



# MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

(Autonomous)

(ISO/IEC-270001 – 2005 certified)

## WINTER-14 EXAMINATION

Subject code: 17503

Model Answer

Page No: 1/19

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

Q.1A) Attempt <b>any three</b>	12
a) Define design period. State factors affecting it.	
<p><b>Ans: - Design period:-</b>The number of years for which a provision is made in designing the capacities of the various components of the water supply scheme is known as design period.</p> <p><b>Factors affecting design period:-</b></p> <ol style="list-style-type: none"> <li>i) Useful life of component structure and the chances of their becoming old and absolute. Design period should not exceed those respective values.</li> <li>ii) Ease and difficulty that is likely to be faced in expansions. If under taking at future dates.</li> <li>iii) Amount and availability of additional investment likely to be incurred for additional provision.</li> <li>iv) The rate of interest on the borrowings and the additional money invested.</li> <li>v) Anticipated Rate of population growth including possible shift's in communities, industries and commercial establishment.</li> </ol> <p><b>* Note:- ( Definition 2 marks and any two factors 2 marks)</b></p>	*
b) Enlist various surface and subsurface sources of water.	

**Ans:-I) surface sources of water:-**

- i) Ponds and lakes
- ii) Streams and rivers
- iii) Storage reservoirs and
- iv) Oceans,

**II) subsurface sources of water:-**

- i) Springs
- ii) Infiltration galleries
- iii) Infiltration wells and
- iv) Wells and tube wells

**\*Note:-**(Any two surface source of water 2 marks and any two subsurface 2mark).

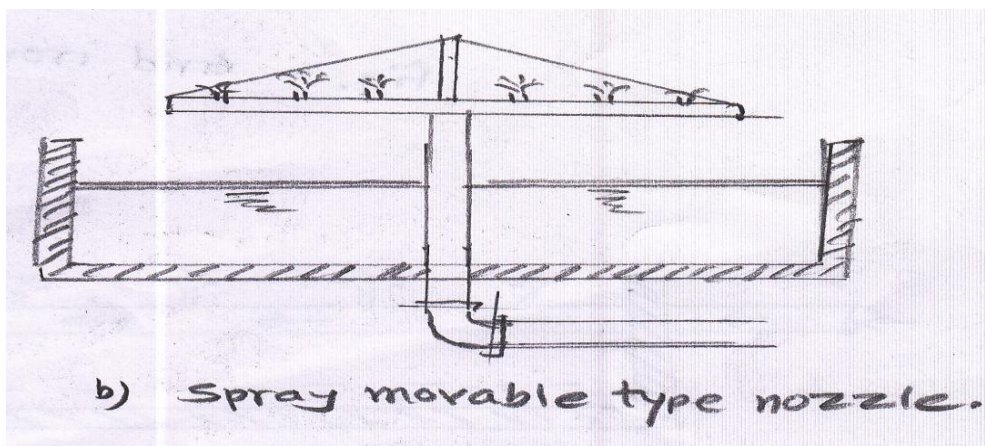
c) State method of aeration .Explain any one method with sketch.

**Ans.: Aeration:-**Under the process of aeration water is brought in intimate contact with air so has to absolute oxygen and to remove carbon dioxide gas.

Methods of aeration:-

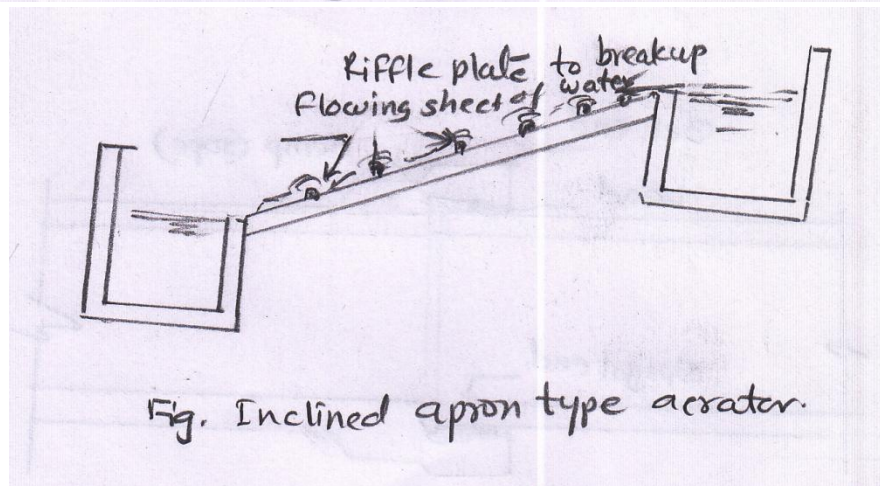
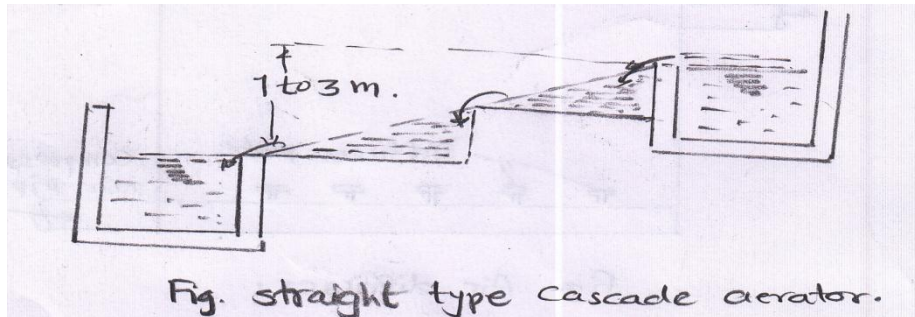
- i) By using spray nozzles.
- ii) By permitting water to trickle over cascades.
- iii) By air diffusion.
- iv) By using trickling beds.

**i) By using spray nozzles:-** In this method water is sprinkled in air through special nozzles Which breaks the water in to droplets, those permitting the escape of dissolved gases .Carbon dioxide gas is considerably removed up to 90 % .

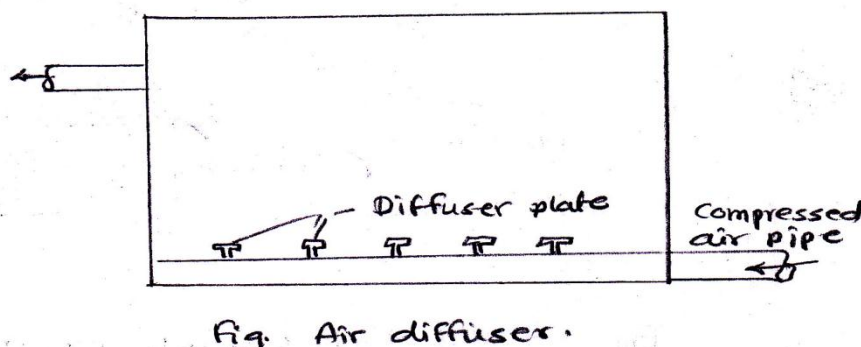


**ii) By permitting water to trickle over cascades :-**in this method the water is made to fall

through a certain height (1 to 3m) over a series of steps (three to ten) with a fall of about 0.15 to 0.3 m in each step. The structure so formed is known as free-fall aerator. The simplest type of a free-fall aerator known as a cascade aerator.



**iii) By air diffusion:-** In this method, compressed air is bubbled through the water so as to thoroughly mix it with water. Perforated pipes are, therefore, installed at the bottom of the settling tanks and the compressed air is bubbled up from the bottom of the tanks. During its upward movement through the water body, it gets thoroughly mixed up with the water contained in the tank, thereby completing the aeration process.



**iv) By using trickling beds:-** In this method water is allowed to trickle down the beds of cokes, supported over the perforated bottomed trays and arranged vertically in series. Generally three beds are used the depth of each being about 0.6 m with a clear distance of about 0.45 m in between. The water is applied from the top through perforated distribution pipes and allows trickling down up to the bottom bed. During this downward motion the water gets mixed up with air and aeration takes place.

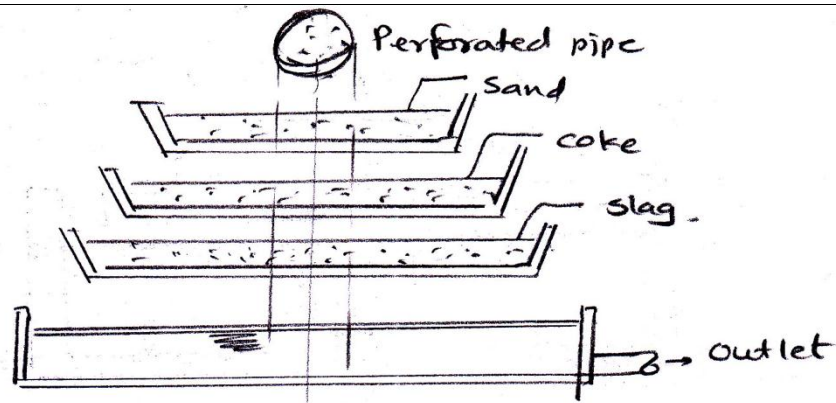


Fig. Trickling filter.

*\*Note:- (Methods of aeration 2 marks and any one method of it with explanation & sketch 2 mark)*

d) Explain principle of coagulation

**Ans.:** Principle of coagulation can be explained with the help of following two considerations

- i) **Floc formation:** - When coagulants are dissolved in water and thoroughly mixed with it, they produce a thick gelatinous precipitate. This precipitate known as the flock and this flock has got the property of arresting the suspended impurities in water during its downward travel towards the bottom of tank.
- ii) **Electric charges:** - The ions of floc are found to possess positive electric charge. Hence they will attract the negative charged colloidal particles of clay and thus they cause the removal of such particles from water.

02

02

Q1B) Attempt any one

06

a) State significance of ground water recharge; explain any one method of GWR.

**Ans:-a)** Significance of ground water recharge.

- 1) To increase ground water table for later use.
- 2) Area where ground water is a important component of the water supply and rain fall is less.
- 3) To avoid /minimise evaporation losses of water
- 4) To recharge underground water.

**Method of recharge :-**

**i) Recharge through a recharge pit** \_this method is suitable in areas having shallow ground water table and for smaller buildings with roof area of 100-500sqm. A pit of 1-2 m deep is excavated at a suitable location in the plot and the run off water from the catchment area is diverted into this recharge pit. The pit is filled with crushed gravel and coarses sand to filter out the rain water.

**ii) Recharge through a recharge well :-** This method is suitable in area having low ground water table. In this method a bore hole is dug or drilled up to or near the ground water level or up to the porous strata or rock fracture for effective recharge. The diameter of the bore hole may vary from 0.2 to 0.8m depending upon the porosity of the receiving strata. Slotted pipe are then installed into this bore hole to

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enable permeability in the ground water table .

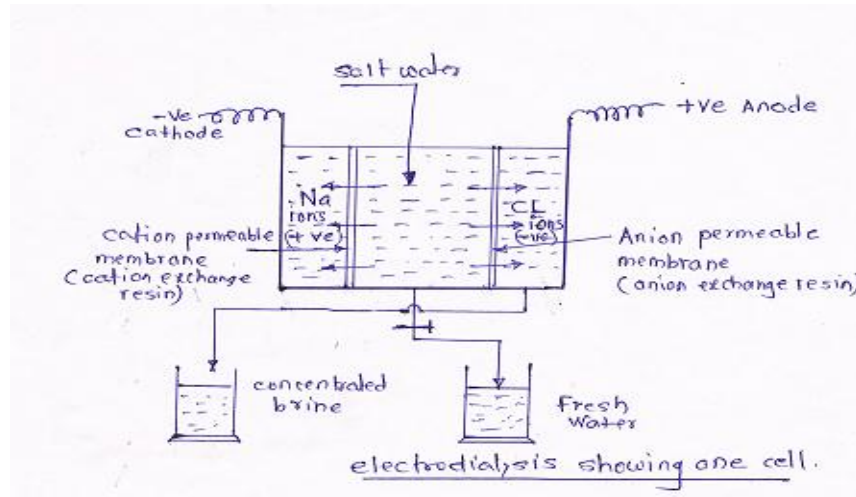
**iii) Recharge through a recharge well with pressure filter:-** This Method is suitable for areas with low ground water tables .In this method rain water is first collected into an underground tank ,from where it is lifted up by a pump and pressured down into the recharge well. The shaft or well is drilled up to the ground water level or just above the normal tube well with gravel level and may be made by lowering GI tube well type pipe into a bore hole of 0.15 to 0.3 dia .top be lowered in the bore must be slotted in the lower part of the well to enable permeability in the ground water table .The slots in the upper length may also be located to coincide with favourable permeable strata.

**\*Note:-**(Any 2 significance of ground water 02 marks and any one method of it with explanation 04 marks)

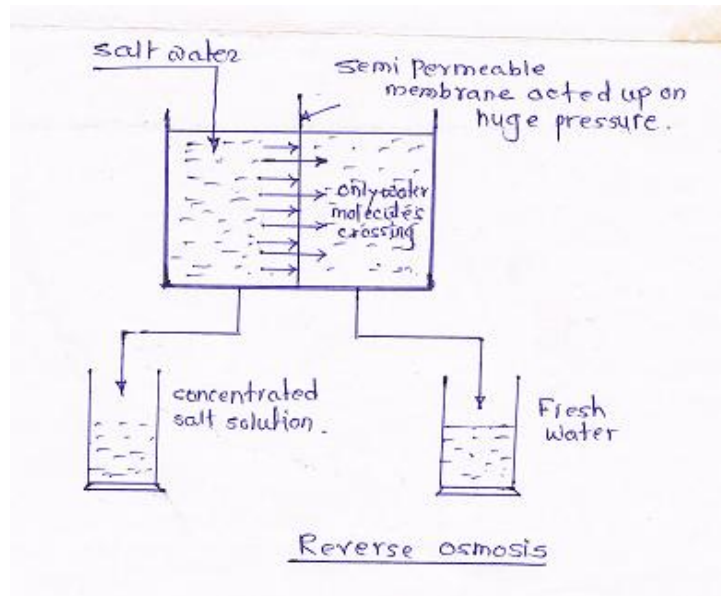
b) State different advance water treatment methods. Explain any two methods with sketch.

Ans:- Advance water treatment methods

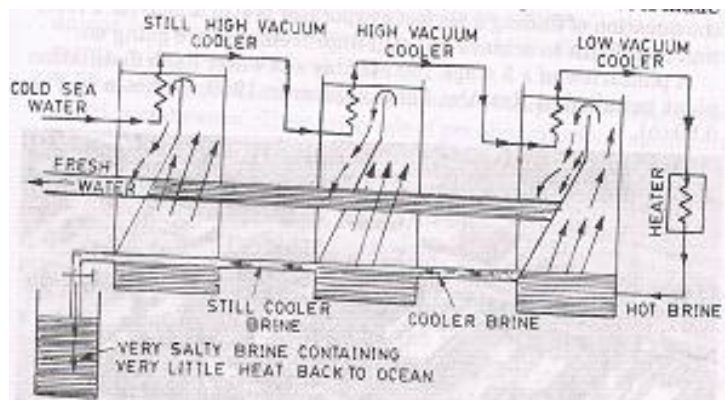
- 1) Electrolysis.
- 2) Reverse osmosis
- 3) Desalination by evaporation and distillation
- 4) **Electrolysis:** - Electrolysis means transport of ions from a salt solution through ions exchange membranes as a result of an applied electric field .  
The cations and anions migrate towards the cathode and anode through cations and anion exchange membranes respectively leaving the deplete in salt while the neighbouring /Compartment become concentrated .



- 5) **Reverse osmosis:** Pressure applied to salt water is greater than the osmotic pressure, then water from salt water diffuses from solution through the membranes to fresh water side .this is reverse osmosis.  
- Generally there are two types of membranes namely cellulose acetate and aromatic polyamide.  
- Membranes are assembled in modular unit that impact a large membranes 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 removed of hardness ,reducing the potential of calcium carbonate and calcium sulphate precipitate.



- 6) **Desalination by evaporation and distillation:-** This method plays an important role to turn salt water into fresh water by distillation. The water obtained by this process is the purest form.



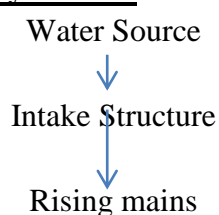
**\*Note:-** (List methods of adv. Water treatment 2 mark and explanation of any two method with sketch 4 mark)

Q.2 Attempt **any four**

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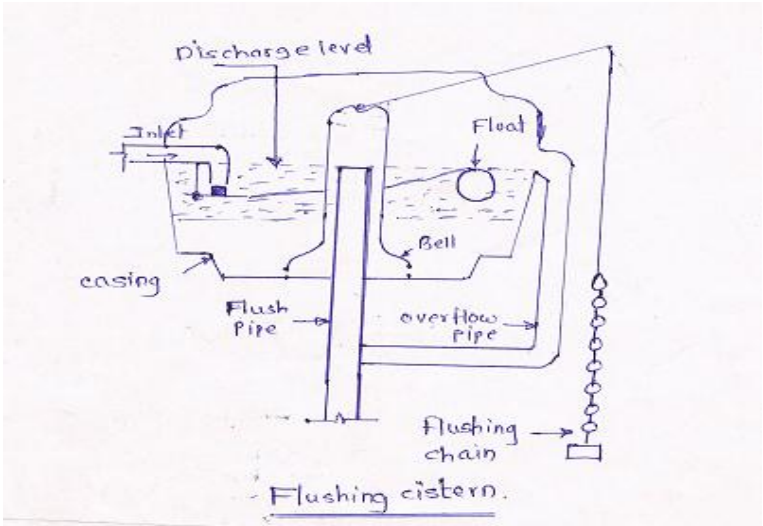
a) Draw flow diagram of water supply scheme for source to consumer. Mention one function of each unit.

Ans:- **Flow Diagram Of water Supply Scheme**



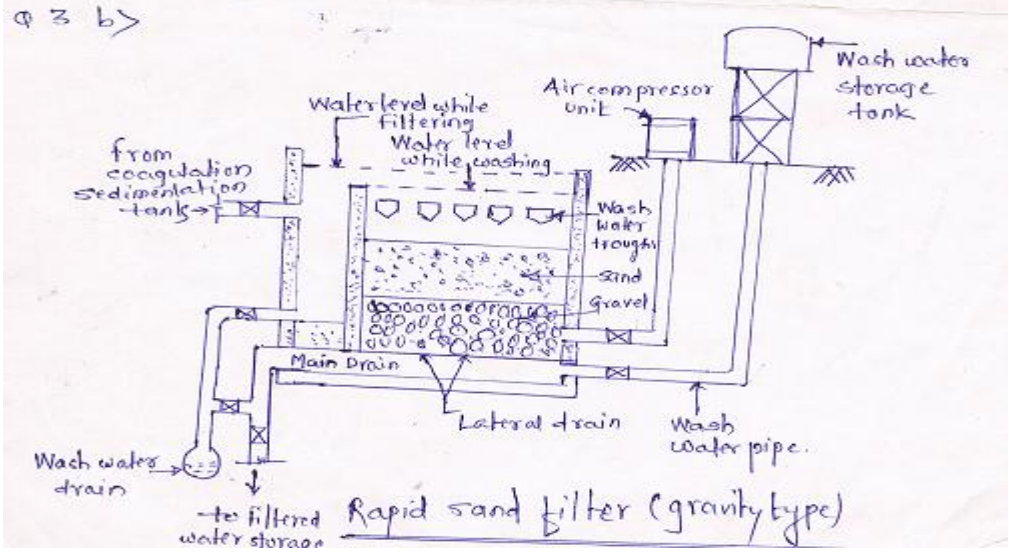
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<p style="text-align: center;">             Pump house &amp; sump well              ↓              WTP              ↓              ESR /GSR              ↓              Distribution system              ↓              User           </p>	
<p> <b>1) Water Source :-</b>To provide water to water supply scheme  <b>2) Intake Structures:-</b>To permit the withdrawal of water from the source.  <b>3) Rising mains:-</b>To carry water from intake structure to sump well.  <b>4) Pump house :-</b>To lift water from sump well to deliver to WTP  <b>5) Sump well:-</b>To store water.  <b>6) WTP :-</b>To purify impure water  <b>7) GSR/ESR :-</b>To store the pure water at ground level in case of GSR and to crate pressure head over water supply pipe line in case of ESR  <b>8) Distribution system:-</b>To distribute water to consumer / public.  <i>*Note:- (Flow diagram 2 marks and function of any two units 2 mark)</i> </p>	
<p>b) What is jar test? State its significance.</p>	
<p>             Ans.: To determine optimum chemical dose controlled test performed in the laboratory commonly called as jar test.  <b>Significance</b> to determine optimum dose of coagulants and thus to achieve economic in its use .           </p>	<p>02</p> <p>02</p>
<p>c) Explain procedure of defluoridation technique.</p>	
<p>             Ans Defluoridation technique.              1) Absorption by activated alumina Or Prasanti Technology              2) Iron Exchange Adsorption Method              3) Nalgonda technique              4) Reverse Osmosis Process              1) <b>Procedure of Absorption by activated alumina Or Prasanti Technology :-</b>The raw water containing high contents of floride is passed through the insoluble granular beds of substance like Activated alumina              2) <b>Procedure of Iron Exchange Adsorption Method;</b> In this transport of ions from a salt solution through ions exchange membranes as a result of an applied electric field .The cations and anions migrate to words the cathode and anode through cations and anion exchange membranes respectively leaving the deplete in salt while the neighbouring /Compartment become concentrated.-              3) <b>Procedure of Nalgonda technique:-</b>In this method raw water is added to rapid mixing unit ,in this unit lime and alum added to it and flocculation carried out for           </p>	<p>*</p>

<p>nine min. then it is transported to sedimentation tank in this tank bleaching powder is added to it then it is transported to filtration unit. After filtration then water is stored in ESR.</p> <p>4) <b>Procedure of Reverse Osmosis Process:-</b> Pressure applied to salt water is greater than the osmotic pressure, then water from source diffuses from solution through the membranes to fresh water side. This is reverse osmosis. Generally there are two types of membranes namely cellulose acetate and aromatic polyamide. 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>(*Note –List of technique 02 marks any one procedure 02 marks)</p>	
<p>d) State measures for prevention of pollution of bores and well waters.</p>	
<p>Ans:- Measures for prevention of pollution of bores and well waters.</p> <ol style="list-style-type: none"> <li>By Galvanizing the bore well materials</li> <li>By using stainless steel pipes</li> <li>By reducing the rate of pumping to reduce corrosion of bore materials</li> <li>By using acid resistant materials screens so that incrusting deposits can be removed</li> <li>By providing the mesh or screens which are placed against the water bearing.</li> </ol> <p>(*Note –any four points -4marks)</p>	<p>*</p>
<p>e) Explain working of flushing cistern with sketch.</p>	
<p>Ans:- <b>Working :-</b>The working of flushing cistern is simple. The flushing chain is pulled by hand by the lever action, the bell inside the cistern is lifted up. As a result of this action, the partial vacuum is created at the crown of bell which causes water to spill over the top of flush pipe. The siphonic action thus starts and the water of tank enters the bell through holes provided near its bottom portion. When the tank empties out, the float is lowered and the water from inlet starts to accumulate in the tank. One precaution is necessary before starting the siphonic action. The chain should be released immediately after being pulled to force the water out of flush pipe, if this precaution is not taken, the partial vacuum developed by pulling of chain may be destroyed by the entry of air from the flush pipe.</p> 	<p>02</p> <p>02</p>



f) State Significance rain water harvesting. Explain any one method of it.	
<p>Ans: Following are significance rain water harvesting</p> <ul style="list-style-type: none"> <li>i) To increase ground water table for later use</li> <li>ii) To avoid evaporation losses of stored water</li> <li>iii) To recharge well and bore well</li> </ul> <p>Methods :- (i) Storage of surface rain water :-In this method water is collected from roof of buildings and it is collected through gutters or pipes then filtered through mechanical filter ,lastly stored in tank made from RCC or bricks.</p> <p>(ii) Recharging the underground aquifer :-</p> <p>In this method water is stored for its later use .It can be achieved through, canals, water traps, cut water, surface runoff drainage wells, trough dug wells etc. There are two types of structures for artificial recharge :- Shallow structures ,Deeper structures</p> <p><b>(*Note-any two significance 2 marks and explanation of any one method 2 marks )</b></p>	*
<b>Q.3 Attempt any four</b>	16
a) Explain E-coli test with Significance.	
<p>Ans:-E-coli is most commonly found coliform, and is further sub divided into biotype and serotype. E coli are a parasite living only in the human or animal intestines. Voided in faeces it remains visible in environment only for some day. E coli in drinking water, therefore it is taken as a evidence of recent pollution.</p> <p><b>Significance:-</b></p> <ol style="list-style-type: none"> <li>1) <b>The presence of</b> E-coli in ground water source indicates that ground water is contaminated by faecal material and unsafe for drinking without further treatment.</li> <li>2) <b>The presence of</b> E-coli in water leaving a treatment plant signifies that treatment has been in adequate.</li> <li>3) <b>The presence of</b> E-coli in any point in the treated water indicates that there is a potential health risk for consuming the water.</li> </ol> <p><b>(*Note - E-coli explanation -2 marks and any two significance-2 marks )</b></p>	*
b) Explain with neat sketch rapid sand filter.	
<p>Ans:-Rapid sand filter consist of five parts</p> <ul style="list-style-type: none"> <li>(i)Enclosure tank :- A watertight tank is constructed either of masonry or concrete The sides and floor are also coated with waterproof material .The depth of tank is about 2.5m to 3.5 m</li> <li>(ii)Under drainage system :-There are various forms of under drainage system of rapid sand filter and most of them are patented by manufacture</li> <li>(iii) Base material:- It is gravel placed on the top of under drainage system. The gravel to be used for base material should be clean and free from dust,silt,clay and vegetable matter</li> <li>(iv) Filter media of sand :-A layer of sand is placed above gravel The depth of sand layer varies from 600 mm to 900 mm</li> <li>(v) Appurtenances:-It consists of air compressors wash water troughs and rate control.</li> </ul>	*

 <p>Q 3 b)</p> <p>from coagulation sedimentation tank</p> <p>Water level while filtering</p> <p>Water level while washing</p> <p>Air compressor unit</p> <p>Wash water storage tank</p> <p>Wash water trough</p> <p>Sand</p> <p>Gravel</p> <p>Main Drain</p> <p>Lateral drain</p> <p>Wash water pipe</p> <p>Wash water drain</p> <p>to filtered water storage</p> <p><b>Rapid sand filter (gravity type)</b></p>	
<p>(*Note- explanation -2 marks and correct sketch -1 marks and correct labelling -1 mark)</p>	
<p>c) State principle of building sanitation.</p> <p>Ans: Following are some of the fundamental or rather ideal principles of sanitation which ,if observed ,result in better living Condition:</p> <ol style="list-style-type: none"> <li>1) Collection and conveyance</li> <li>2) Interior decoration</li> <li>3) Orientation of building</li> <li>4) Prevention of dampness</li> <li>5) Supply of water</li> <li>6) Treatment of waste</li> </ol> <p>(*Note – any four principle of building sanitation 4 marks)</p>	<p>*</p>
<p>D )Explain principle of recycle and reuse of domestic waste.</p>	
<p>Ans:- Principle of recycle and reuse of domestic waste to prevent pollution and to maintain healthy environment as well as to remove</p> <ol style="list-style-type: none"> <li>i) Inorganic matter</li> <li>ii) Toxic substance</li> <li>iii) To kill pathogenic organisms.</li> <li>iv) To reduce organic matter.</li> </ol>	<p>01</p> <p>01</p> <p>01</p> <p>01</p>
<p>e) State factors affecting sewer design.</p>	
<p>Ans:-Following are factors affecting sewer design</p> <ol style="list-style-type: none"> <li>i) Minimum and maximum velocity of sewer</li> <li>ii) Size of sewer</li> <li>iii) Time of concentration</li> <li>iv) Arrangement of sewer</li> <li>v) Quantity of swage</li> <li>vi) Section of sewer</li> <li>vii) Gradient of sewer</li> <li>viii) Type of ventilation system</li> </ol> <p>(*Note- any four points -4 marks )</p>	<p>*</p>

Q.4A) Attempt **any three**

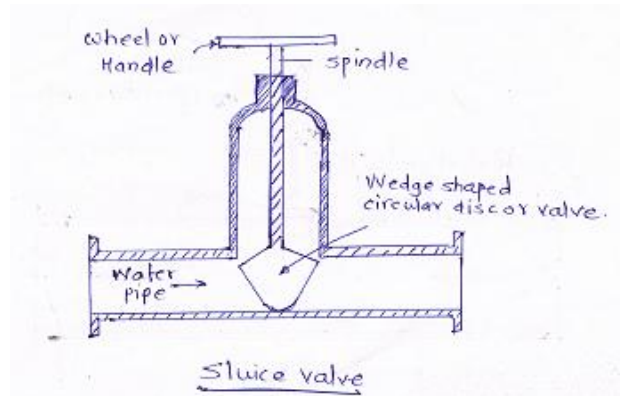
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a) State different types of valves in water Supply. Explain working of any one valve with sketch.

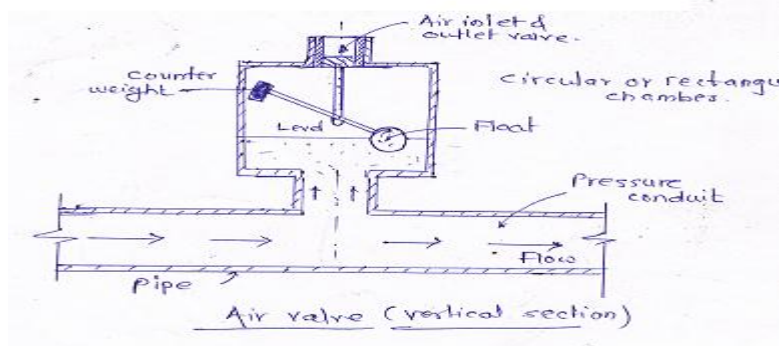
Ans: a) Gate valves or Sluice valves      b) Air valves

c) Blow Off valves or Drain valves or Scour valves.      d) Pressure –relief valves

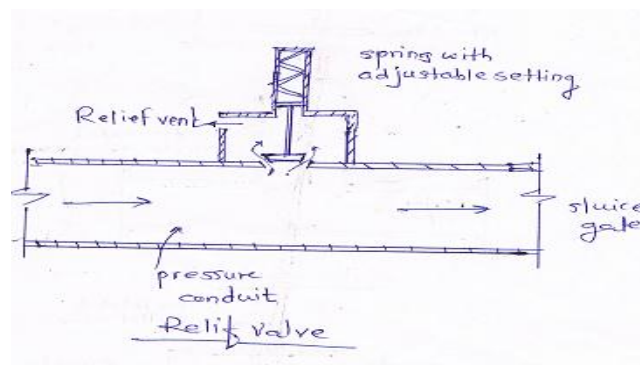
**Working of Gate valves or Sluice valves:-**By rotating the handle from top the raising or lowering of valve.



**Working of air valves :-**When water from water pipe enters the chamber it start accumulating just below the roof of chamber this accumulation of air makes the lever to work and to bring down the float. When air escapes ,the water raises again in the chamber and lever works to raise the float .It ultimately results in the closing of poppet valve.



**Pressure –relief valves**

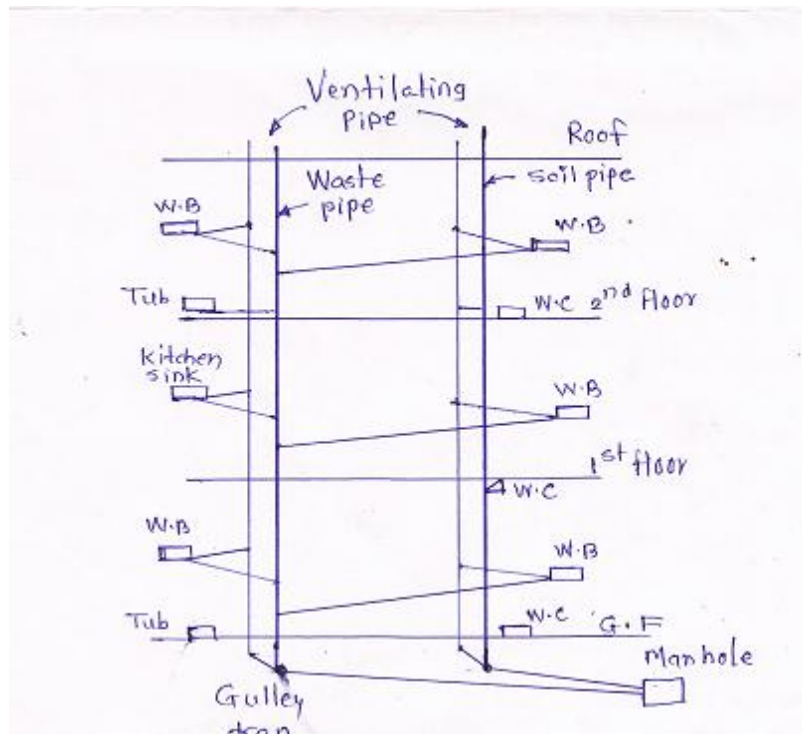


**\*Note ( Types of valve 2 marks working of any one valve 1 mark and its sketch 1 mark)**

b) Explain working of two pipe system of plumbing with sketch.

Ans:- **Working of two pipe system of plumbing :-**

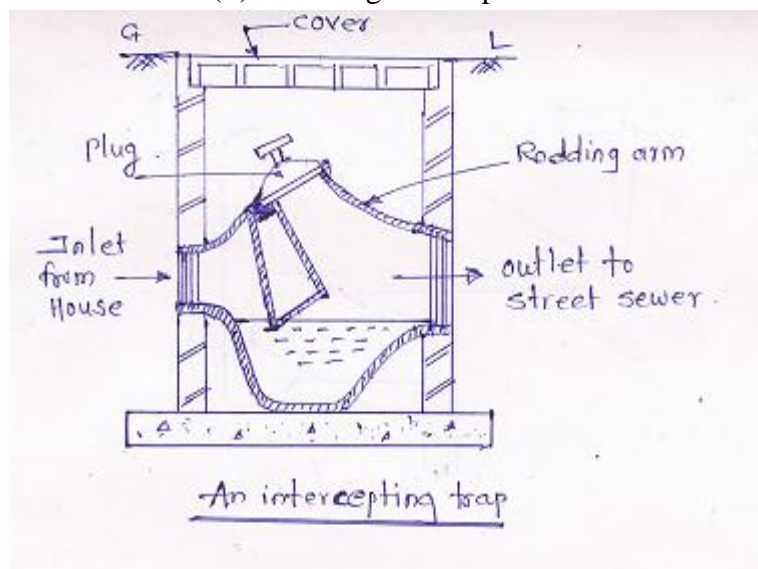
- i) Two pipes are laid .One pipe can be connected to the soil fixtures such as urinals and water closets. And another pipe is used to collect the waste matter from baths, kitchen etc. The soil pipe and waste pipe are provided with separate vent pipes. In this system four pipes are required hence it is costly.



(\*Note-explanation 2 marks sketch -1 marks and labelling -1 marks)

c) Explain necessity of intercepting trap with sketch.

Ans:- Necessity of intercepting trap :- (i) To prevent the entry of sewer gases from public sewer line into the house drains (ii) Cleaning and inspection as it consist of inspection arm.



(\*Note-any two necessity 2 marks sketch -1 marks and labelling -1 marks)

d) State norms for maintenance of domestic sanitary units.						
Ans:- Norms for maintenance of domestic sanitary units The house drainage system should be properly maintained and cleaned at regular intervals for its efficient workings .Following points should be carefully noted :- i) Entry of undesired elements ii) Flushing iii) Inspection iv) Quality of materials v) Use of disinfectants vi) workmanship (*Note-any four points -4 marks)						*
Q.4 b)Attempt any one						06
a) Determine population in 2011						
Year	1951	1961	1971	1981	1991	
Population	36,000	39,000	44,400	55,000	56,500	
Use decrease rate of growth method.						
Year	Population	Increase in population	% increase in Population	Decrease in the % increase		
1951	36,000	3000	$\frac{3000}{36000} * 100 = 8.33$	-5.52%		
1961	39,000	5400	$\frac{5400}{39000} * 100 = 13.85$	-10.02		
1971	44,400	10600	$\frac{10600}{44,400} * 100 = 23.87$	+21.14		
1981	55,000	1500	$\frac{1500}{55000} * 100 = 2.73$			
1991	56,500					
Total				+5.6		
Average Per decade				5.6/3=1.87		04
The expected population at the end of year 2001 = 56500 +[ $\frac{273-1.87}{100}$ ]*56500 =56500 + 485.9 =56985.9 =56986 (say) The expected population at the end of year 20011 = 56986 +[ $\frac{0.86-1.87}{100}$ ]*56986 =56986-575.56 =56410						01  

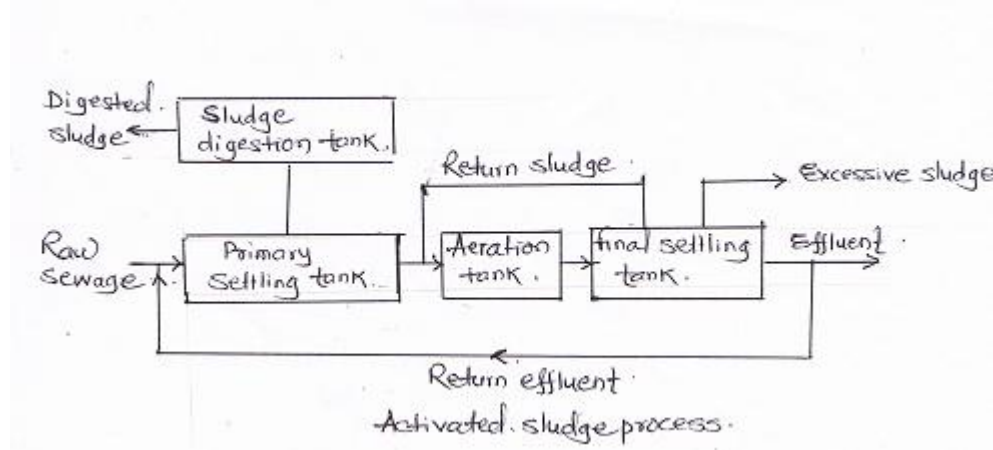


b) Define following terms. Sewage, Sullage, Garbage	
Ans:- <b>i) Sewage-</b> The liquid waste (foul in nature) collected from household is called sewage. <b>ii) Sullage</b> – The liquid waste (not foul in nature) collected from wash basin, baths and kitchen sink is called as sullage. <b>iii) Garbage-</b> The putrescible solid waste constituents produced during the preparation or storage of meat, fruit, and vegetables is known as garbage	02 02 02
<b>Q.5 Attempt any four</b>	<b>16</b>
a) State steps in laying of sewers. Explain any two steps .	
Ans:-steps in laying of sewers:- 1) Marking centre lines of sewers and locating the position of sewers appurtenances 2) Excavation of trenches. 3) Sheet piling, bracing and dewatering of trenches. 4) Laying of pipe sewers and their jointing 5) Testing of sewers lines. 6) Back filling of trenches. <b>1) Marking centre lines of sewers and locating the position of sewers appurtenances</b> The centre lines of sewers are marked on the streets and roads from the plans starting from the lowest point of the main proceeding upwards. The setting out of work is done by means of chain and theodolite or compass. <b>2) Excavation of trenches:-</b> After marking the layout of sewers lines on the ground the first step is the removal of pavement. After removal of pavement the excavation of trenches is started the excavation is done manually or by means of machinery <b>3) Sheet piling, bracing and dewatering of trenches:-</b> In case of soft soils the trench side required shoring and strutting to prevent their collapse till the sewers are laid and tested. When sewers lines are to be laid below the ground water table, the ground water enters the trench and causes much difficulties. Therefore the dewatering of trenches is compulsory. <b>4) Laying of pipe sewers and their jointing :-</b> The sewers pipes are not laid directly on the soil in the trenches. Before actual laying the concreting is done. The centre line of sewers and their grades are transferred from the ground dimension of sight rail and boning rod. Smaller size pipes can be laid by the pipe-layers by hand only but larger size pipes are lowered in the trenches by passing rope around them and supporting through a hook. Then jointing of sewers is done by usual method. <b>5) Testing of sewers lines.-</b> The testing of the sewers is done with the help of water test or air test by usual method. <b>6) Back filling of trenches:-</b> After testing and removing defects of pipe line the trenches are back-filled with earth generally the excavated soil of trench is used for back filling. Back filling is done step by step. <i>(*Note –any four steps -2 marks and explanation of any two steps -2 marks)</i>	*
b) What is BOD? Explain any one method of measurement of BOD.	
Ans:- BOD:- The Biological oxygen demand of a sewage is the quantity of oxygen required for the biochemical oxidation of the decomposable matter at specified temperature within	02



e) Explain working of activated sludge process with sketch.

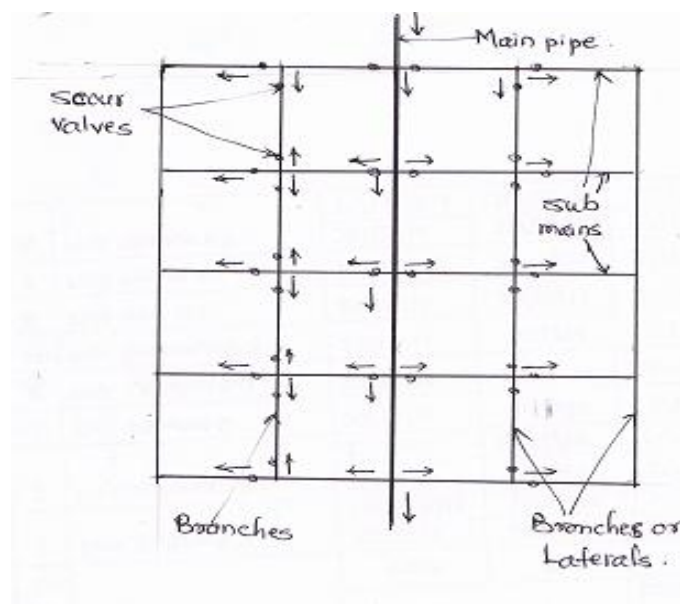
Ans:-1) The raw sewage is given the primary treatment in the primary settling tank.  
 2) After primary treatment, the raw sewage is mixed up with the required quantity of activated sludge which is called as Return sludge. And sent in the aeration tank.  
 3) In the aeration tank the mixed liquor is aerated and simultaneously agitated for 4-10 hours depending upon the degree of purification desired and the strength of the sewage.  
 4) The aerated liquor is sent in the final settling tank, where the sludge settles.  
 5) the effluent from the final settling tank which is clear is disposed off. A portion of the effluent is mixed in the raw sewage before sending it in the primary settling tank.  
 6) A part of settled sludge is sent back in the aeration tank for seeding the raw sewage and the excessive quantity is treated and disposed of in a suitable manner.



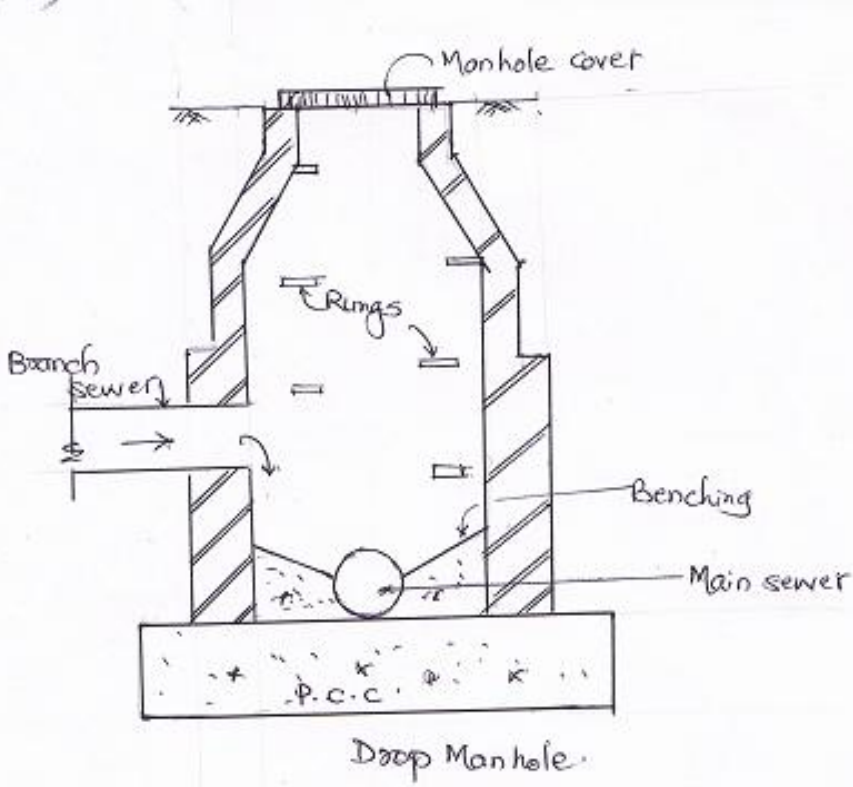
Q.6 Attempt any four

a) Draw labelled Sketch of grid-iron system.

Ans:-



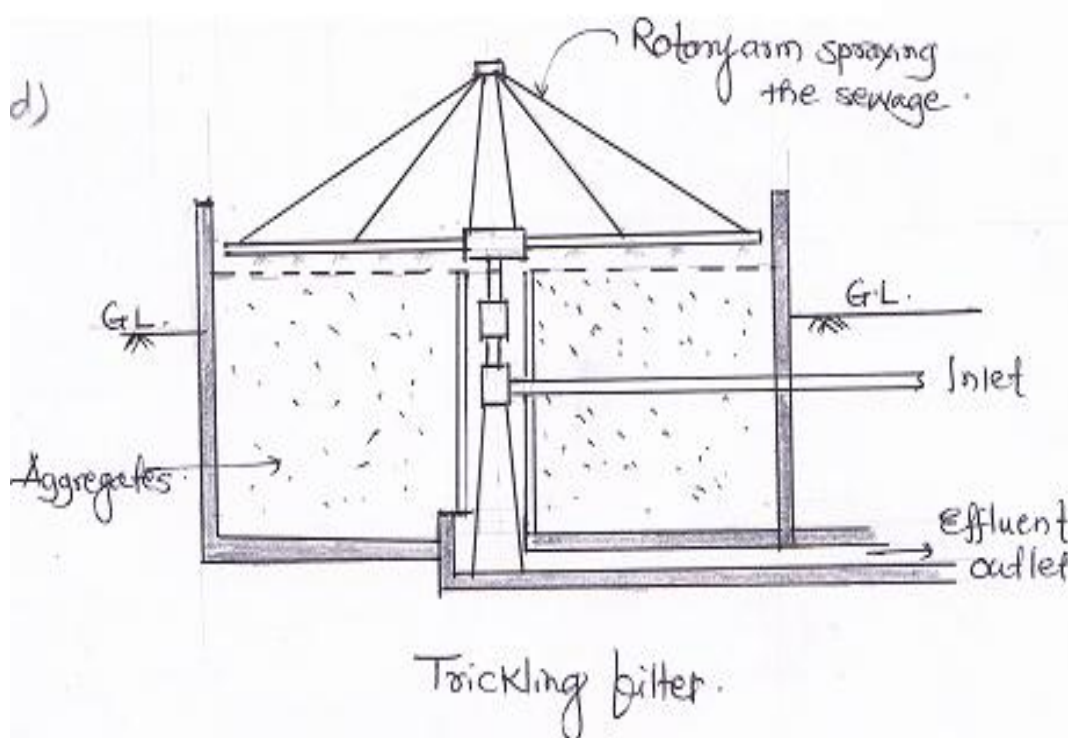
(\*Note-correct sketch 2 marks and correct labelling 2 marks)

b) State factors affecting selection of pipe materials. Mention types of pipes	
<p>Ans:-The selection of material for the pipe is done on the following point :-</p> <ol style="list-style-type: none"> <li>1) Carrying capacity of the pipe.</li> <li>2) Durability and life of the pipe.</li> <li>3) Type of water to be conveyed and its possible corrosive effect on the pipe material.</li> <li>4) Availability of funds .</li> <li>5) Maintenance cost, repair etc.</li> </ol> <p><b>Following types of pipe :-</b></p> <ol style="list-style-type: none"> <li>a) cast iron pipes . b) Wrought iron pipes.</li> <li>c) Steel pipe . d) Concrete and lead pipe .</li> <li>e) Cement lined cast iron pipe . f) Asbestos cement pipe .</li> <li>g) Copper and lead pipe . h) Wooden pipes.</li> <li>i) Vitrified clay pipes.</li> </ol> <p>(*Note –any four factors -2 marks and any four types of -2 marks )</p>	*
c) Explain drop man hole with sketch .	
<p>Ans: <b>Explanation of drop man hole:-</b> A vertical shaft is constructed outside the manhole chamber through which the sewage of branch sewer is allowed to enter the manhole. The difference in level between the branch sewer and main sewer is within 60cm and there is sufficient roof within the working chamber ,the connecting pipe may be directly brought through the manhole wall by providing a ramp in the benching .Such manhole which drop the level of invert of the incoming sewer ,by providing a vertical shaft ,are called drop manhole ,the main purpose being to avoid the splashing of sewage on the man working and on the masonry work.</p>  <p>(*Note explanation 2 marks and fig -1 marks and labelling 1 marks)</p>	

d) Explain with sketch trickling filters

Ans:

-It essentially consist of a masonry or R.C.C tank which is circular or rectangular in plan. Course aggregate impervious nature is filled in this tank which acts as filtering media. The under –drainage system is provided in the bed to collect the effluent. the under –drainage system provided in the trickling filters. Rack, but large gravel anthracite coal, blast furnace slag, broken bricks, clinker cinder ceramic and other such materials can also be used. Whatsoever type of media may be used, it must be weather –resistant and strong enough. Before filling the media, it must be washed with water and dried to remove the dirts and other impurities. The size of the media should be between 5 to 7.5 cm. The surface area decrease with the increase in size, but it offers less resistance to the flow of swage during sprinkling.

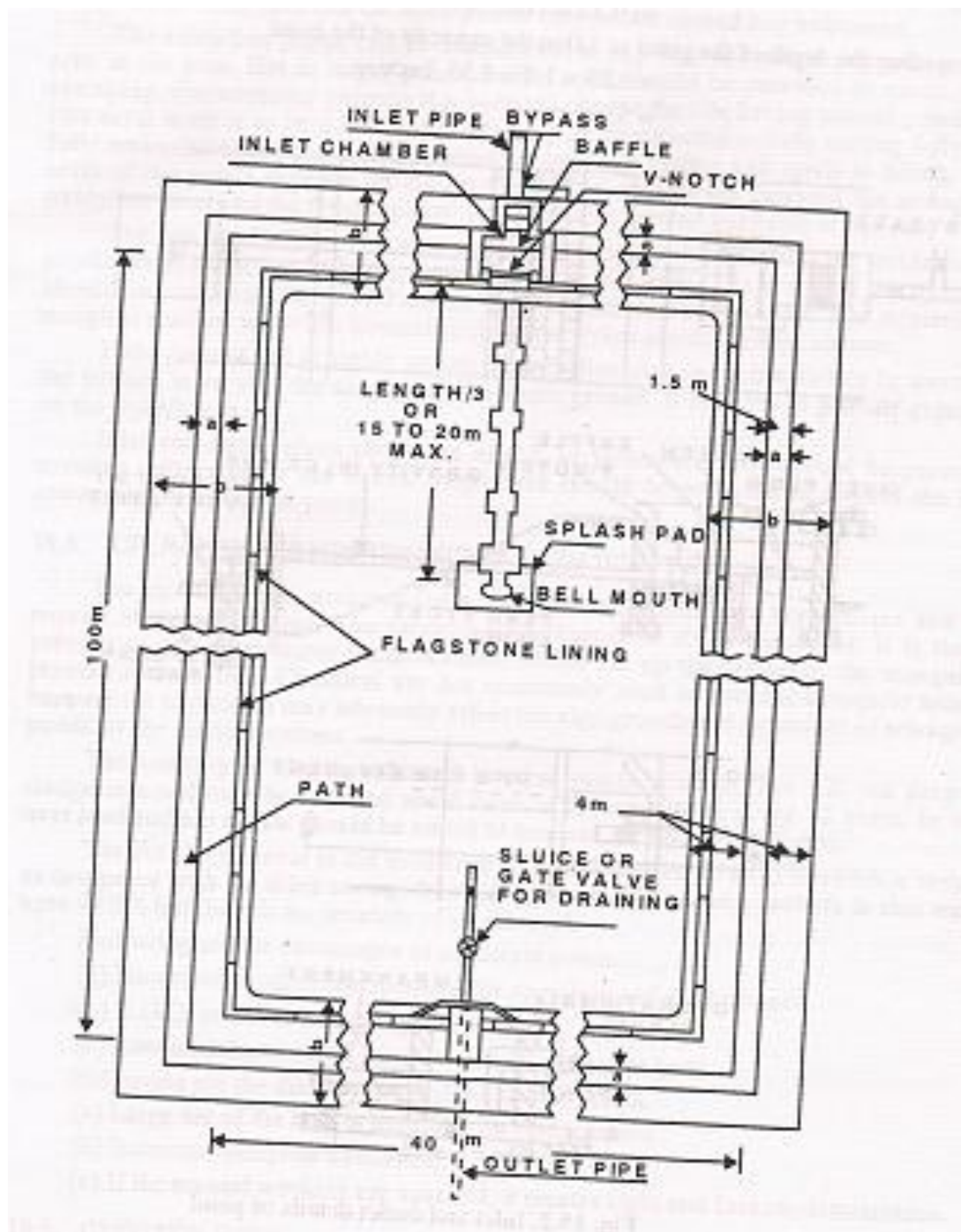


(\*Note explanation 2 marks and fig -1 marks and labelling 1 marks)

e) Explain working of oxidation ditch with sketch.

Ans:-The oxidation ditch are aeration units in the shape of long channel 150 to 1000m long, 1 to 5 m wide and 1 to 1.5 m deep. These aeration cylinders are rotated at about 75 r.p.m. Detention period of 12 to 15 hours is normally provided. The loading of sewage can be 0.8 to 2.5 cu.m/kg of B.O.D. After aeration the sewage is allowed to settle in the settling tanks. The activated sludge is returned back to the aeration units. For economy purpose sometimes the aeration units also act as the settling units. The rotors are stopped for 2 hours and the suspended solids settle in the bed, the effluent is taken out.





(\*Note explanation 2 marks and fig -1 marks and labelling 1 marks)