كلية الهندسة

ME436 System Dynamics and Modeling (Required Course)

Code and Name: ME436 System Dynamics and Modeling
Credit Hours: 3 (Lecture: 3, Tutorial: 0)

Textbook:
- System Dynamics, William J. Palm III, 3rd Edition, McGraw Hill, 2009.

Other References:
- System Dynamics, Katsuhiko Ogata, 4th Edition, Pearson Prentice Hall, 2004.
- Dynamic Systems: Modeling and Analysis, Hung V. Vu, and Ramin S. Enfandiari, McGraw-Hill, 1996

Course Description:
This course introduces the mathematical modeling and simulation of systems including mechanical, electrical, electro-mechanical, fluid and thermal systems. Topics include frequency response analysis, stability, and feedback control design.

Pre-requisites: ME333 Mechanical vibrations
Co-requisites: None

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

1. Define the parameters of dynamic systems. (1)
2. Write equivalent differential equation, transfer function, and state space models for a given system. (1, 6)
3. Recognize the classical control system analysis techniques, including stability, system response and performance characteristics (1)
4. List the classical controller design methodologies to design a control system. (2)
5. Summarize the different steps for modelling the various dynamic systems (1)
6. Analyze and simulate an existing mechanical and electro-mechanical systems (1, 6)
7. Analyze mechanical systems like mass spring damper system, gears and shafts etc. (1)
8. Interpret the behavior of various dynamic systems (4)
9. Demonstrate the behavior of dynamic systems by simulation using MATLAB. (1, 2, 4, 6)
10. Choose related topics in class weekly. (2, 5)
11. Write comments about the control of dynamic systems (3)

Topics to be covered:

- Introduction to Dynamic Systems
- The Laplace Transform
- Mechanical Systems
- State-Space Approach to Modeling Dynamic Systems
- Electrical Systems and Electromechanical Systems
- Fluid Systems and Thermal Systems
- Time-Domain Analysis of Dynamic Systems
- System analysis in the frequency domain.
- State-Space Approach to Modeling Dynamic Systems.

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.