Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (CE)/SEM-5/CE-503/2010-11

2010-11
ENVIRONMENTAL 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) Which of the following is not a sub-surface source ?

a) Storage reservoir b) Springs

c) Tube wells d) Infiltration galleries.

ii) Water supply projects under normal circumstances are designed for a design period of

a) 25 years

b) 15 years

c) 30 years

d) 20 years

e) none of these.

iii) Discharge per unit drawn in case of an aquifer is known as

a) Specific capacity b) Specific yield

c) Field capacity d) none of these.

iv) Chances of Arsenic contamination is minimum among which of the following water sources

a) Tube wells b) River water

c) Infiltration galleries d) None of these.

v) The ratio of maximum daily demand to average daily demand is

a) 1·48

b) 1·8

c) 1·2

d) 2·7

e) 2·4.

vi) Per capita demand is

a) Total yearly water requirement (litres)/

365 × population

b) Total yearly water requirement (litres)/

population

c) Total yearly water requirement (litres)/

design population

d) Total yearly water requirement (litres)/

365 × design population.

e) None of these.

vii) Permanent hardness in water is caused by

a) Bicarbonates of Ca^{+2} and Mg^{+2}

b) Chlorides and sulphates of Ca^{+2} and Mg^{+2}

c) Nitrates of $Ca^{+2}$and Mg^{+2}

d) All of these.

viii) At break point chlorination the residual chlorine

a) is zero b) is minimum

c) is maximum d) reappears.

ix) The BOD-5 of a sample is y and COD of the sample is x. Then choose the most appropriate relation among the following.

a) $y = x$ b) $y > x$

c) $x > y$ d) None of these.

x) Alkalinity of a water sample is mainly due to

a) HCO_3^- b) H_2CO_3

c) SO_4^{2-} d) Cl^-.

xi) Ripple's curve is related to

a) determination of design population

b) determination of field capacity aquifer

c) determination of storage capacity of reservoir

d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. Calculate the "fire demand" for a city having population of 2,00,000 using at least three formulae.

3. Write a note on variations in rate of demand. Write the variations in maximum percentage for seasonal, monthly, daily, hourly. Find the percentage of daily consumption using R.O. Goodrich formula.

4. What objections could be there, if there is

   i) Turbidity

   ii) Chlorides

   iii) Hardness

   vi) Nitrates

   in water.

5. Write short notes on any *two* of the following : $2 \times 2\frac{1}{2}$

   i) pH values and its determination

   ii) Hardness of water

   iii) M.P.N.

   iv) E-coli

   v) Nitrogen and its compound.

6. State and discuss assumptions and limitation of Dupuit's theory.

7. A city is to treat 7000 m^3/day of water. Laboratory column analysis indicates that an overflow rate of 20 m/day will produce satisfactory removal at a depth of 3·5 m. Determine the size of the required sedimentation tank and the detention time in hours. (Assume length to width ratio of 3).

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

8. a) The maximum daily demand at a water purification plant has been estimated as 12 MLD. Design the dimensions of a suitable sedimentation tank for the raw supplies assuming a detention period of 6 hrs and the velocity of flow as 20 cm/min. 7

b) A rectangular sedimentation basin is to handle 10 MLD of raw water. A detention basin of width to length ratio of 1/3 is proposed to trap all particles large than 0·04 mm in size. Assuming a relative density of 2·65 for the particles and 20° C as the average temperature, compute the basin dimensions. If the depth of the tank is 3·5. Calculate the detention time. 8

9. a) Derive the expression for logistic curve method for forecasting population. Clearly define all the terms used in the derivation. 5

b) Calculate the prospective population at the end of 2001 by Incremental Increase method and by Decreasing rate of growth method. Comment on the two methods on the basis of the values obtained : 10

Year	1961	1971	1981	1991
Population	90,000	1,35,000	1,89,000	2,57,000

10. a) Find the radius of a deep tube well by Dupuit's method for a confined acquifer. 10

Given : Yield = 0·1 m^3/sec.

Radius of circle of influence = 200 m.

Co-efficient of permeability = 65 m/day.

Draw down = 6 m

Thickness of confined acquifer = 25 m.

b) Calculate the quantity in kg/day of filter alum required and quick lime required to coagulate 3 MLD of water containing a natural alkalinity of 15 mg/L as $CaCO_3$ if the optimum dosage of filter alum is 45 mg/L. 5

11. Calculate the storage required to supply the demand shown in the following table if the inflow of water to the reservoir is maintained at a uniform rate throughout 24 hrs :

Time	00-04	04-08	08-12	12-16	16-20	20-24
Demand in Million Liters	0·48	0·87	1·33	1·00	0·82	0·54

Solve the problem by Analytical method. 15

12. Write short notes on any *three* of the following : 3 × 5

a) Disinfection

b) Water softening

c) Hardness and pH

d) Impurities in water

e) Sedimentation with coagulation

f) Water borne diseases

g) Standards for potable water.

13. a) Briefly describe the process of coagulation. How does it improve the purification of drinking water ?

b) Sketch the flow diagram for a typical surface water treatment plant.

c) Prove that the area and overflow rates rather than the detention period govern the design of a settling tank.

5 + 5 + 5