

Course Number & Name	MIME 4450 – Automation Design
Credits & Contact hours	3 Credits – 3 lec, 0 lab
Coordinator	Wm Ted Evans, PhD, PE
Textbook	Hybrid Text, Hybrid Lab Text both at hybridplc.org youtube videos, other texts, books, manuals as needed (see link)
Course Information	This course continues with automation topics following MIME 4440. The PLC was the main tool in this first course. In MIME 4450, integration of various control elements is emphasized. The course begins with a study of robotics. Later robots are linked to PLCs. Then vision systems are added. Also included are advanced topics such as speed and position control of single axes servo and stepper motors as well as coordination of multiple axes. The PID algorithm is emphasized. Also, the safety PLC is discussed.
Topics	<ol style="list-style-type: none"> 1. Sequential Programming Concepts 2. Process control PLC programming including Faceplate 3. HMI Programming Organization 4. Siemens Function/Function Blocks 5. Motion Control of single axis motion systems 6. PID implementation including HMI 7. Robotic Programming 8. Communications between Robots, PLCs and other devices 9. Robotic Vision Integration into Robot

Class will be graded:	Five Labs (8 pts/ea) 40 %
	Midterm exam 20 %
	Final Exam 20 %
	Report 10 %
	Discretionary 10 %
	(A >= 90, B >= 80, C >= 70, D >= 60)
	Midterm Class Period
	Final Finals Week

There are no make-up exams for this course. If you have a problem or conflict and cannot attend an exam, let me know beforehand and we will try to work something out. No credit will be given for a missed exam that we haven't made arrangements about beforehand unless you have a **really excusable** emergency. Cell phone use will not be allowed. If you do not have a calculator, buy one and bring it to class.

Cheating is not allowed and will be punished by rules of U of Toledo Student Handbook.

Credit for labs consists of presentation of a finished lab (signed) and a summary statement. Alternatively, if no one is present to sign your lab, you may submit as many screen shots of your lab as you deem sufficient to prove that you in fact performed the lab in a run-time situation. Also, submit a summary of your lab with this option. Three labs must be completed by end of week Nov. 12.

A report will also be required, either of a topic approved by the instructor or a summary report of a lab that was assigned or approved.

Lectures

1	Introduction	Lab Safety	Robots and other equipment
2	Fanuc Robot	Handling Tool – Whispering Txt	Hello, World (pg 8), Control Flow (pg 17)
3	Fanuc Robot	Handling Tool – Whispering Txt	Using I/O (pg 21), Tool Frames (pg 28, 36),
4	Fanuc Robot	Handling Tool – Whispering Txt	Alarms (45), Wait (51), End (53)
5	Fanuc Robot	Handling Tool – Whispering Txt	Subroutines (65,66), Mapping I/O
			Lab 1 – Completion of the above
6	PLC Addressing	Review	
7	PLC Program	Review	Lab 2 – Start-up Lab on PLCs
8	PLC Tmr/Ctr	Review	
9	Universal Robot	Collaborative Robot	
10	Fanuc Robot	Collaborative Robot	
11	Cognex	Vision	Lab 3 - Communication between Cognex and PLC
12	Fanuc	Vision	Lab 4 – Communication between Robot and PLC
13	Conveyors	Tracking with PLC Control	
	HMI	with PLC, other	
14	Midterm Test		
15	Hybr Txt Ch. 11	State Diagrams	Lab 5 - Choose only one lab from Ch. 11-15 Text
	Hybr Txt Ch. 13	Batching/Scales/Arrays	
16	Hybr Txt Ch. 14	Function Block Handling	
	Hybr Txt Ch. 15	HMI	
17	Hybr Txt Ch. 16	Communications	
18	Comm. Project	Peer-to-Peer	Lab 6 - Various Labs on Communication
	Comm. Project	RFID	
19	Hybr Txt Ch. 17	Motion Control through PLC	Lab 7 - Various Labs on Motion Control
	Single Axis	Projects in lab	
	Coordinated	Projects from programs	
20	Hybr Txt Ch. 19	PID – Process Control	Lab 8 - Various Labs on PID
		Process Programming	
21	Hybr Txt Ch. 20	Safety Programming	Lab 9 - Lab on Safe PLC
		Safety Communications	
27	Lecture/Lab		Lab 10 – Mini-Capstone Lab – Must be Pre-Approved – Must Choose This as one of 5 Labs
	Final Exam		
			Each lab worth 8 points (5 total = 40 pts)

The mini-capstone lab may be from a number of areas including:

1. Robot connected to PLC connected to Vision doing something
2. PLC connected to PLC playing game
3. RFID connected to PLC performing task
4. PID with HMI
5. Safety with added features
6. Single Axis control of one or more motors
7. Rubiks Cube
8. Batching system using load cells as scale input
9. Analysis of programs from Festo's old system or new system
10. Analysis of program from your source
11. Analysis of new Festo Manuals – either A-B or Siemens
12. Something connected to your Capstone Project that was enhanced using the robot/plc/vision systems of this course
13. Use of AI capabilities of newer vision system (3805's)
14.