كلية الهندسة

ME334 Automatic Control (Required Course)

Code and Name: ME334 Automatic Control
Credit Hours: 3 (Lecture: 3, Tutorial: 1)

Textbook:
- Modern Control Engineering, Katsuhiko Ogata, 5th Edition, Pearson Prentice Hall, 2010.

Other References:
- System Dynamics, Katsuhiko Ogata, 4th Edition, Pearson Prentice Hall, 2004.
- Feedback Control of Dynamic Systems, Gene F. Franklin, J. David Powell, and Abbas Emami-Naeini, 7th Edition, Pearson, 20104.

Course Description:
Theory and analysis of linear closed-loop control systems containing electronic, hydraulic, and mechanical components, Differential equations, Laplace transforms, Stability, Nyquist and Bode diagrams.

Pre-requisites: ME333 Mechanical Vibrations.
Co-requisites: None

Course Learning Outcomes:
With relation to ABET Student Outcomes (SOs: 1-7)

1. List and describe types and applications of control systems. (1)
2. List different types of sensors and controllers used in control systems. (1)
3. Recall Laplace transform method for solving ordinary differential equations (ODE). (1)
4. Recall different analytical methods for solving various dynamic systems, such as mechanical and electrical. (1, 2)
5. Reproduce design principles of different types of controllers, such as P, PI, PID controllers using time and frequency methods (1)
6. Explain how to model different dynamic systems, such as mechanical, electrical, etc. (1)
7. Analyze the output response of linear dynamic systems for different inputs, such as step, impulse, ramp, (1)
8. Interpret how to develop block diagram and signal flow graph for a physical system. (1)
9. Examine the stability of dynamic systems using different techniques such as Routh criterion, root locus and Nyquist criteria. (1)

Topics to be covered:

- Introduction to feedback control of dynamic systems
- Mathematical models of control systems and Laplace Transform
- Mathematical models of control systems and block and signal flow diagrams
- Exercises on block and signal flow diagrams
- Transient and steady-state response analysis (characteristics)
- Transient and steady-state response analysis (Stability)
- Transient and steady-state response analysis (steady-state error)
- Control systems analysis and design by root locus
- PID controllers and modified PID controllers (pole Placement Method)
- PID controllers and modified PID controllers (Ziegler-Nichols method)

Grading Policy:
The grading for the course are 60% coursework and 40% Final Exam. The course work consists of two Midterm Exams, where each midterm exam is worth 20%. It also includes quizzes, homework, and projects for the remaining 20% that is modified by the course instructor.