

**SUBJECT TITLE : ENVIRONMENTAL ENGINEERING**  
**SUBJECT CODE : 4011**  
**COURSE CATEGORY : A**  
**PERIOD/WEEK : 6**  
**PERIOD/SEMESTER : 108**  
**CREDITS : 4**

### TIME SCHEDULE

MODULE	TOPIC	PERIODS
I	Water Supply Engineering Introduction, Estimating water requirement, Sources of water, Conveyance & Quality of water	24
	Test I	3
II	Purification of water, Distribution system, Appurtenances, Water Supply arrangement in buildings	24
	Test II	3
III	Sanitary Engineering Introduction, Quantity of sewage, Sever sections and layout, Sewer appurtenances, Characteristics of sewage	24
	Test III	3
IV	Sewage treatment and disposal, Solid waste disposal, Drainage and sanitation in buildings Rural water supply and sanitation, Air Pollution, Pollution control boards	24
	Test IV	3
	<b>TOTAL</b>	<b>108</b>

### OBJECTIVES

Upon completion of course the student should be able to understand,

#### MODULE I

##### **1.1.0 To Know the importance of water supply**

- 1.1.1 State the necessity for public water supply
- 1.1.2 Describe the different systems of water supply
- 1.1.3 List the need for protected water supply

##### **1.2.0 To know the procedure to estimate water requirements for a water supply scheme**

- 1.2.1 List the factors affecting per capita demand
- 1.2.2 State the requirements of water for various purposes: Domestic purposes, Industrial use, Fire fighting, commercial and Institutional needs, Public use
- 1.2.3 Explain the variation in demand for water supply scheme for a town
- 1.2.4 Works out simple problems on forecasting population by different methods
- 1.2.5 State the method of determining total quantity of water supply scheme

##### **1.3.0 To Understands the method of determining yield from surface and under ground sources for a water supply scheme**

- 1.3.1 State the salient features of various surface sources
- 1.3.2 Define terms: Aquifer, Ground water table
- 1.3.3 Definitions of various types of wells according to construction
- 1.3.4 Define terms: draw down, critical depression of head, circle of influences, cone of depression, confined and unconfined aquifer, and specific yield
- 1.3.6 Explain the methods of determining yield from surface and underground sources
- 1.3.7 Explain procedure for determining yield of well by pumping tests
- 1.3.8 Explain with sketches: Infiltration galleries, Infiltration Wells

##### **1.4.0 To Understands conveyance of water**

- 1.4.1 Describe with sketches in take for collection of water
- 1.4.2 Explain the different methods of conveyance of water
- 1.4.3 List the merits and demerits of different types of pipes used for conveyance of water
- 1.4.4 Explain with sketches the different joints used for connecting pipes
- 1.4.5 State the causes and prevention of pipe corrosion.

## **MODULE II**

### **2.1.0 To Understand the standard tests for analyzing water for drinking purposes as per IS.code**

- 2.1.1 State the need for laboratory tests for testing water
- 2.1.2 List the various impurities of water
- 2.1.3 Explain the method of obtaining sample for testing
- 2.1.4 Explain the different tests for analyzing quality of water with their significance
- 2.1.5 List various standards of potable water.

### **2.2.0 To understand the methods of purification of water**

- 2.2.1 Sketch the overall layout of water treatment plant indicating the different stages
- 2.2.2 State the objects of aeration, plain sedimentation, sedimentation with coagulation, filtration, and disinfection.
- 2.2.3 Explain the process of aeration, plain sedimentation by coagulation, filtration
- 2.2.4 Describe the construction and operation of slow sand, rapid and pressure filters and compare them
- 2.2.5 Explain the necessity and methods of disinfection of water
- 2.2.6 Explain the different forms and points of chlorination
- 2.2.7 Briefly explain the treatment methods to control of odour, colour, taste and hardness of water.

### **2.3.0 To Understand the systems of distribution and layouts**

- 2.3.1 Explain with sketches the different systems of distribution systems
- 2.3.2 Explain with sketches the different layouts of distribution system
- 2.3.3 List the merits and demerits of layouts with their suitability for a given locality

### **2.4.0 To Know the appurtenances in distribution system**

- 2.4.1 Understand the various appurtenances in a distribution system
- 2.4.2 Explain with sketches the functions of the various appurtenances in a distribution system

### **2.5.0 To Understand the water supply arrangements in single and multi storeyed buildings**

- 2.5.1 Define terms: Water main, supply pipe, service pipe, distribution pipe, communication pipe, air gap,
- 2.5.2 Explain the general layout of water supply connections of buildings – Public water supply and Individual water supply arrangements for single and multi storeyed building as per I.S. Code.

## **MODULE III**

### **3.1.0 Know basic facts about sanitary engineering.**

- 3.1.1 Define terms: Sewage, Sewerage, Sewer, refuse, sullage, and garbage
- 3.1.2 State the objects of sewage disposal works
- 3.1.3 Compare conservancy system with water carriage system
- 3.1.4 Explain different sewerage systems
- 3.1.5 Compare the systems of sewerage with each other

### **3.2.0 Understand the principles of designing a sewer**

- 3.2.1 State the main constituents of sewage for calculating quantity
- 3.2.2 State the factors on which dry weather flow depends
- 3.2.3 Explain the variation in rate of sewage
- 3.2.4 Estimate the quantity of storm water flow using empirical formulae
- 3.2.5 Brief description of the different types of surface drains and their functions
- 3.2.6 Determine the relationship between gradient, diameter, discharge and velocity using nomograms as per I.S. 1742

### **3.3.0 Understand the types of sewers**

- 3.3.1 Various shapes and materials used for sewers
- 3.3.2 State any two merits and demerits for each type

### **3.4.0 Understand the various types of sewer appurtenances**

- 3.4.1 State the necessity for pumping sewage

- 3.4.3 Explain the component parts of a pumping station and factors influencing its location
- 3.4.4 Explain the location, function and construction of various sewer appurtenances.
- 3.5.0 Understands the characteristics of sewage**
- 3.5.1 Define strength of sewage
- 3.5.2 State the method of sampling sewage.
- 3.5.3 State the physical, chemical and biological characteristics of sewage
- 3.5.4 State the significance of the various tests to analyze sewage

#### **MODULE IV**

##### **4.1.0 Understands the primary and secondary treatment of sewage**

- 4.1.1 State the objects of sewage treatment
- 4.1.2 State the functions and working of screens, skimming tanks , and grit chambers.
- 4.1.3 Determine the dimension of a septic tank of given data
- 4.1.4 Describe with sketch the following treatment works: Sedimentation tank, Contact beds, Intermittent sand filters, Trickling filter, Activated sludge process, Sludge drying, Sludge disposal, Aeration tank
- 4.1.5 Explain with sketches the disposal of sewage by imhoff and septic tanks
- 4.1.6 Explain the term: Self purification
- 4.1.7 Brief Explanation of the methods of disposal of sewage wastes

##### **4.2.0 Know the methods of disposal of solid wastes**

- 4.2.1 State classification of solid wastes
- 4.2.2 Brief Explanation of the methods of disposal of solid wastes
- 4.2.3 State any two merits and demerits of the disposal methods

##### **4.3.0 Know the drainage arrangements for single and multi storeyed buildings**

- 4.3.1 State the aims of buildings drainage and its requirements
- 4.3.2 Describe different sanitary fittings like water closets, flushing cistern, urinals, inspection chambers, traps, anti-siphonage pipes

##### **4.4.0 Know the methods of rural sanitation**

- 4.4.1 Explain the methods of rural sanitation
- 4.4.2 Describe with sketches the construction of sanitary latrines in rural areas
- 4.4.3 Describe the operation of a bio gas plant using cow dung, night soil and agricultural waste

##### **4.5.0 Know the effects of air pollution**

- 4.5.1 State the causes of air pollution
- 4.5.2 State effects of air pollution

##### **4.6.0 Understand the working of pollution control boards**

- 4.6.1 State the functions of pollution control boards

### **COURSE CONTENT**

#### **MODULE I - WATER SUPPLY ENGINEERING**

General importance of water supply-Development of water supply-Different systems of water supply-Need for protect water supply-Estimating water requirement:- Total quantity of water for a town, per capita demand and factors affecting demand- Water requirements for domestic purposes, industrial use, fire fighting, commercial and industrial needs, public use- Variation in demand – Peak demand during day, month and year- Fore casting population by arithmetical, geometrical and incremental increase method (problems)

Sources of Water:-Surface source – lakes, streams, rivers and impounded reservoirs, Yield from surface source-Underground sources – springs, wells, infiltration wells and galleries- Yield from wells – test for yield. Conveyance of water:-Types of Intakes-Reservoir intake-River intake-Canal intake. Conveyance of water – open channels, aqueduct pipes- List of pipe materials – C.I. pipes, steel pipes, concrete pipes, A.C. pipes, G.I. pipes, plastic and P.V.C. pipes, high density polythene pipes, merits and demerits of each type (brief description only). Pipe joints – spigot and socket joint, flange joint, expansion joint for C.I. pipe, joints for concrete and asbestos cement pipe- methods of leak detection –prevention – rectification- Pipe corrosion – causes and prevention

#### **MODULE II - PURIFICATION OF WATER**

Quality of Water:- Impurities of water – need for laboratory test. Sampling and Testing of water – physical, chemical, and bacteriological tests (brief description only) –Various standards of water such as pH value, color, taste, hardness, odour - for potable water

Flow diagram of different treatment units for both surface and ground sources – reservoir / pond and well  
Aeration – methods of aeration- Sedimentation – plain sedimentation and sedimentation by coagulation-  
Filtration –construction and operation of slow sand, rapid sand and pressure filters-  
Disinfections of water – necessity and method, chlorination, pre-chlorination, break point chlorination, super chlorination

Removal of Taste, colour, odour and hardness Note: (No design for treatment units)

**Distribution system:-** General requirements, system of distribution, gravity system, combined system, direct pumping- Methods of supply – intermitted and continuous – advantages & disadvantages – Layout of distribution system -Types – dead end, grid, radial and ring system their merits and demerits and their suitability.

**Appurtenances in Distribution system:** - Uses of Sluice valves, Check valves or reflux valves, Air valves, Drain valves or blow-off valves, Scour valves, Fire hydrants and Water meters- (brief description only).

**Water supply arrangements in Building,** Definition of terms- water main, service pipe, communication pipe, supply pipe, distribution pipe, air gap- General layout of water supply arrangements for single and multistoried building as per I.S. Code of practice general principles and precautions in laying pipe line with in the premises of a building- Connection from water main to building- (Brief description only)

### **MODULE III - SANITARY ENGINEERING**

Objects of providing sewerage works - Definition of terms – sewage, sewerage, sewer, refuse, garbage, sullage etc- Systems of sewage disposal – conservancy and water carriage systems- Types of sewerage systems and their suitability – separate, combined and partially separate- Quantity of Sewage- Quantity of discharge in sewers, dry weather flow, variability of flow, limiting velocities of sewers- Use of nomograms I.S. 1742. –Determination of storm water flow – run-off coefficient – time of concentration, empirical formulae for run-off-

Surface drainages – requirements, shapes

Different shapes of cross section for sewers – rectangular, circular, egg shaped – merits and demerits of each. Brief description and choice of types of sewers – stone ware, cast iron, cement concrete, pre cast sewers, AC pipe.

Sewer appurtenances:- location, function and construction of Man holes, Drop man holes, Catch basins , Flush tanks and Inverted siphon -(Brief description only).

Necessity of pumping sewage – location and component parts of pumping station

Sewage characteristics:- Strength of sewage, sampling of sewage, characteristics of sewage – physical, chemical and biological – significance of the following tests for –Solids, Oxygen demand, BOD, COD, Ph-value, Chlorides-

### **MODULE IV - SEWAGE TREATMENT AND DISPOSAL**

Preliminary treatment – brief description and functions of Screens, Skimming tanks and Grit chambers.

Primary treatment – brief description and functions of plain sedimentation.

Secondary treatment – brief description of Trickling filters, Activated sludge process, Secondary clarifier and Sludge digestion, drying, disposal

Miscellaneous treatment – septic tank – imhoff tank

Calculation of dimension of a septic tank from a given data.

Sewage disposal – dilution, disposal on lands, oxidation ponds, oxidation ditch, aerated lagoons, an aerobic lagoons. (brief description only)

Solid waste disposal- Methods of disposal – uncontrolled dumping, sanitary landfill, incineration and composting. Drainage and Sanitation in Buildings (brief description)

Sanitary fittings – traps, water closets, flushing cisterns, urinals, inspection chambers, anti syphonage pipe.

Rural sanitation and sanitary latrines, brief description of operational details of bio-gas plants using cow dung, night soil and agricultural wastes

Air Pollution: Definition – sources of air pollution – effects of pollution on human, animal, vegetation material.

Pollution Control Board:- The functions with respect to monitoring and control of air and water pollution.

### **REFERENCE**

1. Water Supply and Sanitary Engineering – S.C.Rangwala, Charotar Publishing House
2. Elements of Public Health Engineering – K.N.Dugal, S.Chand &Co
3. Public Health Engineering – S.K.Hussain, S.Chand &Co

4. Water Supply and Sanitary Engineering – V.N.Vizirani, Khanna Publishers
5. Environmental Engineering – G.N. Pandey & G.C. Carney, Dhanpat Rai&Sons