KATHMANDU UNIVERSITY
End Semester Examination [C]
November/December, 2023

Marks Scored:

Level : B.E.
Year : III
Course : CIEG 313
Semester : II

Exam Roll No. :
Time: 30 mins.
F. M. : 10

Registration No.:
Date 28 NOV 2023

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate answer among the given choices.

1. Cast iron pipes having plain ends are joined by _____.
   a. flanged joint
   b. dresser coupling
   c. collar joint
   d. spigot and socket join

2. Which of the following instrument is commonly used for determining the turbidity of water?
   a. Jackson turbidity meter
   b. Baylis turbidity meter
   c. Nepholometer
   d. Hellige turbidity meter

3. The alkalinity in water is expressed as milligrams per liter in terms of equivalent of ____.
   a. $CaCO_3$ b. CaOH c. $MgCO_3$ d. $NaCO_3$

4. The sewer section that pass beneath an obstacle and runs full under gravity flow at a pressure above atmosphere is _____.
   a. relief sewer
   b. depressed sewer
   c. clean outs
   d. trunk sewer

5. Which of the following forms of nitrogen conversion happens during the denitrification process in wastewater treatment?
   a. NO_3^- converts to N_2
   b. NH_4^+ converts to NO_2^-
   c. NO_2^- converts to NO_3^-
   d. NO_3^- converts to NO_2^-

6. If the influent flow to the WWTP is 60 L/s and phosphorus load is of 60 kgN/d. The concentration of phosphorus in influent water is _____.
   a. 277.8 mgP/L b. 33.9 mgP/L c. 21.5 mgP/L d. 11.6 mgP/L

7. Which layout requires overhead tanks for water distribution system?
   a. Tree system
   b. Grid iron system
   c. Radial system
   d. Circular system

8. The total quantity of available water in the earth that is saline is about _____
   a. 75 % b. 79 % c. 95 % d. 97 %

9. The common term used to indicate the human and animal excreta is _____
   a. night soil b. sewage c. sullage d. black water

10. The end products produced during the secondary treatment of wastewater under anaerobic condition are _____
    a. CH_4, CO_2 and biomass
    b. CH_4 and CO_2
    c. CH_4 and biomass
    d. CO_2 and biomass

11. Submerged intakes are mainly suitable for _____
    a. lakes b. springs c. rivers d. canals

12. The dewatering ability of sludge is enhanced by _____ process.
    a. anaerobic digestion
    b. floatation thickening
    c. centrifugation
    d. sludge conditioning

13. The multiplying factor usually adopted to obtain maximum hourly demand of water from the annual average hourly demand of water is _____
    a. 1.50 b. 1.80 c. 2.70 d. 3.24

14. In which system or type, a single mixed reactor is used to complete all the steps of the activated sludge process for wastewater treatment?
    a. Oxidation ditch
    b. Sequencing batch reactor
    c. Contact stabilization
    d. Detritus tank

15. The growth of population can be represented by a _____
    a. straight line curve
    b. logistic curve
    c. semi-log curve
    d. logarithmic curve

16. Which one of the following is **CORRECT**?
    a. COD>BOD>TOC
    b. BOD>COD>TOC
    c. TOC>BOD>COD
    d. TOC>COD>BOC

17. Optimum dose of chlorine is that dose of chlorine which leaves____ of free residual chlorine in water during disinfection process.
    a. 22 ppm b. 2 ppm c. 0.2 ppm d. 0.02 ppm

18. The technique of overland runoff for disposal of sewage by land treatment is applied when _____
    a. soil have good absorptivity
    b. soil have poor absorptivity
    c. sewage is from household
    d. sewage is from industries

19. Air binding phenomenon in rapid sand filters occur due to _____
    a. low temperature
    b. excessive negative head
    c. formation of mud balls
    d. higher turbidity in the effluent

20. The efficiency of sediment removal in a continuous flow type sedimentation tank does not depend up on _____
    a. length of the tank
    b. width of the tank
    c. discharge through the tank
    d. depth of tank

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Year : III
Time : 2 hrs. 30 mins.

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Semester : II
F. M. : 40

SECTION "B"
[4 Q. × 5= 20 marks]

Attempt *ANY FOUR* questions. Assume suitable data where necessary.

1. a. Draw the complete flow diagram of water supply system showing its various essential components. [2]
   b. List out the various factors that must be considered in determining the quantity of water for any water supply project. Explain any one factor in brief. [1+2]

2. a. A settling tank is designed for the SOR of 4 $m^3/m^2/hr$. What percentage of particles of diameter 0.025 mm will be removed in this tank? If the specific gravity of particle is 2.65 and temperature of water is 25 °C. [2]
   b. How would you divert water from the canal for any water supply project? Briefly explain the provision with the help of appropriate figure. [3]

3. a. What is water filtration? Draw a well labelled section of slow sand filter. [1+1]
   b. The hardness of a water sample was found to be 150 mg/l as $CaCO_3$. The hardness was found due to Ca and Mg ions only. The concentrations of these ions are equal in water. The water analysis showed the concentration of HCO_3 was 75 mg/l. calculate (i) the concentrations of Ca and Mg ions (ii) alkalinity of water and (iii) carbonate hardness and non-carbonate hardness of water. [3]

4. a. Define the most probable number (MPN) index used in bacteriological test. [1]
   b. Find the diameter of a 950 m long equivalent pipe with Hazen William's coefficient of 110 to replace the series-parallel system between A-B as shown in the figure 1. [4]

Pipe	Length, m	Diameter, mm	Hazen William's coefficient
1	290	250	110
2	410	300	120
3	200	200	100
4	490	400	125
5	310	250	95

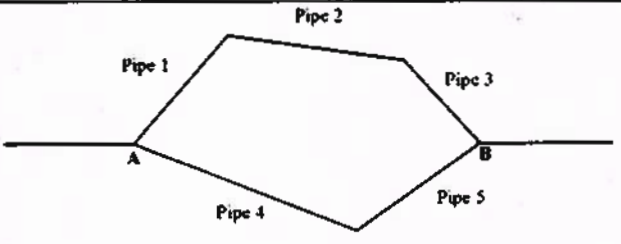

Figure. 1

5. Design the sizes of pipes AB and BC for a branch system as shown in figure 2. The average water supply = 120 lpcd. RL of A=122.5 m, RL of B=101.5 m and RL of C=94.5 m, Length of AB=430 m, Length of BC=500 m, Minimum pressure to be maintained at any point = 10 kg/cm^2, Hazen William constant, C=100, Peak factor = 2.0. Also draw the HGL of the branch system.

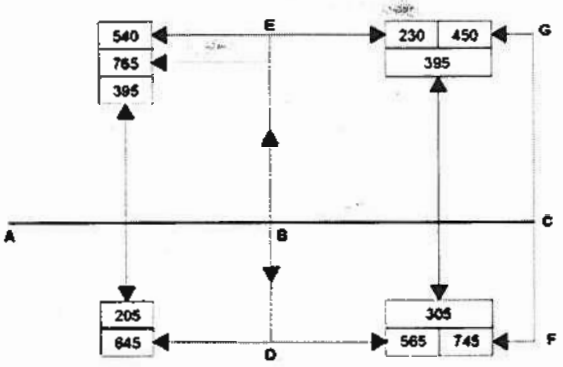

Figure. 2

SECTION "C"

[4 Q. × 5 = 20 marks]

Attempt *ANY FOUR* questions. Assume suitable data where necessary.

6. a. Under what conditions would you incorporate manhole in the sewer network. Explain in brief with necessary figures. [3]
   b. Briefly explain the merits of combine sewerage system. [2]

7. a. Briefly mention the possible reasons for selecting coliform group bacteria as indicator organism for faecal contamination in water sources. [2]
   b. Explain in brief what the BOD of wastewater indicates and its determination method. [3]

8. a. A stream with DO of 7. 4 mg/l has a flow of 1.75 m^3/s, BOD_5 of 8 mg/l and reoxygenation constant of 0.3 per day (base 10) at 20 °C. It receives wastewater with discharge of 0.55 m^3/s having BOD_5 35 mg/l, DO 4.5 mg/l and deoxygenation constant of 0.13 per day (base 10) at 20 °C. The temperature of stream is at 15 °C and that of wastewater is at 20 °C. The average velocity of flow of the stream is 0.20 m/s. Calculate the DO level at point 40 km downstream. The saturation DO at 16 °C is 10.0 mg/l and at 17 °C is 9.7 mg/l. [3]
   b. Briefly explain any one of the common method of disposal of wastewater in land with the help of appropriate figure. [2]

9. a. Briefly explain the working principle of trickling filter for wastewater treatment with the help of appropriate figure. [2]
   b. Explain how the facultative stabilization ponds works during the treatment of wastewater with the help of appropriate figure. [3]

10. a. List out the various methods for final disposal of sludge. Briefly explain any one method. [1+1]
    b. Explain the working mechanism of sludge drying beds with the help of appropriate figures. [3]