

ENVIRONMENTAL ENGINEERING – I

Lectures : 4 Periods/Week

Sessional marks : 40

Semester End Exam. : 3 Hours

Semester End Exam. Marks : 60

Credits : 4

Course Objectives:

- To emphasize the importance of protected water supply, understand the design period concept and to estimate future population and to determine water requirement to satisfy various water demands.
- To learn about various sources of water and to select a suitable source based on quality and quantity criteria.
- To design required pipe diameter by using various hydraulic formulae and to discuss the method of laying and testing of pipes.
- To discuss methods for determining the physical, chemical and biological characteristics of water and to ascertain suitability for drinking based on BIS standards for drinking water.
- To understand theory and design aspects of water treatment facilities-sedimentation, coagulation, filtration.
- To discuss various methods of disinfection with special emphasis on chlorination and types of chlorination.
- To introduce methods for water softening, defloridation and removal of colour, odour and taste.
- To learn about various layouts of distribution networks and analyse distribution systems by Hardy-cross method and Equivalent pipe method.

Course Outcomes:

- At the end of the course the student will be able to:
- Determine the future population at the end of design period and per capita water requirement.
- Choose a suitable source of water supply based on required quantity and available quality.
- Conduct various test to ascertain physical, chemical and biological quality of water.
- Ascertain the suitability of water for drinking based on water quality standards.
- Design various water treatment facilities.
- Select a suitable method of disinfection depending on the situation.
- Suggest suitable treatment method for removal of hardness, excess fluorides and colour, odour and taste.
- Analyse complex water distribution networks.
- Design complete water treatment plant for given population and per capita consumption.

UNIT - I

Introduction to Water Supply Engineering

Need for protected water supplies; Objectives of water supply systems; Water borne diseases; Role of Environmental Engineers.

Quantity of Water

Estimating requirements; Design period; Per capita consumption; Factors affecting per capita consumption; Fire demand; Fluctuations in demand; Prediction of population.

Sources & Intake Works

Classification of sources of water supply; Choice of source; Suitability with regard to quality and

quantity; River, reservoir and canal intakes.

UNIT - II

Transportation and Pumping of Water

Types of conduits; Capacity and design; Materials for pipes, Laying and Jointing of pipes; Leakages; Classification of pumps; Choice of pumps.

Quality of Water

Impurities in water; Routine water analysis - physical, chemical and bacteriological tests; BIS Standards for drinking water.

Purification of Water

Methods of purification of water; Sequence of treatment units.

Plain Sedimentation and Coagulation

Theory of sedimentation; Stoke's law; Sedimentation tanks; Design aspects; Principle of coagulation; Chemicals used for coagulation; Units of coagulation plant; Optimum Dose of Coagulant.

UNIT - III

Filtration of Water

Theory of filtration; Filter materials; Slow sand and rapid sand filters; Construction operation and design; Slow sand filters verses rapid sand filters; Under drainage system design in rapid sand filters; Troubles in rapid sand filters; Pressure filters.

Disinfection of Water

Different methods of disinfection; Chlorination; Types of chlorination

Miscellaneous Treatment Methods

Water softening: Methods of removing temporary and permanent hardness; Removal of colour, odour and taste from water; Defluoridation.

UNIT - IV

Distribution System

General requirements; Classification; Methods of supply; Available pressure in the distribution system; Layouts of distribution networks; Distribution reservoirs; Functions; Types; Capacity of balancing tank; Analysis of distribution system by Hardy-cross method and Equivalent pipe method.

Pipe Appurtenances

Appurtenances in the distribution system; Service connection, Sluice valves; Check valve; Air valve; Drain valve; Hydrants; Meters.

*Field visit to water treatment facility covering all treatment units

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. I - Water supply engineering by S. K. Garg; Khanna Publishers, Delhi, 2010.

REFERENCE BOOKS

1. Water Supply and Sanitary Engineering Vol. 1 by Gurucharan Singh; Standard Publishers Distributors, 2009.
2. Environmental Engineering by Peavy and Rowe, Mc Graw Hill 7th Edition, 1987.
3. Water Supply and Sewerage by E.W. Steel and Terence J. Mc Ghee, Mc Graw Hill Publishers, New York.
4. Water & Wastewater Technology by Mark J. Hammer; John Wiley & Sons.
5. Manual on Water Supply & Treatment; CPH and EEO, Ministry of Urban Development; Govt. of India, New Delhi.

WEB REFERNCES:

www.nptel.iitm.ac.in