

Introduction to Robotics

Course 501: Introduction to Robotics

Provides the background required for a detailed study of robot systems and their maintenance. Introduces the trainee to the basics of robotics, using clear, easy-to-follow language. Includes expanded coverage of robot safety and updated sensor and programming information.

TPC Training is accredited by IACET to offer **0.7 CEU** for this program.



Lesson 1: Robotics in Automated Manufacturing

Topics

Evolution of Robotics; What is an Industrial Robot?; Essential Characteristics; Robots and Automated Manufacturing; Project Manufacturing; Job Shop; Batch Manufacturing; Repetitive (Flow) Manufacturing; Continuous Manufacturing; Robot Safety

Objectives

- Identify why robots did not appear in large numbers in manufacturing until the late 1970s.
- State the Robot Industries Association's definition of an industrial robot and explain the two key words.
- Describe how industrial robots are used in batch production systems.
- Explain how industrial robots are used in repetitive manufacturing systems that utilize transfer lines.
- List at least three factors that should be considered as part of a risk assessment when a robot system is in the development stage.
- Describe and contrast the following guarding methods: barrier, presence-sensing device, awareness device, warning system.
- Define the term zero-energy state.

Lesson 2: The Basic Robot System

Topics

Manufacturing and Robot Systems; Robot Arm; Robot Controller; Power Source; Tooling; Teaching/Programming Devices; Data Storage; Definition of Terms; Critical Specifications; Payload; Degrees of Freedom; Drive Power; Repeatability; Accuracy; Work Envelope Dimensions; Speed; Memory Capacity; Programming Support; End-of-Arm Tooling; Environmental Requirements

Objectives

- Name and describe the basic building blocks of an industrial robot.
- Name and describe the additional components that make up a robot system.
- Define the following robot terms: degrees of freedom, position axes, orientation axes, work envelope, tool center point.
- Define and give an example of the following specifications for industrial robots: payload, repeatability, memory capacity, and environmental requirements.
- Explain the difference between accuracy and repeatability in robots.

Lesson 3: Robot Classification I

Topics

Robot Classification; Classification by Control System; Open-Loop Control; Nonservo Operation; Advantages of Open-Loop Control; Disadvantages of Open-Loop Control; Applications for Open-Loop Control; Closed-Loop Control; Advantages of Closed-Loop Control; Disadvantages of Closed-Loop Control; Applications for Closed-Loop Control; Classification by Application

Objectives

- Identify the five methods of classifying industrial robots.
- Explain the difference between robots with closed-loop control and those with open-loop control.
- Describe the techniques used in closed- and open-loop control in robot systems.
- List the advantages and disadvantages of open- and closed-loop control in robot systems.
- Distinguish between assembly and nonassembly robots according to the application for which they were designed.

Lesson 4: Robot Classification II

Topics

Classification by Arm Geometry; Cartesian (Rectangular) Arm Geometry; Cylindrical Arm Geometry; Spherical (Polar) Arm Geometry; Articulated Arm Geometry; Classification by Power Source; Classification by Path Control; Classification by Intelligence Level

Objectives

- Classify robots by arm geometry, power source, and path control techniques.
- Identify the basic robot work envelopes and name the arm geometries that produce them.
- Name the basic power sources used for robot motion and give an advantage and disadvantage of each.
- Identify the basic path-control techniques and describe their characteristics.

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Lesson 5: Work-Cell Sensors

Topics

Sensor Overview; Simple Contact Sensors; Simple Noncontact Sensors; Simple Process Control Sensors; Complex Sensors; Complex Sensor Interface; Complex Contact Sensors; Complex Noncontact Sensors; Complex Process Control Sensors

Objectives

- List the two types of interfaces and three groups of sensors used in industrial robot systems.
- Describe the primary simple contact sensor commonly found in robot systems.
- Identify and explain the operation of the two simple noncontact sensors most often used in industrial robot installations.
- Explain the difference between the simple sensor interface and complex sensor interface.

Lesson 6: End-of-Arm Tooling

Topics

General Requirements; Tooling Terms; Tooling Power Sources; Tooling Overview; Standard Grippers; Servo or Nonservo Grippers; Vacuum Devices; Magnetic Devices; Flexible Pneumatic Devices; Special-Purpose Tooling; Protecting End-of-Arm Tooling; Compliance

Objectives

- Name the five general requirements all tooling must satisfy.
- Identify and describe briefly the four basic tooling power sources.
- Describe the five categories of end-of-arm tooling used in robot applications.
- Explain the function and advantages of a quick-change device.
- Define the term compliance and explain why it is important.

Lesson 7: Robot Teaching and Programming

Topics

Work-Cell Programming; Controller Functions; Robot Programming; On-Line Programming; On-Line Programming Example; Off-Line Programming; Defining Programmed Points; Writing Program Statements; Work Cell Control with a PLC; PLC Programming Example

Objectives

- List and describe the four basic functions of the computer(s) controlling an automated work cell.
- Name the two major types of robot programming and give advantages and disadvantages of each.
- Name and describe two basic methods of teach programming and tell when each is used.
- List three advantages of off-line programming.
- Name the two elements of a computer program for off-line robot programming.
- Explain the basics of ladder logic programming.