

# SHIV NADAR UNIVERSITY

## UNDERGRADUATE COURSE DESCRIPTION

- I. **COURSE TITLE:** Environmental Engineering
- II. **COURSE CODE:** CED 308
- III. **COURSE CREDITS (L:T:P):** 3:0:1
- IV. **TOTAL CONTACT HOURS/ BATCH/WEEK (L:T:P):** 3-0-2
- V. **NO. OF BATCHES:** 2
- VI. **COURSE TYPE (MAJOR/UWE/CCC/REAL/VELS/IC), PLEASE MENTION ALL THAT APPLIES:** Major, Minor, and UWE
- VII. **PREREQUISITE/S (IF ANY):** Not required
- VIII. **COURSE COORDINATOR/INSTRUCTOR(S):** Dr. Susant Kumar Padhi
- IX. **SCHOOL/ DEPARTMENT:** SoE/CIVIL ENGINEERING
- X. **DISCIPLINES TO WHICH THE COURSE MAY BE OF INTEREST:** All
- XI. **Objective:** The objective of this course is to provide an introduction of Environmental Engineering. This course gives the students an opportunity to understand the quality and quantity of water. It also addresses the problems related to water supply, sewerage, sewage treatment. It also provides various technologies to meet the desired stand of water.
- XII. **Learning Outcomes:**
- Identify the environmental problems arising due to anthropogenic activity
  - Estimate the water consumption rate, population forecasting to determine the water demands
  - Analyze the physical, chemical and biological characteristics of water and wastewater
  - Estimate the quality and quantity of water and wastewater generated
  - Design of various unit operation and process for water and wastewater treatment
- XIII. **COURSE CONTENT:**
- CHAPTER 1: Introduction to water and waste water engineering: Objectives of environmental engineering, water and wastewater engineering, quantity of water, quality of water, pollution level, extent of treatment, treatment plants, water and wastewater

quality enhancement- philosophy of treatment, removal of turbidity and pathogens, IS standards for drinking water supply.

- CHAPTER 2: Water and waste water quantity estimation: Water consumption rate, population forecasting methods for estimation of water demands.
- CHAPTER 3: Water and wastewater characteristics: Sources of raw water, physical characteristics, chemical characteristics, Biological aspects, kinetic aspects of BOD, COD and other characteristics.  
Unit operations and processes of water treatment systems: Briefs of different operations and processes taking place during water treatment.
- CHAPTER 4: Sedimentation: Discrete Particles, average settling velocity, measurement of settling velocities, relationship between settling velocity and surface over flow rate, surface loadings and detention periods, inlet and outlet, designing circular settling basin, tube settlers or inclined plate settling, co-current settling, more designs of primary and secondary settling tanks.
- CHAPTER 5: Coagulation and flocculation: colloidal stability, energy barrier - net attractive force, coagulation theory, ionic layer compression, adsorption and inter-particle bridging, jar test for optimum coagulant dosage, coagulation practice, flocculation, orthokinetic flocculation, design of flocculators, various types of flocculation, factors influencing coagulation flocculation.
- CHAPTER 6: Softening and filtration: Chemical precipitation, lime and soda ash requirement, one and two stage recarbonation, Filtration, most common filter - granular medium, types of filters (slow sand, rapid sand, dual media or multi-media, activated carbon and pressure filters), transport Mechanism, head loss in filters, filter washing, design of filters.
- CHAPTER 7: Disinfection: Mechanism, steps involved, chemical disinfectant, factors influencing chemical disinfection, rate of disinfection - Chick's law of disinfection, Disinfection by Chlorine, Mechanism of Chlorine disinfection, Inhibition of respiratory enzymes, prechlorination, post chlorination, dechlorination, non-chemical methods for disinfection (UV- radiation, Gamma and X-ray).
- CHAPTER 8: Introduction to domestic waste-water treatment: Waste-water management, schematic of waste-water treatment plant, primary, secondary and tertiary treatments, system of sanitation, sewage appurtenances, sewage and storm water pumping stations, quantity estimation of sewage and storm water, hydraulic design of sewers and storm water.
- CHAPTER 9: Physical treatment processes: Flow equalization, aeration, screening, design of fine screens, grit, effect of grit, grit removal facility, skimming tank, water quality and estimation of organic content.
- CHAPTER 10: Waste water treatment analysis: Introduction to microbiology, biological processes, wastewater treatment system, fundamentals of process kinetics, determination of reaction orders, reactor analysis, continuous - flow stirred tank reactor, plug flow reactor.
- CHAPTER 11: Activated sludge process and lagoons: Kinetic modelling of activated sludge process, substrate concentration, recirculation ratio  $r$  and small SVI, design of activated sludge process, ponds and lagoons, kinetics involved in ponds and lagoons, design of lagoons.
- CHAPTER 12: Attached growth aerobic process: Trickling filters and rotating biological contractors, types of trickling filters, and design of trickling filters.  
Sequential batch reactor: Operating parameters, nitrification and denitrification.

Anaerobic treatment: Anaerobic process-UASB reactor.

MEMBRANE,

Membrane technology for waste-water treatment: Process classification, membrane materials and configurations, membrane fouling.

Sludge processing and drying: Sludge processing, thickening, conditioning, dewatering, and sludge disposal.

#### XIV. RECOMMENDED BOOK(S):

##### Text Books

1. Howard S. Peavy, Donald R. Rowe, and George Tchobanoglous “Environmental Engineering”, McGraw-Hill Book Co.,
2. Arcadio Sincero, and Pacquiao Sincero. “Environmental Engineering: A design approach”, PHI Learning Pvt Ltd.,
3. Metcalf and Eddy “Inc., Wastewater Engineering, Treatment and Reuse.” McGraw-Hill Higher Education.

##### Reference Books

1. Masters, Gilbert M., and Wendell Ela. “Introduction to Environmental Engineering and Science.” PHI Learning Pvt Ltd.,
2. Santosh Kumar Garg, “Water Supply Engineering” Khanna Publishers.
3. Santosh Kumar Garg, “Environmental Engineering: Sewage Disposal and Air Pollution Engineering” Khanna Publishers.
4. B. C. Punmia, Arun Kumar Jain, Ashok Kumar Jain “Water Supply Engineering”, Laxmi Publications.
5. Dr. B. C. Punmia Ashok Kr. Jain Arun Kr. Jain “Environmental Engineering – II Waste Water Engineering”, Laxmi Publications.

*In addition to above reference books, handouts, web references and lecture slides are considered as relevant reference materials for the students to study.*

#### XV. ASSESSMENT SCHEME:

Particulars	Marks
Mid-sem exam:	25
End-sem exam:	30
Quiz:	10
Attendance, assignment & class performance:	10
Laboratory:	25
<b>Total:</b>	<b>100</b>
<b>Break-up of Lab evaluation:</b>	

Regular lab performance:	7
Lab report :	6
Final lab exam:	8
Viva-voce:	4
Total:	25