## B. Tech III Year I Semester

# JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA 19AME53 – AUTOMATION AND ROBOTICS

L T P C 3 0 0 3

Course Objectives: The objectives of the course are to make the students learn about

- Describe the basic concepts of automation in manufacturing systems.
- Acquire the fundamental concepts of automated flow lines and their analysis.
- Classify automated material handling, automated storage and retrieval systems.
- Illustrate adaptive control systems and automated inspection methods.

#### **UNIT - 1: Introduction**

10 Hrs

**Introduction:** Automation in production system, need, types, Principles and Strategies of automation, levels of automation, basic elements of an automated system, hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

Automated flow lines & transfer mechanisms, fundamentals of transfer Lines, flow lines with or without buffer storage.

# **Learning Outcomes:**

At the end of this unit, the student will be able to

- Define the automation in production system.
- Describing the concept of automated flow lines.
  Classify the types of hardware components of automation and control system.
  L3
- Compare various types of part transfer mechanisms.

## UNIT - II: Assembly Line Balancing

10 Hrs

Assembly Line Balancing: Assembly process and systems assembly line, line balancing algorithms, ways of improving line balance, flexible assembly lines.

Material handling and Identification Technologies: Overview of automatic material handling systems, principles and design consideration, material transport systems, storage systems, overview of automatic identification methods.

**Automated Manufacturing Systems:** Components, classification and overview of manufacturing systems, manufacturing cells, GT and cellular manufacturing, FMS and its planning and implementation.

#### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Describing the concept of assembly line balancing.
   Identify the components of automated manufacturing system
- Understand the concept of GT, FMS, cellular manufacturing and material handling system L1
- Understand the concept of G1, FMS, cellular manufacturing and material handling system
   Classify the types of automated manufacturing system.
- Design a simple material handling system for low cost manufacturing

  L6

#### **UNIT – III: Introduction Robotics**

8 Hrs

**Introduction:** Brief history of robots, classification of robot, functional line diagram, degrees of freedom. Elements of robot - types and its functions, 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 Outcomes:**

At the end of this unit, the student will be able to

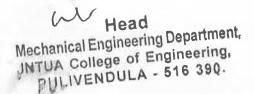
• Design a simple gripper for robot.

**L6** 

• Compare the types of actuators used in robot manipulator.

**L4** 

Page 1 of 2



Department of Mechanical Engineering	R19
<ul> <li>List out the various types of robots and feedback components.</li> <li>Define the degree of freedom for robot.</li> </ul>	L1 L1
UNIT – IV: Manipulator Kinematics & Dynamics	Hrs
Manipulator Kinematics: Homogenous transformations as applicable to translation, rotation, Forward and inverse kinematics.  Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newt	
formations.	
Learning Outcomes: At the end of this unit, the student will be able to	
Evaluate D-H notations for simple robot manipulator	L4
Identify the path and position of robot gripper within work volume	L1
<ul> <li>Use the Jacobian, Lagrange-Euler and Newton- Euler formations to solve manipu dynamic problems</li> </ul>	Lo
<ul> <li>Explain the concepts of manipulator kinematics and dynamics</li> </ul>	L3
UNIT - V: Robot Programming & Applications	8 Hrs
Robot Programming: Methods of programming - requirements and features of programming software packages, problems with programming languages. Motion path control- slew motion; avoidance of obstacles.  Robot Application in Manufacturing: Material Transfer - Material handling, loading and Process - spot and continuous arc welding & spray painting; Assembly and Inspection.	tion, joint
Learning Outcomes:	
At the end of this unit, the student will be able to	
<ul> <li>Understand the requirements and features of robot programming</li> </ul>	L1
Demonstrate the various applications of robots in manufacturing.	L6
• List the various methods of robot programming.	L1
Use various software packages to write the robot programming	L4
<ol> <li>Text Books:</li> <li>Mikell P.Groover, Automation, Production Systems and Computer Integrated Manu Pearson Education. 5/e, 2009.</li> </ol>	
2. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel, Nicholas G.Odrey, Industrial — Mc Graw Hill, 1986.	Kobotics –
Reference Books:	
<ol> <li>S. R. Deb &amp; Sankha Deb, Robotics Technology and Flexible Automation, Tata Mc Education.</li> </ol>	Graw-Hill
2. R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGraw 2003.	
3. Saeed B. Niku, Introduction to Robotics – Analysis, System, Applications, 2 <sup>nd</sup> Edi Wiley & Sons, 2010.	
4. Richard D. Klafter, Thomas Robotic Engineering an integrated approach, PHI publication Course Outcomes:	ons 1988.
At the end of this Course the student will be able to	
Explain the principles and Strategies of automation.	L2
Select type of automatic material handling system	L1
• Use D-H parameters for determining the position of the end effecter.	L3
Explain the manipulator kinematics and dynamics	L2
Write the program for robot	L5

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Page 2 of 2