

**III B.Tech I Semester Regular Examinations, November 2006**  
**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) What are intakes? How are they classified? What are the factors which govern the selection of a site for an intake. [8+8]  
(b) Write a detailed note on quality of water.
2. (a) What factors are to be considered while designing a pumping main. [8+8]  
(b) Explain the various hydraulic tests conducted for water pipe lines.
3. Explain how B.O.D and C.O.D can be determined in the laboratory. [16]
4. Distinguish between [8+8]  
(a) Lampholes and manholes  
(b) One pipe and two pipe systems of plumbing.
5. (a) Sketch and explain dry feeders of coagulants in water treatment process. [8+8]  
(b) A municipal water treatment plant of design capacity 200 million litres per day uses bleaching powder as a disinfectant which contains 23% available chlorine. The chlorine dosage determined from chlorine demand test to ensure 0.2 mg/l is 1.5 mg/l. Calculate the monthly requirement of bleaching powder in tonnes.
6. (a) Explain the use of the following in the rapid sand filtration: [8+8]  
i. Flow rate controller  
ii. Air compressor  
iii. Wash water trough  
(b) How is the dosage of chlorine determined in the laboratory?
7. Design a grit chamber for a city of 2.8 lakhs population with a combined sewerage system. Water supply rate is 140 l/d on an average basis. Grit concentration is 50 mg/l. Grit of 0.2 mm size and above with specific gravity of 2.60 is to be removed. Temperature is 20°C. [16]
8. Design an oxidation pond for the following data [8+8]  
Location - - - - - 27° Latitude  
Elevation - - - - - 200 m above MSL.  
Mean monthly temperature - - - - - 25° C max and 10° 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. (a) The population of a town as obtained from the census report is as follows. [8+8]

Year	1901	1911	1921	1931	1941	1951	1961
Population	24831	25293	25423	27263	38284	49909	67105

Estimate the population of the town as in 1981, 1991 and 2000 and 2001 by Geometrical Increase Method

- (b) For the above data, find out the population of the town in 1981, 1991 and 2000 and 2001 by Arithmetical Increase Method
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? [8+8]
3. Why is the knowledge of storm sewage necessary? How is storm sewage Computed? Describe the factors affecting the quantity of storm sewage. [16]
4. Mention the various sewer appurtenances used in a sewerage system and state the location and utility of each of them. [16]
5. (a) Draw suitable treatment flow sheets for different sources of water and briefly explain the situations to adopt the same. [8+8]
- (b) Mention the various units in conventional water treatment plants and explain in two sentences the treatment achieved in each unit.
6. (a) Compare the design and working features of the slow sand filter and rapid sand gravity filter. [8+8]
- (b) Design the rapid sand gravity filters for a flow of 20 million liters/day. Give the plan and section of the filter.
7. (a) What are the operational problems and their remedies in trickling filters. [8+8]
- (b) What are the different methods of disposal of screenings?
8. Design an oxidation pond for the population of 12000 and sewage flow rate of 140l/h/d. BOD of sewage is 300 mg/l and effluent BOD required is not greater than 50 mg/l. Temperature is 24° C.  $K_{20}$  is  $0.25d^{-1}$  [16]

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1. (a) Compare Surface and Ground waters as source of water supply from the considerations of quantity and quality. [8+8]
- (b) Following are census figures of population of a city. Estimate the population as on 2001 by using incremental increase method and geometric method.

Year	Population
1951	20,000
1961	45,000
1971	80,000
1981	1,20,000

2. (a) What are the different types of joints used in pipe for conveyance of water for public water supply schemes. [6]
- (b) Explain, in brief, equivalent pipe method for the analysis of pipe network system of a water supply scheme. [10]
3. (a) How is the capacity of a sewer calculated for its design. What is the design period adopted for different components of a Sewerage Scheme [8+8]
- (b) What are the causes of variation in the flow of sewage. What are their effects on the design of sewers?
4. What are the principles adopted in providing an efficient and economical system of drainage in buildings. [16]
5. (a) Show that the efficiency of a sedimentation tank is independent of depth of tank.
- (b) 10 mg of copperas is consumed with lime at a coagulation basin per litre of water. Determine the quantity of copperas and the quick lime required to treat 10 million litres of water per day for one year. Molecular weight of copperas is 278 and of quick lime is 56. [8+8]
6. (a) Explain the use of the following in the rapid sand filtration: [8+8]
  - i. Flow rate controller
  - ii. Air compressor
  - iii. Wash water trough
- (b) How is the dosage of chlorine determined in the laboratory?

7. Draw a neat layout of various units employed in wastewater treatment plant and briefly explain the function of each unit. [16]
8. (a) Explain the components of a septic tank with a neat sketch. [8+8]  
(b) What are the design criteria for design of septic tank?

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- (b) How is the capacity of a distribution reservoir determined? [8+8]
3. (a) Explain what is separate and combined system of sewerage. [8+8]
- (b) Discuss the relative merits of the separate and combined systems of sewerage and give the conditions favorable for the adoption of each one of them.
4. What are the principles adopted in providing an efficient and economical system of drainage in buildings. [16]
5. (a) Explain briefly the sedimentation process in a water treatment plant with the help of a neat sketch. [10]
- (b) What are the common types of sedimentation tanks? [6]
6. (a) Explain the advantages and disadvantages of multimedia filters. [6]
- (b) Design six slow sand filter beds from the following data and show the arrangements in bed. Population to be served: 50000, Quantity of water to be supplied: 200lpcd, Rate of filtration: 300 liters/ $m^2$ /hr, Length of each bed is twice the breadth. [10]
7. Calculate the effluent  $BOD_5$  of a two stage trickling filter with the following flows,  $BOD_5$  and dimensions, using [16]
- (a) NRC formula

(b) Velz formula

(c) Rankine's formula.

$Q=5500 \text{ m}^3/\text{day}$

$BOD_5 = 280 \text{ mg/l}$

Volume of primary filter=  $1200 \text{ m}^3$

Volume of secondary filter =  $900 \text{ m}^3$ .

Filter depth = 2m.

Recirculation for primary filter =1.5.

Recirculation for secondary filter =1.25.

8. (a) What do you understand by [8+8]
- i. Conventional digestion
  - ii. Multistage digestion.
  - iii. High rate digestion.
- (b) What are the various methods of obtaining uniform flow in sedimentation tanks?

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