Syllabus: Robotic Welding, MECH 2700

Part 1: Course Information

Description

This course is a basic robotic welding programming class. Students will be introduced to robotic welding systems as well as learn how to perform basic procedures on a system. The student will learn how to create welding routines, program their own weld paths, and be able to store and retrieve programs and parameters. Students will learn to program a welding robot through a teach pendant and through simulation software, edit programs, set weld schedules, as well as learn basic operator controls and indicators on the teach pendant and operator panel. This course also provides fundamental safety precautions while programming and operating the robotic equipment.

This course is designed to meet over a period of 14 weeks, 1 meetings per week, and 3 hours per meeting in a combined lecture-lab meeting.

Prerequisites

None

Required Materials

List of materials students should purchase

Recommended Reference Materials

Tools to be used

Part 2: Course Learning Outcomes (CLOs)

The course learning outcomes are to have students:







- Use appropriate safety precautions while programming and operating the robot system.
- 2. Use and explain the operator controls and indicators on the teach pendant and standard operating panel (SOP).
- 3. Explain the fundamentals of teach pendant and arc tool programming languages and menu structures.
- 4. Correctly position the robot using teach pendant and various motion types.
- 5. Implement welding program structure and operation including straight line, circles, and weaving fundamentals.
- 6. Use proper editing procedures, program commands/functions, and basic error recovery techniques.
- 7. Conduct proper torch and wrist alignment checks and set up a Tool Center Point.
- 8. Set up/incorporate User, Tool, and Jog frames into a weld program.
- 9. Create Position Registers, manipulate Inputs/Outputs (I/O)
- 10. Make temporary adjustments to weld points to compensate for batch runs.
- 11. Program weld commands and parameters, monitor feedback signals, and change weld procedures in the middle of a weld.
- 12. Use logic instructions to simplify programming of parts with multiple, similar weld joints.

Part 3: Course Topics and Roadmap

Roadmap

The following roadmap is recommended for instructors

Week	Student Learning Outcomes	Content to be covered	Student Assignments and Supplementary Material	
1	1,2,3	Safety Lock-out/Tag-Out Software Introduction - Getting started with WeldPro™	PPT 1 Intro & Safety PPT 2 Basic Robot Operations Safety Procedures on and around the robot	
2	1,2,3	Motion Types Termination Types Position Data Travel Speeds Cell Browser – navigation, view manipulation, adding objects to cell browser, selecting objects	PPT 3 Teach Pendant Operations PPT 4 Power up, Jog, Initial set-up WeldPro SW: WorkCell Creation Wizard + Robot Motion Robot: Power up, Jogging, & initial set-up Labs 1 thru 6	
3	1,2,3,4,5	Robot coordinated motion (COORD) WORLD, TOOL, USER, and JOG Frames Working with fixtures, parts	PPT 6 Frames PPT 7 Motion Programs WeldPro SW: adding objects to work cells, creating program Robot: creating a Teach Pendant	





	1		
		Creating a Robot program	program
		Quiz 1	Labs 7 thru 9
		Create and test a program using	PPT 8 Motion Instructions
		speed rules	PPT 9 Copy/Edit Programs
4	1,2,3,4,5	Testing a program and getting around obstactacles	WeldPro SW: Motion Instructions
	, , , , , ,		Robot: Motion Instructions,
		Saving time in motion	Copy/Edit programs
			Labs 10 thru 14
		Motion changes, speed changes	PPT 10 Branching instructions
		Western Grianges, speed changes	The Branding medications
		Position duplication	WeldPro SW: programming a path,
5	1 - 6		joint, linear, circular motions
		Branching of programs	Dobot: program aditing from TD
			Robot: program editing from TP Labs 17 thru 19
		Programming patterns with PRs	PPT 11 Position Registers
		Using Position Registers	WeldPro SW: programming tasks
6	1 – 6	Ouiz 2	Pohot: Tooch Pondont
		Quiz 2	Robot: Teach Pendant programming tasks
			Lab 20
	1 - 7	Turn weld on	WeldPro SW: Creating a Tool
		Program full and half circle	Center. Point, Tool and Wrist
		Entaring and Object 1971	Alignments
		Entering and Changing Weld Procedures	Robot: Circle and Half Circle
7		1 locedules	programming
		Torch and Wrist Alignment	Tool Center Points
		Tool Center Points	Weld procedures
		Mid Term Exam	Lab 21 Inputs and Outputs
		Program a circle to weld and test	PPT 13 Macros
	1 - 8	run	PPT 14 Program Adjust
		Assigning Macros	WeldPro SW: individual
8		A disast man area of the second	programming tasks
		Adjust program to compensate for batch runs	Pohot: Lah 12 individual
		ioi batcii iulis	Robot: Lab 12, individual programming
			Lab 22
	1 - 9	Adjust weld points for batch runs	
		Programming Weave Patterns	WeldPro SW & Robot: weave
9		1 Togramming Weave Fallerins	patterns
		Correct weld deformities in	
		patterns using Program Adjust	Robot: Lab 13, individual
		Oui- 3	programming tasks
		Quiz 3 Weld commands and	WeldPro SW: Commands and
10	1 - 10	parameters (wait and timer	modifying parameters
		instructions)	, , , , , , , , , , , , , , , , , , , ,





		Feedback signals	Robot: Lab 14, individual programming tasks
11	1 – 12	Program manipulation Logic instructions Zero Program	WeldPro SW: Logic instructions, program adjust
12	1 – 12	File management 6-point tool center point Editing programs; on-the-fly changes to weld procedures Quiz 4	Robot: individual programming tasks WeldPro SW: Program adjust; Program & File manipulation Robot: individual programming tasks
13	1 - 12	Program editing using "replace" command Individual programming tasks	WeldPro SW: Robot: individual programming tasks Robot: individual programming tasks
14	1 -12	Individual programming tasks	Individual programming tasks
15	1 -12	Individual programming tasks	Individual programming tasks
16	1 – 12	Final Exam	

Part 4: Grading and Assessment

Graded Assignments

Course grades are determined through programming assignments in class and participation. Instructor to create quizzes and exams as needed.

Proposed Grading Schedule

	Participation	10%
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	Lab Assignments	60%

Part 5: Notes to Program Administrators Resources

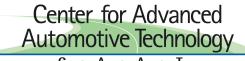
- Welding / Material Handling Robots
- Computer lab with FANUC WeldPro software

Instructor Qualification

- Bachelor's or higher degree in a qualifying field or
- Bachelor's or higher degree in any discipline and certifying credentials:
 - 30 undergraduate hours or 18 graduate hours of coursework in a qualifying field, or







- Bachelor's or higher degree with relevant supplemental experiential experience:
 - o Two years professional employment or
 - o Research or publications, or
- A.A.S. in a qualifying discipline and four years of relevant professional employment

Qualifying fields:

Mechanical or Electrical Engineering (including their subdisciplines and related interdisciplinary engineering fields)

Engineering Technology

Mechatronics/Industrial Automation or equivalent field

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