

**III B.Tech. I Semester Supplementary Examinations, April/May -2005**  
**ENVIRONMENTAL ENGINEERING-I**  
**(Civil Engineering)**

Time: 3 hours

Max Marks: 80

**Answer any FIVE Questions**  
**All Questions carry equal marks**

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1. (a) Explain briefly the main objectives of analysis of water used for domestic purposes.
- (b) The following are the results of the Physical and Chemical analysis of a sample of surface water considered as the only available source of supply. Calculate the hardness and alkalinity of water and mention the proposed treatment for this type of water.

Chemical Constituent	Concentration mg/lit	Chemical Constituent	Concentration mg/lit
Ca	30	Fe	0.4
Mg	40	Mn	0.3
Na	30	Turbidity	600
K	10	pH	8.5
$CO_3$	30	F	4.0
$HCO_3$	70	$NO_3$	0.1
$SO_4$	80	-	-

2. (a) What are the different kinds of pipes available for use in water supply systems? Discuss the merits of each.
- (b) Explain the circumstances when pumping is required in a water supply scheme.
- (c) What is the most accurate method of determining hardness of a water sample? Discuss its principle.
3. A Combined sewer of a circular section is to be laid to serve a particular area. Calculate the size of the sewer from the following data.  
 Area to be served=120 hectares.  
 Population=100000  
 Maximum permissible flow velocity=3m/sec  
 Time of entry for storm water=10 minutes  
 Time of flow channel=20 minutes.  
 Per capita water supply=250 litres/day/person  
 Coefficient of run off for the area=0.45  
 Hourly maximum rainfall for the area at the design frequency=5cm.  
 Assume any other data not given and if needed.
4. What are the principles adopted in providing an efficient and economical system of drainage in buildings.

5. (a) Design a set of four clari-flocculators to treat 30 mld of water with a depth of 3 m. Also check the values of surface and weir loadings. Comment on the values obtained.
- (b) Determine the quantity of alum required to treat 10 mld of water at a treatment plant. The dosage of alum is 10 mg/l. Also determine the amount of carbon dioxide released per litre of water.
6. (a) What are the advantages of multimedia filters? Explain.
- (b) What do you understand by loss of head and negative head in a rapid sand filter? What are their permissible values? What will happen if the negative head is excessive?
- (c) What is Mud ball formation? Explain.
7. Design a standard rate trickling filter plant and check for hydraulic loading rate
- |  |                               |
|--|-------------------------------|
| Population                                 | = 1,00,000                    |
| Amount of water of water supply            | = 150 lpcd                    |
| Amount of sewage                           | = 80 % of water supply        |
| Peak discharge                             | = 1.5 times average discharge |
| BOD of raw sewage                          | = 400mg/l                     |
| Amount of BOD removal in Primary Treatment | = 30 %                        |
| BOD loading rate                           | = 0.25 kg/ $m^3$ /day         |
| Number of units                            | = 2                           |
| Depth of filter                            | = 2m.                         |
8. (a) Explain different methods of effluent disposal of septic tanks.
- (b) Discuss the criteria for the design of a septic tank.

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1. (a) Differentiate between
  - i. Infiltration and percolation
  - ii. Pure water and safe water
  - iii. Gravity well and pressure well(b) What is meant by per capita demand of water? Explain.
2. (a) A distribution main is tapped at a point where R.L. is 30m and where pressure is 12m head. The service pipe is 60m long and supplies water to 12 occupants at an average rate of 135 LPCD. The hourly variation factor is given as 4. Calculate the size of the supply main if residual head at the top outlet having R.L of 33m is not to fall 1.5m. use the formula  $V = 835 m^{2/3} s^{1/2}$   
(b) How is the capacity of a distribution reservoir determined?
3. (a) Differentiate between
  - i. Sanitary Sewage and Storm Sewage
  - ii. Inlet time and Channel flow time(b) Discuss the use of Rational formula for the design of drains.
4. (a) What is a storm water drain? What are the requirements of a storm water drain?  
(b) Explain the different types of drains that are commonly used with neat figures.
5. (a) Explain the following:
  - i. Plain chlorination
  - ii. Pre chlorination
  - iii. de chlorination
  - iv. Super chlorination(b) Explain the mechanism of filtration.
6. (a) How sand required in rapid sand filter is specified?  
(b) Compare slow and rapid gravity filter.
7. Design a screen chamber for the data given below  
Maximum flow-  $0.45 m^3/s$   
Average flow-  $0.23 m^3/s$   
Minimum flow-  $0.084 m^3/s$

Also draw the plan and section of a swing chamber.

8. Design an oxidation pond for the following data  
Location - - - - -  $27^{\circ}$  Latitude  
Elevation - - - - - 200 m above MSL.  
Mean monthly temperature - - - - -  $25^{\circ}$  C max and  $10^{\circ}$  C min.  
Population to be served - - - - - 12000.  
Sewage flow - - - - - 150 lpcd.  
Desired effluent  $BOD_5$  - - - - - 30mg/l.  
Pond removal constant at 20 C —0.1/d.  
BOD5 for raw sewage- - - - - 300mg/l.  
Sky clearance factor- - - - - 0.60.  
Per capita BOD contribution per day - - - - - 0.045kg/day.

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1. Explain the various methods of forecasting population.
2. Write short notes on the following .
  - (a) Spigot and Socket Joint
  - (b) Water meter
  - (c) Fire- Hydrant
  - (d) Air valve
3. (a) The Area of a city is 250 hectares .The surfaces on which the rainfalls are classified as follows.

Type of Surface	% Area	Run off Coefficient
Roofs	30	0.90
Pavement and Yards	20	0.80
Lawns and Gardens	20	0.10
Macadam Roads	20	0.10

Calculate the impervious factor C.If the intensity of rainfall is 50mm/hr,calculate the quantity of storm water which will reach sewer lines.

- (b) If for the above problem the density of population is 400 persons per hectare and rate of water supply is 240 liters/capita/day. Calculate the quantity of sanitary sewage for
  - i. separate system and
  - ii. for partially separate system.
4. What are the principles adopted in providing an efficient and economical system of drainage in buildings.
5. (a) What are the design considerations for sedimentation tanks?  
 (b) Explain with a neat sketch the jar test for the determination of optimum dosage of coagulant for treating water.
6. (a) Explain with neat sketch the details of perforated pipe under drains.  
 (b) A filter unit of size 4mx8m. After filtering 8500  $m^3$  in 24 hour period, the filter is back- washed at the rate of 10  $l/m^2/sec$  for 10 minutes. Compute the average filtration rate, quantity and percentage of treated water used in washing and the ate of wash water flow in each trough.  
 The unit has 4 troughs.

7. Design an aerated grit chamber for the treatment of municipal waste water. The average flow rate is 0.5cu.m/sec. Peaking factor 2.75.
- |                        |  |
|------------------------|--|
| Average detention time | = 3 minutes                              |
| Width                  | = 3m                                     |
| Depth-width ratio      | = 1.2                                    |
| Air supply requirement | = 0.04 cu.m/minute per metre length.     |
| Quantity grit          | = $50 \times 10^{-3}$ cu.m/ $10^3$ cu.m. |
8. (a) Design a septic tank for the following data.
- |                     |             |
|---------------------|-------------|
| No of persons       | :120        |
| Sewage /capita /day | :130litres. |
| Desludging period   | :1 year     |
- (b) Discuss the advantages and disadvantages of a septic tank.

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2. (a) What are the different types of joints used in pipe for conveyance of water for public water supply schemes.
- (b) Explain, in brief, equivalent pipe method for the analysis of pipe network system of a water supply scheme.
3. (a) Differentiate between
  - i. Sanitary Sewage and Storm Sewage
  - ii. Inlet time and Channel flow time
- (b) Discuss the use of Rational formula for the design of drains.
4. (a) Explain the difference between the dilution process if the waste water effluents are disposed of in a lake or in a sea. .
- (b) Explain clearly the methods, problems and limitation of land disposal of sewa.
5. (a) What are the factors to be considered for location of a water treatment plant?
- (b) Sketch and explain different types of inlet and outlet arrangements for sedimentation tanks.
6. (a) Explain any two methods of disinfection with their merits and demerits.
- (b) Describe a suitable method for applying chlorine to a rural water supply system.

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