



South Central College

## MECA 2235 Robotics

### Course Outcome Summary

#### Course Information

**Description** This course will provide students with the principles of programming and control of multi-axis robotic systems used in an industrial environment. The student will gain the ability to program FANUC Robots and setup an automated robotic work cell. The student will also perform fundamental automated system troubleshooting procedures. Technical writing skills and safety procedures will be implemented throughout the course. This course builds on the student's understanding of basic electrical, mechanical and programming concepts.

(Prerequisites: MECA 2110 Sensors and Controls and MECA 2150 Mechatronics System Operation II).

**Total Credits** 3

**Total Hours** 64

#### Types of Instruction

Instruction Type	Credits/Hours
Lecture	2/32
Lab	1/32

#### Pre/Corequisites

MECA 2110 Sensors and Controls

MECA 2150 Mechatronic System Operation II

#### Institutional Core Competencies

Communication - Students will be able to demonstrate appropriate and effective interactions with others to achieve their personal, academic, and professional objectives.

Critical and Creative Thinking - Students will be able to demonstrate purposeful thinking with the goal of using a creative process for developing and building upon ideas and/or the goal of using a critical process for the analyzing and evaluating of ideas.

#### Course Competencies

1. **Determine the need for workspace safety.**

### **Learning Objectives**

Review Lab Safety.  
Demonstrate Lab Safety.  
Identify Industrial Safeguards and Guarding Methods.  
Demonstrate the proper use of Lock-Out Tag-Out.  
Characterize Redundant Safety Systems.

## **2. Discuss basic robotic systems.**

### **Learning Objectives**

Identify and Recognize Robotic Specifications.  
Discuss difference between Robot and Automated Machinery.  
Explain Robot classifications.  
Identify Basic Components.  
Define terms commonly used with Robotic Technology.  
Identify 5 Characteristics that determine Robot Classification.  
Identify Robot Classification by Arm Geometry.

## **3. Acquire an understanding of effectors and manipulation.**

### **Learning Objectives**

Define an effector.  
Determine the two basic purposes of effectors.  
Define an actuator.  
Describe what types of actuation is used in robotics.  
Define degree of freedom (DOF).  
Evaluate how the controllable DOF compares to the total DOF in a system.  
Define a robotic manipulator.

## **4. Program a virtual work-cell using computer simulation software.**

### **Learning Objectives**

Create a work-cell.  
Move a robot in 3D.  
Adjust the display to create multiple views.  
Edit robot properties.  
Define and add parts to a work-cell.  
Create fixtures to be used in a work-cell.

## **5. Operate a robot using a teach pendant.**

### **Learning Objectives**

Explain the purposes of the Teach Pendant Keys.  
Differentiate between a traditional teach pendant vs. the iPendant.  
Identify the reason for Quick vs. Full Menus.  
Explain the Function Menu and Status Indicators on a Teach Pendant.  
Employ the different Deadman Switch positions and identify how the robot reacts.

## **6. Demonstrate ability to Power Up and Jog a FANUC robot using the Teach Pendant.**

### **Learning Objectives**

Explain the steps to Power Up the Robot safely.  
Explain how to recover from Faults and Reset DCS Faults.  
Create Predefined Positions.  
Explain the steps to JOINT jog and set the Speed.  
Explain how to view robot JOINT positions.  
Display Software Axis Limits.  
Explain what is indicated by a Motion Limit Error.  
Demonstrate ability to access the Over-travel Release Screen.

## **7. Obtain basic knowledge about FANUC Robot Frames.**

### **Learning Objectives**

Explain the Cartesian Coordinate System.

Explain what is meant by the term Singularity.  
Demonstrate how to recover from a Singularity error.  
Define WORLD Frame, Tool Frame, USER Frame, and Jog Frame.  
Demonstrate how to select Tool Frame, USER Frame, and Jog Frame.  
Demonstrate how to Jog the robot in Tool Frame, USER Frame, and Jog Frame.  
Demonstrate accessing the Position menu.  
Explain how the robot location and orientation is measured.

## **8. Create, write and edit a FANUC robot program using a teach pendant.**

### **Learning Objectives**

Explain what is meant by Motion Groups and Extended Axes.  
Plan and create a program.  
Demonstrate ability to write a program.  
Demonstrate how to insert blank lines in a program.  
Demonstrate how to delete lines from a program.  
Demonstrate how to find program instructions within a program.  
Demonstrate how to replace items in a program.  
Demonstrate ability to Renumber Position ID's.  
Demonstrate ability to copy a program.  
Explain the copy and paste options for program lines.  
Demonstrate ability to use Comments, Replace, Remark and Undo commands.  
Identify items and information found in Program DETAIL.  
Demonstrate how to safely test a program using single step or continuous testing.  
Demonstrate the use of Unconditional and Conditional Branching instructions.  
Apply IF and SELECT instructions to a program.  
Use WAIT instruction in a program.

## **9. Utilize Motion Instructions in a FANUC robot program.**

### **Learning Objectives**

Explain the different Motion Types used in a FANUC program.  
Explain the different elements that define a motion instruction.  
Describe what is meant by Position Register.  
Demonstrate the use of a Position Register in a program.  
Explain how the robot speed affects the robot's program path.  
Explain when to use a different terminator type when defining a motion instruction.  
Explain when to apply motion options.  
Demonstrate how to add and delete motion instructions.  
Explain and demonstrate the use of predefined positions.  
Demonstrate how to set default motion instructions.  
Demonstrate how to insert motion instructions.  
Demonstrate ability to touch up points.  
Explain how and when to use predefined positions.  
Demonstrate the application of the OFFSET, PR motion option instruction.  
Explain other Miscellaneous Instructions.

## **10. Explain the use of Inputs and Outputs.**

### **Learning Objectives**

Obtain an understanding of I/O signals.  
Identify different kinds of Controller I/O.  
Describe different types of hardware I/O.  
Explain how to configure I/O.  
Describe monitoring and controller I/O.  
Demonstrate the setup and application of Group I/O.

## **11. Describe the modification of System Variables and how they alter the Robot's configuration.**

### **Learning Objectives**

Describe system variables.  
Alter system variables.  
Demonstrate the ability to display system variables.

## **12. Demonstrate use of Macros.**

### **Learning Objectives**

Explain the use of Macro Commands.

Write a Macro.

Explain how to assign a Macro.

Demonstrate procedure for setting up a Macro command.

### **SCC Accessibility Statement**

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Additional information and forms can be found at: [www.southcentral.edu/disability](http://www.southcentral.edu/disability)

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