

## IV B.Tech II Semester

## 15AME81-AUTOMATION AND ROBOTICS

L T P C

3103

**Course Objective:**

The subject should enable the students to understand the principles of automation, importance of automated flow lines and its types. To learn the concepts of Robotics, kinematics of robot, principles of robot drives and controls, sensors used in robots and programming methods.

**UNIT I**

**INTRODUCTION TO AUTOMATION:** Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation. Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

**Learning outcome & Suggested Student Activities:**

After completion of this unit students are able to understand to know what is automation, types of automation, components of automation, strategies and levels of automation.

**UNIT II**

**AUTOMATED FLOW LINES:** Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines.

**ASSEMBLY LINE BALANCING:** Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

**Learning outcome & Suggested Student Activities:**

After completion of this unit students are able to understand the types of flow lines, quantitative analysis of flow lines, how the assembly is carried out on automated flow line without interruption and how to balance the line and flexible assembly lines.

**UNIT III**

**INTRODUCTION TO INDUSTRIAL ROBOTICS:** Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers.

**ROBOT ACTUATORS AND FEEDBACK COMPONENTS:** Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

**Learning outcome & Suggested Student Activities:**

Student should come to know the various components in the anatomy of robot. By knowing this the student may apply in the design of new robotic structure.

**UNIT IV**

**MANIPULATOR KINEMATICS:** Homogenous transformations as applicable to rotation and transition - D-H notation, Forward inverse kinematics.

**MANIPULATOR DYNAMICS:** Differential transformations, Jacobians, Lagrange - Euler and Newton - Euler formations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

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**Learning outcome & Suggested Student Activities:**

After completion of this unit students are able to understand the applications of various types of end effectors, and sensor devices. Student should also learn about the homogeneous transformations and its applications in the analysis of a robotic structure and method of developing different types of mechanisms and kinematics of the robot.

**UNIT V**

**ROBOT PROGRAMMING:** Methods of programming - requirements and features of programming languages, software packages. Problems with programming languages.

**ROBOT APPLICATION IN MANUFACTURING:** Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

**Learning outcome & Suggested Student Activities:**

After completion of this unit students are able to understand robot programming languages which may adopt in different applications of robot. Student also knows the control motion mechanism in all devices of robot and application of robots in manufacturing sector.

**TEXT BOOKS:**

1. Automation , Production systems and CIM, M.P. Groover /Pearson Edu.
2. Industrial Robotics – Mikell P. Groover and Mitchell Weiss, Roger N. Nagel, Nicholas, G.Odrey – McGraw Hill, 1986..

**REFERENCE BOOKS:**

1. Robotics and control - R K Mittal and I J nagrath, TataMcGraw Hill 2004.
2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. Robotic Engineering - integrated approach by Richard d Klafter-London: Prentice-Hall-1989.
4. Robotics, Fundamental Concepts and analysis –AshitaveGhosal, Oxford Press
5. Introduction to Robotics - John J. Craig, PearsonEdu.

**SUGGESTED LINKS:**

- <http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv071-Page1.htm>
- [http://www.cadcamfunda.com/cam\\_computer\\_aided\\_manufacturing](http://www.cadcamfunda.com/cam_computer_aided_manufacturing)
- <http://wings.buffalo.edu/eng/mae/courses/460-564/Course-Notes/cnc-classnotes.pdf>
- <http://nptel.iitm.ac.in/courses.php?branch=Mechanical>
- <http://academicearth.org/courses/introduction-to-roboticsVideo>
- <http://nptel.iitm.ac.in/video.php?courseId=1052>
- [http://www.nptel.iitm.ac.in/and\\_iitb.ac.in](http://www.nptel.iitm.ac.in/and_iitb.ac.in) ,
- <http://www.learnerstv.com/video/Free-video-Lecture-30103-Engineering.htm>

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