

WASTEWATER ENGINEERING AND REUSE

Paper code: ETCE-311

Paper: Wastewater Engineering and Reuse

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

Objective: The course deals with planning of sewerage collection and treatment processes such as attached culture system, suspended culture system. The subject also deals with nutrient removal, sludge thickening, sludge digestion.

UNIT I

Sewerage systems and their components: Introduction to sewerage system, Estimation of sewerage and drainage discharge, Dry weather flow, capacity of sewers, self cleansing and non scouring velocities, calculations of sizes and grades, forms and cross sections of sewers, hydraulic characteristics of circular sewer sections, use of tables and monograms, egg shaped sewers, systems of drainage, separate, combined and partially combined systems.

Quality and characteristics of sewage: physical, chemical and biological characteristics of sewage, Aerobic and anaerobic decomposition of sewage, nitrogen, sulphur and carbon cycles, collection of sewage sample, bacteriological and virological testing.

Sewage disposal: Disposal of treated / untreated / partially treated effluents in natural water bodies, Standard for effluent disposal on land, Disposal by land treatment / sewage farming methods, sewage sickness and its preventive measures, Treatment standards for sewage effluents, Bangalore and Indore methods of disposal.

[T1][No. of Hours: 12]

UNIT II

Engineered systems for waste water treatment: Types of treatment units in preliminary, primary and secondary treatment, their functions and efficiencies, analysis and design of screening, grit chambers, detritus tanks, skimming tanks, design of septic tanks and Imhoff tanks.

Ponds and lagoons: Principle, operations, construction, design and detailing of Oxidation ponds, Aerated lagoons, Facultative ponds, Oxidation ditches, Anaerobic lagoons.

Attached culture systems: System microbiology, Contact beds, Principle, operations, Construction and design details of Trickling filters, Bio towers, Rotating biological contractors (RBC).

[T1,T2][No. of Hours: 12]

UNIT III

Design of Suspended culture systems : Activated sludge, concept of completely mixed and Plug flow reactors, process variation and design considerations, Aeration of activated sludge, Air diffusers and mechanical aerators, activated sludge clarifiers, Secondary clarifier design based on limiting flux rate.

Advanced waste water treatment: Nutrient removal, Nitrification and denitrification, Air stripping for ammonia removal, phosphorus removal, dissolved solids removal, Waste water reuse.

Sludge thickening and sludge digestion: Sludge characteristics, sludge volume and solids relationships, Aerobic and anaerobic digestion, Factors affecting sludge digestion and their control, disposal of digested sludge.

[T1,T2][No. of Hours: 11]

UNIT IV

Sewage collection from houses and buildings: General principles for design of sanitary plumbing system, Functions and types of traps, types of plumbing systems, one pipe / two pipe, single stack / partially ventilated single stack system, .

Construction and maintenance of sewers: Forces acting on sewer pipes, materials used in construction, laying and testing of sewer pipes, sewer appurtenances such as manholes, street inlets, gullies, catch basins, grease and oil traps, storm water overflows, inverted siphons, flushing and ventilation of sewers, Pumps for lifting sewage.

[T1,T2][No. of Hours: 10]

Text Books:

[T1] S.K.Garg, "Sewage Disposal and Air Pollution Engineering", Khanna Publishers

[T2] Venugopala Rao, "Principles of Environmental Science and Engineering", Prentice Hall India

References:

- [R1] Davis and Cornwell, "Introduction to Environmental Engineering", McGraw Hill
- [R2] Peavy, Rowe and Tchobanoglous, "Environmental Engineering", McGraw Hill
- [R3] Amal K. Dutta, "Introduction to Environmental Science and Technology", Oxford and IBH
- [R4] Kiely, "Environmental Engineering" Tata McGraw Hill
- [R5] Henry and Heinke, "Environmental Science and Engineering", Prentice Hall India

