

B.Tech 6th Semester Exam., 2018

ENVIRONMENTAL ENGINEERING—I

Time : 3 hours

Full Marks : 70

Instructions :

- (i) The marks are indicated in the right-hand margin.
 (ii) There are **NINE** questions in this paper.
 (iii) Attempt **FIVE** questions in all.
 (iv) Question No. 1 is compulsory.

1. Choose the correct answer of the following
 (any seven) : $2 \times 7 = 14$

(a) The population of a city in three consecutive decades are 2 lakh, 2.7 lakh and 3.6 lakh respectively. The population of this city in the fourth consecutive decade, according to geometric method, would be

- ~~(i)~~ 4.7 lakh
~~(ii)~~ 4.8 lakh
 (iii) 4.9 lakh
 (iv) 5.0 lakh

(b) The permissible limit of nitrate content in potable water is

- (i) 25 ppm
 (ii) 45 ppm
 (iii) 100 ppm
 (iv) 150 ppm

(c) The pipe mains carrying water from the source to the reservoir are designed for the

- (i) maximum daily draft
 (ii) average daily draft
 (iii) maximum hourly draft of the maximum day
 (iv) maximum weekly draft

(d) The valve which allows the flow only in one direction is

- (i) reflux valve
~~(ii)~~ sluice valve
 (iii) relief valve
 (iv) gate valve

(e) The amount of dissolve oxygen for potable waters should not exceed

- (i) 0-5 ppm
 (ii) 5-10 ppm
 (iii) 10-15 ppm
 (iv) 15-20 ppm

- (f) The treatments which are generally given to treat raw water supplies follow the sequence :
- (i) Screening, Sedimentation, Disinfection, Filtration, Softening
 - (ii) Screening, Sedimentation, Softening, Disinfection, Filtration
 - ~~(iii)~~ Screening, Sedimentation, Filtration, Softening, Disinfection
 - (iv) Screening, Sedimentation, Filtration, Disinfection, Softening

- (g) Stokes' law gives the equation for settling velocity (v_s) of small particles and viscous flow is

$$(i) \frac{4}{3} g(G-1) \frac{d^2 \rho}{24 \nu}$$

$$~~(ii)~~ \frac{g}{18} (G-1) \frac{d^2}{\nu}$$

(iii) Both (i) and (ii)

~~(iv)~~ None of the above

Where, d = diameter of the particle in m ;
 R_e = Reynolds number; g = acceleration due to gravity; G = specific gravity and
 ν = kinematic viscosity of water (liquid) in m^2/sec .

- (h) Air binding phenomenon in rapid sand filters may occur due to
- ~~(i)~~ excessive negative pressure
 - (ii) mud ball formation
 - (iii) higher turbidity in the effluent
 - (iv) None of the above
- (i) The percentage of chlorine in fresh bleaching powder is about
- (i) 50-60
 - ~~(ii)~~ 30-35
 - (iii) 20-25
 - (iv) 10-15
- (j) According to Indian Standards, the consumption of water per capita per day for nursing homes, boarding schools and hostels is
- (i) 45 liters
 - (ii) 85 liters
 - (iii) 115 liters
 - (iv) 135 liters

(a) What are the factors that affect per capita demand for water? Explain in detail. 6

(b) The population of a locality as obtained from census report is as follows :

Census year	1980	1990	2000	2010
Population	42000	49000	60000	72000

Examine the population of the locality in the year 2020 by using arithmetical and geometrical increase methods. 8

3. (a) What are intake towers? Differentiate between 'dry' and 'wet' intake towers. 7

(b) A 30 cm diameter well penetrates 25 m below the static water table. After 24 hours of pumping @ 5000 litres/minute, the water level in a test well at 90 m is lowered by 0.53 m, and in a well 30 m away the drawdown is 1.11 m.

(i) What is the transmissibility of the aquifer?

(ii) Also determine the drawdown in the main well. 7

4. (a) Explain the sedimentation process used in a water treatment plant. Draw a neat sketch of a sedimentation tank in which coagulant is used. 7

(b) Two million liters of water per day is passing through a sedimentation tank which is 6.0 m wide, 15.0 m long and having a water depth of 4.0 m.

(i) Find the detention time of the tank.

(ii) Find the average flow velocity through the tank.

(iii) If 75 ppm is the concentration of suspended solids present in turbid raw water, how much dry solids will be deposited per day in the tank, assuming 70% removal in the basin, the average specific gravity of the deposit as 2?

(iv) Compute the overflow rate. 7

5. (a) How does water quality criteria differ for industrial supplies from those for domestic municipal supplies? 7

(b) Design seven slow sand filter beds from the following data : 7

Population to be served
= 50000 persons

Per capita demand
= 150 liters/head/day

Rate of filtration
= 180 liters/hr./sq.m

Length of each bed
= Twice the breadth

6. ~~(a)~~ Illustrate with sketches the different types of layouts of pipe systems in distributing water and compare their comparative merits and demerits. 7
- (b) The observed cumulative drafts by a town are stated below; the drafts are at four-hour interval :

Time	4 am	8 am	Noon	4 pm	8 pm	Midnight
Cumulative draft millions liters	0.50	1.40	2.60	3.70	4.50	5.00

Determine the equalizing storage for the above draft, when the pumping is (i) 24 hours and (ii) between 10 am and 10 pm. 7

- (a) What is pollutant? Explain in brief about primary and secondary air pollutants. 7
- (b) Explain equivalent noise level (L_{eq}). How shall we calculate equivalent noise level (L_{eq})? Explain with example. 7

8. (a) 125 cumecs of sewage of a city is discharged in a perennial river which is fully saturated with oxygen and flows at a minimum rate of 1600 cumecs with a minimum velocity of 0.15 m/sec. If the 5-day BOD of the sewage is 300 mg/l, find out whether the critical DO will occur in the river. Assume—
- coefficient of purification of the river as 4.0;
 - coefficient of DO is 0.12;
 - ultimate BOD is 120% of the 5-day BOD of the mixture of sewage and river water. 8
- (b) Explain the different characteristics and quality of sewage. 6

9. Write short notes on any four of the following : $3\frac{1}{2} \times 4 = 14$

- Water-borne diseases
- Biochemical oxygen demand
- Metering in distributed systems
- Intensity of sound
- Air pollution control of gaseous pollutants
- Physical characteristics of water