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) In a BOD test, 5 ml of waste water is added to 295 ml of aerated pure water. Initial dissolved oxygen (DO) of the diluted sample is 7.8 mg/l. After 5 days of incubation at 20OC the DO content of the sample id reduced to 4.4 mg/l. The BOD of the waste water is
(a) 196 mg/l (b) 200 mg/l
(c) 204 mg/l (d) 208 mg/l.

(ii) What is the ratio of maximum monthly demand to average monthly demand?
(a) 1.8 (b) 2.7 (c) 1.28 (d) 1.48.

(iii) With high altitude the pH level in human blood stream will?
(a) Increase (b) Decrease
(c) Remains unchanged (d) None of the above.

(iv) MPN index is a measure of which of the following:
(a) Coliform bacteria (b) BOD_5
(c) Dissolved oxygen content (d) Hardness.

(v) Temperature variations affect the
(a) biological activity of bacteria in sewage (b) viscosity of sewage
(c) solubility of gases in sewage (d) all of the above.

(vi) The size of the filtering media in a trickling filter varies between _____ and _____ when cubically broken stones & slag are used.
(a) 75 mm, 100 mm (b) 110 mm, 130 mm
(c) 25 mm, 75 mm (d) 45 mm, 65 mm.

(vii) At the same mean velocity, the ratio of head loss per unit length of a sewer pipe, flowing full; to that of the same pipe, flowing half-full would be:
(a) 2 (b) 1.63 (c) 1 (d) 0.61.

(viii) MPN index is a measure of which of the following:
(a) Coliform bacteria (b) BOD_5
(c) Dissolved oxygen content (d) Hardness.

(ix) Crown corrosion in a reinforced concrete sewer is caused by:
(a) H_2S (b) CO_2 (c) CH_4 (d) NH_3

(x) Minimum D.O prescribed for river stream, for aquatic organism:
(a) 2ppm (b) 4ppm (c) 8ppm (d) 10ppm.

Group – B

2. (a) Write short note on :
(i) Ring system
(ii) Methods of distribution. [(CO6) (Remember/LOCQ)]
(b) Draw and describe the advantage and disadvantage of Dead End System and Grid Iron System. [(CO6)(Understand/IOCQ)]

6 + 6 = 12

3. The average increase in the population of a town per decade over a period of 6 decades was 4100 and the average percentage increase was 12 % if the population at the end of 6th decade was 2,20,000. Estimate the population 2 decades later by (i) arithmetic mean (ii) geometric increase method. [(CO2)(Analyze/HOCQ)]

(6 + 6) = 12

Group – C

4. (a) What are the different forms of Nitrogen? Describe each and state the permissible limits of each? What is the disease caused by the consumption of excess amount of nitrate? [(CO1)(Understand/IOCQ)]
(b) Write short notes on:
(i) B-coli
(ii) Turbidity. [(CO1)(Remember/LOCQ)]

6 + 6 = 12

5. (a) Two primary settling basins are 25 m in diameter with 2.1 m 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. [(CO3)(Analyze/HOCQ)]
(b) Draw and describe the flowchart of water treatment process. [(CO3) (Understand/IOCQ)]

7 + 5 = 12

Group – D

6. (a) Explain in detail about the different types of forces acting on sewer material. [(CO6)(Remember/LOCQ)]

(b) What are different materials used in sewer pipes. Write down their merits and demerits. [(CO6)(Understand/IOCQ)]

6 + 6 = 12

7. Write short notes on: - **(4 × 3) = 12**
   (i) Sewer appurtenances
   (ii) Shapes of sewer pipes
   (iii) Flexural & temperature stresses acting on sewer pipes. [(CO5)(Remember/LOCQ)]

Group – E

8. (a) Average sewage flow from a city is 80 × 106 L/day. If average 5day BOD is 280 mg/L, compute total 5 day daily oxygen demand in kg and population equivalent of storage. [(CO4)(Evaluate/HOCQ)]
   (b) Write short notes on Biochemical Oxygen Demand (BOD) and Chemical oxygen demand (COD), and establish a relation between them. [(CO1)(Understand/IOCQ)]

4 + (6 + 2) = 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 m^3/d, and a recirculation factor of 2.78. The influent BOD_5 is 150mg/L. [(CO4)(Evaluate/HOCQ)]
   (b) Mention the operational troubles of a standard rate trickling filter and their remedies. [(CO4) (Evaluate/HOCQ)]

8 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	28.5%	35.7%	35.7%

Course Outcome (CO):

After the completion of the course students will be able to

1. Identify the nature and quality of water & waste water as per its characteristics like physical, chemical & biological.
2. Estimate the future water demand by using various population forecasting methods.
3. Define & design in detail about the various water treatment units.
4. Define & design in detail about the various waste water treatment units.
5. Estimate the quantity of sewage produced and design the sewerage system.
6. Analysis and design of water distribution networks.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question

Department & Section	Submission Link
CE & SEC A	https://classroom.google.com/c/MzQ2MjI2NjkyODYw/a/NDYzNjg4MjI5ODQz/details
CE & SEC B	https://classroom.google.com/c/NDU4Njc1Njc3NDEz/a/NDU4Njc1Njc3NDk4/details