Course Type	Course Code	Name of the course	L	T	P	Credit
DE	CED404	Environmental Engineering II	3	0	0	9

Course Objective

This course is to provide an understanding the functioning and design of various water and waste water treatment methodologies.

Learning Outcomes

After studying this course, students should be able to:

- Understand the role of each unit process within typical treatment process trains, their interaction and the context of when they are applied.
- Appreciate the advantages, disadvantages and limitations of the technologies adopted for waste water treatment

Unit No.	Topics to be Covered	Lectures	Learning Outcome
1	Design of water treatment units, Design and operation of Plain Sedimentation (type-1 settling) and Sedimentation aided coagulation (type-2 settling), Design of filtration systems – slow sand and rapid sand filter, Design of disinfection – Chlorination and other means of disinfection, , water softening - lime soda process, single stage and two stage, re-carbonation, ion exchange	**14**	Understand the operation and design of treatment units of water treatment plants.
2	Industrial Wastewater and Sewage characteristics, Environmental Standard for domestic and industrial wastewater disposal, Quantity & Quality, flow rate, treatment flow -sheets. Design of Sewerage: Types & Design of sewerage, Hydraulic Design of Sewer: construction laying and testing of sewer lines, Design of Sewage Pumping Station, Maintenance of sewerage system.	**[10L]**	Understand the fundamentals of sewerage design.
3	Sewage treatment process, reactor type, Preliminary treatment-design and operation of screening and grit chamber. Sedimentation, design and operation PST, Sewage disposal in isolated unsewered areas: septic tank, cesspools and their effluent disposal methods.	**8L**	An understanding of the operation and design of primary treatment units of wastewater treatment systems.
4	Principle of biological treatment-derivation of bacterial growth kinetics used in designing of wastewater treatment plant. Process design and operation of Activated sludge process and its modification. Design of secondary settling tank. Design and operation of nutrient removal system, Process design and operation of trickling filter, RBC, Biofilter. Anaerobic treatment: Design and operation of UASB process. Sludge characteristics and disposal methods: design and operation of sludge drying bed. Concept of common effluent treatment plant (CETP). Wastewater treatment for small communities: Oxidation ditch, SBR and lagoon etc.	**[10L]**	An in-depth-knowledge of the secondary (biological) treatment of wastewater.

Recommended Text Books:

1. Wastewater Treatment Plants: Planning, Design and Operation Holt - SR Qasim, Rinehart & Winston, NY, 1985.
2. Water and wastewater technology (7th ed.)- Hammer and Hammer, PHI, Delhi.

Recommended References:

1. Wastewater Engineering: Treatment and Reuse (4th ed.)-Metcalf and Eddy
2. Wastewater Treatment for Pollution Control (3rd ed.) - SJ Arceivala, Tata McGraw Hill,1998.