INTRODUCTION TO INDUSTRIAL ROBOTICS

Course Code	**23ME2601**	**Year**	III	**Semester**	
Course Category	Open Elective - 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:**	

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

CO	**Statement**	**BTL**	**Units**
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	2	1
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.	2	2
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.	3	3
CO4	**Describe** robotic trajectories considering path planning, obstacle avoidance, and motion types using appropriate robot programming languages and tools.	2	4
CO5	**Describe** the basic concepts of machine vision systems and **explain** the image acquisition, digitization, and processing techniques used in robotic applications	2	5

Syllabus		
Unit	**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:** **Actuators:** Pneumatic, Hydraulic actuators, electric& stepper motors. Comparison of Electric, Hydraulic and Pneumatic types of actuation devices. **Feedback components:** position sensors–potentiometers, resolvers, encoders–Velocity sensors.	**CO2**
3	**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.	**CO3**
4	**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.	**CO4**
5	**IMAGE PROCESSING AND MACHINE VISION:** Introduction to Machine Vision, Sensing and Digitizing function in Machine Vision, Training and Vision System, Robotic Applications.	**CO5**

Learning Resources
Text Book(s): 1. Industrial Robotics/Groover MP/Pearson Edu. 2. Robotics and Control /Mittal R K &Nagrathi J /TMH.
References: 1. Robotics/Fu KS/ McGraw Hill. 2. Robotic Engineering /Richard D. Klafter, Prentice Hall 3. Robot Analysis and Control/ H. Asada and J.J.E. Slotine/BSP Books Pvt.Ltd. 4. Introduction to Robotics/John J Craig/PearsonEdu.