B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME53 – AUTOMATION AND ROBOTICS

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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. **L1**
- Describing the concept of automated flow lines. **L2**
- Classify the types of hardware components of automation and control system. **L3**
- Compare various types of part transfer mechanisms. **L4**

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. **L2**
- Identify the components of automated manufacturing system **L1**
- Understand the concept of GT, FMS, cellular manufacturing and material handling system **L1**
- Classify the types of automated manufacturing system. **L2**
- 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**

Head
Mechanical Engineering Department,
JNTUA College of Engineering,
PULIVENDULA - 516 390.

- List out the various types of robots and feedback components. **L1**
- Define the degree of freedom for robot. **L1**

UNIT – IV: Manipulator Kinematics & Dynamics **12 Hrs**

Manipulator Kinematics: Homogenous transformations as applicable to translation, rotations- D-H notation, Forward and inverse kinematics.

Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton - Euler 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**
- Use the Jacobian, Lagrange-Euler and Newton- Euler formations to solve manipulator dynamic problems **L6**
- Explain the concepts of manipulator kinematics and dynamics **L3**

UNIT – V: Robot Programming & Applications **8 Hrs**

Robot Programming: Methods of programming - requirements and features of programming languages, software packages, problems with programming languages. Motion path control- slew motion, joint integrated motion, straight line motion; avoidance of obstacles.

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading; Process - spot and continuous arc welding & spray painting; Assembly and Inspection.

Learning Outcomes:

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

- Understand the requirements and features of robot programming **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**

Text Books:

1. Mikell P.Groover, Automation, Production Systems and Computer Integrated Manufacturing-Pearson Education.5/e, 2009.
2. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel, Nicholas G.Odrey , Industrial Robotics – – Mc Graw Hill, 1986.

Reference Books:

1. S. R. Deb & Sankha Deb, Robotics Technology and Flexible Automation, Tata McGraw-Hill Education.
2. R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGraw Hill India 2003.
3. Saeed B. Niku, Introduction to Robotics – Analysis, System, Applications, 2nd Edition, John Wiley & Sons, 2010.
4. Richard D. Klafter, Thomas Robotic Engineering an integrated approach, PHI publications 1988.

Course Outcomes:

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**