KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2024

Marks Scored:

Level : B.E.
Year : III

Course : CIEG 313
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 08 AUG 2024

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Choose and encircle in the most appropriate option from each set of choices

1. Which of the following water is not suitable for consumption to the human health?
   a. Potable water b. Pure water c. Palatable water d. Wholesome water

2. In the design of water supply project for any city, the population should be forecasted up to the
   a. survey year b. base year
   c. service year d. minimum of three decades

3. Which of the following graphical method of forecasting population is suitable for projecting the population of the town with similar growth pattern and development to the nation?
   a. Ratio method b. Comparative graphical method
   c. Master plan method d. Simple graphical method

4. The hardness of water sample is generally expressed in term of
   a. ppm of Ca or Mg or Sr b. mg/l as $CaCO_3$
   c. French scale d. Clark's scale

5. During the water analysis for determining TON of a water sample, 80 ml of odorous water was mixed with 120 ml of odour-free water to produce a 200 ml of mixture with barely detectable smell. Then, TON of the water sample will be
   a. 2.5 b. 1.67 c. 1.5 d. 0.40

6. Which of the following intake will generate relatively less superior water quality compared to one another?
   a. Spring intake b. Reservoir intake c. Lake intake d. River intake

7. Which of the following valve will prevent the flow of water in reverse direction in the pipe line?
   a. Sluice valve b. Ball valve c. Reflux valve d. Butterfly valve

8. The regeneration of zeolite after the exhaustion in removal of hardness of water is done by passing the concentrated solution of _____through it.
   a. HCl b. H_2SO_4 c. KCl d. NaCl

9. The method of aeration effective in removal of CO_2 from the water is
   a. gravel packed bed aerator b. diffuse aerator
   c. spray aerator d. mechanical aerator

10. The commonly used coagulants in water treatment process requires the water to have natural or artificial _____ for the effective flocculation process.
a. alkalinity b. turbidity c. softness d. dissolved solids

11. Which of the following reservoir is constructed just before the distribution network to store and distribute the filtered water from the treatment plant?
a. service reservoir b. semi-underground reservoir
c. elevated reservoir d. clear water reservoir

12. The sewer appurtenance provided at the end of outfall sewer to prevent the entry of water from water stream into it is
a. clean out b. leaping weir c. syphon spillway d. flap gate

13. Which of the following sewer runs fully and under the pressure higher than the atmospheric pressure?
a. lateral sewer b. trunk sewer c. depressed sewer d. outfall sewer

14. Malaria is an example of _____ disease.
a. water based b. water borne c. water related d. water hygiene

15. The nitrogen load of a treatment plant with influent flow of 50 L/s is 194 kgN/d. Then the concentration of flow is of
a. 2.69 mgN/L b. 44.91 mgN/L c. 64.67 mgN/L d. 161.67 mgN/L

16. During the self-purification process of river, the oxygen sag is minimum at the zone of
a. recovery b. degradation
c. clear water d. active decomposition

17. The most appropriate type of activated sludge process for the treatment of wastewater for the decentralized approach is
a. Oxidation ditch b. Contact stabilization ASP
c. Extended aeration ASP d. Sequencing batch reactor ASP

18. The combination of waste stabilization ponds suitable for the treatment of wastewater with higher strength of organic pollutant is
a. Aerobic pond + Facultative pond b. Anaerobic pond + Facultative pond
c. Aerobic pond + Anaerobic pond d. Anaerobic pond + Maturation pond

19. Which of the following process should be completed for the removal of nitrogen from the wastewater during the treatment process?
a. Ammonification + Denitrification + Nitrification
b. Ammonification + Nitrification + Denitrification
c. Denitrification + Nitrification
d. Ammonification + Denitrification

20. Sludge drying bed is one of the method of _____ in the treatment process of sludge.
a. sludge thickening b. sludge conditioning
c. sludge digestion d. sludge dewatering

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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. Briefly explain the historical development of water supply system. [2]
b. List out the various factors which will affect the demand of water in any water supply project. The population of a locality as obtained from census report is as follows: [1+2]

Census year	1980	1990	2000	2010	2020
Population	86,000	96,000	1,07,000	1,17,000	1,28,000

Which method of population forecast will be appropriate for the locality and why? Estimated the population of this locality for the year 2040 AD by the proposed method.

2.
a. Explain in brief how application of alum will remove the colloidal or suspended impurities from the water during the sedimentation with coagulation process. [2]
b. Under what conditions will you recommend the reservoir intake for any water supply project? Briefly explain how you would divert the water from the reservoir intake with the help of appropriate figure. [1+2]

3.
a. The semi-underground tank having sizes of 11 m X 5 m X 3 m is available in a locality. It is proposed to use as a sedimentation tank. At least 93 % of particles having diameter of 0.025 mm, specific gravity 2.65 is expected to remove on the tank at 20° C. What will be its surface overflow rate on using that tank? Are tank dimensions enough to remove 99 % of particles having diameter 0.05 mm at same conditions? [3]
b. 500 ml of sample A with pH of 5 is mixed with 1500 ml of sample B with pH of 8. Compare the strength of mixture of samples A and B with the sample C with pH of 4. [2]

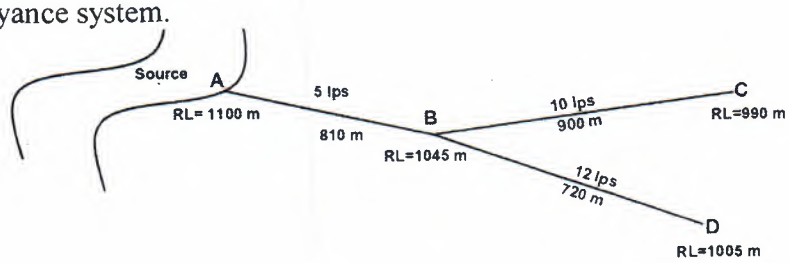
4.
a. Explain in brief the laboratory process for determining the colour of water. [1]
b. A water supply project has been developed for a settlement to provide 60 l water per person per day to the design year population of 10,000. In order to fulfill the demand, water from the canal intake has been diverted as a supply with flow of 7.10 lps. The consumption patter of the settlement is as follows: [4]

Time	Consumption Pattern, %
7 am to 10 am	35 %
10 am to 5 pm	20 %
5 pm to 8 pm	30 %
8 pm to 7 am	15 %

Is balancing reservoir necessary for the settlement? Justify your answer. Calculate its capacity, if necessary.

P.T.O.

5. For the conveyance of water from the source to the settlement the pipes AB, BC and CD has been laid. Design the pipelines so that the minimum pressure at any point is 12 kg/cm^2. Take Hazen William constant, C = 110, Peak factor = 20. Also draw the HGL of the conveyance system. [5]



SECTION "C"

[4 Q. × 5 = 20 marks]

Attempt ANY FOUR questions. Assume suitable data where necessary.

6.
   a. When will you provide the inverted siphon in the sewerage system? Explain the conditions and appurtenance in brief with the help of well labelled diagram. [3]
   b. Which type of water carriage sewerage system will you recommend for conveyance of wastewater for the new settlement and why? Explain in brief. [2]

7.
   a. Why is it necessary to determine the characteristics of the wastewater samples? List out the possible reasons. [2]
   b. For a wastewater sample, BOD_5 for 35° C is 160 mg/l and is 82 % of the ultimate BOD. What fraction of ultimate BOD remain unoxidised after 16 day at 20° C. [3]

8.
   a. A stream with 85 % saturated DO has a flow of 1.65 m^3/s, BOD_5 of 6 mg/l and reoxygenation constant of 0.3 per day (base 10). It receives an effluent discharge of 0.35 m^3/s having BOD_5 35 mg/l, DO 4.6 mg/l and deoxygenation constant 0.13 per day (base 10). The average velocity of flow of the stream is 0.24 m/s. Find the amount of critical DO deficit and its location in the downstream portion of the river. Assume that the temperature is 20°C throughout. Take saturation DO at 20° C as 9.20 mg/l. [3]
   b. Which method of land disposal of wastewater will you recommend for your locality and Why? Explain the method in brief. [2]

9.
   a. Briefly explain the working principle of waste stabilization pond in wastewater treatment with the help of appropriate figure. [2]
   b. Which type of activated sludge process will you recommend for the secondary treatment of wastewater for a decentralized wastewater treatment plant and why? Explain the process in brief with the help of well labelled figure. [3]

10.
   a. List out the various sources of sludge along with its type that will be generated during the wastewater treatment. [1]
   b. Under what conditions will you recommend the flotation thickening of sludge? Mention the conditions and the process in brief with the help of well labelled figure. [3]