EET 4450 Automatic Control Systems Spring 2024

When and where	Lecture (001) NE 2106 T, R - 2:30 – 3:50 pm	Lab (002) NE 2350 T 3:55 - 5:25 pm Lab (003) NE 2350 T 12:45 – 2:25 pm
Instructor	Prof. Wm Ted Evans, PhD, PE (Ohio)-Office: NE 1607, Phone 419-530-3349, cell 419-343-3681 Email: william.evans@utoledo.edu, web www.hybridplc.org	
Office Hours	9:30-12:00 M,W	
Prerequisite	**Prerequisites:** EET 3250 for UG with min of D- or ENGT 3050 for UG with min of D-	
Textbook	All posted on hybridplc.org website under course.	
Useful References	DiStefano et al, Schaums Outlines – Feedback and Control Systems, 2nd ed. Astrom and Murray, Feedback Systems – An Introduction for Scientists and Engineers, v2.11b, online and at hybridplc.org website Liptak, Instrument Engineers' Handbook, Process Measurement and Analysis, Process Control ISA (International Society of Automation), www.isa.org	
Grading	**Homework 10 %, Pop Quizes 10 %, Labs 20 %** **Midterm exam I 20 %, Midterm exam II 20 %** **Completion of Cognex Project 20%**	
Class rules and regulations	1. No eating, drinking, or smoking in classrooms. 2. 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.***	
Catalog descriptions	This course is an introduction to industrial controls, including the PID control of closed-loop servo and process systems, with emphasis placed on the electronic circuits of the closed-loop sub-systems.	
Topics and reading assignments (subject to change, any changes will be notified in the class beforehand)	• To study the basic elements of an automatic control system • To use block diagrams to describe the elements of a control system • To study the difference between open-loop and closed-loop systems • To use the knowledge of math and science in deriving the process model and use it in the controller design • To determine and design signal conditioning for the system • To study the operation of different transducers/sensors and their importance in a control system • To be able to design a controller for a system to satisfy a certain performance criterion • To study the operation and performance of different control strategies such as P, PI, PD and PID • To use Bode plots to study the stability of controlled systems • To use labs for hands on experience with different measuring devices and compare different control techniques	
Class dates (Exam dates are subject to change.)	Homework assignments are listed on the website and are accepted only before or on the assigned day. Labs are to be printed from the website and brought to lab. Labs to be graded only if submitted at end of assigned class period. Pop quizzes may occur any day at the end of the class period.	

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	Date	Lecture/Lab Schedule	Homewrk/Lab Due Date
Week 1	1/16	Intro and Terms (Video EET_4450_Lec_1)	
	1/18	Instruments and Linear Conversion (Video EET_4450_Lec_2)	
Week 2	1/23	Automatic Control, Lab 1 (Video EET_4450_Lec_3)	
	1/25	Intro to Laplace (Video EET_4450_Lec_4)	HW 1
Week 3	1/30	Laplace Cont, Lab 2 (Video EET_4450_Lec_5)	
	2/1	Laplace Cont (Video EET_4450_Lec_6)	HW 2 - Lab 1
Week 4	2/6	Laplace Cont, Lab 3 (Video EET_4450_Lec_7)	
	2/8	Laplace Cont (Video EET_4450_Lec_8)	HW 3 thru 4.12 - Lab 2
Week 5	2/13	Laplace Cont, Lab 4 (Video EET_4450_Lec_9)	
	2/15	Boxes (Video EET_4450_Lec_10)	HW 4 any 15 - Lab 3
Week 6	2/20	Boxes, Lab 5 (Video EET_4450_Lec_11)	
	2/22	Boxes, Laplace Review (Video EET 4450_Lec_12)	HW 5 any 10 - Lab 4
Week 7	2/27	Midterm Test 1 – no lab	
	2/29	Return Midtern Test 1, (Video EET 4450_Lec_13)	Lab 5, all labs, HWs due
Week 8	3/4 – 3/8	Spring Break	
Week 9	3/12	Bode Plot, Lab 6,	HW6
	3/14	Bode Plot, (Video EET_4450_Lec_14)	
Week 10	3/19	Measurements – PPT 158-203, Lab 7, (Video EET_4450_Lec_15)	
	3/21	Sensors – PPT 204-249, (Video EET_4450_Lec_16)	Lab 6
Week 11	3/26	Pressure and Flow – PT 250-284, Lab 9, (Video_Lec_17)	
	3/28	Level – PPT 285-308, Cognex Video – Introduction - Cognex 1-3	Lab 7
Week 12	4/2	Temperature – PPT 309-351 – Lab 9 (Cognex 1-3), (VideoLec18)	
	4/4	Control Valves – PPT 352-372, (Video EET_4450_Lec_19)	Lab 8
Week 13	4/9	Pneumatics – PPT 373-391, Lab 10 (Cognex 4), (VideoLec20)	HW 7
	4/11	Electric Machines – PPT 392-435, (Video EET_4450_Lec_21)	Lab 9
Week 14	4/16	PID Revisited – PPT 436-499, Lab 11 (Cognex 5), VideoLec22)	HW 8
	4/18	Review (Video EET_4450_Lec_23)	Lab 10
Week 15	4/23	Test 2	HW 4a and 4b
	4/25	Return Test and Wrap Up	Lab 11
Week 16		Final Exam Week	Cognex Final Project

The Cognex Final Project consists of building a Cognex Spread Sheet Application with an image furnished by the instructor capable of determining a good or bad image using all four of the Cognex inspection techniques – Pattern (Patmax), Histogram, Edge and Blob. Modify Image00000 and Image00001 to include your name instead of the Cognex logo and use these images as a comparison of a good and bad part. Change one of the name images to 'bold' so the size will change. Submit the final project with a test run witnessed by the instructor for credit. This project can be a team effort but with no more than 3 persons per team. Final approval of the lab and a report of two pages or more on Cognex will be graded as test 3 – or the Final Test.