

**COURSE TITLE : ENVIRONMENTAL ENGINEERING**  
**COURSE CODE : 6012**  
**COURSE CATEGORY : A**  
**PERIODS/WEEK : 5**  
**PERIODS/SEMESTER: 75**  
**CREDITS : 4**

**TIME SCHEDULE**

<b>Module</b>	<b>Topics</b>	<b>Period</b>
1	Introduction to water supply engineering Sources of water Quality of water	17
2	Treatment of water Distribution system Water supply arrangements in building	20
3	Introduction to sanitary engineering Quality of sewage Sewer sections and layout Sewer appurtenances	18
4	Sewage treatment and disposal Solid waste management Drainage and sanitation in buildings Rural water supply and sanitation Pollution control board	20
<b>TOTAL</b>		<b>75</b>

**COURSE OUTCOME**

<b>Sl.</b>	<b>Sub</b>	<b>Student will be able to</b>
<b>1</b>	1	Estimate water demands
	2	Analyze the quality of water
	3	Suggest the treatment required by knowing the quality of water
<b>2</b>	1	Know the sewerage system.
	2	Analyze the sewage
	3	Suggest the waste water treatment
<b>3</b>	1	Suggest the treatment for industrial waste
	2	Know the solid waste management

## **SPECIFIC OUT COME**

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

### **MODULE - I**

#### **1.1.0 Understand importance of water supply**

- 1.1.1 List the necessity for public water supply
- 1.1.2 List the need for protected water supply

#### **1.2.0 Understand the method of determining yield from surface and underground sources for a water supply scheme.**

- 1.2.1 Identify the salient features of various surface sources
- 1.2.2 Define terms: Aquifer, Ground water table & perched water table.
- 1.2.3 Define various types of wells according to construction.
- 1.2.4 Define terms: draw down, critical depression of head, circle of influences, cone of depression, confined and unconfined aquifer, and specific yield
- 1.2.5 Explain the methods of determining yield from surface and underground sources
- 1.2.6 Explain procedure for determining yield of well by pumping tests
- 1.2.7 Explain with sketches: Infiltration galleries, Infiltration Wells

#### **1.3.0 Apply the procedure to estimate water requirements for a water supply scheme**

- 1.3.1 List the factors affecting per capita demand
- 1.3.2 List the requirements of water for various purposes: Domestic purposes, Industrial use, Fire fighting, commercial and Institutional needs, Public use
- 1.3.3 Identify the variation in demand for water supply scheme for a town
- 1.3.4 Describe methods to forecast population.
- 1.3.5 Solve simple problems on forecasting population by different methods
- 1.3.6 State the method of determining total quantity of water supply scheme

#### **1.4.0 To Understand the standard tests for analyzing water for drinking purposes as per IS Code**

- 1.4.1 State the need for laboratory tests for testing water
- 1.4.2 List the various impurities of water
- 1.4.3 Explain the method of obtaining sample for testing
- 1.4.4 Explain the different tests for analyzing quality of water with their significance
- 1.4.5 List various standards of potable water.

### **MODULE - II**

#### **2.1.0 Understand the methods of purification of water**

- 2.1.1 Draw the overall layout of water treatment plant indicating the different stages
- 2.1.2 List the objects of aeration, plain sedimentation, sedimentation with coagulation, filtration, and disinfection.
- 2.1.3 Explain the process of aeration, plain sedimentation by coagulation, filtration
- 2.1.4 Describe the construction and operation of slow sand, rapid and pressure filters and compare them
- 2.1.5 Explain the necessity and methods of disinfection of water

- 2.1.6 Identify the different forms and points of chlorination
- 2.1.7 Explain the treatment methods to control of odour, colour, taste and hardness of water.

**2.2.0 Understand the methods of conveyance of water**

- 2.2.1 Describe with sketches intake for collection of water
- 2.2.2 Explain the different methods of conveyance of water
- 2.2.3 List the merits and demerits of different types of pipes used for conveyance of water
- 2.2.4 Explain with sketches the different joints used for connecting pipes
- 2.2.5 State the causes and prevention of pipe corrosion.

**2.3.0 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 Understand the appurtenances in distribution system**

- 2.4.1 Identify 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 Understand the water supply arrangements in single and multi storied 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 storied building as per IS Code.

**MODULE - III**

**3.1.0 Understand basic facts about sanitary engineering.**

- 3.1.1 Define terms: Sewage, Sewerage, Sewer, refuse, sullage, and garbage
- 3.1.2 List 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 characteristics of sewage**

- 3.2.1 Define strength of sewage
- 3.2.2 Explain the method of sampling sewage.
- 3.2.3 State the physical, chemical and biological characteristics of sewage
- 3.2.4 List various tests to analyze sewage

**3.3.0 Understand the types of sewers**

- 3.3.1 List shapes and materials used for sewers
- 3.3.2 List merits and demerits for each type

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

- 3.2.1 List the main constituents of sewage for calculating quantity
- 3.2.2 List the factors on which dry weather flow depends

- 3.2.3 Identify the variation in rate of sewage
- 3.2.4 Identify the different types of surface drains and their functions

**3.3.0 Understand the various types of sewer appurtenances**

- 3.3.1 State the necessity for pumping sewage
- 3.3.2 Explain the component parts of a pumping station and factors influencing its location
- 3.3.3 Identify the location, function and construction of various sewer appurtenances.

**MODULE - IV**

**4.1.0 Understand the primary and secondary treatment of sewage**

- 4.1.1 List the objects of sewage treatment
- 4.1.2 Describe the functions and working of screens, skimming tanks , and grit chambers.
- 4.1.3 Draw 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 List the methods of disposal of sewage wastes

**4.2.0 Know the drainage arrangements for single and multi storied buildings.**

- 4.2.1 State the aims of buildings drainage and its requirements
- 4.2.2 Draw different sanitary fittings like water closets, flushing cistern, urinals, inspection chambers, traps, anti-syphonage pipes.

**4.3.0 Understand the methods of rural sanitation**

- 4.3.1 List the methods of rural sanitation
- 4.3.2 Draw sanitary latrines in rural areas
- 4.3.3 Describe the operation of a bio gas plant using cow dung, night soil and agricultural waste.

**4.4.0 Understand the working of pollution control boards**

- 4.4.1 State the functions of pollution control boards

**CONTENT DETAILS**

**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- 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 within 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- 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)

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

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

## **REFERENCE**

1. S.C.Rangwala : Water Supply and Sanitary Engineering ; Charotar Publishing House
2. K.N.Dugal : Elements of Public Health Engineering ; S.Chand &Co
3. S.K.Hussain : Public Health Engineering ; S.Chand &Co
4. V.N.Vizirani : Water Supply and Sanitary Engineering ; Khanna Publishers
5. G.N. Pandey & G.C. Carney : Environmental Engineering ; Dhanpat R