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**Question Paper Code: U4104**

B.E./B.Tech. DEGREE EXAMINATION, APRIL 2024

Fourth Semester

Civil Engineering

21UCE404 WASTE WATER ENGINEERING

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer All Questions

PART A - (10 x 1 = 10 Marks)

1. The gas which is generally found present in sewers is: CO1- U  
(a) H<sub>2</sub>S                      (b) CO<sub>2</sub>                      (c) CH<sub>4</sub>                      (d) All the above
2. The following is the physical characteristic of sewage CO1- U  
(a) Turbidity                      (b) Colour                      (c) Odour                      (d) All the above.
3. Detention time for septic tank is, CO1- U  
(a) 4-6 hour                      (b) 20-30 days                      (c) 2-6 weeks                      (d) 12-36 hour
4. The maximum spacing of steel bars in coarse screens used for the treatment of sewage is, CO1- U  
(a) 10mm                      (b) 20mm                      (c) 30mm                      (d) 50mm
5. The waste stabilization ponds can be CO1- U  
(a) aerobic                      (b) anaerobic                      (c) facultative                      (d) all the above
6. The mixture of wastewater and activated sludge is \_\_\_\_\_ CO1- U  
(a) sewage                      (b) sullage                      (c) mixed liquor                      (d) none of them
7. Energy may be recovered from sludge as \_\_\_\_\_ CO1- U  
(a) LPG                      (b) Methane gas                      (c) Air                      (d) Hydrogen gas

8. Water reclamation processes essentially involve CO1- U
- (a) Reuse of treated wastewater
- (b) Recycling of treated wastewater
- (c) Production of usable quality water by treating wastewater
- (d) All of these
9. Which one of the following is the basic indicator of river health? CO1- U
- (a) BOD                      (b) DOD                      (c) COD                      (d) None of the above
10. The biogas composed of CO1- U
- (a) O<sub>2</sub> and CO<sub>2</sub>              (b) CO<sub>2</sub> and NO<sub>2</sub>              (c) CH<sub>4</sub> and O<sub>2</sub>              (d) CH<sub>4</sub> and O<sub>2</sub>

PART – B (5 x 2= 10 Marks)

11. A sewer of 0.6m dia laid at a gradient of 1 in 400 runs full. Using Crimp and Brudge's formula, Calculate the velocity of flow and the discharge. CO2- App
12. What are the differences in the functions of screen chamber and grit chamber in sewage treatment? CO1- U
13. The moisture content of sludge is reduced from 98% to 96%, calculate the decrease in volume of sludge. CO2- App
14. What are the design considerations to be followed for Sequential batch reactor? CO1- U
15. Under what conditions effluent irrigation method can be favorably adopted? CO1- U

PART – C (5 x 16= 80 Marks)

16. (a) (i) Find the minimum velocity and gradient required to transport coarse sand through a sewer of 60cm dia. With sand particles of 1mm dia. And specific gravity 2.66. Assume  $\beta = 0.06$  and  $f = 0.02$ . Assume the sewer to run half full. Take  $N = 0.012$ . (8) CO2 -App (16)
- (ii) Prepare a report for requirement of plumbing materials for isolated building which is under construction, with a neat sketch, Discuss about different types of plumbing system that is to be used in your house with their advantages and disadvantages. (8)

Or

- (b) (i) A population of 30000 is residing in a town having an area of 60 hectares. If the coefficient of runoff for this area is 0.60 and the time of concentration of the design rain is 30min. Calculate the sewage discharge for these sewers in a combined sewerage system. Assume suitable data. (8) CO2- App (16)
- (ii) Calculate the velocity of flow, and discharge in a sewer of circular section having diameter of 1m, laid at a gradient of 1 in 500. Use Manning's formula taking  $N = 0.012$ . Assume that sewer is running half full. (8)
17. (a) (i) State the design criteria for Grit Chamber and brief its construction and functioning. (8) CO1- U (16)
- (ii) Classify the types of screens adopted in sewage treatment with neat sketch. (8)
- Or
- (b) It is mandatory that you have to remove the organic matter from the effluent sent out after the removal of the inorganic floatable grits, elaborate in detail with diagram about the principle, construction details and process involved in carrying out the above mentioned process CO1- U (16)
18. (a) Enumerate the various methods that can be adopted for secondary treatment of sewage. Suggest a suitable treatment method which removes 75% of BOD and suspended solids. Explain the process with neat sketch. CO2- App (16)
- Or
- (b) Design a high rate trickling filter for treating sewage of 22 ML/d with a raw sewage BOD5 of 320 mg/L. Assume a recirculation ratio of 1.5 and efficiency of the PST as 35% and filter as 75%. Use NRC equation. CO2- App (16)
19. (a) Elaborate the various available methods used for nitrogen and phosphorous removal as per BIS standards. CO1- U (16)
- Or
- (b) (i) Explain the Reclamation and Reuse of Sewage. (8) CO1- U (16)
- (ii) Explain in detail about constructed Wetland. (8)

20. (a) Discover how UASB is related with treatment of waste water. CO1- U (16)  
Write in detail about the UASB reactor with neat sketch, advantages and disadvantages. Explain its function and operation.
- Or
- (b) Analyze and discuss about the following concepts with its merits CO1- U (16)  
and demerits.
- (i) Land disposal of sludge
  - (ii) Sewage farming