

Devi Ahilya University, Indore, India Institute of Engineering & Technology				1 Year M.E.(Design & Thermal Engg.) Full Time			
Subject Code & Name	Instructions Hours per Week			Credits			
DTR1E3 Mechanism and Robot Kinematics	L	T	P	L	T	P	Total
	3	1	2	3	1	1	5
Duration of Theory Paper: 3 Hours							

Objective and Pre requisites: The objective of the subject is to introduce the students about the basic analytical techniques and fundamental principles of Robot Kinematics. The Pre requisites are knowledge of the basic course in theory of machines, matrix theory, probability, computer programming and mathematical analysis.

COURSE CONTENT

UNIT-1

Introduction to Robotics & Mechanisms

Introduction, Automation and Robotics, Robot anatomy and Robot configurations, Links and joints notations, End effectors, Work volume and Obstacles, Overview of Robot drive systems and Control systems, Robot sensing, Dynamic performance and Precision of movement, Applications in Robotics.

UNIT-2

Robot Arm Kinematics

Introduction, Forward or direct Kinematics Problem, Matrix Representations, Robot arm coordinates and Transformation matrix, Composite homogeneous transformation matrix, Denavit-Hartenberg representation, Kinematic equations, Location of end effector, Inverse kinematic problem, Geometric approach for solution of inverse kinematic problem.

UNIT-3

Trajectory Planning

Introduction, Constraints and Path specifications, Basic algorithm for generation of joint trajectory, joint interpolated trajectories, Cartesian path trajectory planning.

UNIT-4

Robot Arm Control.

Fundamentals of control system theory, Joint motion controls: Servo mechanism, Computed torque technique, Minimum time control, Variable structure control. Adaptive control modes.

UNIT-5

Robot Programming and Task Planning

Introduction, Characteristics of robotic programming languages, position and motion specification, development and debugging facilities, task-level programming and robot program synthesis, Robot intelligence and task planning.

BOOKS RECOMMENDED:

- [1] Mikell P. Groover, *Industrial Robotics*, McGraw Hill Pvt. Ltd., New Delhi.
- [2] K. S. Fu, R. C. Gonzalez, C. S.G. Lee, *Robotics: Control, Sensing, Vision and Intelligence*, McGraw Hill Book Company, Singapore, International Edition 1987.
- [3] Robert J. Schilling, *Fundamentals of Robotics: Analysis & Control*, Prentice-Hall of India Private Limited, New Delhi, 5th Reprint, 2003