

**Course Title: Automation and Robotics**

**Course no: CSC-358**

**Credit hours: 3**

**Full Marks: 70+10+20**

**Pass Marks: 28+4+8**

**Nature of course:** Theory (3 Hrs.) + Lab (3 Hrs.)

**Course Synopsis:** this course has the idea of automation and robotics.

**Goal:** To provide students with information on how to apply robots and manufacturing automated systems with the basic principles underlying the design, analysis and synthesis of robotic systems.

**Course Contents:**

**Unit 1. Introduction**

**6 Hrs.**

Robot definition, Major Components, Human arm characteristics, Geometric motion configuration, Robot Classification, Direct and Indirect Drives, Characteristics of Robot Performance, Historical development of Robot, Degrees of freedom, 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. Kinematic Analysis**

**10 Hrs.**

Manipulator Kinematics, Manipulator Geometry and Degrees of Freedom, Workspace and Joint Space, Coordinate Transformation, Rotation Matrices and Transformation, Homogeneous Transformation, Translation Matrices, Orientation Specification, Rotation Matrices.

**Unit 5. Process Control**

**9 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. Other Issues**

**4 Hrs.**

Robot Safety, Safety Hazards, Safety Measures, Economic Analysis and Installation, Robot Manufacturing Systems, selection of a robot.

### **References:**

1. Jain K.C. and Aggarwal B.E., *Robotics – Principles and Practice*, Khanna Publishers
2. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., *Industrial Robotics*, McGraw Hill.
3. Ghosh, *Control in Robotics and Automation: Sensor Based Integration*, Allied Publishers.
4. Schuler, C.A. and McNamee, W.L. *Modern Industrial Electronics*, Macmillan/McGraw-Hill
5. Klafter R.D., Chimielewski T.A., Negin M., *Robotic Engineering – An integrated approach*, Prentice Hall of India.