III Year-I Semester
(20CE5757) Sanitary Engineering

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

Pre- Requisites: Fundamentals of Environmental Studies and Chemistry

Course Objectives:
The objective of this course is:

- Outline planning and the design of waste water collection, conveyance and treatment systems for a community/town/city
- Provide knowledge of characterization of wastewater generated in a community
- Impart understanding of treatment of sewage and the need for its treatment.
- Summarize the appurtenance in sewerage systems and their necessity
- Teach planning, and design of septic tank and off tank and the disposal of the effluent from the slow cost treatment systems
- Effluent disposal method and realize the importance of regulations in the disposal of effluents in rivers.

UNIT-I:
Introduction to Sanitation–collection and conveyance of waste water–sewerage – classification of sewerage systems-Estimation of sewage flow and storm water drainage –fluctuations–Hydraulics of sewers and storm drains–design of sewers–appurtenances in sewerage –cleaning and ventilation of sewers

UNIT-II:
Pumping of waste water: Pumping stations– location – components– types of pumps and their suitability with regard to waste waters.
Sewage characteristics–Sampling and analysis of waste water - Physical, Chemical and Biological Examination-Measurement of BOD and COD- BOD equations

UNIT-III:
Treatment of sewage: Primary treatment-Screens-grit chambers-grease traps– floatation– sedimentation – design of preliminary and primary treatment units.

UNIT- IV:
Secondary treatment: Aerobic and anaerobic treatment process- comparison. Septic Tanks and Imh off tanks
Suspended growth process: Activated Sludge Process, principles, designs, and operational problems, modifications of Activated Sludge Processes, Oxidation ponds, Aerated Lagoons.
Attached Growth Process: Trickling Filters–mechanism of impurities removal-classification–design-operation and maintenance problems. RBCs.

UNIT-V
Bio-solids (Sludge) management: Characteristics, handling and treatment of sludge-thickening–anaerobic digestion of sludge, Sludge Drying Beds. Centrifuge.
Disposal of sewage: Methods of disposal–disposal into water bodies- disposal on land- sewage sickness.

Course Outcomes:

S.No	Course Outcomes	BTL
1	Plan and design the sewerage systems	L5
2	Suggest a suitable pump for pumping of waste water	L5
3	Analyze sewage and suggest and design suitable treatment system for sewage treatment	L4
4	Suggest a suitable disposal method with respect to effluent standards.	L5
5	Select the appropriate appurtenances in the sewerage systems	L5

Text Books:

1. Waste water Engineering Treatment and Reuse, Metcalf & Eddy, Tata McGraw-Hill edition.
2. Industrial Water and Waste water Management, K.V.S.G. Murali Krishna.
3. Elements of Environmental Engineering, K. N. Duggal, S. Chand & Company Ltd. New Delhi, 2012.

Reference Books:

1. Environmental Engineering, Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985
2. Waste water Treatment for Pollution Control and Reuse, Soli. J Arceivala, Sham R Asolekar, Mc-Graw Hill, New Delhi; 3rdEdition
3. Environmental Engineering –II: Sewage disposal and Air Pollution Engineering, Garg, S.K., Khanna Publishers
4. Sewage treatment and disposal, P.N. Modi & Sethi Environment Enginnering, Ruth F.Weinerand Robin Mathhews-4th Edition Elsevier 2003