

OBJECTIVES

On completion of this course, students will be able to:

1. Forecast the population for designing of distribution system.
2. Calculate the sufficient quantity of water for fire fighting in a town
3. Know the permissible limits of drinking water and industrial water.
4. Know the design considerations of intakes and infiltration galleries.
5. Find optimum dosage of coagulant in sedimentation process.
6. Design water treatment plant units such as sedimentation tank and clarifiers and Filters
7. Understand various troubles in operation of filters and control measures.
8. Design and analysis of distribution system and appurtenances in distribution system
9. Estimate storm water and sewage and characteristics of sewage.
10. Design skimming tank, grit chambers, sedimentation tank and trickling filters.
11. Design sludge digestion tank, oxidation pond and working principles of septic tanks.

1. Group - A (Short Answer Questions)

S.No	QUESTION	Blooms Taxonomy Level	Course Outcome
UNIT-I			
INTRODUCTION- WATER BORN DISEASES			
1	Discuss the various parameters for deciding the design period of components in water supply projects?	Remember	a
2	Enumerate the various methods for population forecast. On which factors increase in population depends?	Understand	a
3	What is "Design period " in water supply projects ? Describe the life span for various components ?	Analyze	a
4	Explain the following: (i) Storage capacity of reservoir (ii) Fire demand?	Remember	a
5	Classify the demands of a city or town. Describe briefly the water demand ?	Understand	b
6	Discuss Water meters of displacement type and velocity type?	Remember	b
7	Explain Arithmetical increase method of population and geometrical increase method of population?	Remember	a
8	Write a note on drinking water quality standards in India ?	Remember	c
9	State the importance of treating water for public supply ?	Understand	c
10	Write short note on the maintenance of purity of waters ?	Remember	b

S.No	QUESTION	Blooms Taxonomy Level	Course Outcome
UNIT-II			
SOURCES OF WATER			
1	Classify the sources of water. On which factor the quantity and reliability of water depends ?	Analyze	b
2	Compare surface and ground waters as source of water supply from the considerations of quantity and quality ?	Analyze	b
3	Explain the function of intakes. What factors are responsible for site selection of intakes ?	Remember	c
4	What is Gravity spring and surface spring ?	Analyze	d
5	Define Deep well and tube well ?	Understand	e
6	Write short notes on, Well development ?	Understand	f
7	Differentiate between confined and unconfined aquifers ?	Analyze	d
8	How distribution systems are classified ? Explain any one in detail ?	Analyze	h
9	What are the requirement of a good distributed system ?	Analyze	h
10	What is Dead end or tree system ?	Remember	f
UNIT-III			
LAYOUT AND GENERAL OUTLINE OF WATER TREATMENT UNITS			
1	Draw the layout of water treatment plant, indicate the various process used ?	Analyze	d
2	What are the objectives of water treatment process ?	Remember	d
3	Explain the Fill and draw type settling tank ?	Remember	f
4	Explain the Continuous flow type settling tank ?	Understand	d
5	In an ideal settling tank,16% of 30 mm diameter particles are removed having specific gravity of 1.20. Temperature at the time of removal in 20 ⁰ C. What will be the size of the particles for which the tank is actually designed ? Assume the specific gravity of these particles same as that of 30 mm diameter particles ?	Analyze	f
6	List the factors which affects the dosage of coagulants and explain the procedure to determine the optimum dose of coagulante by Jurtest apparatus ?	Analyze	g
7	Explain the Fill and draw type settling tank ?	Understand	j
8	Mention the chemical reactions when the following are used as coagulants : (a) Sodium aluminate (b) Ferrous sulphate and lime (c) Magnesium carbonate ?	Understand	e
9	Write a short notes on Coagulation ?	Understand	e
10	Write a short notes on Flocculation ?	Remember	e
UNIT-IV			
FILTRATION			
1	With the help of neat sketch describe the construction and working of slow sand filters ?	Analyze	e
2	Explain rapid sand filter a neat sketch ?	Remember	g
3	Explain pressure filter with a neat sketch and mention its advantages and disadvantages ?	Analyze	e
4	Write short notes on Dual media filters ?	Remember	e
5	Write short notes on Mixed media filters ?	Understand	e
6	Compare and contrast between slow sand filter and rapid gravity filters ?	Remember	e
7	Distinguish between the pressure filters and toughing filters ?	Remember	e
8	Distinguish between the High velocity wash and low velocity wash ?	Understand	e
9	Design five slow sand filter beds from the following data for the waterworks of a town population 75,000, per capita demand =135 litres/day /capita.	Analyze	e

S.No	QUESTION	Blooms Taxonomy Level	Course Outcome
10	What are the requirements of good disinfectants ?	Remember	e
UNIT-V DISTRUBUTION SYSTEMS			
1	What is a distribution system? What are general requirements that are to be satisfied by the distribution system?	Understand	k
2	Explain the classification of distribution system?	Understand	k
3	What are the various on which the design of distribution system depend?	Analyze	k
4	What are the condition that are be fulfilled for any closed network of pipes in the distribution system?	Remember	k
5	Explain the routine maintenance of distribution systems. What pressure are usually adopted for various pipes?	Understand	l
6	Write the Hazen William's formula for flow of water through pipe ?	Remember	l
7	Describe the laying process of water supply lines ?	Understand	g
8	Write short notes on pump house structure ?	Remember	h
9	Explain Direct Dumping system with diagram	Understand	f
10	What are the various factors on which the design of distribution system depends	Understand	k
UNIT-VI CONSERVANCY AND WATER CARRIAGE SYSTEM OF SEWAGE AND STORM			
1	Explain the method of sewage collection and method their relative merits and demerits ?	Understand	j
2	Define the terms sewage and sewerage ?	Understand	l
3	Compare conservancy and water carriage system of sanitation ?	Understand	g
4	Differentiate between separate and combined systems of sewerage suitable to a twon. List their merits and demerits ?	Analyze	k
5	Write down advantages and disadvantages of combined systems of sewage ?	Remember	l
6	Define the terms, (i) BOD (ii) Sullage (iii) Sewage (iv) Aerobic Bacteria (v) Time of Concentration ?	Analyze	e
7	State the factors on which the storm water flow of an area depends ?	Understand	g
8	Explain the term the of concentration and its significance in design of storm sewers ?	Analyze	g
9	Explain the different principles that should be considered while designing a house drainage system ?	Analyze	f
10	Draw a typical house drainage plan of a residential building ?	Analyze	g
UNIT-VII WATER TREATMENT PLANT			
1	Write treatment measures of a drainage line ?	Analyze	h
2	Write short notes on : (a) Screens (b) Grit chambers (c) Sedimentation tanks	Understand	h
3	Design a circular sedimentation tank to treat 1 MLD of domestic waste water treatment plant. Make suitable assumptions ?	Analyze	h
4	Design a primary sedimentation for treating 1 MLD of waste water . Make suitable assumptions ?	Analyze	h
5	List out methods for removal of dissolved inorganic impurities from waste	Analyze	h

S.No	QUESTION	Blooms Taxonomy Level	Course Outcome
	water ?		
6	Explain the activated sludge process with a flow diagram ?	Remember	j
7	Give advantage and disadvantages of ASP ?	Remember	h
8	Differentiate between activated sludge process and trickling filter ?	Remember	g
9	Explain the trickling filter process with a flow diagram ?	Remember	g
10	Discuss how the symbiotic relationship between algae and bacteria is useful in the treatment of sewage in an oxidation pond ?	Remember	g
UNIT-VIII PONDS AND DIGESTION TANKS			
1	Which is the most suitable low cost method of sewage treatment in tropical countries ? Discuss its working principle and advantages?	Remember	j
2	Draw a neat sketch of the layout of an oxidation and explain the working and functions of various component works ?	Analyze	j
3	Explain the construction and design of sludge digestion tank with a neat sketch ?	Remember	j
4	What are the advantages and disadvantages of stabilization (oxidation) ponds ?	Remember	j
5	Design and sketch an oxidation pond of population 30,000 in a tropical country like India, assuming necessary data. Determine detention time also ?	Analyze	j
6	Present a note on the characteristics of sludge. Why are proper methods of disposal necessary ?	Remember	j
7	What are the conditions that increase the efficiency of sludge digestion ? How are these incorporated in a sludge digestion unit ?	Analyze	j
8	Discuss anaerobic sludge digestion. Explain the effect of temperature and p^H ?	Analyze	j
9	State the objectives of sludge digestion ?	Understand	j
10	Write is sludge gas ? What is its typical composition ? What are the used of sludge gas ?	Remember	j

2. Group - II (Long Answer Questions)

S. No	Question	Blooms Taxonomy Level	Course outcome
UNIT-I INTRODUCTION- WATER BORN DISEASES			
1	Write short note on the maintenance of purity of waters?	Remember	c
2	Write short note on, (a) MPN (b) Sampling of water?	Remember	c
3	Describe the different microorganisms commonly found in water?	Understand	b
4	Explain "Fluctuation in water demand"?	Understand	b
5	Write a note on drinking water quality standards in India?	Remember	a
6	Write an account on the common water-borne diseases?	Understand	a
7	Explain in brief various factors affecting the rate of demand?	Remember	b
8	State the importance of treating water for public supply ?	Analyze	a
9	What is B.coli index? How is it determined ? (Or) Write short note on B-coli index?	Analyze	a

10	Discuss two standard tests which are employed to examine water bacteriologically ?	Remember	a
UNIT-II			
SOURCES OF WATER			
1	What are infiltration galleries and infiltration wells? Explain with the help of neat sketches?	Analyze	c
2	Explain the meaning of yield of a well and mention the factors on which it depends ?	Understand	k
3	Describe the various types of wells?	Understand	k
4	Explain the meaning of yield of a well and mention the factors on which it depends?	Remember	c
5	Classify the sources of water. On which factor the quantity and reliability of water depends.	Understand	c
6	Explain the function of Intakes. What factors are responsible for site selection of intake	Analyze	c
7	Explain the meaning of yield of a well and mention the factors on which it depends.	Analyze	c
8	What are infiltration galleries and infiltration wells? Explain with the help of neat sketches?	Analyze	c
UNIT-III			
LATOUT AND GENERAL OUTLINE OF WATER TREATMENT UNITS			
1	Discuss in detail the usual coagulants which are employed for the treatment of water ?	Remember	f
2	Explain various types of sedimentation tanks based on shapes with neat sketches ?	Remember	f
3	Explain the aspects which influence design and performance of sedimentation tanks ?	Analyze	f
4	Explain the principle of sedimentation and derive the equation for uniform setting velocity in terms of specific gravity of a particle ?	Analyze	f
5	What are the feature of fill and draw settling tanks.	Understand	f
6	Explain in detail alum or Aluminium Sulphate and sodium aluminate	Remember	d
7	Mention the chemical reactions when sodium aluminate and ferrous sulphate and lime are used as coagulants.	understand	c
8	write the determinations of optimum dose of coagulant by jar-test Apparatus	Remember	d
9	Draw a neat sketch of conical plug solution feeding device.	Analyze	d
10	What is conical plug solution feeding Device	Remember	c
UNIT-IV			
FILTRATION			
1	Describe the various method of dechlorination ?	Remember	e
2	Write short notes on the following, (a) Pre-chlorination and double chlorination (b) Chlorine demand (c) Chlorine compounds ?	Understand	e
3	(a)How does orthotolidin test carries out? What are the points to be noted in this test? (b)State the procedure of starch –iodide test?	Understand	e
4	What do you understand by filtration? Explain theory of filtration?	Remember	e
5	Discuss any four methods of disinfection of water ?	Remember	e
6	Design a rapid sand filter unit for 4.5 MLD with all its principal components?	Analyze	e
8	What do you understand by filtration ? Explain theory of filtration ?	Understand	

9	Discuss slow sand filters and explain	Remember	
10	Discuss any four methods of disinfection of water ?	Remember	
UNIT-V			
DISTRUBUTION SYSTEMS			
1	What is a service reservoir? Given its importance in a distribution system? Draw a neat diagram of an elevate tank and show all its component ports and appurtenances?	Understand	f
2	Draw a neat diagram of elevated tank and show all its component ports and appurtenances	Understand	f
3	Write a Hazen William's formula for flow of water through pipe.	Remember	f
4	What are the different appurtenance used in a distributed system ? Explain ?	Remember	f
5	What are the different methods used for the detection of water from the under. Ground water mains? Explain any two?	Understand	f
6	What are the requirements of good water meter? Discuss the advantages?	Remember	f
7	What is the different appurtenance used in a distributed system? Explain?	Analyze	f
8	What is different method used for the analysis of flow in pipe network. Explain, (a) Hardy-cross method and (b) Equivalent pipe method?	Understand	f
9	Explain the pipe system?	Remember	f
10	What are the requirements of good water meter?	Remember	f
UNIT-VI			
CONSERVANCY AND WATER CARRIAGE SYSTEM			
1	What is the foundation of storm water regulator in sewerage systems? Draw a neat sketch of "leaping weir storm regulator "?	Remember	g
2	(a) Explain BOD and derive the expression for it? (b) Explain COD and derive the expression for it?	Analyze	g
3	Draw a neat diagram of circular pipes Sewer Section and Explain.	Analyze	g
4	Explain the classification of traps ?	Analyze	g
5	What are the different parameters that are considered in the Sewer design?	Analyze	g
6	What are the different sewers sections explain with neat diagrams?	Understand	f
7	Explain the following with neat sketches, (a) Manholes (b) Inverted siphon (c) Catch Basin?	Understand	k
8	Write short notes on the various materials used in sewer construction?	Remember	f
9	Distinguish between the loss of head and negative head?	Understand	e
10	Explain the different types of sanitary fitting used in buildings?	Understand	h
UNIT-VII			
WATER TREATMENT PLANTS			
1	Write an account an effluent treatment?	Remember	h
2	Write an account on floating surface Aerator	Remember	f
3	Design a horizontal flow type grit chamber for a proposed sewage treatment plant expected to treat 60,000 m ³ /day respectively. The flow through velocity is to be controlled by a proportional weir ?	Analyze	l
4	Explain the operational problems of trickling filter and their remedies?	Analyze	g
5	Write down the summary of reactions during Anaerobic Treatment	Remember	e
6	List out the methods for removal of dissolved inorganic impurities from waste water.	Analyze	j
7	Explain the activated sludge process with a flow diagram	Understand	j
8	Explain the operational problems of trickling filter and their remedies.	Evaluate	g
9	Give the advantages and disadvantages of ASP	Evaluate	h
10	Discuss how the symbolic relationship between algae and bacteria is useful in	Analyze	h

	the treatment of sewage in an oxidation pond.		
UNIT-VIII PONDS AND DIGESTON TANKS			
1	Explain the design considerations and working principles of septic tank with sketch ?	Analyze	h
2	Write are the advantages and disadvantages of septic tanks ?	Understand	h
3	What are the conditions that increase the efficiency of sludge digestion ? How are these incorporated in a sludge digestion unit ?	Remember	h
4	Discuss anaerobic sludge digestion. Explain the effect of temperature and p^H ?	Remember	j
5	Present a note on the characteristics of sludge. Why are proper methods of disposal necessary ?	Remember	j
6	Present a note on the characteristics of sludge. Why are proper methods of disposal necessary ?	Remember	j
7	What are the conditions that increase the efficiency of sluge digestion? How are these incorporated in sluge digestion unit?	Understand	j
8	Septic tanks working principles and design- Soak pits	Understand	j
9	Which is the most suitable low cost method of sewage treatments in tropical countries? Discuss is working principle and advantages.	Remember	l
10	Draw a neat sketch of the layout of an oxidation ditch and explain the working and functions of various components works.	Analyze	k

3. Group - III (Analytical Questions)

S.No	QUESTIONS	Blooms Taxonomy Level	Course outcome
UNIT-I INTRODUCTION- WATER BORNE DISEASES			
1	What are factors affecting fluctuations – fire Demand – storage capacity	Apply	a
2	Discuss two standard test which are employed to examine water bacterologically.	Apply	a
3	What are the drinking water quality standards near your surroundings.	Apply	a
4	Discuss the test is used to differentiate between E.coli and Aerobacter aerogenes.	Apply	a
5	What are the methods used in industries for the recycling of the water.	Apply	a
UNIT-II SOURCES OF WATER			
1	What are wells according to the aquifer tapped.	Apply	c
2	Describe the wells according to type of construction and according to the condition of flow.	Apply	c
3	In a recuperation test, the following results were obtained, Initial depression head = 8 m Final depression head = 5m Time of recuperation = 2 hours Diameter specific capacity of well and yield under a head of 3 m.	Analyze	c
UNIT-III LATOUT AND GENERAL OUTLINE OF WATER TREATMENT UNITS			
1	The population of a town is 1,00,000 and the average per capita demand is 135 litres/day/capita. Design the coagulation cum sedimentation tank for the water work, supplying water tank to the town. The maximum demand may be taken as 1.5 times the average demand. Assume the detention periods of 5 hours and 30 minutes for setting tank and floc chamber respectively. Also assume the flow rate as 900 litres/hour/m ² of plan area?	Analyze	k
2	In a ideal setting tank, 16 %of 30 mm diameter particles are removed having	Analyze	d

S.No	QUESTIONS	Blooms Taxonomy Level	Course outcome
	specific gravity of 1.20. Temperature at the time of removal in 20 ⁰ C. What will be the size of particles for which the tank is actually designed? Assume the specific gravity of these particles same as that of 30 mm diameter particles.		
3	If rectangular sedimentation tank is treating 2.5x10 ⁶ liters /day. The size of the tank is 17.5x5.5x3.5 m. If 80p.p.m (parts per million) suspended solids are present in the water, assuming the 75% removal in the basin and the average specific gravity as 2.0 determine the following, (a) Average flow of water through tank (b) Detention time (c) Over flow rate?	Analyze	d
UNIT-IV CONSERVANCY AND WATER CARRIAGE SYSTEM			
1	How is orthotolidin test carried out? What are the points to be noted in this test?	Apply	h
2	Discuss the procedure for starch Iodine Test.	Apply	l
3	Design five slow sand filter beds from the following data for the water works of a town population 75,000, per capita demand = 135 liters/per/ capita. Rate of filtration = 210 liters/ hour/m ² . Assume maximum demand as 1.5 times the average demand. Out of five units, one is to be kept standby and used while repairing other units.	Apply	f
4	Design a rapid sand filter unit for 4.5 MLD with all its principal components.	Analyze	f
UNIT-V DISTRUBUTION SYSTEMS			
1	Determine the sizes of the networks of given below figure-2. The average water is to be supplied at 200 liters/day /capital. The maximum rate of supply is 2.5 times the average ?	Analyze	f
2	For the network shown in the figure, flow rate in each pipe and head at each node A =100 m. Use Hazen Williams equation for calculation of head loss c _H for all pipes is 100?	Analyze	f
3	How the water consumed by the customers measured? Describe any suitable device for the same. Discuss on the policy of metering the water supply systems?	Apply	f
4	What is a service reservoir? Given its importance in a distribution system? Draw a neat diagram of an elevate tank and show all its component ports and appurtenances?	Apply	f
UNIT-VI CONSERVANCY AND WATER CARRIAGE SYSTEM			
1	What are the different parameters that are considered in the sewer design?	Apply	f
2	What do you understand by 'Dry weather flow '? Discuss in brief various factors affecting the dry weather flow?	Apply	f
3	Explain the different principles that should be considered while designing a house drainage system.	Apply	f
4	Draw a typical house drainage plan of a residential building.	Analyze	h
UNIT-VII WATER TREATMENT PLANTS			
1	Design a horizontal flow type grit chamber for a proposed sewage treatment plant expected to treat 60,000 m ³ / day respectively. The flow through velocity is to be controlled by a proportional weir ?	Analyze	f
2	Design a primary sedimentation for treating 1 MLD of waste water. Make suitable assumptions.	Analyze	f

UNIT-VIII			
PONDS AND DIGESTON TANKS			
1	Design and sketch an oxidation pond of a colony of population 30,000 in a tropical country like India, assuming necessary data. Determine detention time also	Analyze	f
2	Explain the design considerations and working principles of septic tank with neat sketch.	Apply	f