



MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION
(Autonomous)

(ISO/IEC -270001 – 2005 certified)

Subject code: 17503

SUMMER -2019 EXAMINATION

Model Answer

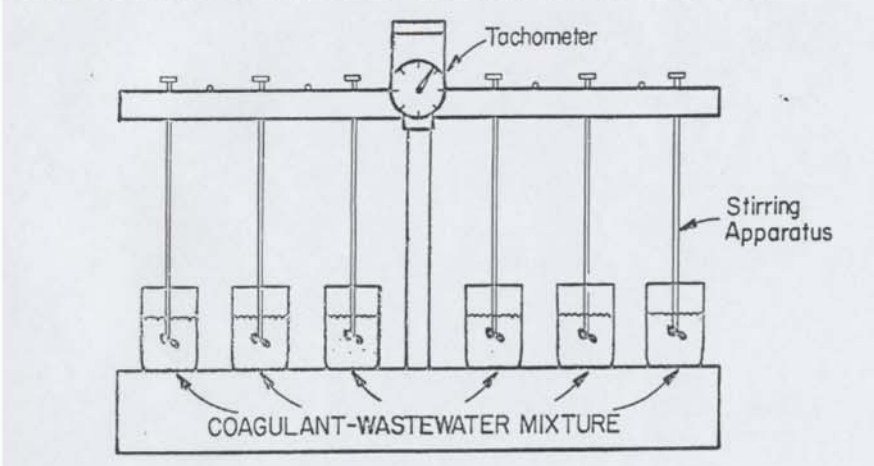
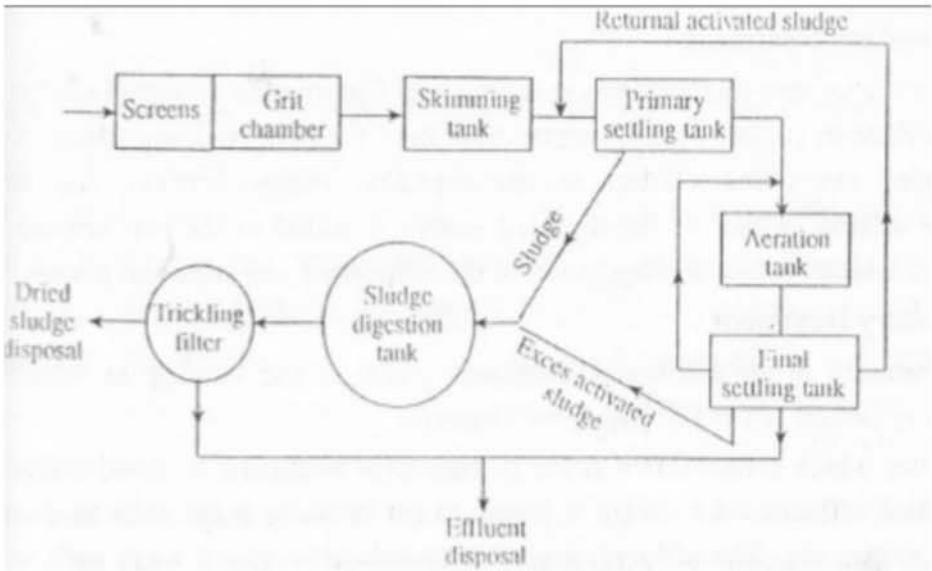
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Important Instructions to examiners:

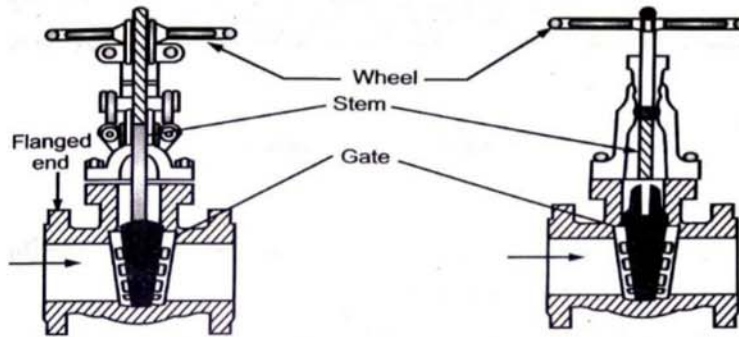
- 1) The answer should be examined by keywords and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language error such as grammatical, spelling errors should not be given more importance. (Not applicable for subject English and communication skill).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figure drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In the some cases, the assumed constants values may vary and there may be some difference in the candidates answer and model answer.
- 6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidates understanding

Q. No.	Question and Model Answers	Marks
1 (a)	Attempt any THREE of the following:	12M
i)	State the importance of Public Health Engineering	4M
	Ans: <u>Importance of Public Health Engineering</u> - Public Health Engineering provides knowledge regarding, a) Municipal water supply system to provide safe drinking water. b) How to determine future population to workout water demand of the city c) Engineering treatment systems for water purification. d) Develop collection and treatment systems to carry domestic or industrial waste water discharges away and remove some of the pollutants before discharging it in to the environment.	1M (for each point)
ii)	State the factors governing the location of an intake structure.	4M
	Ans: <u>Factors governing the location of an intake structure-</u> 1. The quality of water available at the site should be good. 2. The site of intake should be easily accessible. 3. Intake should not get flooded during floods. 4. Intake works should not be located on curves as far as possible.	1M (each for Any four)

	<ol style="list-style-type: none"> 5. Power supply should be available and reliable near the site. 6. The intake should not be located near the navigation channel. 7. The site should be such as to permit greater withdrawal of water, if required in future. 8. It must be located at a place from where it can draw water even during the driest period of the year. 9. The intake should be as near the pumping station as possible. 10. Places of rapid current that will endanger the safety of the intake structure should be avoided. 																	
iii)	State the importance and necessity of sanitation.	4M																
	<p>Ans: <u>Necessity and importance of sanitation:-</u></p> <ol style="list-style-type: none"> 1) Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and feces. The word 'sanitation' also refers to the maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal or sewage disposal, after suitable treatment. 2) Sanitation includes collection/ containment, conveyance/ transport, treatment, disposal or reuse. 3) In addition of this disease, bacteria will breed up in the stagnate water and the health of the public will be in danger. 4) If proper arrangements for the collection, treatment and disposal of all the wastes produced from the town or city are not made, they will go on accumulating and create such a foul condition that the safety of the structures such as buildings, roads will be in danger due to accumulation of spent water in their foundations. 5) Proper sanitation helps in preventing the occurrence of diseases such as typhoid, malaria, tuberculosis, smallpox, chickenpox, etc. 6) It helps in preventing the pollution of natural streams and rivers, also results in protection of groundwater sources. 7) It helps in maintaining good environments for the health of the public. 8) It helps in the general development of the city. 	4M (for any four points)																
iv)	Differentiate between aerobic and anaerobic process.	4M																
	<p>Ans:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Aerobic Process</th> <th style="text-align: center;">Anaerobic process</th> </tr> </thead> <tbody> <tr> <td>When the decomposition of organic matter takes place in the presence of oxygen, it is called aerobic process.</td> <td>When the decomposition of organic matter takes place in the absence of oxygen, it is called aerobic process.</td> </tr> <tr> <td>Aerobic bacteria involved.</td> <td>Anaerobic bacteria involved.</td> </tr> <tr> <td>Process in presence of oxygen and light.</td> <td>Process in absence of oxygen and light.</td> </tr> <tr> <td>Not offensive.</td> <td>Offensive.</td> </tr> <tr> <td>End products – CO₂, H₂O, NO₃, SO₄</td> <td>End products- CH₄, H₂S, CO₂</td> </tr> <tr> <td>Applied for moderate waste.</td> <td>Applied for strong waste.</td> </tr> <tr> <td>End product requires another treatment.</td> <td>Well stabilized end product.</td> </tr> </tbody> </table>	Aerobic Process	Anaerobic process	When the decomposition of organic matter takes place in the presence of oxygen, it is called aerobic process.	When the decomposition of organic matter takes place in the absence of oxygen, it is called aerobic process.	Aerobic bacteria involved.	Anaerobic bacteria involved.	Process in presence of oxygen and light.	Process in absence of oxygen and light.	Not offensive.	Offensive.	End products – CO ₂ , H ₂ O, NO ₃ , SO ₄	End products- CH ₄ , H ₂ S, CO ₂	Applied for moderate waste.	Applied for strong waste.	End product requires another treatment.	Well stabilized end product.	1 M (for any four points of difference)
Aerobic Process	Anaerobic process																	
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No methane gas produced. e.g. aerated lagoon.	Methane gas produced. e.g. bio gas plant.			
1 (b)	Attempt any <u>ONE</u> of the following	6M		
i)	Explain jar test with neat labeled sketch.	6M		
	<p>Ans: Jar Test To determine optimum chemical dose, controlled test performed in the laboratory commonly called as jar test.</p> <p>Procedure-</p> <ol style="list-style-type: none"> 1) Fill the 6 jars with 1000ml water sample. 2) Add the coagulant dose in increasing order and stir the sample with 60-80 RPM for one minute. 3) After one minute reduce the speed of stirrer to 30 RPM for 15 minutes. 4) Then turn off the mixer and allow to settle for 30 minutes. 5) Observe and measure the turbidity of each jar sample. 6) Good floc formation will be the optimum dose of coagulant. 	<p>1M</p> <p>2M</p> <p>2M (for sketch)</p> <p>1M (for labeling)</p>		
	 <p style="text-align: center;">Jar test apparatus</p>			
ii)	Draw general layout and flow diagram sewage treatment plant.	6M		
	<p>Ans:</p> 	<p>3M stating units</p> <p>3M Correct sequencing of units.</p>		

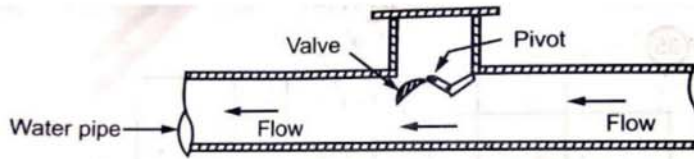
2.	Attempt any FOUR of the following	16M
a)	Draw flow diagram of water supply scheme.	4M
	<p>Ans:</p> <p>OR</p> <p>(*Note: Student may draw flow diagram in any manner i.e. either lay out or flow diagram. So give credit 02 marks for naming components and 02 marks for correct sequence of units.)</p>	<p>2M stating units</p> <p>2M Correct sequencing</p> <p>OR</p> <p>2M stating units</p> <p>2M* Correct sequencing of units.</p>
b)	List of sources of water.	4M
	<p>Ans:</p> <p><u>Sources of water</u></p> <p>I) Surface Sources</p> <ol style="list-style-type: none"> i) Lakes ii) Streams iii) Rivers iv) Ponds v) Storage reservoirs or dams <p>II) Sub surface Sources</p> <ol style="list-style-type: none"> i) Infiltration galleries ii) Infiltration wells iii) Springs iv) Wells 	<p>2M</p> <p>2M</p>



Pressure Relief Valve:-At every point along the water pipe where pressure is likely to be maximum.

Scour Valve: - They are located at the dead ends and depression or at lowest points in mains to remove sand and silt deposited in pipeline.

Reflux Valve:-These valves are used in water pipe, which obtains water directly from pump. When pump fails or stops, the water will not return back to pump and thus pumping equipment will be saved from the damage.



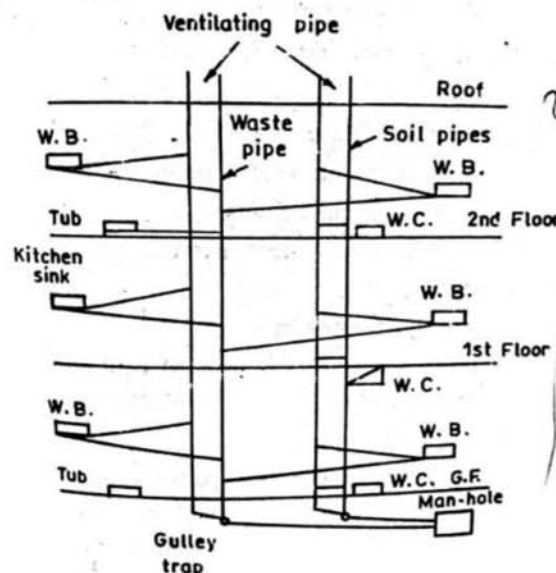
e) Explain with sketch two pipe system of plumbing.

4M

Ans:

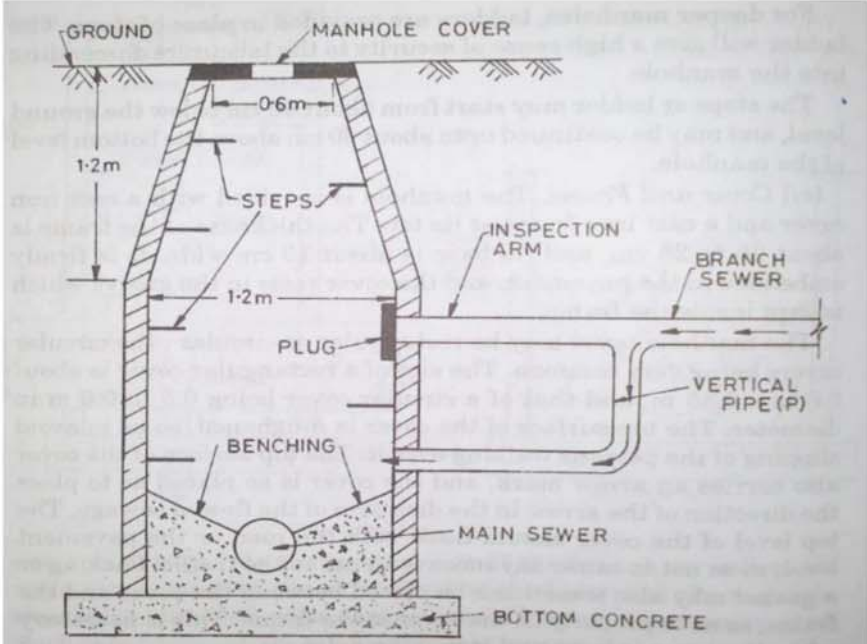
Two-pipe system:-

In this system, two sets of pipes are laid. The soil fixtures such as urinals and water closets are connected to vertical soil pipe. The connections of waste matter from baths, kitchens, etc. are made to another vertical waste pipe. The soil pipe and the waste pipe are provided with separate vent pipes. It will thus require four pipes and hence it becomes costly. The number of pipes on wall face is also more and if not properly maintained, these pipes from nuisance.



2M
(for
descrip
tion)

2M
(for
sketch)

f)	Draw the sketch of drop manhole with their components.	4M
	<p>Ans:</p>  <p style="text-align: center;">Drop Manhole</p>	<p>2M (for sketch)</p> <p>2M (for labeling)</p>
3.	Attempt any <u>FOUR</u> of the following:	16M
a)	State the factors affecting rate of demand.	4M
	<p>Ans: <u>Factors affecting rate of demand-</u></p> <ol style="list-style-type: none"> 1. Climatic condition - The per capita consumption of water is more in hot climate than in the cold climate. 2. Living standards of people – Per capita consumption is more for rich people than the poor and middle class people. 3. Size of the community – Water demand of town is more with its size. 4. Industrial and commercial activities- Per capita water consumption increases with industrial and commercial activities in town. 5. Pressure in the distribution system- The water demand increases with increase in the pressure of water in distribution lines. And there will be more loss due to leakage & thefts. 6. System of sanitation- The per capita water demand of town having water carriage will be more than town where it is not used. 7. Cost of water- If the cost of water is more less quantity of water will be used. 8. System of supply- In continuous system of supply, consumption is more than intermittent system. 9. Quality of water- If the quality of water is good water consumption will be more. 10. Metering of supply- Metering reduces consumption, that means less wastage. <p style="text-align: center;"><i>(*Note- If no description is given by student for each point, then give 4M for list of eight points.)</i></p>	1M* (each for any four with description)
b)	Explain the necessity of ground water recharging.	4M
	<p>Ans: <u>Necessity and Importance of Ground water recharging-</u></p> <ol style="list-style-type: none"> 1. Increase ground water storage 	½ M

f)	i) Define: 1) Sewage, 2) Sullage	2M																				
	Ans: 1) Sewage- The liquid waste from the community and it includes Sullage, discharge from latrines, urinals, stables and storm water. 2) Sullage- The liquid waste (not foul in nature) collected from wash basin, baths and kitchen sink is called as sullage.	1M (for each)																				
f)	ii) List types of sewage.	2M																				
	Ans: <u>Types of Sewage-</u> 1) Domestic Sewage 2) Sanitary Sewage 3) Industrial Sewage 4) Storm Sewage 5) Other – Raw sewage, Dilute or weak sewage, Septic Sewage, Fresh Sewage, etc.	2M (for any four types)																				
4.a)	Attempt any <u>THREE</u> of the following:	12M																				
i)	State the IS standards of following for drinking water. 1) pH value, 2) Fluoride, 3) Hardness, 4) Chlorides	4M																				
	Ans: <table border="1"> <thead> <tr> <th>Sr.No.</th> <th>Description</th> <th>Desirable Limit</th> <th>Permissible Limit</th> </tr> </thead> <tbody> <tr> <td>1)</td> <td>PH value</td> <td>6.5-8.5</td> <td>6.5-8.5</td> </tr> <tr> <td>2)</td> <td>Fluoride</td> <td>1.0 mg/lit</td> <td>1.5 mg/lit</td> </tr> <tr> <td>3)</td> <td>Hardness</td> <td>300mg/l</td> <td>600mg/l</td> </tr> <tr> <td>4)</td> <td>Chlorides.</td> <td>250mg/l</td> <td>1000mg/l</td> </tr> </tbody> </table> <p>(*Note- Give credit to any one correct value of each parameter.)</p>	Sr.No.	Description	Desirable Limit	Permissible Limit	1)	PH value	6.5-8.5	6.5-8.5	2)	Fluoride	1.0 mg/lit	1.5 mg/lit	3)	Hardness	300mg/l	600mg/l	4)	Chlorides.	250mg/l	1000mg/l	1M * (for each)
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ii)	State the advantages and disadvantages of radial system of distribution of water.	4M																				
	Ans: <u>Advantages of Radial system:</u> a) Calculation of pipe size is easy b) Quick service. c) In this system, water is distributed efficiently. d) It ensures high pressures. <u>Disadvantages of Radial system:</u> a) As every zone requires a separate service reservoir, number of reservoirs required is more, and hence the system becomes costly. b) Maintenance cost is very high.	2M																				
iii)	Explain: 1) Self cleaning velocity, 2) Non scouring velocity	4M																				
	Ans: 1) Self cleaning velocity- The minimum velocity which will prevent the silting or deposition of particles of solid matter in sewers is known as self cleaning velocity. OR The minimum velocity at which no solids get deposited in the invert of the sewer is called self cleaning velocity.	2M																				

It is in between 0.6 to 1 m/s. It depends on diameter of pipe.

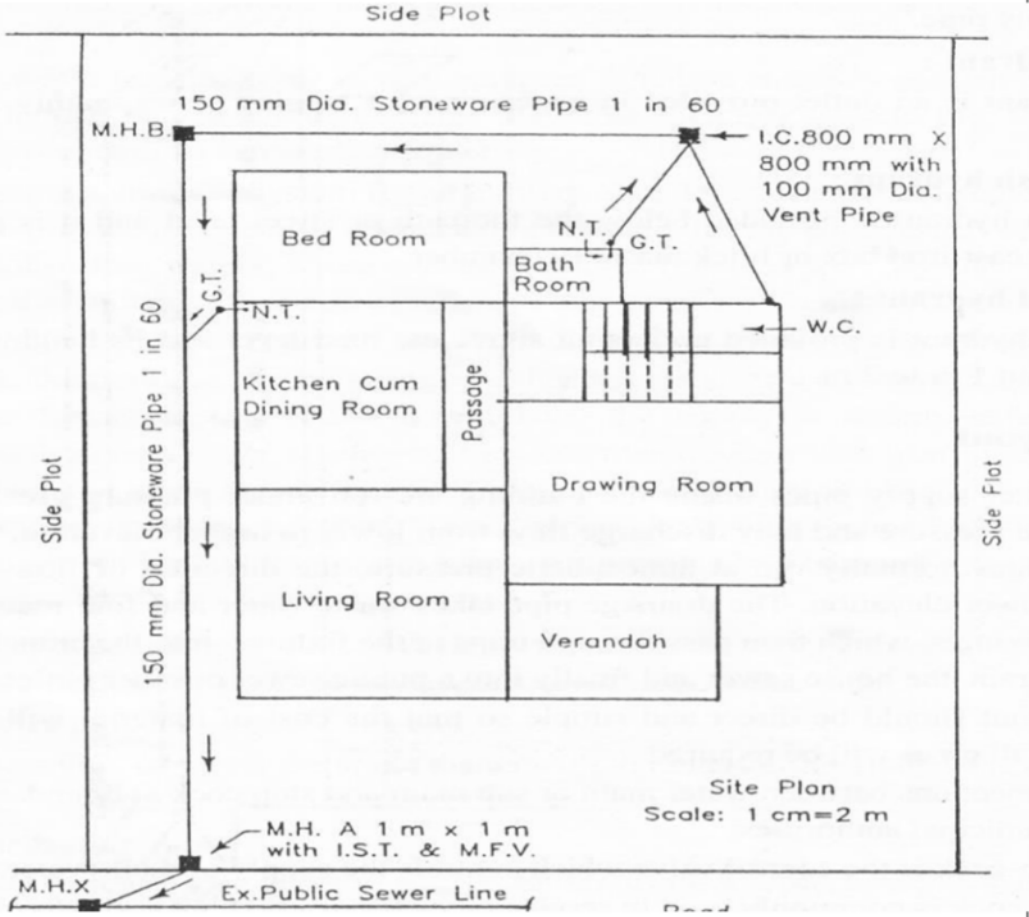
2) Non scouring velocity-
 The maximum permissible velocity at which no scouring action by the solid particles of sewage on inside smooth surface of sewers will occur is known as non-scouring velocity. It mainly depends on material of sewer. It is generally 3 to 3.5 m/s.

2M

iv) Draw the drainage plan for building sanitary fittings.

4M

Ans:



Drainage plan

2M
(for Plan)

2M
(for labelin
g)

4. b Attempt any ONE of the following:

6M

i) Explain advanced water treatment for 1) Water softening, 2) Defluoridation technique

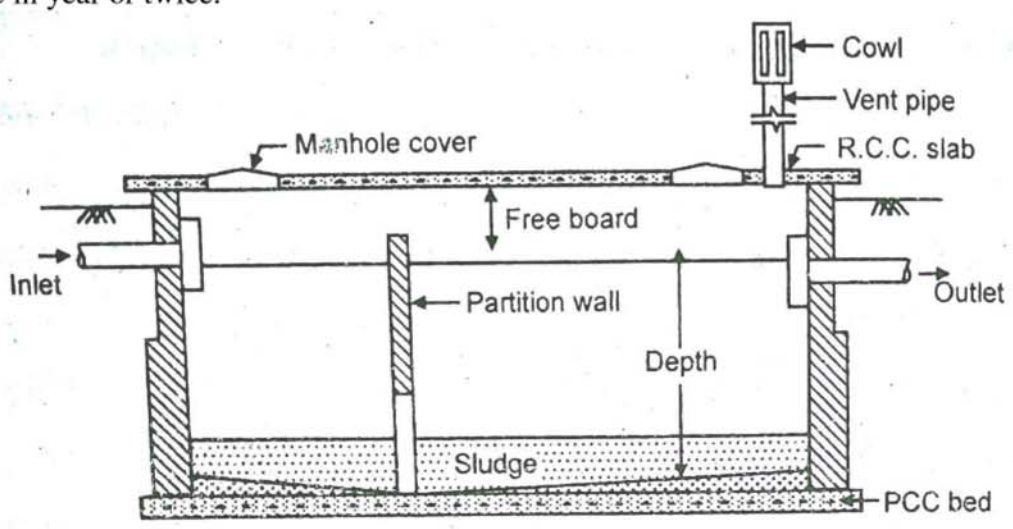
6M

Ans:

1) Water Softening

Zeolite process of water softening:-
 This is also known as the base-exchange or ion-exchange process. The zeolite process is compounds of aluminium, silica and soda. They have got the excellent property of interchanging base.
 The most common artificial zeolite is the permutit. It is manufactured from feldspar, kaolin clay and soda.
 The permutit is white in colour and its chemical formula is $2SiO_2Al_2O_3Na_2O$.
 Thus hard water comes into contact with zeolite the calcium and magnesium are

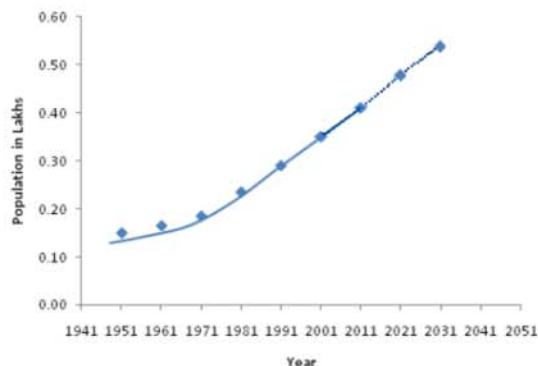
3M*

	<p>removed is given in exchange. Thus the hard water is softened and its sodium content is increased as indicated by the above process.</p> <p>After some process, the sodium present in zeolite is exhausted as the entire sodium zeolite has been converted to calcium zeolite and magnesium zeolite. This is regenerated by passing a solution of salt through the zeolite.</p> <p>2) Defluoridation technique</p> <p>Defluoridation is the minimisation of the level of fluoride in drinking water. Techniques are 1) Absorption by activated Alumina, 2) Iron exchange Adsorption, 3) Nalgonda technique or 4) Reverse Osmosis Process</p> <p><u>Reverse Osmosis Process:-</u> Pressure applied to salt water is greater than the osmotic pressure, then water from solution diffuses from solution through the membranes to fresh water side. This is reverse osmosis.</p> <p>Generally there are two types of membranes namely cellulose acetate and aromatic polyamide.</p> <p>Members are assembled in modular unit that impact a large membrane surface in a cylindrical container fitted with inlet and outlet arrangements - pre-treatment may consist of coagulation and filtration to remove turbidity, suspended matter, iron, manganese, softening, removal of hardness, reducing the potential of calcium carbonate and calcium sulphate precipitate</p> <p><i>*(Note- Student may draw figure to explain each process. Give credit accordingly. i.e. 2M for figure and 1M for description.)</i></p>	3M*
ii)	<p>Explain working of septic tank with sketch.</p>	6M
	<p>Ans:</p> <p>Working of Septic Tank- Septic tank is a closed water-tight chamber where combined sedimentation and digestion of sludge are carried out under anaerobic conditions.</p> <p>The sewage is detained for some period (12-36 Hrs.) when suspended solids are settled down which are treated by anaerobic digestion and result in reduction of volume and release of CH_4, CO_2, H_2S gases.</p> <p>The foul gases are escaped through vent pipe and the offensive effluent is disposed off into the ground through soak pit. The digested sludge is periodically removed once in a year or twice.</p>  <p style="text-align: center;">Sectional elevation L-section of Septic Tank</p>	3M

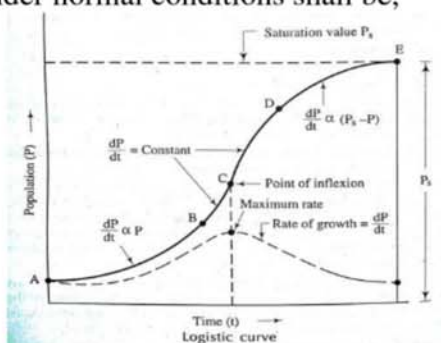
5.	Attempt any FOUR of the following	16M
a)	Enlist the methods of population forecasting and explain any one.	4M
	<p>Ans: Methods of forecasting of population-</p> <ol style="list-style-type: none"> 1. Arithmetic Increase method 2. Geometric Increase method 3. Incremental increase method 4. Decrease rate of growth method 5. Simple graphical method 6. Comparative graphical method 7. Master plan or zoning method 8. Logistic curve method 9. Apportionment method (National ratio) <p>1. Arithmetic Increase method-This method is based on the assumption that the population is increasing at a constant rate. The average increase of population for the last three or four decades is worked out and then for each successive future decade, this average is added. This method is used for large old city.</p> $P_n = P_o + n.c.....$ <p>Where, P_n = Future population after n^{th} decade P_o = Last known decade population c = Average increase in population n = Future no. of decade</p> <p>2. Geometric Increase method- The per decade percentage increase is assumed to be constant and increase is compounded over the existing population every decade.</p> $P_n = P_o \times \left(1 + \frac{r}{100}\right)^n$ <p style="text-align: right;">r = geometric mean</p> <p>3. Incremental increase method – In this method decade growth rate is progressively increasing or decreasing. The population for future decade is worked out by adding the mean arithmetic increase to the last known population as in arithmetic increase method and to this is added the average of the incremental increase, once for the first decade, twice for the second decade and so on.</p> $P_n = P_o + n.x + \frac{n.(n+1).y}{2}$ <p style="text-align: center;">x = Average increase in population y = Average of incremental increase in population</p> <p>4. Decrease rate of growth method- In this method the average decrease in the percentage increase is worked out and is then subtracted from the latest</p>	<p style="text-align: center;">2M (for Any four)</p> <p style="text-align: center;">2M (Any one method)</p>

percentage increase for each successive decade.

5. **Simple Graphical method-** In this method the population of last few decades are correctly plotted to a suitable scale on the graph w.r.t. decade. The curve thus obtained is smoothly extended to forecast the future population.



6. **Comparative graph method-** The future population can be predicted by plotting the population of other cities. The curve of past population of the city under consideration is plotted on the same graph. Cities to be compared should be as similar as possible to city being studied. Factors to be considered i) geographical proximity, ii) likeness of economic base, iii) access to similar transportation systems. Population of the city is expected to grow in a similar manner to cities used for comparison.
7. **The Master Plan method-** For the proper development of the cities, their master plans are prepared. The city is divided in various zones such as residential, commercial, industrial, educational, parks & gardens etc. The future expansion of the city is strictly regulated by various bye-laws of corporation and other local bodies according to master plan. The master plans are prepared for 25-30 years.
8. **Logistic Curve method-** If the population of town is plotted w.r.t. time the curve so obtained under normal conditions shall be,



b) **State applications of chlorine and state forms of chlorine.**

4M

Ans:

Applications of Chlorine-

1. Free Chlorine: It is available in gaseous or liquid form. It stored in cylinders.
2. Chloramines: Chlorine is not stable in water, hence to form stable compound it mixed with ammonia which is called 'Chloramine'.
3. Bleaching Powder: It is chlorine compound which is available in powder form and it consists about 35% of chlorine contents.

2M

Forms of Chlorine-

- 1) Plain Chlorination

	<ul style="list-style-type: none"> 2) Pre Chlorination 3) Post Chlorination 4) Re chlorination 5) Super Chlorination 6) De chlorination 7) Break point chlorination 	<p>2M (for any four)</p>
c)	<p>Explain gravity pumping with sketch.</p>	<p>4M</p>
	<p>Ans: <u>Gravity Pumping Method-</u> This is also known as combined gravity & pumping system or Dual system. The pump is connected to the mains as well as to the elevated reservoir. In the beginning when demand is small, the water is stored in the elevated reservoir. But when demand increases the rate of pumping, the flow in the distribution system comes from both the pumping station as well as elevated reservoir.</p>	<p>2M (for description)</p>
		<p>2M (for sketch)</p>
d)	<p>Define: 1) Water pipe, 2) Rain water pipe, 3) Soil pipe, 4) Vent pipe</p>	<p>4M</p>
	<p>Ans: 1) Water pipe: Pipe which is used to carry the water under pressure is known as Water pipe. 2) Rain water pipe: Pipe which is used to carry the rain water is known as Rain water pipe. 3) Soil pipe: The pipe that receives and conveys discharge from soil fittings such as water closet, urinal etc. is called as Soil pipe. 4) Vent pipe: The pipe installed for ventilation purpose is called as Vent pipe.</p>	<p>1M (for each)</p>
e)	<p>State the factors affecting on sewer design.</p>	<p>4M</p>
	<p>Ans: <u>Factors affecting sewer design-</u></p> <ul style="list-style-type: none"> 1. Quantity of sewage, 2. Design period 3. Area to be served 4. Minimum and maximum velocity of sewer, 5. Time of concentration, 6. Arrangement of sewer, 	<p>½ M* (for any eight)</p>

	<p>7. Gradient of sewer, 8. Funds available 9. Type of material - Resistance to corrosion and abrasion, 10. Section of sewer</p> <p><i>*(Note- If description is given for point, then give 4M for any four points)</i></p>	
f)	Explain grit chamber with neat labeled sketch.	4M
	<p>Ans: Grit chamber- The grit chamber is used to remove grit, consisting of sand, gravel, cinder, or other heavy solids materials that have specific gravity much higher than those of the organic solids in waste water. Purpose: i) To protect moving mechanical equipment from abrasion and abnormal wear. ii) Avoid deposition in pipelines, channels, and conduits. iii) To reduce frequency of digester cleaning. Location: Grit chamber is located after screen.</p>	2M (for description)
		2M (for sketch)
6.	Attempt any <u>FOUR</u> of the following	16M
a)	State and explain theory of filtration.	4M
	<p>Ans: Theory of filtration: The filtration process is carried out in following four actions-</p> <ol style="list-style-type: none"> 1) Mechanical Straining: Sand consists of small pores, therefore suspended particles which are larger in size, can not pass through sand bed. Small particles of suspended impurities adhere causing further reduction in pore size. This increase the straining action. 2) Sedimentation: The voids act as small settling basins. The particles are arrested due to gelatinous film formation and attraction between particles. 3) Biological Action: Suspended impurities contain some portion of organic impurities like algae, 	1M (for each point with description)

etc. and form a layer. This food consumed by micro organisms with chemical and biological action.

4) Electrolytic action:

Sand particles of filter media carry electrical charges of opposite nature. They therefore attract each other and are neutralized. The characteristics of water are thus changed. Washing of filter media renews the electrical charges.

b) Enlist the types of traps and draw sketch of any one trap.

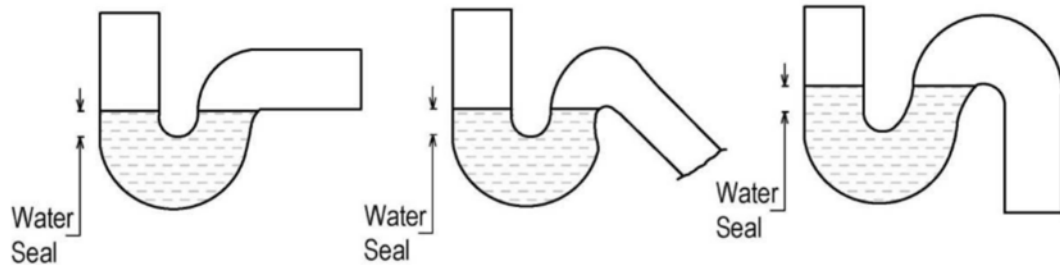
4M

Ans:

Types of traps-

- 1) P trap
- 2) Q trap
- 3) S trap
- 4) Floor trap or Nahani trap
- 5) Gully trap
- 6) Intercepting trap

**2M
(for
any
four)**

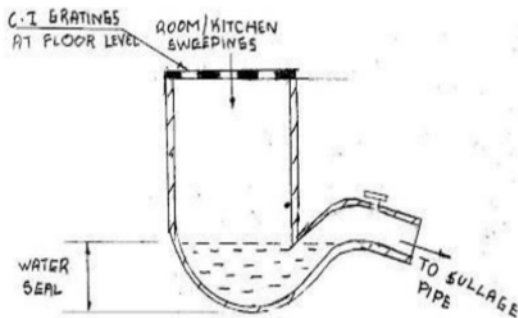


P- Trap

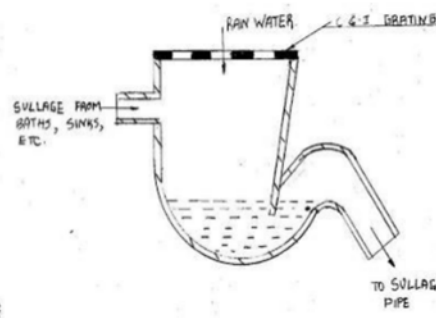
Q- Trap

S- Trap

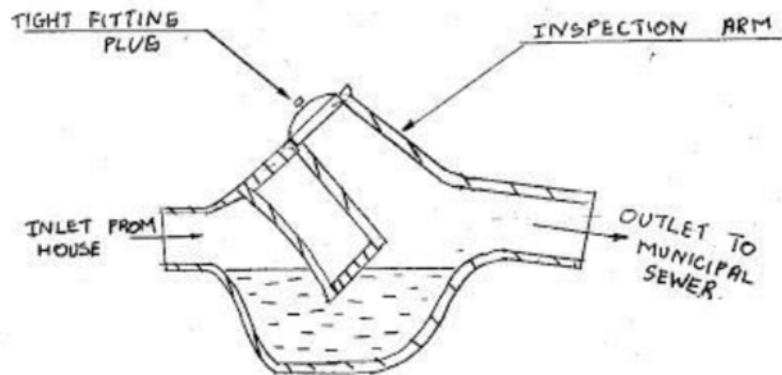
**2M
(for
sketch
of any
one)**



Floor Trap



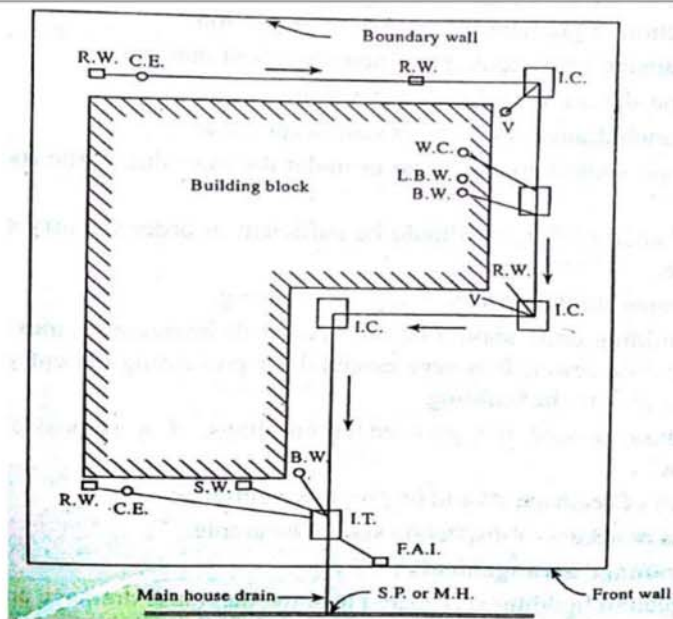
Gully Trap



Intercepting Trap

c)	State the qualities of good trap.	4M																																																																																																																					
	<p>Ans: Qualities of good trap:</p> <ol style="list-style-type: none"> 1) It should be simple in construction. 2) It should be non-absorbent material. 3) It should provide sufficient depth of water seal. 4) It should be self-cleansing. 5) It should have smooth internal and external surface. 6) It should not obstruct the sewage flow. 7) It should have provision for means of access. 	4M (for any four)																																																																																																																					
d)	State any four Norms of Maharashtra Pollution Control Board.	4M																																																																																																																					
	<p>Ans: Norms suggested by Maharashtra Pollution Control Board for the discharge of treated sewage:</p> <table border="1" data-bbox="284 718 1286 1843"> <thead> <tr> <th rowspan="2">Characteristics of effluent</th> <th rowspan="2">Tolerance limit for sewage effluents discharged into inland surface water (I)</th> <th colspan="2">Tolerance limits for industrialeffluents discharged into</th> <th rowspan="2">Tolerance limits for inland surface water, when used as raw for public water for supplies and bathing ghats (IV)</th> </tr> <tr> <th>Inland surface water (II)</th> <th>Public sewers (III)</th> </tr> </thead> <tbody> <tr><td>B.O.D. (mg/l)</td><td>20</td><td>30</td><td>500</td><td>3</td></tr> <tr><td>C.O.D. (mg/l)</td><td>-</td><td>250</td><td>-</td><td>-</td></tr> <tr><td>pH</td><td>-</td><td>5.5-9.0</td><td>5.5-9.0</td><td>6.0-9.0</td></tr> <tr><td>Total Suspended Solids (mg/l)</td><td>30</td><td>100</td><td>600</td><td>-</td></tr> <tr><td>Temperature</td><td>-</td><td>40</td><td>45</td><td>-</td></tr> <tr><td>oil and greese (mg/l)</td><td>-</td><td>10</td><td>100</td><td>0.1</td></tr> <tr><td>Phenolic compound (mg/l)</td><td>-</td><td>1</td><td>5</td><td>0.005</td></tr> <tr><td>Cynides (mg/l)</td><td>-</td><td>0.2</td><td>2</td><td>0.01</td></tr> <tr><td>Sulphides (mg/l)</td><td>-</td><td>2</td><td>-</td><td>-</td></tr> <tr><td>fluorides (mg/l)</td><td>-</td><td>2</td><td>-</td><td>1.5</td></tr> <tr><td>total residual chlorine (mg/l)</td><td>-</td><td>1</td><td>-</td><td>-</td></tr> <tr><td>Insecticides ,mg/l</td><td>-</td><td>0</td><td>-</td><td>0</td></tr> <tr><td>Arsenic (mg/l)</td><td>-</td><td>0.2</td><td>-</td><td>0.2</td></tr> <tr><td>Cadmium ,mg/l</td><td>-</td><td>2</td><td>-</td><td>-</td></tr> <tr><td>Chromium ,mg/l</td><td>-</td><td>0.1</td><td>2</td><td>0.05</td></tr> <tr><td>Sulphates, mg/l</td><td>-</td><td>-</td><td>-</td><td>1000</td></tr> <tr><td>Copper,mg/l</td><td>-</td><td>3</td><td>3</td><td>-</td></tr> <tr><td>lead,mg/l</td><td>-</td><td>0.1</td><td>1</td><td>0.1</td></tr> <tr><td>Mercury,mg/l</td><td>-</td><td>0.01</td><td>-</td><td>-</td></tr> <tr><td>Nickel,mg/l</td><td>-</td><td>3</td><td>2</td><td>-</td></tr> <tr><td>Zinc,mg/l</td><td>-</td><td>5</td><td>15</td><td>-</td></tr> <tr><td>Chlorides ,mg/l</td><td>-</td><td>-</td><td>600</td><td>600</td></tr> </tbody> </table> <p>Note:- Students can write any four points from any of the columns (I), (II), (III), (IV).</p> <p><i>2.Student may write only characteristic without limit value, give credit accordingly, limited to 2M</i></p>	Characteristics of effluent	Tolerance limit for sewage effluents discharged into inland surface water (I)	Tolerance limits for industrialeffluents discharged into		Tolerance limits for inland surface water, when used as raw for public water for supplies and bathing ghats (IV)	Inland surface water (II)	Public sewers (III)	B.O.D. (mg/l)	20	30	500	3	C.O.D. (mg/l)	-	250	-	-	pH	-	5.5-9.0	5.5-9.0	6.0-9.0	Total Suspended Solids (mg/l)	30	100	600	-	Temperature	-	40	45	-	oil and greese (mg/l)	-	10	100	0.1	Phenolic compound (mg/l)	-	1	5	0.005	Cynides (mg/l)	-	0.2	2	0.01	Sulphides (mg/l)	-	2	-	-	fluorides (mg/l)	-	2	-	1.5	total residual chlorine (mg/l)	-	1	-	-	Insecticides ,mg/l	-	0	-	0	Arsenic (mg/l)	-	0.2	-	0.2	Cadmium ,mg/l	-	2	-	-	Chromium ,mg/l	-	0.1	2	0.05	Sulphates, mg/l	-	-	-	1000	Copper,mg/l	-	3	3	-	lead,mg/l	-	0.1	1	0.1	Mercury,mg/l	-	0.01	-	-	Nickel,mg/l	-	3	2	-	Zinc,mg/l	-	5	15	-	Chlorides ,mg/l	-	-	600	600	1M each for any four (i.e. ½ M for writing characteristic and ½ M for writing correct value)
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e)	State the impurities removed in skimming tank and state how it help in improving further biological treatment.	4M
	<p>Ans: <u>Impurities removed in skimming tank:</u> These tanks are used for removing impurities like oil, grease and fats from the sewage.</p> <p><u>How it helps to improving biological action:</u> It helps to improve biological actions by, 1. Sewage becomes fresh i.e. oxygen contents are increased. 2. Objectionable gases such as H₂S are ejected from sewage. 3. The Flocculation of colloidal matter takes place and they are easily removed in sedimentation tank.</p>	<p>2M</p> <p>2M</p>
f)	Describe rain water and sewage collection system for residential building.	4M
	<p>Ans: <u>Rainwater and sewage collection system for residential building:</u> An efficient rainwater and sewage collection system is important for any residential building. This can be achieved in following ways-</p> <ol style="list-style-type: none"> 1) The house sewers should be laid by side of the building rather than below the building. 2) The drains should be laid straight between inspection chambers. 3) The entire system should be properly ventilated. 4) The drains should be laid with sufficient slope and grade to achieve self cleaning velocity. 5) The house sewer should be connected to public sewer at sufficiently higher level than the public sewer water level. 6) The house sewer should be connected to public sewer through intercepting trap. 7) The house drainage system should be of non absorbent material and the size should be taken for maximum discharge. 8) The rain water from houses is collected from roofs and is allowed to flow freely on the road for catch basins or inlets of sewer. Sufficient slope shall be provided to roof top for easy flow and collection of rain water. <p style="text-align: center;">OR</p> <p>Typical drainage system for residential building :</p>	<p>4M* (For any four points)</p> <p>OR</p>



3M*
(for
plan)

R.W.- Rain water pipe
 C.E.- Cleaning eye
 S.W. Sink waste
 V- Vent pipe
 W.C.- Water closet
 L.B.W.- Lavotary basin waste

B.W.- Bath waste
 I.C.- Intercepting chamber
 I.T.- Intercepting trap
 F.A.I.- Fresh Air Inlet
 S.P.- Saddle point
 M.H.- Manhole

1M*
(for
labelin
g

(*Note: Student may draw figure with explanation also. Give credit accordingly.)

---- End ----