Western Technical College

10664107 Intro to Industrial Robotics

Course Outcome Summary

Course Information

Description	In this course, learners are introduced to programming techniques for industrial robots. The learner examines teach pendant programming including I/O, routines, decision making, six frames of positional operation, and robot communication. Upon completion of the course, learners will be able to operate and program industrial robots commonly used in Industry 4.0.
Career Cluster	Manufacturing
Instructional Level	Associate Degree Courses
Total Credits	2
Total Hours	54

Textbooks

Handling Tool Operations and Programming. Copyright 2020. FANUC. Publisher: FANUC. Required.

Course Competencies

1. Operate an industrial robot system.

Assessment Strategies

1.1. Skill Demonstration
1.2. in the lab
1.3. Written Product

Criteria

You will know you are successful when

1.1. you power up industrial robot controller safely
1.2. you power down industrial robot safely.
1.3. you activate the emergency stop.
1.4. you recover from an emergency stop event.
1.5. you switch between automatic and manual operating modes.
1.6. you enable the robot in Manual Operating Mode.
1.7. you restart the controller.
1.8. you identify robot joint numbers.

1.9. you identify teach pendant features.

Learning Objectives

1.a. Identify robot hazards.
1.b. Explain teach pendant features.
1.c. Identify robot system components.
1.d. Practice operating a robot system.

2. Manipulate an industrial robot arm.

Assessment Strategies

2.1. Skill demonstration
2.2. In the lab
2.3. Written product

Criteria

You will know you are successful when

2.1. you identify teach pendant keys specific to jogging.
2.2. you identify Quickset Menu features.
2.3. you jog individual robot joints.
2.4. you explain the purpose of Linear Motion Mode.
2.5. you explain the purpose of Joint Motion Mode.
2.6. you explain the purpose of Reorient Motion Mode.
2.7. you explain the different coordinate systems.
2.8. you apply the Right-Hand Rule for coordinate systems.
2.9. you acknowledge Error Messages.
2.10. you apply point-to-point programming to move a robotic arm.

Learning Objectives

2.a. Use a teach pendant to manipulate robot arm position.
2.b. Apply Motion Modes (world, joint, tool, user, jog).
2.c. Apply Coordinate Systems.
2.d. Interpret position information.

3. Develop an industrial robot program with joint motions.

Assessment Strategies

3.1. Skill demonstration
3.2. In the lab
3.3. Written product

Criteria

You will know you are successful when

3.1. you explain robot target data.
3.2. you explain joint target data.
3.3. you create a robot program.
3.4. you save a robot program.
3.5. you implement absolute joint moves in a program.
3.6. you explain benefits of joint moves.
3.7. you create named robot targets.
3.8. you apply speed and zone data in joint motion instructions.
3.9. you apply tool and work object data in joint motion instructions.
3.10. you select step mode in the Quickset Menu.
3.11. you reset the program pointer.
3.12. you test the program in manual and automatic mode.

Learning Objectives

3.a. Create a robot program.
3.b. Implement absolute joint motions.
3.c. Implement joint motions.
3.d. Verify a robot program.

4. Calibrate an end-of-arm tool on an industrial robot.

Assessment Strategies

4.1. Skill demonstration
4.2. In the lab
4.3. Written product

Criteria

You will know you are successful when

4.1. you explain the concept of a Tool Center Point (TCP).
4.2. you explain tool X, Y, and Z directions.
4.3. you identify tool zero.
4.4. you create tool data.
4.5. you explain X, Y, and Z translational offsets relative the default tool.
4.6. you calibrate a tool using the TCP & Z method.
4.7. you select a tool using the Quickset Menu or Jogging Menu.
4.8. you jog robot tool using tool coordinates.
4.9. you verify the tool rotates around the TCP.
4.10. you verify Z direction aligns with physical feature of tool.
4.11. you save tool data to a file.
4.12. you load tool data from a file.

Learning Objectives

4.a. Explain tool concept.
4.b. Create tool data.
4.c. Calibrate tool TCP and Z direction.
4.d. Verify tool calibration.
4.e. Modify tool data.

5. Calibrate a user frame work object.

Assessment Strategies

5.1. Skill demonstration
5.2. In the lab
5.3. Written product

Criteria

You will know you are successful when

5.1. you explain the work object concept
5.2. you identify work object zero from World
5.3. you explain X, Y, and Z work object directions
5.4. you create work object data
5.5. you calibrate a work object using the 3-point Object Method
5.6. you select a work object using the Quickset Menu or Jogging Menu
5.7. you jog the robot tool using work object coordinates
5.8. you verify the work object X, Y, and Z directions
5.9. you save work object data to a file
5.10. you load work object data from a file

Learning Objectives

5.a. Explain work object concept.
5.b. Create work object data.
5.c. Calibrate a work object.
5.d. Verify work object calibration.

6. Develop an industrial robot program with linear and circular motions.

Assessment Strategies

6.1. Skill demonstration
6.2. In the lab
6.3. Written product

Criteria

You will know you are successful when

6.1. you create a program to trace a pattern.
6.2. you explain linear motion
6.3. you implement linear moves in a program
6.4. you apply robot targets in linear motion instructions
6.5. you apply speed and zone data in linear motion instructions
6.6. you apply work object data in linear motion instructions
6.7. you explain circular motion
6.8. you apply speed and zone data in circular motion instructions
6.9. you test a pattern tracing program in manual and automatic mode
6.10. you modify a work object to shift a pattern

Learning Objectives

6.a. Create program to trace a pattern.
6.b. Implement linear motion.
6.c. Implement circular motion.
6.d. Verify a pattern tracing program.

7. Develop a structured program for an industrial robot.

Assessment Strategies

7.1. Skill demonstration
7.2. In the lab
7.3. Written product

Criteria

You will know you are successful when

7.1. you identify digital inputs and outputs.
7.2. you monitor digital inputs and outputs
7.3. you simulate digital inputs and outputs
7.4. you implement set instructions to latch on outputs
7.5. you implement rest instructions to latch off outputs
7.6. you implement invert instructions to toggle outputs
7.7. you implement pulse instructions to turn on outputs for a specified time period
7.8. you implement wait instructions to pause a program until an input conditions are met
7.9. you implement wait instructions to pause a program for specific time period
7.10. you create routines
7.11. learner sets the program pointer at the beginning of a routine
7.12. learner tests routines in manual and automatic mode
7.13. learner creates a complete material handling program

Learning Objectives

7.a. Develop a material handling program.
7.b. Manipulate inputs and outputs.
7.c. Implement routines in a program.
7.d. Verify a material handling program.