MET-2250: ROBOTICS OPERATIONS CERTIFICATION

Cuyahoga Community College

Viewing: MET-2250 : Robotics Operations Certification

Board of Trustees:
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Academic Term:
Fall 2023

Subject Code
MET - Mech Eng/Manuf Ind Eng Tech

Course Number:
2250

Title:
Robotics Operations Certification

Catalog Description:
This course is intended for an operator, technician, engineer or programmer who must setup and record programs on a robot for industrial applications. The course covers the Robot Operations outline intermixed with the tasks required to program robot instruction, set up the Handling Tool application, test, run and refine the program and production setup. It prepares students to take Robotics Operations Certification, Tests for FANUC robots and other systems.

Credit Hour(s):
3

Lecture Hour(s):
2
Lab Hour(s):
3

Requisites

Prerequisite and Corequisite
None.

Outcomes
Course Outcome(s):
Set up robot for programming and operations

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
a. Identify the Robot components.
b. Identify and learn the Robot's major and minor axes, joints, and links.
c. Describe Servo Motors and Serial Pulse Coders.
d. Describe what Software and Operating System that drive Robots' Operations.
e. Identify with Controller types.
f. Discuss the different Deadman Switch positions and how the Robot reacts.
g. Identify and describe the robot's teach pendant.
h. Learn functions of Teach Pendant key.
i. Differentiate between standard Teach Pendant and iPendant.
j. Differentiate between Quick and Full Menus.
k. Describe the function Menu and Status indicators
l. Discuss different Deadman switch positions and how Robots react.

m. Power up, jog, and perform initial setup of the robot.
n. Identify the robot frames.
o. Describe the Cartesian Coordinate System.
p. Identify the WORLD Frame, TOOL Frame, USER Frame, and JOG Frame.
q. Access the position screen and how the location and orientation is measured.
r. Jog in different Jog Coordinates.

Course Outcome(s):

Create, record, interpret, and troubleshoot programs for robot.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
a. Create a Motion program.
b. Practice the program naming methods.
c. Explain program details.
d. Record a position.
e. Interpret motion instructions.
f. Test the program.
g. Explain and practice how to add and delete motion instructions.
h. Explain the use of redefined positions.
i. Create and edit program.
j. Program Instruction branching
k. Apply Position Register instructions and positional register statement.
l. Apply the OFFSET, PR [i, j] motion option instruction.
m. Apply Miscellaneous Instructions in a program.
n. Program robot's IO's.
o. Create and assign a Macro program.
p. Create a program adjust schedule.
q. Perform program adjustments.
r. Perform program and file handling and preservation activities.
s. Recognize errors and faults and perform robot recovery.

Methods of Evaluation:
a. Laboratory Activities
b. Quizzes
c. Tests

Course Content Outline:
a. Pre-Test
b. Robot System
    i. Components
    ii. Major and minor axes
    iii. Joints
    iv. Links
    v. Servo Motors
    vi. Serial Pulse Coders
    vii. Software and Operating System
    viii. Controller types
    ix. Deadman switch positions
c. Teach Pendant

      i. Functions
     ii. Standard teach Pendant vs. iPendant
    iii. Quick Menu
    iv. Full Menu
     v. Function Menu
    vi. Status Indicators
   vii. Deadman Switch positions

d. Power up, Jogging and Initial Setup
      i. Powering up Robot
     ii. Jogging the Robot in Joint and World
    iii. Viewing positional data
    iv. Robot axes Limits
     v. Robot mastering

e. Error and Faults Recovery
      i. Common faults and errors
     ii. Robot singularity
    iii. Recovering Robot from DCS faults
    iv. Chain failure detection error

f. Frames
      i. Cartesian Coordinate System
     ii. WORLD Frame
    iii. TOOL Frame
    iv. USER Frame
     v. JOG Frame
    vi. Position Screen
   vii. Measuring location and orientation
  viii. Jog Coordinates

g. Motion Programs
      i. How to create a motion program
     ii. Program naming methods
    iii. Program Details
    iv. Recording a position

h. Motion Instructions
      i. Testing the program
     ii. Motion types
    iii. Elements that describe a motion instruction
    iv. Position Register
     v. Robot Speed
    vi. Termination Types
   vii. Motion Option
  viii. Adding motion instructions
   ix. Deleting motion instructions
    x. Use of redefined positions

i. Copying and Editing Programs
      i. Inserting a blank line into a program
     ii. Deleting lines from program
    iii. Finding program instructions within a program
    iv. Replacing items
     v. Renumbering positional ID's
    vi. Copying a program
   vii. Copying and pasting program lines
  viii. Comments, Replace, Remark, Renumber and Undo Commands

j. Branching
      i. Unconditional Branching instructions
     ii. Use of Data registers
    iii. Conditional Branching
    iv. If and Select instructions
     v. Wait instructions

k. Instructions-Position Register and Miscellaneous
    i. Position Register instructions
    ii. Positional register statement
    iii. OFFSET, PR [I,j] motion option instructions
    iv. Miscellaneous Instructions
l. Inputs and Outputs
    i. I/O signals
    ii. Types of hardware
    iii. Configuration
    iv. Monitoring of control I/O
    v. Group I/O
m. Macros
    i. Creating a Macro Program
    ii. Assigning a Macro
    iii. Program Adjust Schedule
n. Program Adjustment
    i. Adjusting programs running in Auto
    ii. Deleting program from select menu
o. Program and File Manipulation
    i. File backup
    ii. Image Backup
    iii. Restore
    iv. Setting the default storage device
    v. Loading program from device after generating a directory
p. Post-Test
q. Mastering

Resources

Dinwiddie, Keith. (2016) *Basic Robotics*, Boston, MA: Cengage Learning.

Dinwiddie, Keith. (2018) *Industrial Robotics*, Boston, MA: Cengage .

FANUC America Corporation. (2016) *HandlingTool Operations & Programming.* , FANUC America Corporation .

James W. Gruenke. *Programming FANUC Robots for Industry Applications*. Orland Park, IL: American Technical Publishers, 2021.

Jonathan Cacace. *Mastering ROS for Robotic Programming*. Birmingham UK: Packt Publishing Ltd., 2021.

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