1. **Course number and name**
   COE 481 – Real-time Industrial Networks

2. **Credits and contact hours**
   3 credit hours, 3 contact hours

3. **Instructor's or course coordinator's name**
   Dr. Tarik Ozkul

4. **Textbook, title, author, and year**
   T. Ozkul, *Fieldbus Network Design: Real-Time Industrial Networks*, CreateSpace Press, 2010.

   Other supplemental materials
   J. Berge, *Fieldbuses for Process Control: Engineering, Operation and Maintenance*, ISA press, 2001.

5. **Specific course information**
   a. **Brief description of content of the course (catalog description)**
      Explores industrial computer network principles, commercial industrial networks, third-generation industrial networks, network layout and intrinsic safety considerations, software issues, real-time data processing and case studies.

   b. **Prerequisites or co-requisites**
      Prerequisites: COE 370 (Communication Networks) or COE 371 (Computer Networks I)

   c. **Indicate whether a required, elective, or selected elective course in the program**
      Selected Elective

6. **Specific goals for the course**
   a. **Specific outcomes of instruction**
      This course requires the student to demonstrate the following:
      1. Get familiar with the basic terminology for process control like 4-20 mA current loop, process control instruments and classical process control architectures like Direct Digital Control (DDC), Distributed Control System (DCS)
      2. Design HART network with one or multiple devices. Select wiring and choose power supply voltage
      3. Demonstrate CAN network functions and the non-destructive protocol used for arbitration
      4. Identify the advantages of Foundation Fieldbus (FF) over the traditional process control systems. Evaluate and reason the cost benefits behind Foundation Fieldbus
      5. Design Foundation Fieldbus network H1 segment
      6. Identify and know functions of FF system like LAS, probe node, active list

7. Know the good engineering design practices for FF like leaving enough room for future expansion and taking care of redundancy
8. Design redundant Ethernet for Foundation Fieldbus (HSE) and know where to use what type of media. (twisted pair, fiber optic cable, distances etc.)
9. Design intrinsically safe systems when the environment is explosive/flammable
10. Identify additional devices to use to make safe networks.

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

This course contributes in a significant way to the accomplishment of the following program outcomes:

Program outcome	Emphasis in this course
(a) an ability to apply knowledge of mathematics, science, and engineering	○
(b) an ability to design and conduct experiments, as well as to analyze and interpret data	
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	●
(d) an ability to function on multidisciplinary teams	◑
(e) an ability to identify, formulate, and solve engineering problems	●
(f) an understanding of professional and ethical responsibility	○
(g) an ability to communicate effectively	○
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	○
(i) a recognition of the need for, and an ability to engage in life-long learning	
(j) a knowledge of contemporary issues	●
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	●

Emphasis: ● High; ◑ Medium; ○ Low; Blank – Nothing Specific Expected

7. Brief list of topics to be covered

i. Introduction to automation networks
ii. Fieldbus benefits, savings and concerns
iii. Installation and commissioning of third generation industrial networks
iv. Network and device configuration for Hart networks
v. Network and device configuration for Fieldbus networks
vi. Engineering and design of Fieldbus networks
vii. Availability and safety issues of Fieldbus, intrinsic safety considerations
viii. Case studies of Fieldbus networks).