ENVIRONMENTAL ENGINEERING – II

Lectures : 4 Periods/Week Sessional marks : 40
Semester End Exam. : 3 Hours Semester End Exam. marks: 60
Credits : 4

Course Objectives:

- To introduce water carriage systems of sanitation and their relative merits.
- To estimate quantities of sewage and drainage and to learn procedures for sewer design and to discuss the importance of various sewer appurtenances like manholes etc.
- To discuss cycles of decomposition and methods for determining the quality and characteristics of waste water.
- To discuss theoretical aspects and design procedures for primary and secondary wastewater treatment units – grit chambers, sedimentation tanks, Trickling Filters and Activated Sludge Process ,Oxidation ponds ,Oxidation ditches and lagoons.
- To design wastewater treatment and disposal in un-sewered areas – septic tanks.
- To learn methods of ultimate sewage disposal.
- To discuss various stages and factors affecting anaerobic sludge digestion and to design anaerobic sludge digester and to learn methods of sludge handling and disposal.
- To introduce sanitary fittings and plumbing systems of drainage and to discuss principles governing house drainage.

Course Outcomes:

- At the end of the course the student will be able to:
- Select a suitable type of water carriage system based on relative merits.
- Determine the quantity of drainage and sewage produced from a community.
- Design sewers and to select suitable locations for various sewer appurtenances.
- Ascertain the quality and characteristics of wastewater.
- Design primary treatment units like grit chambers, sedimentation tanks etc.
- Design conventional biological treatment units – Trickling Filters and Activated
- Sludge Process with all its component parts.
- Design septic tanks and its effluent disposal methods like cess pools and soak pits.
- Select suitable method for disposal of sewage treated or untreated.
- Design anaerobic digester for primary and secondary sludge and to select suitable method for disposal of wet or conditioned sludge
- Plan plumbing system for various types of residential buildings

UNIT – 1

Introduction to Sanitary Engineering

Sanitation; Sewerage systems; Relative merits and Suitability.

Sanitary Sewage and Storm Sewage

Sanitary Sewage: Factors affecting sanitary sewage; Determination of quantity of sanitary sewage; Storm Water Sewage: Factors affecting storm water sewage; Determination of quantity of storm water sewage.

Sewers, Sewer Appurtenances and Sewage Pumping

Types of sewers; Design of sewers; Construction; Testing; Maintenance of sewers; Sewer appurtenances – Man holes, Drop man holes, Inverted siphons; Street inlets; Catch basins; Storm water regulators; Sewage pumping; Types of pumps.

UNIT – II

Quality and Characteristics of Sewage

Characteristics of sewage; Decomposition of sewage; Carbon, nitrogen and sulphur cycles of decomposition; BOD; COD; Physical and chemical analysis of sewage.

Primary Treatment of Sewage

Screens; Grit chamber; Grease traps; Skimming tanks; Sedimentation tanks.

Septic Tank

Septic tank design; Septic tank effluent disposal, soak pits, leaching cess pools;

UNIT – III

Secondary Treatment of Sewage

Trickling filters: Principles of action; Filter types; Recirculation; Operational problems and remedies; Activated sludge process: Principle of action; Features of operation; Organic loading parameters; Methods of aeration; Diffused air system; Mechanical aeration; Combined system; Activated sludge process *vs* Trickling filter process; Sludge bulking; Sludge volume index, Secondary Settling Tanks.

Miscellaneous treatment methods

Oxidation Ponds - Working principle and design; Oxidation ditches and aerated lagoon (only theoretical aspects)

UNIT – IV

Sewage Disposal

Objects; Methods; Disposal by dilution; Disposal by irrigation; Sewage sickness.

Sludge Treatment and Disposal

Characteristics of sewage sludge; Anaerobic sludge digestion process; Stages of sludge digestion; Factors affecting sludge digestion; Sludge digestion tank; Methods of de-watering the sludge; Methods of sludge disposal.

House Plumbing

House drainage - Sanitary fittings, Traps; Plumbing system of drainage – Single stack, One pipe and Two pipe systems; Principles governing design of building drainage.

NOTE

Two questions of 12 marks each will be given from each unit out of which one is to be answered. Twelve questions of one mark each will be given from entire syllabus which is a compulsory question.

TEXT BOOKS

1. Elements of Environmental Engineering by K. N. Duggal, S. Chand & Company Ltd., 2012.
2. Environmental Engineering vol. II – Sewage disposal and air pollution engineering by S. K. Garg; Khanna Publishers, Delhi., 2010.

REFERENCE BOOKS

1. Wastewater Engineering : Treatment, Disposal & Reuse by Met Calf ,McGraw-Hill.
2. Water & Wastewater Technology by Hammer and Hammer, PHI, 2012.
3. Water Supply and Sewerage by E.W. Steel and Terence J. Mc Ghee, McGraw-Hill,1991.
4. Environmental Engineering by Peavy and Rowe, McGraw-hill, 1987.
5. Manual on Sewerage & Sewage treatment; CPH and EEO, Ministry of Works and Housing; Govt. of India; New Delhi.

WEB REFERENCES:

www.nptel.iitm.ac.in