## ROBOTICS AND ITS APPLICATIONS

| Course Code | 19ME4701C | Year | IV | Semester | I |
|---|---|---|---|---|---|
| Course Category: | Program Elective | Branch | ME | Course Type | Theory |
| Credits: | 3 | L – T – P | 3 – 0 – 0 | Prerequisites: | Nil |
| Continuous Evaluation: | 30 | Semester End Evaluation: | 70 | Total Marks: | 100 |

| Course Outcomes | | |
|---|---|---|
| Upon successful completion of the course, the student will be able to | | |
| CO1 | Understand the basic anatomy of robots. | L2 |
| CO2 | Solve kinematic and dynamic problems of the robot. | L3 |
| CO3 | Develop robot program and joint trajectory for path planning. | L3 |
| CO4 | Describe working principle of various robot sensors. | L2 |
| CO5 | Outline the applications of robots in industry. | L2 |

| Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | | | | | 1 | | 1 | | | | 1 | 3 | 1 |
| CO2 | 3 | 3 | 2 | | | | | | | | | 1 | 3 | 1 |
| CO3 | 3 | 3 | 2 | | | | | | | | | 1 | 3 | 1 |
| CO4 | 3 | | | | | | | | | | | 1 | 3 | 1 |
| CO5 | 3 | | | | 1 | | | | | | | 1 | 3 | 1 |

| Course Content | | |
|---|---|---|
| UNIT-1 | **INTRODUCTION:** Basic concepts - Robot anatomy - classification, robot specifications and Work volume, Types of Robot actuators- Pneumatic, Hydraulic actuators, electric and stepper motors<br>**END EFFECTORS**- types of end effectors, grippers and tools, Requirements and challenges of end effectors. | CO1 |
| UNIT-2 | **TRANSFORMATIONS**- Homogeneous coordinates for translation and rotation<br>**MANIPULATOR KINEMATICS:** D-H notation, Forward and inverse kinematics, simple problems, Dynamics- lagrangian formulation, introduction to jacobian computation. | CO2 |
| UNIT-3 | **TRAJECTORY PLANNING** :Trajectory planning with cubic polynomial, blending, higher order trajectories<br>**ROBOT PROGRAMMING:** Robot language classification - programming methods - off and on-line programming - Lead through method - Teach pendent method - VAL systems and language, simple programs. | CO3 |
| UNIT-4 | **SENSORS:** Sensor devices, Types of sensors - contact, position and displacement sensors, Force and torque sensors - Proximity and range sensors - acoustic sensors –slip sensors, Robot vision systems | CO4 |

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| **UNIT-5** | **INDUSTRIAL APPLICATIONS:** Application of robots - material handling - machine loading and unloading, assembly, inspection, welding, spray painting,<br>Recent Developments In Robotics: mobile robot, microbots, safety considerations. | CO5 |
| **Learning Resources** | | |
| **Text Books** | 1. Mikell P. Groover. Industrial Robotics Technology Programming and Applications, McGraw Hill Co., Singapore, 1995.<br>2. Robotics and Control / Mittal R K & Nagrath I J / TMH.2017. | |
| **Reference Books** | 1. Robotic Engineering by Richard D.Klafter, Prentice Hall<br>2. Introduction to Robotics – Saeed B.Niku, Prentice Hall<br>3. Introduction to Robotics – John J. Craig, Addison Wesley | |
| **e- Resources & other digital material** | 1. http://nptel.ac.in/downloads/112101098/<br>2. https://nptel.ac.in/courses/112/105/112105249/<br>3. https://nptel.ac.in/courses/107/106/107106090/ | |