Department of Electrical Engineering

College of Engineering
Salahaddin University – Erbil
Subject: Control Engineering

Course Book –4th Year All

Lecturer's name: Assist Prof. Dr. Fadhil Toufick Aula

Academic Year: 2020 -2021 Fall Semster

Course Book

1. Course name	**Control Engineering**
2. Lecturer	**Assist Prof. Dr. Fadhil Toufick Aula**
3. Department/ College	**Electrical / Engineering**
4. Contact	**e-mail: Fadhil.aula@su.edu.krd**
5. Time (hr. / week)	**4 hrs/week**
6. Office hours	**4**

7. Course overview: Introduction to theory and practice of automatic control for continuous-time systems. Representations of the system: transfer function, block diagram, signal flow graph, differential state equation and output equation. Analysis of control system components. Transient and steady-state performance. System analysis: Routh-Hurwitz, root-locus, Nyquist, Bode plots. System design: PID controller, and lead-lag compensators, pole placement via state feedback, observer, stability margins in Nyquist and Bode plots. Emphasis on design principles and their implementation. Design exercises with a MATLAB package for specific engineering problems.

8. Course Objective:

1. Understand the importance of automation and feedback control in modern society.
2. Identify all the subsystems in a closed loop system block diagram, and discuss their roles.
3. Reconstruct the block diagram of any feedback control application.
4. Derive mathematical models for electrical, mechanical, electromechanical and hydraulic systems in time domain and frequency domain.
5. Manipulate and simplify block diagrams.
6. Differentiate between transient response and steady state response.
7. Understand and explain the step response of a proportional system, first order lag system, and second order lag system.
8. Model a system as a first order system using system step response.
9. Understand and explain the frequency response of a proportional system, first order lag system, and second order lag system.
10. Identify the properties of feedback system in terms of good transient response, tracking accuracy, disturbance rejection, and sensitivity to model errors.
11. Evaluate the performance of a closed system in terms of percentage of steady state error, tracking, percentage of overshoot, rise time, settling time, gain margin and phase margin.
12. Explain the effect of P,PI, PID controllers on closed loop system performance if the reference signal is a constant or a ramp signal and in the presence of constant disturbances.

13. Differentiate between the different implementation of PID controllers: series PID and parallel PID implementation.
14. Review Bode plots, and analyze and evaluate the frequency response of closed loop system.
15. Designing and analyzing system in state space modeling.
16. Ability of using MATLAB software for studying different types of control system aspects

9. Student's Obligation

- Regular attendance is required according to the university rules.
- The use of mobile phone during the class is prohibited.
- Only the students who are officially enrolled can attend the class, guests and children are not admitted.
- Daily participation and conducting assignments are required.

10. Forms of Teaching

Teaching methods include overhead project presentation, online materials, classroom website, in class whiteboard usage.

11. Assessment Scheme

Midterm Exam	20%
Daily + assignments + Quizzes	20%
Final Exam	60%
Total	100%

12. Course Reading List:

Textbook: Katshuhiko Ogata , " Modern Control Engineering ", 5th Edition, Prentice Hall , 2009.

Reference Text: John Van De Vegter , " Feedback Control Systems ", 3rd Edition, Prentice Hall, 1994.

Fall Semester: 15 Weeks	
Week	**Subject**
1st	Introduction
2nd	Modeling in Frequency Domain

3rd	Reduction of Multiple Subsystems
4th	Modeling in Time Domain
5th	Time Response Analysis
6th	Stability Analysis
7th	Steady-State Error
9th	Root Locus Technique
10th	Midterm Exam
11th	Frequency Response Methods: bode Plot
12th	Frequency Response Methods: Nyquist Plot
13th	PID Controller
14th	Dead Weak
15th	Final Exam