

## **Automation and Robotics**

**Course Title:** Automation and Robotics

**Course No:** CSC371

**Nature of the Course:** Theory + Lab

**Semester:** VI

**Full Marks:** 60 + 20 + 20

**Pass Marks:** 24 + 8 + 8

**Credit Hrs:** 3

### **Course Description:**

This course provides the detailed idea about fields of robotics and its control mechanisms.

### **Course Objective:**

The main objective is to provide information on various parts of robots and idea on fields of robotics. It also focuses on various kinematics and inverse kinematics of robots, trajectory planning of robots and to study the control of robots for some specific applications.

### **Course Contents:**

#### **Unit 1: Introduction (8 Hrs.)**

Definition and Origin of Robotics, Types of Robotics, Major Components, Historical development of Robot, Robotic System and Robot anatomy, Degrees of freedom, Coordinate System and its type Asimov's laws of robotics, Dynamic stabilization of robots

#### **Unit 2: Power Sources and Sensors (8 Hrs.)**

Hydraulic, pneumatic and electric drives, determination of HP of motor and gearing ratio, variable speed arrangements, path determination, micro machines in robotics, machine vision, ranging, laser, acoustic, magnetic, fiber optic and tactile sensors.

#### **Unit 3: Manipulators, Actuators, and Grippers (8 Hrs.)**

Manipulators, Classification, Construction of manipulators, manipulator dynamics and force control, electronic and pneumatic manipulator control, End effectors, Loads and Forces, Grippers, design considerations, Robot motion Control, Position Sensing

#### **Unit 4: Kinematics and Path Planning (8 Hrs.)**

Solution of Inverse Kinematics Problem, Multiple Solution Jacobian Work Envelop, Hill Climbing Techniques, Robot Programming Languages

#### **Unit 5: Process Control (8 Hrs.)**

Process Control and Types, On-Off Control Systems, Proportional Control Systems, Proportional Plus Integral (PI) Control Systems, Three Mode Control (PID) Control Systems, Process Control Tuning.

#### **Unit 6: Case Studies (5 Hrs.)**

Multiple robots, Machine Interface, Robots in Manufacturing and not-Manufacturing Application, Robot Cell Design, Selection of a Robot

### **Laboratory Works:**

The laboratory work should be focused on implementation of sensors, design of control systems. It should also deal with developing programs related Robot design and control using python.

**Text Books:**

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., **Industrial Robotics**, McGraw Hill.
2. Ghosh, **Control in Robotics and Automation: Sensor Based Integration**, Allied Publishers.

**References:**

1. Jain K.C. and Aggarwal B.E., **Robotics – Principles and Practice**, Khanna Publishers
2. Schuler, C.A. and McNamee, W.L. **Modern Industrial Electronics**, Macmillan/McGraw-Hill
3. Klafter R.D., Chimielewski T.A., Negin M., **Robotic Engineering – An Integrated Approach**, Prentice Hall of India.
4. Deb.S.R., **Robotics Technology and Flexible Automation**, John Wiley, USA 1992.
5. Asfahl C.R., **Robots and Manufacturing Automation**, John Wiley, USA 1992
6. Mc Kerrow P.J. **Introduction to Robotics**, Addison Wesley, USA, 1991.
7. Issac Asimov I. **Robot**, Ballantine Books, New York, 1986.