

Low Voltage Controls & Robotics			
Class # 1 - Introduction to Feedback Controls	Lecture Topics	Lab 1 Objectives	Budgeting
			Hrs
	Introductions & class overview	Apply the continuous cycling method to tune a closed loop control system	
	Automation - advantages & disadvantages	Test for and apply the ultimate gain of a closed loop control system	Pre-class Prep 3
	Process types - discrete, batch, continuous, hybrid	Test for and apply the ultimate time of a closed loop control system	Lecture 1.5
	Open & closed loop controls terms and definitions - process variable, manipulated variable, setpoint, feedback, feedforward	Use proportional gain, integral and derivative times to minimize the dynamic response of a closed loop control system	Lab 3
	Error amplifiers - proportional, integral, derivative	Visualize closed loop control performance with various PID settings	Post-lab prep (cleanup) 0.5
	Lab & safety procedures		Preparation Total 3.5
			Classroom Total 4.5

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Class # 2 - PLC Based Feedback Control	Lecture Topics	Lab Objectives	Budgeting
			Hrs
	Previous topics review	Apply alternate closed loop tuning methods using PLC control	
	Ziegler-Nichols tuning methods - classic, Pessen Integral, Tyreus-Luyben, some overshoot, no overshoot	Observe dynamic response characteristics for several closed loop tuning methods	Pre-class Prep 8
	PID command syntax	Collect, analyze and present technical information	Lecture 1
	Program features - PID, gain value adjustment, communications handshake, setting initial conditions		Lab 4
	Lab & safety procedures		Post-lab prep (cleanup) 0.5
			Preparation Total 8.5
			Classroom Total 5

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Class # 3 - Intro to Robotics	Lecture Topics	Lab 1 Objectives	Budgeting
			Hrs
	Previous topics review	Dobot discovery - structured playtime!	Pre-class Prep 3
	History, applications	Record home position coordinates, X, Y, Z, R	Lecture 1
	Actuation - electric motors, linear actuators	Record home joint positions	Lab 3
	Sensing - touch, vision	Manually control the Dobot arm to draw the arm's full operating range on a paper target	Post-lab prep (cleanup) 0.5
	Manipulation - mechanical & vacuum grippers	Use Teach & Playback mode to perform a simple pick and place operation	Preparation Total 3.5
	Total Quality Management, Lean Manufacturing		Classroom Total 4
		Lab 2 Objectives	
		Install and calibrate a gripper end-effector	
		Design and program a pick and place application for the Dobot	
		Apply lean manufacturing and waste minimization concepts to improve process efficiency	

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Class # 3 - Relay Logic to PLC Conversion	Lecture Topics	Lab 1 Objectives	Budgeting
			Hrs
	None	Read and understand the ladder logic diagram of a hydraulic control system.	Pre-class Prep 3
		Prepare a relay logic control system for conversion to PLC control	Lecture 0
		Write a control narrative describing a relay logic control system	Lab 4
		Convert a relay logic control system to PLC control	Post-lab prep (cleanup) 0.5
			Preparation Total 3.5
			Classroom Total 4