1. *Course number and name*
   ENGR 435 Environmental Engineering Design

2. *Credits and contact hours*
   3 units. Two 75-minutes or three 50-minutes lecture per week.

3. *Instructor's or course coordinator's name*
   Instructors: Elahe Enssani, Ph.D., P.E.

   Course coordinator: Elahe Enssani, Ph.D., P.E., and Associate Professor of Civil Engineering

4. *Text book, title, author, and year*
   - Viessman, Jr., Warren and Mark J. Hammer . Water Supply and Pollution Control, 8th edition, Addison Wesley, 2009, Pearson Education, Inc.

   b. other supplemental materials
   - Class slides from ILearn
   - Water Environment Federation and American Society of Civil Engineers Manual of Practice, Wastewater Treatment Plant Design. 1999.
   - Standard Methods for the Examination of Water and Wastewater. American Public Health Association. 22nd edition, 2012.
   - Sawyer and Mccarthy. Chemistry of Waters for Environmental Engineers. 6th edition, McGraw-hill, 1999.

5. *Specific course information*
   d. brief description of the content of the course (catalog description)
   Introduction to conceptual design for cleaning up the environment using the fundamentals of chemistry, physical chemistry, such as conservation of mass, conservation of energy, chemical kinetics and microbial kinetics for degradation of pollutants. Concepts in water quality, process design, process flow regimes will be taught through teaching the design of wastewater treatment and biosolids digestion facilities. The students will take the class with only fresh person chemistry and calculus II as the prerequisite. A review of water quality parameters, criteria and wastewater characteristics will be done to familiarize the students with the concepts with discussion on planning, design and construction of Infrastructure projects and their impact on the environment through a review of California Environmental Quality Act (CEQA) and emerging issues such as Financing to upgrade aging infrastructures through establishment of Infrastructure Banks.

   e. prerequisites or co-requisites
   CHEM 115 or 180 (Chemistry)

   f. indicate whether a required, elective, or selected elective course in the program
   Elective for Civil Engineering.

6. *Specific goals for the course*
   c. *specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.*
      - The student will demonstrate an ability to analyze simple environmental processes.
      - The student will demonstrate an ability to design simple environmental systems.
      - The student will demonstrate a knowledge of the common environmental treatment systems' design parameters such as suspended solids, BOD, etc.
      - The student will demonstrate a knowledge of the common water treatment processes such as filtration and color removal.
      - The student will demonstrate a knowledge of the design of the biological treatment systems.
      - The student will demonstrate a knowledge in the anaerobic systems for wastewater and sludge.
      - The student will demonstrate an understanding of the differences between aerobic and anaerobic systems.
      - The student will demonstrate an understanding of the design and operational parameters for both anaerobic and aerobic systems.
      - The student will demonstrate an understanding of the analysis to obtain the operational concepts for both aerobic and anaerobic systems.

   d. *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): b, c, d, e and i.

7. *Brief list of topics to be covered*
   - Introduction to Environmental Systems
   - Basic design considerations for Environmental systems
   - Fundamentals of Mass Balance
   - Fundamentals of Energy Balance
   - Review of Basic Chemistry as it relates to the environmental systems
   - Review of Basic Physical/Chemistry as it relates to the environmental systems
   - Review of Basic Chemical Kinetics as it relates to the environmental systems
   - Fundamentals of Process Design
   - Fundamentals of ideal flow regimes
   - Physical operations versus chemical processes in environmental design
   - Review of aquatic biology as it relates to environmental processes
   - Wastewater characterization, Oxygen Deficit equations
   - BOD, COD
   - Waste water treatment process design as example of process design
   - Primary Treatment
   - Secondary treatment: Biological Treatment Design: Suspended Growth: Activated Sludge
   - Biological treatment: Suspended Growth: Waste water treatment ponds
   - Biological treatment: Attached Growth: Trickling Filters
   - Sedimentation and sludge settling: Stokes' law
   - Biosolids digestion: Anaerobic Biological Growth