1. *Course number and name*
   ENGR 410: Process Instrumentation and Control

2. *Credits and contact hours*
   3 credit hours; three 50-minute lecture sessions/week, or two 1-hr-15-minute lecture sessions/week, depending on semester

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

4. *Text book, title, author, and year*
   Smith, C.A. and Corripio, A.B. Principles and Practice of Automatic Process Control, 3rd Ed., John Wiley, 2006

   a. *other supplemental materials:*
      1. Seborg, D.E. et al. "Process Dynamics and Control", 4th Ed., Wiley, 2017
      2. King, M. "Process Control: A Practical Approach", 2nd Ed., Wiley, 2016
      3. Marlin, T. "Process Control", McGraw-Hill, 2nd Ed., 2000
      4. Ogata, K. "Modern Control Engineering", 5th Ed. Prentice Hall, 2010
      5. McMillan, G.K. and D. Considine. "Process/Industrial Instruments and Control Handbook", 5th Ed., McGraw-Hill, 1999

5. *Specific course information*
   a. *brief description of the content of the course (catalog description)*
      Principles of control and instrumentation. Control of level, flow, temperature, and pressure. Actuators and transducers. Process modeling

   b. *prerequisites or co-requisites*
      ENGR 300: Engineering Experimentation, ENGR 305: Linear Systems Analysis

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

6. *Specific goals for the course*
   a. *specific outcomes of instruction*

      - Students learn the principles of control theory with emphasis on process control and some of its specific applications in actual industrial systems.
      - Students learn techniques of process modeling and linearization.
      - Students become familiarized with standard process control configurations.

- Students learn about the state space approach to modelling and control and would be able to use MATLAB, Simulink and symbolic computations for modelling, linearization and control simulations.
- A working knowledge of basic techniques of process control and measurement and their applications in the design of process-control systems is provided to students.
- Students develop basic process control design skills including development of component specifications, control-valve sizing techniques, preparation of Piping & Instrumentation Diagrams, tuning of PID controllers and system identification.

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, h, i, j, k.

7. Brief list of topics to be covered

- Process Control: Terminology and Definitions
- Modeling of Simple Processes and Their Linearization
- The State Space Approach
- MATLAB and Simulink for Modeling, Linearization and Control
- Discrete Time Systems and z Transform
- Control Valves
- Process Instrumentation
- Basics of Process Control
- System Identification
- PID Design and Tuning of Simple Control Loops
- Feed-Forward, Cascade and Multivariable Control
- Advanced Control Configurations