1. *Course number and name*
   ENGR 447: Control Systems

2. *Credits and contact hours*
   3 credit hours; three 75-minute lecture sessions/week, or two 1-hr-15-minute lecture sessions/week, depending on semester

3. *Instructor's or course coordinator's name*
   Instructor: M. Azadi, Assistant Professor of Mechanical Engineering
   Course coordinator: M. Azadi, Assistant Professor of Mechanical Engineering

4. *Text book, title, author, and year*
   Nise, N.S., Control Systems Engineering, (Seventh Edition), John Wiley, 2015

   a. *other supplemental materials*
   Ogata, K.: *Modern Control Engineering* (Fifth Edition), Prentice-Hall, 2009
   Dorf, R.C., and Bishop, R.H., *Modern Control Systems*, 11th Edition, Pearson Prentice-Hall Inc., 2008
   Golnaraghi,F and Kuo, B.C., *Auotmatic Control Systems*, (Ninth Ed), John Wiley, 2010
   MATLAB & Simulink Student Version R2015, Mathworks, 2016
   Interactive Control Systems Tutorial (available on the web)

5. *Specific course information*
   a. *brief description of the content of the course (catalog description*
   Analysis and design of continuous and discrete control systems. Systems modeling and stability. System compensation using root-locus and frequency domain techniques. Transfer functions, and state-space representation. Control of systems using state-space methods.

   b. *prerequisites or co-requisites*
   ENGR 305: Systems Analysis Grade C- or better .

   c. *indicate whether a required, elective, or selected elective course in the program*
   Required / Elective for Mechanical Engineering; required for Electrical Engineering.

6. *Specific goals for the course*
   a. *specific outcomes of* instruction,
   - Students will be familiar with the fundamental concepts of Control Theory
   - Students will be introduced to the basic techniques of time and frequency domain analysis.
   - Students will be able to interpret control system specifications
   - Students will be able to develop performance criteria for simple everyday control systems
   - Students will be able to design appropriate controllers for practical systems.
   - Students will be able to use standard software for designing controllers.

- Students will use the Mathworks Control Systems Toolbox for implementing the various controller design techniques.

b. explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

Course addresses ABET Student Outcome(s): a, c, d, e, g, i, j, k.

7. Brief list of topics to be covered

- Review of basic systems concepts
- Transfer Functions and block diagram reduction
- System formulation in State-Space
- Effect of system parameters on system response
- System performance specifications in time domain
- System Stability
- Root Locus Method
- Frequency Characteristics of systems
- Bode Plots and Nyquist Stability Criterion
- System Specifications in frequency domain
- Classical Compensator Design Methods
- Design in State Space
- Design of Controllers and Observers