

ENVIRONMENTAL ENGINEERING
(CIVL 3103)

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

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

Group - A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Septic action is produced by the septic tank by
(a) Fung (b) Virus (c) Termites (d) Anaerobic bacteria.
 - (ii) According to the Indian Standard recommendations, water requirement per capita per day in a residential building is:
(a) 50 litres (b) 115 litres
(c) 135 litres (d) 160 litres.
 - (iii) The flow velocity in a sewer does not depend on:
(a) its grade (b) its hydraulic mean depth
(c) its length (d) its roughness.
 - (iv) Which of the following sewage treatment methods has inherent problems of odour, ponding, and fly nuisance?
(a) UASB system (b) Activated sludge process
(c) Trickling filters (d) Stabilization ponds.
 - (v) Minimum D.O. prescribed for a river stream, to avoid fish kills, is:
(a) 2ppm (b) 4 ppm (c) 8 ppm (d) 10 ppm.
 - (vi) Which water treatment process is done after filtration of water?
(a) Primary sedimentation (b) Disinfection
(c) Secondary sedimentation (d) Flocculation.

- (vii) Crown corrosion in a reinforced concrete sewer is caused by:
(a) H₂S (b) CO₂ (c) CH₄ (d) NH₃.
- (viii) Biochemical Oxygen Demand(BOD) of sewage is the:
(a) Oxygen required to oxidise biologically active organic matter
(b) Oxygen required to oxidise biologically inactive organic matter
(c) (a) and (b) both
(d) none of these.
- (ix) The pathogens can be killed by:
(a) Nitrification (b) Chlorination
(c) Oxidation (d) All of the above.
- (x) The correct relationship between TOD, BOD & COD is given by:
(a) TOD>BOD>COD (b) TOD>COD>BOD
(c) BOD>COD>TOD (d) COD>BOD>TOD

Group - B

2. (a) Given the following data, calculate the population at the end of next three decades by decreasing rate method or incremental increase method.

Year	Population
1940	80000
1950	120000
1960	168000
1970	228580

- (b) Describe coincident draft.

9 + 3 = 12

3. Explain the following water demands:-
(i) Domestic water demand
(ii) Fire demand
(iii) Industrial water demand

(3 × 4) = 12

Group - C

4. (a) A rectangular sedimentation basin is to handle 10 million litres/day of raw water. A detention basin of width to length ratio of 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.

- (b) Define Hardness. Explain any two processes for the removal of permanent hardness.

8+4=12

5. (a) Two primary settling basins are 26m in diameter with 2.1m side water depth. Single effluent weirs are located on the peripheries of the tank. Calculate the (i) surface area and volume (ii) overflow rate in m^3/m^2 (iii) Detention time in hours.
- (b) Draw and describe the flowchart of water treatment process.

7+5=12

Group - D

6. (a) Explain in detail about the forces acting on a sewer pipe.
- (b) Classify the types of pipes based on material.

9 + 3 = 12

7. (a) 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=1,00,000

Maximum permissible flow velocity=3m/sec

Time of entry for storm water=10min

Time of flow in channel=20min

Per capita water supply=250lit/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, if needed.

- (b) Determine the size of a circular sewer for a discharge of 600litres/sec running half full. Assume $i=0001$ and $n=0.015$

8 + 4 = 12

Group - E

8. (a) Write short notes on Biochemical Oxygen Demand (BOD) and Chemical oxygen demand (COD), and establish a relation between them.

- (b) Write the disadvantages of a trickling filter and mention the remedies to overcome it.

7 + 5 = 12

9. (a) Determine the BOD_5 of the effluent from a single-stage, low-rate trickling filter that has a filter volume of 1443 m^3 , a hydraulic flow rate of $1900 \text{ m}^3/\text{d}$, and a recirculation factor of 2.78. The influent BOD_5 is 150mg/L .

- (b) Write a short note on screening process. Differentiate the various types of screens with their size and functions.

7+5=12

Department & Section	Submission Link
CE A	https://classroom.google.com/w/MjMxNDk3NzI5MzQ4/tc/Mjc0NjYyNjQ5ODMw
CE B	https://classroom.google.com/c/Mjc0NTY2MDU4OTE3/a/Mjc0NzE5OTkzNTkw/details