	OE- II	Branch	ME	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes		
Upon successful completion of the course, the student will be able to		BL
CO1	Explain the fundamental concepts of automation, robotics, and CAD/CAM integration, and classify industrial robots based on coordinate systems, control systems, and structural anatomy, including end-effectors	L2
CO2	Compare and analyse various types of robot actuators such as pneumatic, hydraulic, and electric systems, and explain the working of feedback components like position and velocity sensors used in robotic control.	L2
CO3	Apply homogeneous transformation matrices to model robot motion and solve problems related to manipulator kinematics using D-H parameters for both forward and inverse kinematics.	L3
CO4	Describe robotic trajectories considering path planning, obstacle avoidance, and motion types using appropriate robot programming languages and tools.	L2
CO5	Describe the basic concepts of machine vision systems and explain the image acquisition, digitization, and processing techniques used in robotic applications	L2

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2											
CO2	3	3								2			
CO3	3	3	2										
CO4	2	3	3	2	3								
CO5	2				3					2			
Average	3	3	3	2	3					2			

Syllabus		
Unit No.	Contents	Mapped CO
1	Introduction: Automation and Robotics, CAD/CAM and Robotics – An overview of Robotics –present and future applications – classification by Coordinate System and Control System. Components of the Industrial Robotics: Robot anatomy, work volume, components, number of degrees of freedom - robot drive systems, function line diagram representation of robot arms, common types of arms –requirements and challenges of end effectors, determination of the end effectors.	CO1
2	Robot Actuators and Feed Back Components:	CO2

	<p>Actuators: Pneumatic, Hydraulic Actuators, Electric & Stepper Motors. Comparison of Electric, Hydraulic and Pneumatic Types of Actuation Devices.</p> <p>Feedback Components: Position Sensors–Potentiometers, Resolvers, Encoders–Velocity Sensors.</p>	
3	<p>Motion Analysis: Homogeneous Transformations as Applicable to Rotation and Translation – Problems.</p> <p>Manipulator Kinematics: Specifications of Matrices, D-H Notation Joint Coordinates and World Coordinates Forward and Inverse Kinematics–Problems.</p>	CO3
4	<p>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.</p>	CO4
5	<p>Image Processing and Machine Vision: Introduction to Machine Vision, Sensing and Digitizing function in Machine Vision, Training and Vision System, Robotic Applications.</p>	CO5

Learning Resources

Text Books:

1. Groover MP- Industrial Robotics: Technology, Programming and Applications, 2nd Ed., Pearson Education, 2017
2. Mittal R K & Nagrathi J- Robotics and Control- Tata McGraw-Hill.2017

References:

1. K. S. Fu, R. C. Gonzalez, and C. S. G. Lee, Robotics: Control, Sensing, Vision, and Intelligence, McGraw Hill.1987
2. Richard D. Klafter, Thomas A. Chmielewski, and Michael Negin, Robotic Engineering, Prentice Hall,1993
3. H. Asada and J.J.E. Slotine Robot Analysis and Control,Wiley Interscience,, 1986.
4. John J Craig- Introduction to Robotics- 3rd Ed., Pearson Education, 2008

E-Resources:

1. Introduction to Industrial Robotics – NPTEL (ME161)
https://onlinecourses.nptel.ac.in/noc25_me161/preview