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Question Paper Code: R4104

B.E./B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Fourth Semester

Civil Engineering

R21UCE404 – WASTEWATER ENGINEERING

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Define BOD CO 1- U
2. What is meant by Population Equivalent? CO 1- U
3. Differentiate between unit operation and unit processes in waste water treatment. Give two examples for each. CO 1- U
4. What are the differences in the functions of screen chamber and grit chamber in sewage treatment? CO 1- U
5. The moisture content of sludge is reduced from 98% to 96%, calculate the decrease in volume of sludge. CO2 -App
6. Calculate the Sludge density index (SDI) for the MLSS concentration in an aeration tank is 1850 mg/l and the sludge volume after 30 minutes settling in a 1000ml graduated cylinder is 164 ml. CO2 -App
7. List out the different stages in anaerobic process. CO1- U
8. What are the design considerations to be followed for Sequential batch reactor? CO1- U
9. Under what conditions effluent irrigation method can be favorably adopted? CO1- U
10. Mention the different zones of pollution in a river stream. CO1- U

PART – B (5 x 16= 80 Marks)

11. (a) Assume the surface on which rain falls in a district is given below. CO2 - App (16)
20% of the area in the city is roof with runoff coefficient 0.9, 20% of area is pavements for which runoff ration is 0.85, 5 % of area is paved yards of houses with run off coefficient 0.80, 15% of the area is macadam roads with runoff coefficient 0.40, 35% of the

area is lawns, gardens and vegetable fields for which runoff ratio is 0.1 and the remaining 5% of the area is wooded and runoff ratio is 0.05; Determine the coefficient of runoff for the area. If the total area of the district is 36 hectares and maximum rainfall intensity is 5cm/hr, What is the total runoff of the district?

Also, the density of population is 250 per hectare and rate of water supply is 225lpcd. Calculate the quantity of a) sewage for sewers of separate system b) storm water for sewers of partially separate system should be designed.

Or

- (b) Discuss various materials used in sewer construction. Explain the properties, advantages, and disadvantages of at least five different sewer materials. **CO2 - App** (16)

12. (a) A rectangular grit chamber is designed to remove particles a diameter of 0.2 mm, specific gravity 2.65. Settling velocity for these particles has been found to range from 0.016 to 0.022 m/sec, depending on their shape factor. A flow through velocity of 0.3 m/sec will be maintained by proportioning weir. Determine the channel dimensions for a maximum wastewater flow of 10,000 cu m/day. **CO2 - App** (16)

Or

- (b) The wastewater discharged from an industry contains floating suspended matters of size 50 mm to 0.5 mm suggest the possible methods to remove the same through suitable primary treatment methods. **CO2 - App** (16)

13. (a) Describe the process flow and major components of an Activated Sludge System. Explain the roles of aeration tanks, clarifiers, sludge return, and aeration equipment. **CO2 - App** (16)

Or

- (b) Determine the size of a high rate trickling filter for the following data **CO2 - App** (16)
- (i) Sewage flow = 4.5 Mld;
 - (ii) Recirculation ratio = 1.5;
 - (iii) BOD of raw sewage = 250 mg/l;
 - (iv) BOD removal in primary tank = 30%;
 - (v) Final effluent BOD desired = 30 mg/l.

14. (a) Discover how anaerobic digestion is related with treatment of sludge process. Write in detail about the anaerobic digestion reactor with neat sketch, advantages and disadvantages. Explain its function and operation. **CO1 - U** (16)
- Or
- (b) Compare and contrast the different wastewater treatment technologies: Sequencing Batch Reactor (SBR), Moving Bed Biofilm Reactor (MBBR), and Membrane Bioreactor (MBR). Discuss their advantages, limitations, and typical applications. **CO1 - U** (16)
15. (a) Discover how UASB is related with treatment of waste water. Write in detail about the UASB reactor with neat sketch, advantages and disadvantages. Explain its function and operation. **CO2 - App** (16)
- Or
- (b) A stream, saturated with DO, has a flow of $1.2 \text{ m}^3/\text{s}$, BOD of 4 mg/l and rate of constant of 0.3 per day. It receives an effluent discharge of $0.25 \text{ m}^3/\text{s}$ having BOD 20 mg/l , DO 5 mg/l and rate of constant 0.13 per day. The average velocity of flow of the stream is 0.18 m/s . Calculate the DO deficit at point 20 km and 40 km downstream. Assume that the temperature is 20°C throughout and BOD is measured at 5 days. Take saturation DO at 20°C as 9.17 mg/l . **CO2 - App** (16)

