Devi Ahilya University, Indore, India Institute of Engineering & Technology				**III Year B.E. (Mechanical Engg.) (Full Time)**			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
6MERE2: Robotics	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
	3	1	2	3	1	1	5
Duration of Theory Paper: 3 Hrs							

Course Objective:
The course is designed

1. The main objective of the subject is to introduce the students about the new and advanced methods to implement on design of Industrial robot.
2. Objective of the subject to introduce the students about the new and advanced methods to implement on Industry Automation.
3. Students will demonstrate an understanding of how to program robots and computers that control manufacturing automation.

Prerequisite(s):

COURSE CONTENT

UNIT-I
Introduction: Automation and Robotics, An overview of Robotics, History of robots, Classification of robots, Classification by coordinate system and control system. Mechanisms and transmission, Present and future applications, Basic components of robotic system. Function line diagram representation of robot arms, common types of arms.

UNIT-II
Components of the Industrial Robotics: Architecture, Basic terminology- Accuracy, Repeatability, Resolution, number of degrees of freedom, Requirements, classifications, working and applications of end effectors/grippers, determination of the end effectors/grippers, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices. Introduction, classification and working of various sensors.

UNIT-III
Robot Arm Kinematics: Direct and inverse kinematics, Rotation matrices, Composite rotation matrices, Euler angle representation, Homogenous transformation, Denavit Hattenberg representation and various arm configuration.

UNIT-IV
Robot Arm Dynamics: Lagrange – Euler formulation, joint velocities, Kinetic energy, Potential energy and motion equations, Generalised D'Alembert equations of motion.

UNIT-V
Robot controls: Point to point control, Continuous path control, Intelligent robot, Control system for robot joint, Control actions, Feedback devices, Encoder, Resolver, LVDT, Motion Interpolations, Adaptive control.
Introduction to Robotic Programming: On-line and off-line programming, programming examples.

Application of Robotics: Robot Application in Manufacturing: Material Transfer, Material handling, loading and unloading- Processing, Spot and continuous arc welding & spray painting, Assembly and Inspection.

List of Practical Assignments:

10. Assignment on introduction to robot configuration.
11. Demonstration of robot with 2 DOF, 3 DOF, 4 DOF etc.
12. Two assignments on programming the robot for applications.
13. Two assignments on programming the robot for applications in VAL II.
14. Two programming exercises for robots.
15. Two case studies of applications in industry.
16. Exercise on robotic simulation software.

Course Outcome:

Students earned credits will develop ability to

CO1. Familiar with the history, concept development and key components of robotics technologies.

CO2. Familiar with various robot sensors and their perception principles that enable a robot to analyse their environment, reason and take appropriate actions toward the given goal.

CO3. Understand, analyse and solve problems in spatial coordinate representation and spatial transformation, robot locomotion design, kinematics, motion control.

Books Recommended:

[11]. Fu K. S., Robotics (Control, Sensing, Vision and Intelligence), McGraw-Hill, 4e, 2003.
[12]. Schilling R. J., Fundamental of Robotics, Prentice Hall, 1990.
[13]. Wesley, Sryda E., Industrial Robots: Computer interfacing and Control, Prentice Hall, 1985.
[14]. Groover M.P., Industrial Robotics Technology Programming and Applications, McGraw-Hill, 1986.
[15]. Asada and Slotine, Robot Analysis and Control, John Wiley and Sons, 1986.

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Students earned credits will develop ability to

CO.No.	CO	PO
CO1	Familiar with the history, concept development and key components of robotics technologies.	PO1, PO2, PO3
CO2	Familiar with various robot sensors and their perception principles that enable a robot to analyse their environment, reason and take appropriate actions toward the given goal.	PO1, PO4, PO5
CO3	Understand, analyse and solve problems in spatial coordinate representation and spatial transformation, robot locomotion design, kinematics, motion control.	PO1, PO3, PO4, PO12

CO-PO Relationship

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	3									
CO2	3			3	3							
CO3	3		3	3								2
CO4												
CO5												

* CO (rows) mention nil/very small/insignificant contribution to the PO(column)

1→ relevant and small significance 2 → medium or moderate and 3 →stronge