IV B.TECH -I SEMESTER
ROBOTICS

Course Code: ME7T4B **Credits: 3**
Lecture: 3 periods/week **Internal assessment: 30 marks**
Tutorial: 1 period/week **Semester end examination: 70 marks**

COURSE OBJECTIVES:

The objective of the course is to enable students to

- Understand robot configuration, structures, basic components, workspace and generations of robots.
- Get acquainted with performing spatial transformations and solve kinematics of the robot
- Get knowledge and analysis skills associated with trajectory planning
- Learn about various sensors, actuators, robot programming
- Understand the present &future applications of a robot.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

1. Demonstrate knowledge of industrial robots, characteristics, end effectors and actuators.
2. Apply spatial transformation to obtain forward and inverse kinematics
3. Solve robot dynamics problems, generate joint trajectory for path planning
4. Describe working principle of various sensors and program different operations
5. Appreciate applications of robots in industry.

UNIT I

INTRODUCTION TO ROBOTICS: Automation and Robotics, major components of a robot, robotic like devices, Classification by coordinate system and by control method, Specifications of robots, Architecture, number of degrees of freedom, economic analysis, and overview of robot present and future applications.

Robot end effectors: Introduction, end effectors, types of end effectors, grippers and tools, Requirements and challenges of end effectors.

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors.

UNIT II

TRANSFORMATIONS: Homogeneous coordinates, transformations as applicable to translation, rotation, problems.

KINEMATICS: Introduction to Robot Kinematics-forward solution, Denavit-Hartenberg (D-H) Notation, Forward kinematics, Simple problems involving planar manipulators, Simple inverse kinematic problems.

UNIT III

DIFFERENTIAL TRANSFORMATIONS: Differential transformations of manipulators, Jacobians, problems.

DYNAMICS: Lagrange Euler and Newton Euler formulations, Problems.

TRAJECTORY PLANNING:
Path planning, avoidance of obstacles, path planning algorithms, trajectory planning with cubic polynomial, blending, higher order trajectories.

UNIT IV
ROBOTIC SENSORY DEVICES: Introduction, Non-optical position sensors– potentiometers, synchros, optical. position sensors – optical interrupters, optical encoders (absolute & incremental). **Proximity sensors:** Contact type, noncontact type – reflected light scanning laser sensors. **Touch & slip sensors:** Tactile sensors – proximity rod & photo detector sensors, Slip sensors- Forced oscillation slip sensor, interrupted type slip sensors.
ROBOT PROGRAMMING: Robot programming, languages and software packages**.**

UNIT V
ROBOT APPLICATION IN MANUFACTURING: Material Transfer, Material handling, loading and unloading, Processing, spot and continuous arc welding & spray painting Assembly and Inspection.

Learning Resources

Text books:

1. Industrial Robotics by Mikell P.Groover, McGraw-Hill Int. Edition
2. Robotics and Control / Mittal R K & Nagrath I J / TMH.

Reference Books:

1. Robotic Engineering by Richard D.Klafter, Prentice Hall
2. Introduction to Robotics – Saeed B.Niku, Prentice Hall
3. Introduction to Robotics – John J. Craig, Addison Wesley

Web resources:
1.http://nptel.ac.in/downloads/112101098/