Lebanese American University	ELE	443
School of Engineering	Control Systems Lab [Required]	1 credit
Dept of Electrical and Computer Engineering		ELRC 5202
Course syllabus	Ronald Kfouri Email: ronald.kfouri@lau.edu.lb	Fall 2021

1. Course Description and Course Prerequisite

ELE 443 Control Systems-Lab: Laboratory experiments in Control Systems. Introduces students to the implementation of PID-controllers and two-step controllers, first order delay as well as third order delay, such implementations are done using educational PID boards and DC servo boards.
Course Co-requisite: ELE442 Control Systems.
Course Prerequisite: ELE430 Signals & Systems.

2. Course Objectives and Outcomes

This course gives you a deep knowledge in MATLAB programming and simulation techniques, especially in the design of controllers based on root locus and feedback analysis. Also, lab experiments allow you to explore PID controllers and their different usage with 1^{st} and 3^{rd} order delay systems.

Course learning Outcomes:
By the end of this course, the student will be able to:

- Defining and analyzing mathematical models of real-life systems.
- Defining and analyzing Controllers.
- Controlling P-T1 systems using P, PI and two-step controllers.
- Controlling P-T3 systems using P, PD and PID controllers.
- Use MATLAB to acquire experimental data.
- Use MATLAB to define, analyze and simulate real life control systems.
- Use Simulink as an effective tool in the design of control systems.

3. Contribution of course to meeting the professional component

Professional Component	Credits
Mathematics and Basic Sciences	0
Engineering Topic	1
General Education	0

4. Relationship of course to program outcomes

SO 5: **PI 5.1** Ability to collaborate and lead

PI 5.3 Ability to meet objectives

SO 6: **PI 6.1** Ability to develop and conduct experiments

PI 6.2 Ability to analyze and interpret data

PI 6.3 Ability to use engineering judgement to draw conclusions

5. Course Outline

Session 1	Introduction
Session 2	MATLAB 1: Introduction to MATLAB
Session 3	Experiment 1: Control Systems with P-T1, P-T3 and I behavior
Session 4	MATLAB 2: Mathematical Operations & Symbolic Math
Session 5	Experiment 2: P, PI and PD Controllers
Session 6	MATLAB 3: Function files & Graphs
Session 7	Experiment 3: PID and 2-step controllers
Session 8	MATLAB 4: Linear Systems
Sessions 9	Experiment 4: Controlling P-T1 systems
Session 10	MATLAB 5: Control Systems Design
Session 11	Experiment 5: Controlling P-T3 systems
Session 12	MATLAB 6: Simulink & Filters
Session 13	Experiment 6: Temperature and Speed Control

6. Textbook[s]

- N/A.

7. Additional References

- K. Ogata, Modern Control Engineering, 3rd Edition.
- Additional course lectures and handouts will be posted on the course webpage.

8. Grading Percentage and Test Material

- Performance 10%
- Experiments 18%
- MATLAB sets 18%
- Quizzes 24%
- Final Exam 30%

- **Tests Material**
  - Quizzes: As per the experiments done
  - Final Exam: Comprehensive.

9. General Comments

All LAU policies regarding attendance, plagiarism, cheating, and COVID response will be strictly enforced.

Important announcements will be transmitted by e-mail or via blackboard.

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Lab Coordinator: Dr. Noel Maalouf

Course Website: Blackboard.