KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 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 : 22 DEC 2024

SECTION "A"

[20 Q. × 0.5 = 10 marks]

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

1. Palatable water is synonymous to
   a. soft water b. potable water c. clarified water d. wholesome water

2. If the average daily demand of water is 120 lpcd, then the maximum hourly demand of the water will be
   a. 324 lph b. 180 lph c. 13.5 lph d. 9 lph

3. Which of the following relation is correct?
   a. Service Year= Base Year + Design Period
   b. Service Year = Base Period + Design Period
   c. Service Year= Survey Year + Design Period
   d. Service Year= Survey Period + Design Period

4. The modern test conducted for the detection of bacteriological examination in water is
   a. multiple tube fermentation technique b. membrane filter technique
   c. total count test d. agar plate test

5. In electrometric method, pH of water is measured with the help of
   a. potentiometer b. magnetism c. induction d. chemical reagents

6. Which of the following intake will require higher level of treatment compared to one another?
   a. Spring intake b. Reservoir intake c. Lake intake d. River intake

7. Reflux valve is used in the water conveyance system to
   a. divert flow of water b. control flow of water
   c. prevent reverse flow of water d. stop the flow of water

8. The type of settling which majorly occurs in plain sedimentation tank is _____ settling.
   a. compression b. zone c. flocculent d. discrete

9. The key principle in removal of hardness from water using zeolite is
   a. base exchange b. oxidation and reduction
   c. sedimentation d. stabilization

10. Which of the following component of rapid sand filter majorly conveys the effluent during the backwashing operation of filter?
    a. wash water trough
    b. wash water drain
    c. central drain
    d. lateral drain

11. Which of the following layout of distribution system is not generally recommended for a well-planned urban settlement?
    a. Tree System
    b. Grid System
    c. Circular System
    d. Radial System

12. The sewer appurtenance provided at the upper end of lateral sewers in place of manhole is
    a. flap gate
    b. leaping weir
    c. drop manhole
    d. clean out

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

15. The population equivalent of an industry that has the flow of 120 m^3/d with BOD concentration of 2000 mg/l is _____ person. Take per capita load of 0.05 kg/person.d
    a. 480
    b. 4,800
    c. 4,80,000
    d. 48,00,000

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 very important characteristics of media to be used in trickling filter is
    a. less specific gravity
    b. bigger size with angular edges
    c. capability of supporting heavy loads
    d. greater specific surface area

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. If the sewage contains grease and fatty oils, these are removed in
    a. detritus tank
    b. skimming tank
    c. flocculation chamber
    d. sedimentation tank

20. Sludge conditioning is done to _____ sludge.
    a. increase the solid content in
    b. decrease the water content in
    c. stabilize
    d. improve dewater characteristics of

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SECTION "B"
[4 Q. × 5 = 20 marks]

Attempt ANY FOUR questions. Assume suitable data where necessary.

1.
a. Which type of water do you recommend to be supplied from a water supply system? Explain why in brief.
b. Briefly explain about the hourly variation in demand of water. The population of a locality as obtained from census report is as follows:

Census year	1980	1990	2000	2010	2020
Population	96,000	1,06,000	1,21,000	1,42,000	1,68,000

Which method of population forecast will be appropriate for the locality and why? Estimated the population of this locality for the year 2050 AD by the proposed method.

2.
a. How you would prevent the entry of floating debris to the water treatment system? Explain the mechanism with the help of appropriate figures.
b. Under what conditions will you recommend the canal intake for any water supply project? Briefly explain how you would divert the water from the reservoir intake with the help of appropriate figure.

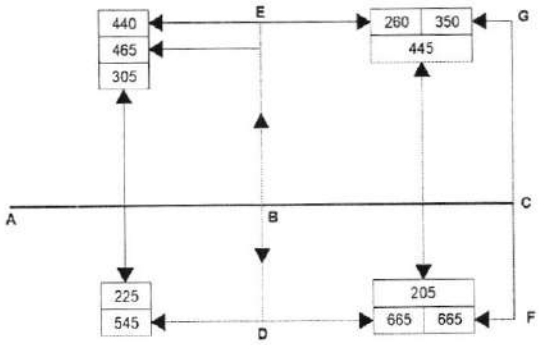
3.
a. Describe the working mechanism of sedimentation tank in removal of suspend impurities from the water. Briefly explain the working mechanism of slow sand filter with the help of cross-section of the filter unit.
b. Why is it necessary to determine the quality of water? Describe the possible reasons. [2]

4.
a. Explain in brief the laboratory process for determining the total dissolved solid in water.[1]
b. A water supply project has been developed for a settlement to provide 100 l water per person per day to the design year population of 20,000. In order to fulfill the demand, water from the canal intake has been diverted as a supply with flow of 30.0 lps. The consumption patter of the settlement is as follows:

Time	**Consumption Pattern, %**
6 am to 10 am	38 %
10 am to 5 pm	24 %
5 pm to 10 pm	32 %
10 pm to 6 am	6 %

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

5. Design the sizes of pipes AB and BC for a branch system as shown in figure below. The average water supply = 110 lpcd. RL of A = 122.5 m, RL of B = 102.5 m and RL of C = 81.8 m, Length of AB = 400 m, Length of BC = 410 m, Minimum pressure to be maintained at any point = 10 m, Hazen William constant, C = 100, Peak factor = 2.0. Also draw the HGL of the branch 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 catch basin 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 old settlement and why? Explain in brief. [2]

7.
a. Classify and define the various types of wastewater generated from the household. [2]
b. During BOD test conducted on a 20% dilution of wastewater sample, the following observations were taken: [3]

DO of aerated water used for dilution = 5.8 mg/l; DO of original sample = 2.6 mg/l and DO of diluted sample after 5 day incubation = 1.6 mg/l. Compute BOD_5 and ultimate BOD of wastewater. Assume deoxygenation constant at test temperature as 0.10 (base 10).

8.
a. Draw a well labelled deoxygenation, reoxygenation and oxygen sag curves. Briefly explain the factors on which the rate of reoxygenation of a natural stream depends. [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 facultative pond in wastewater treatment with the help of appropriate figure. [2]
b. Explain the working mechanism of sequencing batch reactor in treatment of wastewater with the help of appropriate figures. [3]

10.
a. List out the various sources of sludge along with its type that will be generated during the wastewater treatment. [2]
b. Explain any one of the mechanized method of sludge dewatering in detail with the help of appropriate figure. [3]