University of Engineering and Technology,Taxila

Department of Civil Engineering

Course Title **Environmental Engineering-I**

Pre-requisite
1. Hydrology & Water Resources
2. Fluid Mechanics-I
3. Fluid Mechanics-II

Credit Hours	Theory	02 Hours
	Practical	01 Hour
Contact Hours	Theory	02 Hours
	Practical	03 Hours

Text Books
1. Introduction to Environmental Engineering Third Edition by Davis & Cornwell, McGraw Hill
2. Water Supply & Sewerage by E.W Steel and McGhee 4th, 5th, 6th Edition (whichever available)
3. Environmental Engineering Laboratory, by Dr. Khurshid Ahmad

Reference Books

- Waste Water Engineering, Treatment, disposal, Reuse by Metcalf and Eddy, 3rd Edition.
- Environmental Assessment in Practice by D. Owen Harrop & J. Ashley Nixon
- Integrated Solid Waste Management by George Techobanoglous, Hilary Theisen & Samuel A. Vigil
- Elements of public health engineering by K.N Duggal
- Water and Waste water Engineering by Fair & Gayer
- Water and Wastewater Technology by Mark J, Hammer

Catalog Data CE-306

Course Objectives:

- To introduce the concept of environmental pollution, contamination and its sources particularly in context to water.
- Provide an overview of key topics and relevent field issues in environmental engineering

- Gain an understanding of the underlying scientific, engineering, and regulatory concepts in each topical area
- Learn several quantitative approaches for environmental assessment and problem solving
- To learn principles of environmental engineering applied to the design and implementation of water supply schemes.

Course Contents:

CE-306 Environmental Engineering-I

- Introduction to the Environmental Engineering.
- Core environmental science concepts
- Hydrology and earth sciences
- Water quality
- Water treatment
- Water supply systems
- Wastewater collection systems
- Global environmental issues
- National environmental issues
- Wastewater treatment
- Introduction to Air pollution control
- Introduction to Solid waste management
- Introduction to Hazardous and industrial waste management
- Introduction to Environmental impact assessment
- Introduction to Water quality modeling
- Introduction to Noise pollution control

Course Learning Outcomes (CLOs):

1. Students will be able to formulate and identify basic and complex environmental issues in the field of environmental engineering.
2. Students will learn to design water supply and treatment systems.
3. Students will also be able to communicate environmental issues and solutions through environmental assessment reports.

PLO's(Theory)

Student Learning Outcomes:

To learn about basic environmental issues in developing and developed world

To design simple and complex water supply systems along with advance water treatment options.

To understand the environmental management plan for different environmental issues

Course Professional Outcome/Industrial Usage:

The Engineers will be able to plan and execute a water supply and treatment options for small town and metropolitans.

The graduates will be able to design and formulate complex environmental issues in the real life according to the local and international standards.

The students will also be able to prepare environmental study reports as well.

MAPPING (Theory)

CLO's / PLO's	CLO-1	CLO-2	CLO-3
1	✓	✓	✓
2	✓	✓	
3	✓	✓	✓
4	✓		✓
5		✓	
6			✓
7	✓	✓	✓
8	✓		✓
9	✓	✓	✓
10			✓
11			✓
12	✓	✓	✓

CLO's / Assign. Modules	CLO-1	CLO-2	CLO-3
Assignment	✓	✓	✓
Quizzes	✓		
Midterm	✓	✓	
Final Term	✓	✓	

Mapping (LAB)

Mapping of CLOs to Lab PracticalEnvironmental Engineering-I			
Lab Practical	**CLOs**		
	CLO-1	**CLO-2**	**CLO-3**
To prepare the normal and moral solutions in the laboratory.	✓	✓	
To determine the pH values for the given samples	✓	✓	✓
To determine the EC and salinity of water samples	✓	✓	✓
To determine the amount of turbidity in given water sample	✓	✓	
To determine the total hardness of given water samples by EDTA method	✓	✓	✓
To determine calcium and magisum hardness of given water sample by EDTA method	✓		✓
To determine the total hardness of given water sample by kit method	✓	✓	
To determine the alkalinity of given water sample	✓	✓	
To determine the chlorine concentration in different water samples	✓	✓	✓

CLO's(LAB)

Course Learning Outcomes:

At the end of this practical work , the students will:

CLO:1 Learn to analyses the water and apply practical principles to maintain good standards of public health.
CLO:2 Learn fundamentals of EC, turbidity, hardness, alkalinity, chlorides, pH and salinity
CLO:3 Be able to analyses different concentration of hazardous material in water

Practical List

1. To prepare the normal and moral solutions in the laboratory
2. To determine the pH values for the given samples
3. To determine the EC and salinity of water samples
4. To determine the amount of turbidity in given water sample
5. To determine the total hardness of given water samples by EDTA method
6. To determine calcium and magisum hardness of given water sample by EDTA method
7. To determine the total hardness of given water sample by kit method
8. To determine the alkalinity of given water sample
9. To determine the chlorine concentration in different water samples

PLO's(LAB)

Student Learning Outcome:

To learn to analyses the water and apply practical principles to maintain good standards of public health.

To determine the amount of EC, turbidity, hardness, alkalinity, chlorides, pH and salinity
Be able to analyses different concentration of hazardous material in water

Course Professional Outcome/Industrial Usage:

The Engineers will be able to plan parameters for fresh water after removing hazardous materials

The graduates will be able to maintain different concentration of different parameter in water which is required according to international standard

Weekly Lesson Plan:

Weeks	Activities/Topics Studied	Details	Extra Activities
1st Week	**Introduction to Environmental Engineering & Sciences**	✓ Environmental systems ✓ Possible contamination scenarios ✓ Environmental ethics ✓ Environmental engineering-a global perspective ✓ The major environmental problems ✓ Environmental groundwater hydrology ground water resources - quantity ✓ Ground water resources - quality ✓ Ground water: a valuable resource ✓ Aquifer characteristics ✓ Ground water hydraulics	Allocation of presentation topics and sessional briefing
2rd Week	**Overview of Environmental Policy, Law, and Regulation**	✓ Common Environmental Values ✓ Historical Stages of U.S. Environmental Protection Efforts ✓ Looking Ahead: Outcomes-based Environmental Protection ✓ Framework for Protecting Human Health: the Risk Assessment/ Risk Management Model ✓ Risk Assessment/Risk Management Model ✓ Environmental Protection Programs in the U.S. ✓ Primary Environmental Laws ✓ Enforcement ✓ Environmental Code of Ethics ✓	
3th Week	**Chemical View Of Environmental Quality**	✓ Environmental Chemistry ✓ Stoichiometry ✓ Oxygen Demand ✓ CHEMICAL KINETICS ✓ Reaction Order ✓ Half-Life	Submission of Assignment No.01

4th Week	**Chemical Concentrations in Water, Air and Soil**	✓ Air ✓ Water ✓ Water Cycle ✓ Water Distribution ✓ ECOSYSTEMS AND NUTRIENT CYCLES ✓ Human Influences on Ecosystems ✓ Role of Energy ✓ Food Webs ✓ Carbon Cycle ✓ Nitrogen Cycle ✓ Phosphorus Cycle ✓ Sulfur Cycle	
5th Week	**Population Dynamics abd forcasting**	✓ Perspective ✓ Bacterial growth requirements ✓ Growth in pure cultures ✓ Mathematics of growth ✓ Mixed cultures ✓ Human population dynamics	Submission of Assignment No.02
6th Week	**Lake Ecosystem**	✓ Lake ecosystems ✓ Productivity ✓ Limiting nutrients ✓ Succession or eutrophication ✓ A simple phosphorus model ✓ Acidification of lakes ✓ Effects of acid rain ✓ Bicarbonate buffering ✓ Pollution of streams and lakes ✓ Eutrophication ✓	**Presentations**
7th Week	**Risk Perception, Assessment and Management**	✓ Environmental risk ✓ Definitions ✓ Risk perspectives ✓ Risk assessment model ✓ Dose-response assessment ✓ Extending dose-response data to environmentally relevant doses ✓ Carcinogens ✓ Non-carcinogens ✓ Exposure assessment ✓ Key steps in exposure assessment ✓ Elimination of pathways ✓ Concentrations in environmental media that are contacted ✓ Calculate chemical intake risk ✓ Rick characterization	Submission of Assignment No.03

		✓Rational method ✓Time of concentration ✓Rainfall intensity ✓	
	Presentations	✓Presentations	**Presentations** **&** Surprise Quiz
8th Week	**Sewage Characteristics**	✓Definitions of some terms in sewage characterization ✓BOD ✓Significance of BOD ✓Derivation of BOD equation ✓Chemical oxygen demand ✓Domestic sewage characteristics ✓ Water resources management ✓ Determining water demand ✓ Factors affecting water usage ✓ Examples of water resource projects ✓ Environmental impacts	2nd Quiz
	Presentations	✓Presentations	**Presentations**
9th Week	**Environmental Aspects of Surface Water Hydrology**	✓ Hydrologic Cycle ✓ Mass Balance in Hydrologic Systems ✓ Mass Balance Equation for a Lake ✓ Water Sheds ✓ Hydrologic Continuity Equation	Surprise Quiz
	Presentations	✓Presentations	**Presentations**
10th Week	**Water Pollutants and their Sources**	✓ River and Lake Pollutants ✓ Effects of Pollutants ✓ Point sources ✓ Non-point sources ✓ Oxygen-Demanding Material ✓ Nutrients ✓ Salts ✓ Suspended Solids ✓ Pathogenic Organisms	

		✓ Toxic and Hazardous Substances ✓ Volatile Organic Compounds ✓ Chlorinated solvents ✓ Hydrophobic Organics/ Chlorinated Aromatics ✓ Some Other Categories ✓ Arsenic	
11th Week	**Water Quality Management in Rivers**	✓Dissolved Oxygen Depletion ✓Biochemical Oxygen Demand Measurement ✓Modeling BOD Reactions ✓Ultimate Biochemical Oxygen Demand ✓ Biological Oxygen Demand: Temperature Dependence ✓Nitrogenous Oxygen Demand ✓Other Measures Of Oxygen Demand ✓Mass Balance Approach ✓Steps in Developing the DO Sag Curve	
	Presentations	✓Presentations	**Presentations**
12th Week	**Drinking Water Quality and Health**	✓Engineered Water Systems ✓Water and Health ✓Drinking Water Regulation in the U.S ✓Sizes of Particles in Water ✓Palatable vs. Potable ✓Sources of Drinking Water ✓Ground- vs. Surface Water ✓Surface Water Treatment ✓Groundwater Treatment	
13th Week	**Water Treatment**	✓Surface Water Treatment ✓Removal of turbidity ✓Rapid Mixing ✓Coagulation and	

		Flocculation ✓ Coagulant ✓ Flocculation ✓ Softening ✓ Aerators ✓ Oxidation of reduced metals ✓ Hardness ✓ Groundwater Treatment	
14th Week	**Water Treatment: Sedimentation, Filtration and Disinfection**	✓ Sedimentation/Settling ✓ Circular Clarifiers ✓ Overflow rate ✓ Types of Particle Settling ✓ Filtration ✓ Filter Design ✓ Rapid Sand Filtration ✓ Disinfection ✓ Chlorine Reactions in Water ✓ Other Disinfectants ✓ Design of Disinfection Systems ✓ Disinfection By-products ✓ Advanced Treatment Processes ✓ Residuals Management	
15th Week	**Wastewater Treatment: Characteristics and Systems**	✓ Disposal of waste material on land and water bodies ✓ Assimilative capacity ✓ On-land disposal of wastewater ✓ Reuse of treated wastewater ✓ Rapid infiltration ✓ Ground water recharge ✓ Overland runoff / flow ✓ Use of treated sewage for irrigation ✓ Advantages of wastewater irrigation ✓ Scenario of wastewater irrigation in Pakistan ✓ Public health risk associated with raw sewage waste water ✓ Effective wastewater treatment ✓ Significance of wastewater contaminants ✓ Characteristics of domestic wastewater ✓ On-site disposal systems	**Presentations**

		✓ Municipal wastewater treatment systems ✓ Pretreatment of industrial wastewaters ✓ Bar racks ✓ Grit chambers	
16h Week	**Wastewater Treatment: Primary and Secondary Treatment**	✓ Primary Settling Basins ✓ Primary Setting ✓ Primary Settling Tank Design ✓ Secondary Treatment ✓ Diverse Microbial Community ✓ Basic Ingredients ✓ Dispersed growth vs Fixed Growth ✓ Activated Sludge ✓ Activated Sludge Design ✓ F/M Parameter ✓ Trickling Filters ✓ Trickling Filter Plant Layout ✓ Rotating Biological Contactors ✓ Anaerobic Ponds ✓ Land and Wetland Application	
17h Week	**Wastewater Treatment: Disinfection And Sludge Management**	✓ Advanced wastewater treatment ✓ Secondary wastewater treatment ✓ Filtration ✓ Carbon adsorption ✓ Membrane processes ✓ Phosphorus, eutrophication ✓ Phosphorus removal ✓ Nitrogen removal ✓ Air stripping ✓ Sludge treatment ✓ Sludge types ✓ Sludge treatment: thickening ✓ Sludge treatment: stabilization ✓ Stabilization ✓ Sludge treatment: conditioning ✓ Sludge treatment: de-watering ✓ Sludge treatment: volume reduction ✓ Sludge disposal	

18th Week	**Air Pollution: Origin, Fate and Effects of Pollutants**	✓ Air Pollution ✓ Air Pollution and Public Opinion ✓ Air Pollution Standards ✓ Control of "Criteria" Air Pollutants ✓ Carbon Monoxide ✓ Oxides of Nitrogen ✓ Photochemical Smog ✓ Ozone: Health Effects ✓ Ozone: Environmental Effects ✓ Sulfur Oxides ✓ Sulfur Dioxide: Health Effects ✓ Particulate Matter ✓ Health Effects of Particulate Matter ✓ Lead ✓ Lead: Health Effects	
Makeup Lectures	**Air Pollution: Meteorology and Dispersion Modeling**	✓ Air Quality and Meteorology ✓ Stability ✓ Neutral Conditions ✓ Unstable Conditions ✓ Stable Conditions ✓ Temperature Inversions ✓ Effect of Lapse Rate on Plumes ✓ Point Source Gaussian Plume Model ✓ Model Structure and Assumptions ✓	
Makeup Lectures	**Air Pollution: Indoor Air Quality and Air Pollution Control**	✓ Indoor air quality ✓ Sources and types of indoor air pollutants ✓ Movement of air into / out of buildings ✓ Infiltration ✓ Ventilation ✓ Indoor air quality model ✓ Radon risk assessment ✓ Air pollution control ✓	