

4.3 WATER SUPPLY AND WASTE WATER ENGINEERING

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RATIONALE

One of the basic necessities of life is water which is not easily available to a lot of people. Providing potable water at the first place then collection and disposal of waste solids and liquids are important activities of civil engineering field. This subject provides basic knowledge and skills in the field of water supply system and waste disposal system. Classroom instructions should be supplemented by field visits to show functional details of water supply and waste disposal systems. It will also be advantageous to invite professionals from field to deliver extension lectures on specialized operations.

COURSE OUTCOMES

After undergoing the subject, students will be able to:

- CO1: Calculate the water requirement for a particular population
- CO2: Check and improve the quality of water by giving required treatment to water
- CO3: Calculate the size of different pipes to carry water
- CO4: Lay the network of pipes for water supply as well as sewerage in a building
- CO5: Supervise the water supply and waste water schemes

DETAILED CONTENTS

A. WATER SUPPLY

UNIT I

Quantity and Quality of Water

- 1.1 Necessity and brief description of planned water supply system.
- 1.2 Sources of water – surface/sub-surface sources (only description)
- 1.3 Water requirement, Per capita demand, Factors affecting per capita demand
- 1.4 Rate of demand and variation in rate of demand
- 1.5 Design Period, Factors governing the design period, Design period values for different components of a water supply scheme
- 1.6 Population forecasting methods (with Numerical Problems)
- 1.7 Physical, Chemical and bacteriological tests and their significance

- 1.8 Standard of potable water as per Indian Standard, water meter

UNIT II

Water Treatment

- **2.1 Sedimentation - Purpose, Types of sedimentation tanks
- **2.2 Coagulation / Flocculation - usual coagulation and their feeding
- **2.3 Filtration - Slow and Rapid sand filters, their significance and suitability
- 2.4 Necessity of disinfection of water, forms of chlorination, break point chlorine, residual chlorine, application of chlorine.
- 2.5 Miscellaneous Treatments – Aeration, Aquaguard, Reverse Osmosis System

UNIT III

Water Distribution System

- 3.1 Requirement of a good water distribution system
- 3.2 Layout of distribution networks
- 3.3 Methods of distribution
- 3.4 Distribution reservoirs – their functions and types
- 3.5 Storage capacity of distribution reservoirs
- 3.6 Stand Pipes

B. WASTE WATER ENGINEERING

UNIT IV

Waste Water Disposal

- 4.1 Sanitation – Purpose and necessity of sanitation
- 4.2 Components of sewerage system - Manhole
- 4.3 Types of sewage and types of sewerage system
- 4.4 Properties of sewage and IS standards for analysis of sewage
- 4.5 Physical, chemical and bacteriological parameters of sewage
- 4.6 Sewage disposal methods - Disposal by dilution and land treatment
- 4.7 Self-purification of stream, Nuisance due to disposal

UNIT V

Sewage Treatment

- 5.1 Primary and secondary treatment
- 5.2 Screens, Grit chambers, Skimming tanks
- 5.3 Plain sedimentation tanks

- 5.4 Filtration, Trickling filter
- 5.5 Sludge treatment and disposal
- 5.7 Oxidation Ponds (Visit to a sewage treatment plant)

NOTE: ** A field visit may be planned to explain and show the relevant things

PRACTICAL EXERCISES

- 1) To determine turbidity of water sample
- 2) To determine dissolved oxygen of given sample
- 3) To determine pH value of water
- 4) To perform jar test for coagulation
- 5) To determine BOD of given sample
- 6) To determine residual chlorine in water
- 7) To determine conductivity of water and total dissolved solids
- 8) To study the installation of following:
 - a) Water meter
 - b) Connection of water supply of building with main
 - c) Pipe valves and bends
 - d) Water supply and sanitary fittings
- 9) To study and demonstrate the joining / threading of GI Pipes, CI Pipes, SWG pipes, PVC pipes and copper pipes.
- 10) To demonstrate the laying of SWG pipes for sewers
- 11) Study of water purifying process by visiting a field lab.
- 12) To study the installation and working of water cooler available in Institution
- 13) To study the installation and working of Reverse Osmosis System available in Institution
- 14) To study the working of Rain Water Harvesting System
- 15) To demonstrate the drainage of roof top rain water of Institutional building
- 16) Prepare a report of a field visit to sewage treatment plant
- 17) Undertake a field visit to water treatment plant and prepare a report.

RECOMMENDED BOOKS

- 1. KN Duggal, “Elements of Public Health Engineering”; S. Chand and Co. New Delhi.
- 2. SC Rangwala, “Water Supply and Sanitary Engineering”, Charotar Book Stall, Anand.
- 3. SR Kshirsagar, “Water Supply Engineering”, Roorkee Publishing House, Roorkee.
- 4. SR Kshirsagar, “Sewage and Sewage Treatment”, Roorkee Publishing House, Roorkee.

5. Gurjar, B. R., “Sludge Treatment and Disposal” CRC Press
6. Gurjar, B. R., Molina, L. T. and Ojha, C. S. P., “Air Pollution: Health and Environmental Impacts” CRC Press
7. GS Birdie, “Water Supply and Sanitary Engineering”, Dhanpat Rai and Sons, Delhi.
8. Santosh Kumar Garg, “Water Supply Engineering”, Khanna Publishers, Delhi.
9. Santosh Kumar Garg, “Sewage and Waste Water Disposal Engineering”, Khanna Publishers, Delhi.
10. Ajay K Duggal, and Sanjay Sharma, “A Laboratory Manual in Public Health Engineering”, Galgotia Publications, 2006, New Delhi.
11. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

SUGGESTED WEBSITES

1. <http://swayam.gov.in>

INSTRUCTIONAL STRATEGY

Before imparting the instructions in the class room, visits to water works and sewage treatment plants can go a long way for increased motivation of students for learning in the class room. As the subject is of practical nature, lecture work be supplemented by field visits from time to time. Home assignments related to collection of information, pamphlets and catalogues from hardware shop dealing water supply and sanitary fittings will be very helpful for the students. This subject contains five units of equal weightage.