# CE 453 ENE Water Quality Control 3 Units

**USC | SONNY ASTANI DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING**

*ABET Course Syllabus*

## Course Information, Textbook and Supplementary Materials

**Course Description:** Water Quality Control. Water quality criteria and fundamentals of acceptability. Natural purification of surface waters. Processes employed in the treatment of water and wastewater.

**Required for:** BSCE, BSCE-ENE and BSENE **Elective for**: BSCE Building Science

**Prerequisites: 1 from** CHEM 105aL General Chemistry or CHEM 115aL Advanced General Chemistry

**2 Co-Requisites: 1 from** CE 408 Risk Analysis in Civil Engineering or CHE 405 Applications of Probability and Statistics for Chemical Engineers; **and 1 from** CE 309 Fluid Mechanics or ENE 410 Environmental Fluid Mechanics

*Note: CE 309 and ENE 410 have duplicate credit*

**Required Textbook:** Hammer, M. J., and Hammer, M. J., Jr., *Water and Wastewater Technology*, 5th edition, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 2004.

**Reference:** Class Notes for CE 453 adapted by Professor Mike Pirbazari

| Topics Covered | Learning Outcomes |
|---|---|
| Background of Water Chemistry | Students will learn the fundamentals of water quality, distribution systems, collection systems, and water as well as wastewater treatment and technologies, as follows:<br>1. Elements, radicals, and compounds, Chemical water analysis, Hydrogen ion concentration and pH, Chemical equilibria, Chemical kinetics, Gas solubility, Alkalinity, Colloids and coagulation, Organic compounds, Organic matter in wastewater, and Laboratory chemical analyses |
| Water Microbiology | 2. Bacteria and fungi, Viruses, Algae, Protozoa and multi-cellular animals, Aquatic food chain, Waterborne diseases, Coliform bacteria as indicator organisms, Tests for the coliform group, Testing for enteric viruses, Biochemical oxygen demand, and Biological treatment systems |
| Hydraulics and Hydrology | 3. Water pressure, Pressure-velocity-head relationships, Flow in pipes under pressure, Centrifugal pump characteristics, System characteristics, Equivalent pipes, Gravity flow in circular pipes, Flow measurement in pipes, and open channels, Amount of storm runoff, Flow in streams and rivers, Hydrology of lakes and reservoirs, and Groundwater hydrology |
| Water Quality and Pollution | 4. Quality of surface waters, Water quality in flowing waters, Water quality in impounded waters, Groundwater quality, Water quality standards, Microbiological quality of drinking water, and Chemical quality of drinking water |

| | |
|---|---|
| Water Distribution Systems and Water Treatment | 5. Water quality and pressure requirements, Municipal fire protection requirements, Surface-water intakes, Mixing and flocculation, Sedimentation, Flocculator-clarifiers, Filtration, Turbidity removal, Taste and odor control, Synthetic organic chemical removal, Iron and manganese removal, Precipitation softening, Fluoridation, Chlorination, Chlorination by-products, Ozone, Disinfection, Ion exchange softening and nitrate removal, Removal of dissolved salts, Sources of wastes in water treatment, and Dewatering and disposal of wastes from water treatment plants |

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| Topics Covered | Learning Outcomes |
|---|---|
| Wastewater flows, characteristics and treatment | 6. Domestic wastewater, Industrial wastewater, Infiltration and inflow, Considerations in plant design, Preliminary treatment, Pumping stations, Clarification, Biological filtration, Rotating biological contactors, Biological aeration, Stabilization ponds, Effluent disinfection, Individual household disposal systems, Characteristics and quantities of waste sludge, Selection and arrangement of sludge processes, Gravity sludge thickening, Thickening of waste activated sludge, Anaerobic digestion, Aerobic digestion, Pressure filtration, Centrifugation, Composting, Agricultural land application, Incineration and drying, and Odor control |

**Lecture and Lab Schedule**

| Lecture | | Lab | |
|---|---|---|---|
| Sessions per Week | Duration per Session | Sessions per Week | Duration per Session |
| 1 | 3 hours | n/a | |

**Relation of Course, Objectives to Program Outcomes**

The Civil Engineering program is designed to teach beyond the technical content of the curriculum and prepare the students to utilize what they learn in a professional setting.

This course contributes to the program outcomes as outlined in the adjacent table.

| Course Contribution to Program Outcomes (a-k) | ✓ Key |
|---|---|
| a. An ability to apply knowledge of mathematics, science, and engineering. | |
| 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. | |
| e. An ability to identify, formulate and solve engineering problems. | |
| h. The broad education necessary to understand the impact of engineering solutions in a global economic and environmental and societal context. | |
| i. Recognition of the need for, and an ability to engage in life-long learning. | |

| | | |
|---|---|---|
| | j. Knowledge of contemporary issues. | |
| | k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. | |

**Prepared by:** Dr. Mike Pirbazari
Professor

**Date:** Fall 2014