Scoring indicators

COURSE CODE:**601**[illegible] A
COURSE NAME: **PUBLIC HEALTH ENGINEERING**

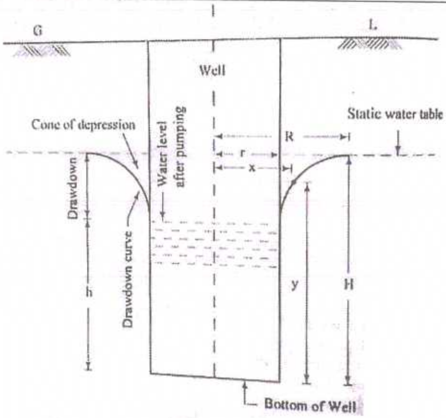
QID:2102240004

Q No.	Scoring indicators	Split score	Sub total	Total score
	PART A			**9**
I 1	hardness	1	1	1
2	1. Socket and spigot joint, 2. Flanged joint, 3. Mechanical joint called dresser coupling, 4. Flexible joint, 5. Expansion joint	any 1	1	1
3	1.Total count or Agar plate count test, 2.B coli test	any 1	1	1
4	Dead end method	1	1	1
5	Sluice valve	1	1	1
6	sewage	1	1	1
7	combined system	1	1	1
8	Skimming tank	1	1	1
9	1. Disposal on land, 2. Distribution by pipe line, 3. Drying on drying beds, 4. Dumping into the sea, 5. Heat drying, 6.Incineration, 7. Lagooning or ponding, 8. Press filters and Vacuum filters 9. Digestion followed by drying	any 1	1	1

	PART B			24
II 1	(1) to ascertain if the supplies maintain the required degree of purity and to find out the extent of any variations which occur; (2) to ascertain the effect of heavy rainfalls or of long-continued drought on river waters; (3) to ascertain the quality of the proposed supply to the new consumers. (4) to decide that the water obtained from some additional source or sources of supply will be pure, wholesome, not too hard and free from the risk of any pollution; (5) to decide the suitability of water for feeding boilers, hot-water pipes, etc. (6) to examine the effect of pumping on well waters, especially when wells are situated near the sea or an estuary; (7) to find out the organisms responsible for the spreading of the water-borne diseases; (8) to identify the organisms responsible for developing certain effects on water with respect to colour, odour, taste, etc.; (9) to know the characteristics of waters at various depths of deep wells and tube wells; (10) to know the quality of water submitted to the various purification processes; (11) to know the quality of water used or proposed to be used for public swimming baths; (12) to know whether water from a particular supply of water is suitable for specific purpose such as paper making, dyeing, tanning, wool washing, brewing, steam raising, etc.; (13) to study the process of self-purification of streams and rivers; (14) to suggest the best method of purifying, of softening or of preventing action on mains and supply pipes; etc.	any 3	3	3
2	Hardness may be determined either by soap test or EDTA method. The EDTA method is considered to be most accurate. In this method the sample of water is titrated against EDTA (Ethylene Diamine Tetra Acetic Acid) until wine red colour changes to blue. Erichrome Black T is used as an indicator in this test.	3	3	3
3	Rainwater harvesting- technology used for collecting & storing rainwater from rooftops, land surface or catchments/ watersheds using various techniques such as tanks or check dams or recharge to aquifer. Most promising alternatives for supplying fresh water in the face of increasing water scarcity & escalating demand.	3	3	3
	Basic Components of RWH: – Precipitation – Collection of water from surface catchment --water storage – Distribution of water			

4	1. Cast Iron (CI) Pipe, 2. Steel Pipe,3. Concrete pipe,4. Asbestos cement (AC) pipes,5. Galvanized iron (GI) pipes,6. Plastic Pipes:	any 3	3	3
5	These are the devices which are installed on the pipes to measure the quantity of water flowing at a particular point along the pipe. The reading obtained from the meters help in working out the quantity of water supplied and thus the consumers can be charged accordingly. The water meters can be classified into the following two categories 1. Positive displacement type meters: This meters record the number of times a container of known volume is filled and emptied with water. 2. Velocity meter: It work on the principle of velocity of entering water.	3	3	3
6	**Sewer**: The underground conduits or drains through which sewage is conveyed are known as the sewers.	1.5	3	3
	Sewerage: It is the general process of removing sewage .The entire science of collecting and carrying sewage by water carriage system through sewers is known as the sewerage and the sewage thus collected and conveyed is taken to a suitable place for its disposal. The entire system of conduits and appurtenances involved is called sewerage system or sewer system	1.5		
7	The following are the aims and objects of sewage disposal 1. Proper disposal of human excreta to a safe place, before its starts decomposition and may cause insanitary conditions in the locality 2. To take out all kinds of wastewater from the locality immediately after its use, so thatmosquitos, files, bacteria etc. may not breed in it and cause nuisance. 3. Final disposal of sewage on land or in nearby watercourses after some treatment so thatreceiving land or water may not get polluted and unsafe for its further use. 4. As far as possible the fertilizing elements of sewage may be used in growing crops through farming and getting some income in addition to the disposal of sewage. 5. In unsewered areas, the treatment of sewage from individual houses should be done by septic tank or other suitable means and the effluent should be disposed of. 6. If the sewage is disposed of on land, it should have such s degree of treatment that it may not affect the sub-soil in anyway	any 3	3	3

8	The physical characteristics are odour, color, turbidity and temperature: Fresh sewage is odourless, has an earthy or grey colour. In 3 to 4 hours, it becomes stale with all the oxygen present in the sewage being practically exhausted. It then starts emitting odour and the colour becomes dark. When all the oxygen has disappeared, the sewage becomes septic. Sewage is normally turbid resembling dirty dish water or waste water from baths having other floating matter viz., faecal solids, bits of paper, matches, grease, vegetable debris, fruit skins etc. The turbidity increases as sewage becomes stronger. The normal temperature of sewage is higher than that of the water supply because of heat added during the utilization of water.	3	3	3
9	1. The C.O.D test is widely used in place of B.O.D test because of its speed of obtaining result. 2. The C.O.D test is very useful to assess the strength of wastes which contains toxic and biologically resistant organic substances. 3. The ratio of B.O.D to C.O.D is useful to assess the amenability of waste for biological treatment 4. The C.O.D test is widely used in the analysis of Industrial waste. 5. It is used to determine the strength of waste water which cannot be determined by B.O.D test.	any 3	3	3
10	1. Preliminary treatment involving • Screening • Grit Chamber • Skimming tank	1.5	3	3
	In primary treatment, the settle able organic solids are sedimented and finally removed for further treatment. This is accomplished in primary sedimentation tank.	1.5		
	PART C			**42**
III	Yield of well is defined as the amount of water flowing into the well per unit time. This term is used to indicate the rate of withdrawal or pumping of water from wells without casing failure or drying of wells. When water is drawn or pumped from a well, water around the well enters it under the action of head (H-h) as shown in figure. This head is known as depression head or depletion head or drawdown. Due to this drawdown, the water table near the well assumes the shape of an inverted cone. It is known as cone of depression and the surface of it is known as the drawdown curve. The base of cone is known as the circle of influence.	5	7	7



Yield of a well

Tests for yield of well

1. *Pumping test or constant level test*
2. *Recuperation test*

2

IV

year	Population	increase per decade	Percentage increase
1950	22500		
1960	29000	6500	28.89
1970	37500	8500	29.31
1980	47000	9500	25.33
1990	57000	10000	21.28
2000	66500	9500	16.67
	sum	44000	121.475829
	Average	8800	24.30
Population in 2010			82460
Population in 2020			102250
Population in 2030			126790

Increase/decade -2

%increase-2

Sum % avg -1

Eqn & Answer-2

V

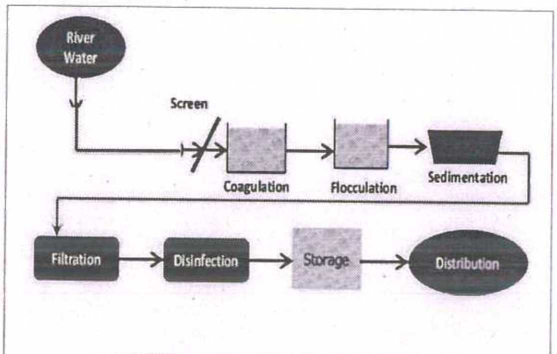
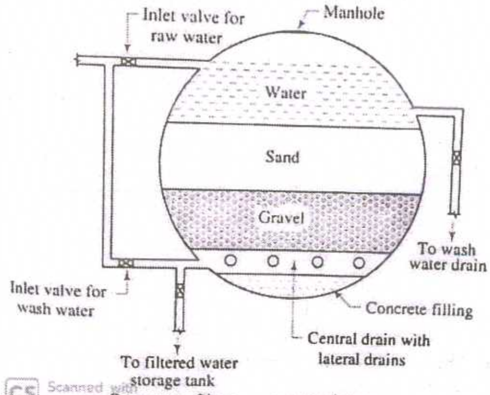


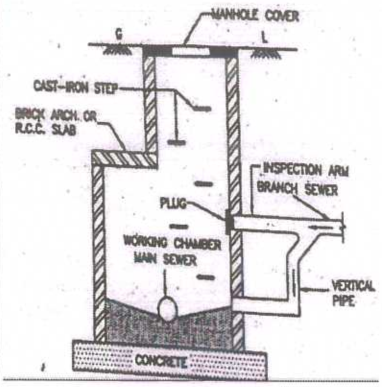
Figure 1: Filtration Treatment Plant (River Water)

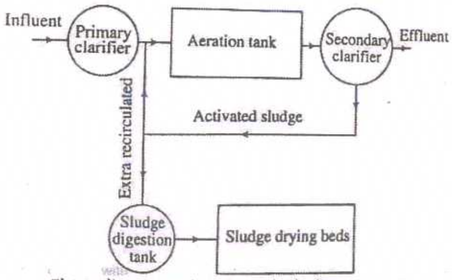
7 7 7

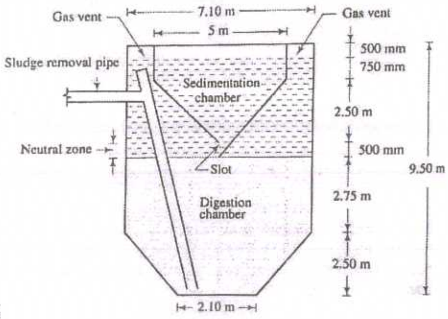
VI	1. Cascade aerators: A cascade aerator consists of a series of steps that the water flows over. In all cascade aerators, aeration is accomplished in the splash zones. Cascade aerators can be used to oxidize iron and to partially reduce dissolved gases.	2	7	7
	2. Spray nozzle aerator • Water is sprayed under pressure through special nozzles. • Water is made into fine droplets, incresing the contact area of water with air for aeration • Nozzles have diameter varying from 10 to 40 mm spaced in the pipe at intervals of 0.5 to 1 m	2		
	3. Diffusion aerators• Air diffusion is a type of aerator in which air is blown through a trough of water.• As water runs through the trough, compressed air is blown upward through porous plates on the bottom.• This method is not very efficient due to limited air transfer	2		
	4. Multiple pan aerators • Water is made to trickle through successive perforated pans arranged one above the other and thus aerated.	1		
VII	 Pressure filter — vertical type		7	7
	Working: The water mixed with coagulant is directly admitted to the pressure filter. Thus the flocculation takes place inside the pressure filter itself. In normal working condition, all valves are closed except those for raw water and filtered water. The water is admitted through inlet and after it is filtered, it is collected in the central drain and conveyed to the filtered water storage tank. Cleaning: The compressed air may be used to agitate sand grains. The valves for raw water and filtered water are in closed position and those for wash water and wash water drain are in open position during the operation of washing of filter. The cleaning of pressure filters may be required more frequently.	7		

VIII	*Removal of Temporary Hardness* • Temporary hardness of water can be removed either by boiling or by adding lime. • The boiling of water on a large scale is impracticable and uneconomical. Hence the addition of lime is preferred to boiling for the removal of temporary hardness. *Removal of Permanent hardness* Permanent hardness canot be easily removed from water. Te special treatment, known as water softening treatment, is to be given to the water for the removal of permanent hardness from it. Following are the methods adopted for the removal of permanent hardness 1. Zeolite process Also known as base exchange or ion exchange processs.The zeolite are compounds of aluminium, silica and soda In this process, hard water is passed through a bed of zeolite sand where by it exchanges its Ca and Mg for sodium in the zeolite until Na becomes exhausted. Thus the hard water is softened and its sodium content in increased. 2. Lime soda process •In this process, the lime and sodium carbonate or soda ash are used to remove permanent hardness from water. 3. De mineralization process Also known as de ioisation process.It is similar to the previous process. But in this process, the hydrogen is exhausted for metallic ions.The hard water is passed through a bed of resin or carbonaceous material in the hydrogen form.	3 1 1 1 1	7	7
IX	In this system, the night soil gets mixed up with sufficient quantity of water forming sewage and is collected in a system of pipes and transported for subsequent treatment and disposal in a harmless manner without any nuisance. The sewage so formed in water carriage systemconsists of 99.9 percentage of water and 0.1 percentage of solid matters. All the solid mattersremain in suspension in the sewage and do not change the specific gravity of water. So all thehydraulic formulae can be directly used in the design of sewerage system and treatment plants. This system is universally used nowadays.	4	3	7

	The following are the merits of water carriage system 1. It is expensive in initial cost, but maintenance cost is low. 2. This system permits compact design of the building as lavatories can be accommodated in any part of the building. It is thus very helpful for modern multistoried buildings in which the toilets or sanitary blocks can be constructed in each floor and connected to a vertical pipe. 3. It is necessarily laid below ground. Hence it is not visible, but hygienic. 4. There is practically no risk of pollution of underground sources of water as sewage is carried in closed sewers and above the water pipes. 5. The night soil, foul matter etc. are carried in this system in closed conduits. Hence the risk of outbreak of epidemic is greatly reduced. There are no chances of putrefaction. 6. The city appears neat and clean 7. Only few labours are required. 8. The area of land required for treatment plant and sewage disposal in this system is smaller than that require in the case of conservancy system. Demerits 1. The main disadvantage of this system is the wastage of water. It requires large quantity of water to the extent of about 100 to 120 litres per day This system is very costly in initial cost	3	3	
X	The term drop manhole is used to indicate the manhole on sewer line which is constructed to provide a connection between the high level branch sewer to the extent of about 500 mm to 600 mm above the main sewer to the low level main sewer with a minimum amount of disturbance. Objects: A drop manhole serves the following two purposes. 1. The branch sewer is generally constructed near the ground level and the main sewer is laid at a greater depth below ground level. The construction of drop manhole avoids unnecessary steep gradient of branch sewer and it thus reduces the quantity of earthwork. 2. If drop manhole is constructed, the discharge of branch sewer appears at the bottom of manhole. It thus avoids the possibilities of sewage being thrown on persons entering the working chamber of manhole	3	7	7

	The branch sewer is jointed to the manhole through a vertical pipe. The sewage trickles down the vertical pipe. A plug is provided at the point where the branch sewer intersects the wall of manhole. If, instead of vertical pipe, an inclined pipe making an angle of 45 degree with groundd is used, the construction is known as a ramp.  	2 2		
XI	The main purpose of the installation of screens is to remove the floating matter of comparatively large size. If such materials are not removed, they will choc k up the small pipes or affects seriously the working of sewage pump. This is the first step in the treatment of sewage and screening is accomplished by means of screens, having openings of uniform size, circular/rectangular in shape. The screening element comprised of parallel bars or rods is called a rack or bar screen and when made from wire mesh, perforated plate ect, it is termed as screen. Screens are sometimes classified as fixed or movable depending upon whether racks/screens are stationary or capable of motion. They may also be classified depending upon the method of cleaning as hand-cleaned or Machine cleaned. The screen is placed at an angle of 300 to 600 to horizontal. The sewage is allowed to flow through the screen with a velocity of at least 0.60m/s. All the floating bodies larger in size than that of the openings are retained on the screen. They are removed periodically either by manual labour or automatically. The screenings contain 90 to 95% or more water, are offensive and should be quickly disposed of. It is usual to allow them on drain off for some time on a perforated platform over the channel. Disposal may be through burial in trenches, incineration and disintegrating in shredders or passing to the sludge disposal plant	7	7	7

XII	The term activated sludge is used to indicate the sludge which is obtained by settling sewage in presence of abundant oxygen. The activate sludge is biologically active and it contains a great number of aerobic bacteria and other microorganisms which have got an unusual property to oxidize the organic matter.The following are the three basic operations involved in the Activated sludge process1. Mixing of Activated sludge: The activated sludge is added to the effluent of primary clarifier.2. Aeration: The mixed liquor containing activated sludge and effluent is agitated or aerated in the aeration tank.3. Settling in secondary clarifier: The mixed liquor after agitation is taken to the secondary clarifier. The sludge is allowed to settle in this tank. The settled sludge is the activated sludge and a portion of it is sent for recirculation. The extra activated sludge is taken to the sludge digestion tank and then to the sludge drying beds for further treatment.	5	7	7
	 Flow diagram of activated sludge process	2	7	7
XIII	The imhoff tank is an improvement over septic tank. The imhoff tank consists of two chambers arranged one below the other. The upper chamber is used for sedimentation of solids and the lower chamber is meant for digestion and storage. The bottom of the lower chamber is provided with hopper bottoms. The sewage enters the sedimentation chamber and solids are deposited in it. The effluent is withdrawn from the outlet and sent to soakage pit or dispersion trench or for biological treatment. The sewage is admitted into the upper chamber (sedimentation chamber) of the Imhoff tank. The sludge settled in the upper chamber slides down into the digestion chamber. Here the sludge undergoes anaerobic digestion. The digested sludge settles into the hoppers from which it is withdrawn by sludge pipe. The gases formed in the digestion chamber (Lower Chamber) are collected in the gas vent area or they may be allowed to escape into the atmosphere. The details of the Imhoff tank are shown in above figure	6		

	 Imhoff tank	1		
XIV	Traps: The depression or bend provided in a drainage system which is always full of water and prevents the entry offoul gases into atmosphere is called trap. The water inside the trap is called water seal. The installation of a trap avoids the nuisance which will be developed due to entry of bad smelling gases into house. The effectiveness of trap naturally depends upon the depth of water seal. Thee greater the water seal, the more effective is the trap. The depth of water seal in practice varies from 25 mm to 75 mm. the trap should contain water seal at all times.	3.5	7	7
	Inspection Chambers: Inspection chamber is similar to manhole. It is constructed on a house drain, to provide access for the cleaning, inspection and repair of the drain. The drainage pipes are made U-shaped and open in the inspection chambers. The chamber is provided with a C.I cover. Size of the chamber depends on the depth and number of branch connections. Its size may be about 60 X 75 cm deep. They should be constructed at all junctions, bends and at about 10 m interval on straight runs of the drains	3.5		

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