The University of Jordan
School of Engineering

Department	Course Name	Course Number	Semester
Mechanical Engineering	Control Lab	0904419	

2019 Course Catalog Description

The lab consists of experiments that are related to: First and second order system analysis control experiments. Servo systems. Stability of dynamical systems. System identification. Design and tuning of a PID controller in closed loop systems. Simulation of systems using Simulink or Matlab.

Instructors

Name	E-mail	Sec	Office Hours		Lecture Time	

Text Books

	Text book 1	Text book 2
Title	Control Lab Manual	(Handouts + Board Notes)
Author(s)	Dr. Musa Abdalla	-
Publisher, Year, Edition	Current	

References

Books	1. K. Ogata, Modern Control Engineering Prentice Hall 2. R Dorf and Bishop, Modern Control System, Prentice Hall 3. B. Kuo, Automatic Control System, Wiley
Journals	
Internet links	The UoJ ELearning: elearning.ju.edu.jo

Prerequisites

Prerequisites by topic	System Dynamics and Control Fundamentals: Response, Stability, Identification and PID
Prerequisites by course	0904418 System Dynamics and Control
Co-requisites by course	-
Prerequisite for	

Topics Covered

Week	Topics	Chapter in Text	Sections
1	Orientation and going over the lab rules and safety	Intro	
2	Simulating first order dynamical systems using Analog Computer	Exp I	
3	Understanding Servo Systems using Simulink	Lecture Notes	
4	Servos: DC Motor Position Control (2^{nd} order system performance)	Exp II	
5	Servos: DC Motor Speed Control (1^{st} order system performance)	Exp III	
6	Process Control	Exp IV	
7	Understanding Stability using Simulink	Lecture Notes	
8	Twin Rotor Chopper	Exp V	
9	Understanding PID controllers and Tuning using Matlab	Lecture Notes	
10	PID Controller Design and Tuning	Exp VI	
11	Understanding frequency based system identification using Matlab	Lecture Notes	
12	System Identification in Frequency Domain	Exp VII	
13-15	Final Lab Project		

Mapping of Course Outcomes to ABET Student Outcomes

SOs	Course Outcomes
1	1. Model and Formulate the dynamic systems mathematically 2. Design a PID based controllers to meet the design desired specifications
2	3. Design and build a dynamic system (mechanical, electrical, thermal and/or fluidic systems)
5	4. Demonstrate and present results of group laboratory project orally and in written format
6	5. Test and analyze uncontrolled dynamics systems in terms of sensor system order, time response, and stability using Laplace transformation and time domain calibration, and analysis 6. Simulate the controlled dynamic system using Matlab 7. Integrate, test, and analyze the controlled dynamic systems

Evaluation

Assessment Tools	Expected Due Date	Weight
Homework		15%
Quizzes		15%
Reports		30 %
Final Exam + Project		40 %

Contribution of Course to Meet the Professional Components

The laboratory contributes to build the fundamentals in designing, realizing physical dynamical systems for both thermal and applied mechanical applications. It also promotes active thinking in designing control systems by enforcing an open-ended project.

Relationship to Student Outcomes

SOs	1	2	3	4	5	6	7
Availability	X	X			X	X	

Relationship to Mechanical Engineering Program Objectives (MEPOs)

MEPO1	MEPO2	MEPO3	MEPO4	MEPO5

ABET Student Outcomes (SOs)

1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2	An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3	An ability to communicate effectively with a range of audiences
4	An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5	An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6	An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7	An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Updated by ABET Committee, 2024