TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2082 Chaitra

Exam.	Regular (New Course)		
Level	BE	Full Marks	60
Programme	BCE	Pass Marks	24
Year / Part	III / I	Time	3 hrs.

Subject: - Sanitary Engineering *(ENCE 305)*

- ✓ *Candidates are required to give their answers in their own words as far as practicable.*
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Explain the significance of sanitation within the WASH framework. [2]
2. Define wet weather and dry weather flow in sewer system. [2]
3. List the type of microorganism based on carbon source. [2]
4. Why storm water regulators are commonly used as sewer appurtenance? [2]
5. Interpret the higher and lower value of rate constant (K) in the BOD equation. [2]
6. What are the steps involved at removing pollutant in Sequencing Batch Reactor (SBR)? [2]
7. Interpret the meaning of 10% sludge with an example. [2]
8. A storm sewer drains a catchment with inlet time (overland flow time) = 8 minutes; length of sewer line = 600m; velocity in sewer = 1.0m/s. Calculate the total time of concentration to the outlet of the sewer. Interpret your answer. [4]
9. Explain bacterial metabolism processes highlighting the waste removal mechanism. [4]
10. A factory produces an average of 250MLD of wastewater per day, with BOD_5 (at 20°C) of 1500mg/L. Compute the BOD equivalent population given that the per capita BOD_5 (at 20°C) load is 80 g/capita/day. Also, Interpret your answer. [4]
11. Identify the operational problems of the activated sludge process and provide possible solutions for each. [4]
12. Describe the pollutant removal mechanism of an anaerobic baffled reactor. [4]
13. As an environmental engineer, how would you evaluate if an anaerobic sludge digestion process is functioning properly? [4]
14. Discuss in brief about the working mechanism of a septic tank with a neat sketch. [4]
15. Design a circular sewer for a separate system flowing 0.6 full at peak conditions to serve a population of 1,90,000 with a per capita water supply of 125 lpcd. The sewer is to be laid at a gradient of 1 in 500. Assume, 80% of water supply contributes for sewage. Adopt, peak factor of 2.5 and Manning's roughness coefficient of 0.013. Also check for the velocity ~~at peak flow to satisfy~~ the self-cleansing velocity ~~requirement of minimum 0.6 m/s.~~ at minimum flow. [6]
16. A city discharges 1500 L/s of sewage into a stream whose minimum flow is 600 L/s. The sewage BOD_5 is 240 mg/L and stream BOD_5 is 3 mg/L. The temperature of both waters is 20°C. The DO content of the stream is 90% of saturation and sewage has zero DO. If the minimum DO in the stream must be 4 mg/L, calculate the required degree of treatment. Use K_1= 0.1 day−1, K_2= 0.3 day−1, and saturation DO at 20°C = 9.17 mg/L. If required, the Streeter Phelps equation is provided below;

$[\frac{L_o}{f_s D_c}]^{f_s-1} \rightarrow [f_s(1-(f_s-1)\frac{D_o}{L_o})]$; f_s= R/K terms used in the equations have usual meaning. [6]

17. Design a "Standard Rate Trickling Filter" to treat 5 MLD of sewage with a BOD of 240 mg/L. The final effluent BOD should not exceed 35 mg/L. Assume organic loading rate = 0.25 Kg-BOD/m^3/day. Assume hydraulic loading rate = 2.5 $m^3/m^2/d$. [6]

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