

Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.TECH(CE)/SEM-5/CE-503/2011-12**

**2011**

**ENVIRONMENT ENGINEERING**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

**GROUP – A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

- i) The ratio of maximum daily demand to average daily demand is
- a) 1·8                                      b) 1·2
- c) 1·48                                      d) 2·7.
- ii) When a town is young and rapidly expanding, the method most suitable for forecasting population is
- a) arithmetic increase method
- b) geometric increase method
- c) incremental increase method
- d) none of these.



- iii) The design period for a water supply project is generally taken as
  - a) 10 years
  - b) 20-30 years
  - c) 50 years
  - d) 50-100 years.
- iv) The average domestic consumption per capita per day for an Indian as per IS:1172-1963 may be taken as
  - a) 135 L/c/d
  - b) 216 L/c/d
  - c) 250 L/c/d
  - d) 270 L/c/d.
- v) The natural outflow of subsurface water at the surface is termed as
  - a) Lake
  - b) Spring
  - c) Infiltration Gallery
  - d) Tubewell.
- vi) A perched aquifer is essentially found within
  - a) an unconfined aquifer
  - b) a confined aquifer
  - c) an aquiclude
  - d) none of these.
- vii) Modern turbidity meters, working on the principle of scattering of light are known as
  - a) spectrophotometer
  - b) tintometer
  - c) turbidity meter
  - d) nephelometer.
- viii) The true colour of water is measured on
  - a) platinum cobalt scale
  - b) silica scale
  - c) nickel scale
  - d) all of these.



- ix) A water having pH = 9, will have hydrogen ion concentration equal to
- a) 9 mol/L                                      b)  $10^{-9}$  mol/L
- c) 109 mol/L                                    d) none of these.
- x) EDTA solution is used by titrating to determine
- a) turbidity of water
- b) hardness of water
- c) dissolved oxygen in water
- d) residual chlorine in water.
- xi) The settling velocity of a particle in a sedimentation tank depends on
- a) depth of the tank
- b) surface area of the tank
- c) both (a) and (b)
- d) none of these.
- xii) Alum as a coagulant is found to be most effective when pH range of water is
- a) 2 to 4    b) 4 to 6
- c) 6 to 8    d) 8 to 10.
- xiii) Which of the following is not a waterborne disease ?
- a) Desentery                                        b) Cholera
- c) typhoid    d) malaria.



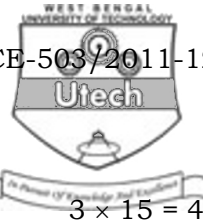
- xiv) As compared to rapid sand filters, slow sand filters give
- a) slower filtration
  - b) higher filtration rate
  - c) lesser efficiency in removal of bacteria
  - d) higher efficiency in removal of bacteria.

**GROUP – B**

**( Short Answer Type Questions )**

Answer any *three* of the following  $3 \times 5 = 15$

2. Given :  $\text{CO}_2 = 8.8 \text{ mg/L}$ ,  $\text{Alk} = 90 \text{ mg/L as CaCO}_3$ ,  
 $\text{Ca}^{++} = 110 \text{ mg/L}$ , Total Hardness =  $145 \text{ mg/L as CaCO}_3$ ,  
 $\text{SO}_4^{--} = 0.5 \text{ mg/L as CaCO}_3$ ,  $\text{NO}_3^- = 0.9 \text{ mg/L as CaCO}_3$ ,  
 $\text{Cl}^- = 0.5 \text{ mg/L as CaCO}_3$ . Prepare the Bar Diagram showing the distribution of the different species.
3. Explain how you can determine the storage capacity of a reservoir for a given inflow and a given demand. Alternatively, also explain how you can fix the demand from a reservoir for a given inflow and a given storage capacity.
4. What is per capita demand ? Explain the factors on which per capita demand depends. What is coincident draft in this context ?  $3 + 2$
5. Differentiate between rapid gravity filter and slow sand filter. What do you mean by break point chlorination ?  $3 + 2$
6. What is design period ? Which factors affect the per capita demand ?  $3 + 2$



**GROUP – C**

**( Long Answer Type Questions )**

Answer any *three* of the following.

$3 \times 15 = 45$

7. a) The following data have been noted from the census department :

Year	Population
1940	8,000
1950	12,000
1960	17,000
1960	22,500

Calculate the probable population in the year 1980, 1990 and 2000 by following methods :

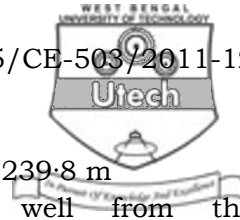
- i) Arithmetical Increase method
  - ii) Geometrical Increase method
  - iii) Incremental Increase method 10
- b) A tubewell penetrates a confined aquifer completely. Determine the diameter of the well from the following data :
- i) Required yield = 100 lits/sec
  - ii) Radius of circle of influence = 200 m
  - iii) Thickness of confined aquifer = 30 m
  - iv) Draw-down = 5 m
  - v) Coefficient of permeability = 60 m/day 5

8. Write short notes on any *three* of the following :  $3 \times 5$

- a) Fire demand
- b) Logistic curve method
- c) Water softening
- d) Total solids
- e) Infiltration gallery.



9. a) A rectangular sedimentation basin is to handle 10 million litres/day of raw water. A detention basin of width to length ratio of  $\frac{1}{3}$  is proposed to trap all particles larger than 0.04 mm in size. Assume a relative density of 2.65 for the particles and 20°C as the average temperature. Compute the basin dimensions. If the depth of tank is 3.5 m, calculate the detention time. 7
- b) The analysis of a hard water shows the following compositions :
- Free carbon dioxide = 6 mg/L  
Alkalinity = 50 mg/L  
Non-carbonate hardness = 70 mg/L  
Total magnesium = 17 mg/L
- Assume that it is possible to remove all but 25 mg/L of carbonate hardness with lime, and that the treated water is to have a total hardness of 70 mg/L. Determine the amount of hydrated lime and soda required for treatment per million litre of raw water. 8
10. a) In order to determine the field permeability of a free aquifer, pumping out test was performed and the following observations were made :
- Diameter of well : 20 cm  
Discharge from the well : 240 m<sup>3</sup>/hr  
R.L. of original water surface, before pumping started : 240.5 m  
R.L. of water in the well at constant pumping : 235.6 m



R.L. of the impervious layer : 210 m

R.L. of the water in observation well : 239.8 m

Radial distance of observation well from the tubewell : 50 m

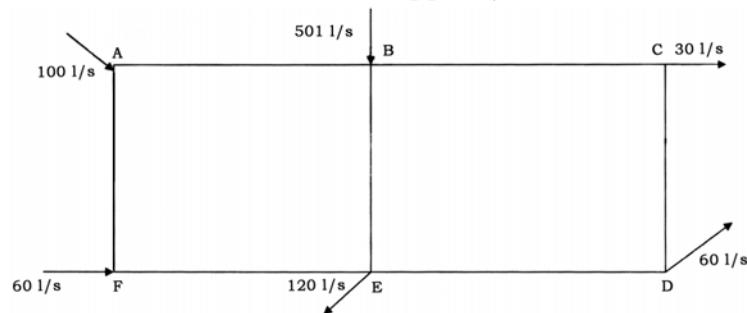
Calculate  $k$ . Also calculate (i) the error in  $k$  if observations are not taken in the observation well, and radius of influence is assumed to be 300 m, (ii) actual radius of influence based on the observations of the observation well. 5

- b) Find out the pH of a mixture formed by mixing of the following solutions :

Solution A : volume 300 ml having pH = 7

Solution B : volume 700 ml having pH = 5. 5

- c) Solve the following complex pipe network by Hardy-Cross Method applying Hazen. Williams formula. (At least two corrections to be applied) 5



Given :

Pipe	Length (m)	Diameter (cm)
AB	300	30
BC	400	40
CD	500	50
DE	200	20
EF	100	10
FA	150	15
BE	350	35



11. a) If a rectangular sedimentation tank is treating 2.5 MLD, the size of tank is  $17.5 \text{ m} \times 5.5 \text{ m} \times 3.5 \text{ m}$ . If 80 ppm suspended solids are present in the water, assuming the 75% removal in the basin and the average specific gravity as 2.0, determine the following :
- i) Average flow of water through tank
  - ii) Detention time
  - iii) Deposition of the solids in tank
  - iv) Overflow rate. 10
- b) Design the approximate dimension of a set of rapid gravity filters for treating water required for a population of 50,000; the rate of supply of 180 litres per day per person. The filters are rated to work 5000 litres per hour per sq.m. Assume whatever data are necessary and not given. 5

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