

Department of Civil Engineering

ENGG-321 ENVIRONMENTAL ENGINEERING-I (2+1)

Pre-requisites: Nil

Specific Objectives of course:

- To introduce the concept of environmental pollution, contamination and its sources particularly in context to water.
- To learn principles of environmental engineering applied to the design and implementation of water supply schemes.

Course Learning Outcomes (CLOs):

Upon successful completion of the course, the student will be able to:

Theory
1 DESCRIBE the demand and services for water supply.
2 DESIGN water distribution networks and treatment systems including DEWATS
Practical
1 PERFORM experiments related to various parameters for water quality.
2 EXPRESS the laboratory tests performed.

Course Outline:

1. Introduction

Environmental Engineering, Water Engineering, Sanitary Engineering, Air & Noise Pollution

2. Water Pollution

- Water chemistry and characteristics,
- Introduction to sources of pollution,
- Effects on water quality, Control parameters

3. Water Demand and Supply

- Population forecast,
- Water uses & consumption,

- Types and variations in demand
- Maximum demand & fire demand

4. Water Quality

- Water impurities & their health significance,
- Water quality guidelines/standards (US., WHO and NSDW Pakistan etc),
- Water quality monitoring

5. Water Sampling and Testing

- Sampling techniques and examination of water (physical, chemical and microbiological parameters),
- Water borne diseases

6. Water Treatment

- Treatment of surface & ground water, Screening, (types of settling),
- coagulation and flocculation,
- Filtration,
- Design aspects of slow sand and rapid sand filters and their operations,
- Pressure filters,
- Membrane Technology (Reverse Osmosis, Ultrafiltration)

7. Miscellaneous Water Treatment Techniques

- Fluoridation,
- Iron & Manganese removal,
- Water softening methods,
- Water disinfection and chemicals,
- Chlorination,
- Ozone, Ultraviolet
- Decentralized Wastewater System (DEWATS)
 - ❖ Introduction to Decentralized Wastewater treatment system
 - ❖ Plant layout and primary components
 - ❖ Working mechanism of DEWATS components i.e. Primary treatment, secondary treatment and advanced system
 - ❖ Design of settling system, Anaerobic Baffle Reactor (ABR), Anaerobic filter
 - ❖ Odour removal
 - ❖ Approaches for Sludge disposal methods

8. Water Distribution

- Layout and design of water transmission works and distribution networks (Hardy Cross and Equivalent Pipe method),
- Service reservoirs,
- Fixtures and their installation,
- Tapping of water mains, Urban and Rural Water Supply

9. Use of relevant software in design

Practical Work:

Following experiments may be taken up for the course.

1. To determine optimum dosage for turbid water.
2. Determination of Coliform bacteria of a given water sample by Multiple Tube
3. To determine the amount of nitrogen in a given sample.
4. Study of single beam Spectrophotometer.
5. To determine the Conductivity of water sample
6. To determine the turbidity of water sample
7. To determine the total dissolved solid of water sample
8. To determine total suspended solids of water sample
9. To determine the ammonia determination
10. To determine the water hardness
11. To determine the odour and pH of raw and treated water of DEWATS

Recommended Books:

1. Mackenzie L. Davis, David A. Cornwell, Introduction to Environmental Engineering, 4th Edition, 2008
2. McGraw-Hill Science/Engineering/Math; 4th Edition (October 3, 2006)
3. S. Peavy, D. R. Rowe, George Technological, Environmental Engineering8oiupulkj
4. Terence J. McGhee, Water Supply and Sewerage, 6th Edition, McGraw Hill
5. Howard McGraw-Hill Publishing Company; 7th Edition (March 1987)

Department of Chemical Engineering

Course Title	ENVIRONMENTAL ENGINEERING
Course Code	ENGG-421
Prerequisite	-
Contact Hours	48
Credit Hours	3
Semester	7th or 8th

Course Learning Outcomes (CLOs):

Upon successful completion of the course, individual student will be able to:

- Understanding basic air pollution control /water treatment processes
- Understand and explain environmental monitoring and its components
- APPLY air pollution prevention techniques for industrial applications
- Describe the typical composition of raw wastewater.
- Explain the effects of wastewater discharges on the receiving stream.
- Identify how treatment plant discharge impacts natural cycles.

Course Contents:

- Introduction to Environmental Engineering

Section 1- Air Pollution

- Air Pollution Classification
- Causes of Air Pollution
- Sources of Air Pollution
- Atmosphere of Earth
- Structure of the Atmosphere
- Laws and EPA Regulations
- Pollution Prevention Act
- Pollution Concept
 - Types of Pollution
 - Air pollution Prevention control technologies
 - Source Reduction
 - Equipment and Process Modifications
 - Particulate Matter
 - Control of Gaseous Pollutants
 - Adsorption, Absorption, Oxidation, Reduction
- Pollution Control Devices and Design
 - Settling Chamber
 - Spray chamber
 - Cyclone
 - Bag house
 - Venturi
 - Electrostatic Precipitator (ESP)

- Plume Dispersion
 - Policy Analysis
 - Regional Planning
 - Supplementary Control Systems / Air Quality Prediction System
 - Emergency Preparedness / Accidental Releases
 - Long Range Transport (Acid Rain)
 - State Implementation Plan Revisions / New Source Review
 - Prevention of Significant Deterioration (PSD)

Section 2 Water Treatment

- Water chemistry and characteristics,
- Introduction to sources of waste water
- Effects on water quality, Control parameters

Water treatment technologies

- Conventional Surface Water Treatment
- Wastewater treatment removal parameters
- Removal of Suspended solids; Organic (biodegradable) material; Nutrients (nitrogen and phosphorous);
- Pathogenic organisms (expressed as E. Coli)
- Medicine residues, organic chemicals (POP's)
- Heavy metals

Removal Methods

- Physical (sedimentation, flotation, screening, filtration)
- Biological (trickling filters, activated sludge)
- Chemical (chemical precipitation, ozonation, chlorination)
- Design of Activated sludge process
- Membrane Filtration
- Advanced Oxidation Processes
- Photocatalysis
- Decentralized Wastewater System (DEWATS)
 - ❖ Introduction to Decentralized Wastewater treatment system
 - ❖ Plant layout and primary components
 - ❖ Working mechanism of DEWATS components i.e. Primary treatment, secondary treatment and advanced system
 - ❖ Design of settling system , Anaerobic Baffle Reactor (ABR), Anaerobic filter
 - ❖ Odour removal
 - ❖ Approaches for Sludge disposal methods

- Principles and purposes of IEE and EIA and its significance for the society
- Cost and benefits of EIA
- Main stages in EIA process
- Public consultation and participation in EIA process

- EIA methods and techniques for impact prediction and evaluation.

Teaching Methods:

- Lecture
- Discussion

Assessment Methods:

- Quiz
- Assignment
- Mid Exam
- Final Exam

Books Recommended:

1. Nemerow, N. L., & Wiley InterScience (Online service). (2009). *Environmental Engineering: Vol. 1*. Hoboken, N.J: John Wiley & Sons.
2. Vesilind, P. A., Peirce, J. J., & Weiner, R. F. (1994). *Environmental engineering*. Boston: Butterworth-Heinemann.
3. Metcalf and Eddy., *Wastewater Engineering: Treatment and Reuse* 5th Edition, Kindle Edition (2017)

Department of Environmental Sciences

Course Title	POLLUTION CONTROL TECHNOLOGIES
Course Code	
Prerequisite	-
Contact Hours	48
Credit Hours	3
Semester	8th

Course Outline:

- Collection, treatment and distribution of drinking water supply;
- Collection, treatment and disposal of municipal and industrial wastewater;
- Low cost water treatment and sanitation techniques;
- Solid and hazardous waste management;
- Cleaner production techniques; Waste hierarchy (Reduce, re-use and recycling);
- Waste site investigation and remediation;
- Decentralized Wastewater System (DEWATS)
 - Introduction to Decentralized Wastewater treatment system
 - Plant layout and primary components
 - Working mechanism of DEWATS components i.e. Primary treatment, secondary treatment and advanced system
 - Design of settling system , Anaerobic Baffle Reactor (ABR), Anaerobic filter
 - Odour removal
 - Approaches for Sludge disposal methods