KATHMANDU UNIVERSITY
End Semester Examination
February, 2025

Marks Scored:

Level : B.E.
Year : III

Course : CIEG 313
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : ~~24~~ 23 FEB 2025

SECTION "A"

[20 Q. × 0.5 = 10 marks]

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

1. When water is stored in copper vessels, copper in a very small quantity will get dissolved in water and will have _____effect to destroy a wide range of microbes present in water.
   a. oligostatic b. oligodynamic c. electrostatic d. brownian

2. The annual average daily demand of water per head is 100 lpcd. Then, the maximum hourly demand of water per head will be
   a. 6.26 l/hr b. 7.5 l/hr c. 11.25 l/hr d. 27 l/hr

3. If a locality has the population of 1.5 million in 2025 AD. The census data of the past few decades of the locality showed the average population increase per decade of 55000 and average incremental increase per decade of 10000. Then its estimated population for 2050 AD by projection from incremental increase method will be
   a. 1,681,250 b. 1,725,000 c. 1,765625 d. 2,006,250

4. The size range of colloidal particle is between
   a. 10^{-1} to 10^{-3} mm b. 10^{-3} to 10^{-6} mm c. 10^{-6} to 10^{-9} mm d. 10^{-9} to 10^{-12} mm

5. The colour in water is measured by_____ method.
   a. Pt-Co b. Pb-Co c. Silica d. EDTA

6. Which of the following statement is correct for the wet river intake?
   a. Consists of only one shell
   b. Inner shell is always filled with water
   c. Outer shell openings are provided with gates
   d. Outer shell is always filled with water

7. Which of the following pipe is the most suitable one for hot water supply?
   a. PVC Pipe b. WI Pipe c. Copper Pipe d. DI Pipe

8. For the formation of floc using alum during sedimentation with coagulation process, water should contain natural or artificial induced_____.
   a. dissolved solids b. softness c. conductivity d. alkalinity

9. Normally for a plain sedimentation process, HRT and SOR are respectively _____ as compared to sedimentation with coagulation process.
   a. more and less b. less and more c. less and less d. more and more

10. Application of chlorine in water beyond breakpoint chlorination is called _____ chlorination.
a. super b. double c. multiple d. post

11. Which of the following system of water supply generally requires greater diameter pipes for distribution of water?
a. Intermittent supply system b. Continuous supply system
c. Grid iron system d. Ring system

12. The flushing tank which holds and flushes the water to the sewer automatically for the purpose of cleaning the sewer functions mainly by _____ action.
a. inverted syphon b. spillway c. capillary d. syphon

13. Which of the following sewer appurtenance could be generally constructed instead of manhole at places where manholes could not be provided due to various reasons related to site?
a. Catch Basin b. Inlet c. Clean Out d. Flushing Tank

14. Which of the following relationship is correct in the case of Nitrogen in wastewater?
a. $TKN = NO_2^- + NO_3^-$ b. $TN = NO_2^- + NO_3^-$
c. $TN = TKN + NO_2^- + NO_3^-$ d. $TN = Ammonia + Organic\ Nitrogen$

15. What will be the population equivalent of an industry with flow of 60 m^3/d with BOD concentration of 900 mg/l? Take per capita BOD load of 0.054 kg/inhab.d.
a. 278 b. 1,000 c. 10,000 d. 54,000

16. The variation in concentration of pollutants with time in natural stream is due to
a. advection and dispersion b. dispersion and conversion
c. advection, dispersion and conversion d. advection and conversion

17. In which ASP type, all the steps of the activated sludge process occurs in a single complete mixed reactor?
a. Oxidation Ditch b. Contact Stabilization ASP
c. Extended Aeration ASP d. Sequencing Batch Reactor ASP

18. The major function of recirculation in high rate trickling filter is
a. maintaining F/M ratio b. dilution
c. maintaining MLSS d. maintaining MLVSS

19. Which of the subsequent methods should be accomplished for the elimination of nitrogen from the wastewater during the treatment process?
a. Ammonification + Denitrification + Nitrification
b. Ammonification + Nitrification + Denitrification
c. Denitrification + Nitrification
d. Ammonification + Denitrification

20. Which of the following process is carried out for improving the dewatering ability of sludge?
a. Floatation Thickening b. Centrifugation
c. Anaerobic Digestion d. Sludge Conditioning

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23
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F. M. : 40

SECTION "B"
[4 Q. × 5 = 20 marks]

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

1.

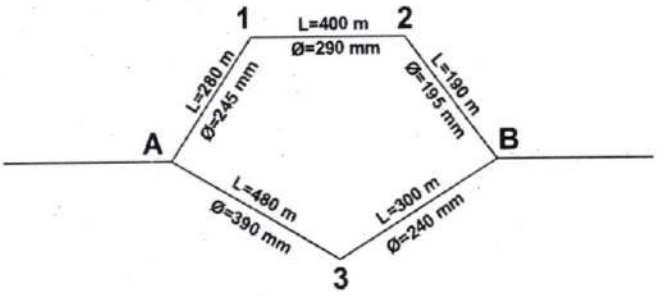
a. Briefly explain the key factors that must be considered for developing the sustainable water supply project for any township. [2]

b. Enumerate the various factors that will affect the demand of water in any water supply project. How will you determine the overall quantity of water required for the design of any water supply project for any locality? Explain the procedure in brief. [1+2]

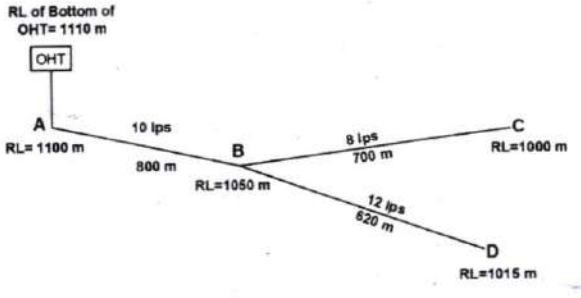
2.

a. Explain how alkalinity is induced naturally in water. [1]

b. Find the diameter of a 900 m long equivalent pipe with Hazen William's coefficient of 120 to replace the series-parallel system between A-B as shown in the figure below. [4]



3. For the conveyance of water from the source to the settlement the pipes AB, BC and BD have been laid. Design the pipelines so that the minimum pressure at any point is 10 kg/cm^2. Take Hazen William constant, C = 110, Peak factor = 1.5. Also draw the HGL of the conveyance system. [5]



P.T.O.

4.

a. List out the factors which will govern the degree of treatment required for water in any treatment plant. List out the essential characteristics of a good disinfectant. [1+1]
b. Under what conditions will you recommend the canal intake for any water supply project? Explain the conditions and the intake in brief with appropriate figure. [1+2]

5.

a. How will zeolite remove the hardness of water? Explain the complete process. [3]
b. Elaborate the most probable number (MPN) index used in bacteriological analysis of a water sample with an example. [2]

SECTION "C"

[4 Q. × 5 = 20 marks]

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

6.

a. Why is it necessary to introduce grease and oil traps in the sewerage system? Explain the key reasons and appurtenance in brief with the help of a well labelled diagram. [3]
b. Draw a well labelled diagram showing different types of sewer which needs to be laid for conveyance of wastewater from households to the treatment plant and then to final disposal. List out the key demerits of a combined water carriage system. [1+1]

7.

a. Classify and define the various types of wastewater generated from a household. [2]
b. For a wastewater sample, BOD_5 for 20° C is 260 mg/l and is 85 % of the ultimate BOD. What fraction of ultimate BOD remains unoxidised after 10 day at 25° C. [3]

8.

a. A stream with DO of 7.5 mg/l has a flow of 1.85 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 DO of 4.0 mg/l, has discharge of 0.55 m^3/s having BOD_5 of 35 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 0.30 m/s. Find the amount of critical DO deficit and its location in the downstream portion of the river. The saturation DO at 16 °C is 9.5 mg/l and at 17 °C is 9.2 mg/l. [3]
b. What information does an oxygen sag curve provide? Explain it in brief. [2]

9.

a. Briefly explain the working principle behind the secondary treatment of wastewater.[2]
b. Elaborate how trickling filter function with the help of neat sketches. [3]

10.

a. Under what conditions will you recommend the centrifugation of sludge? Mention the conditions. Draw a flow diagram showing various stages that occur during the process of anaerobic digestion of sludge. [1+1]
b. Explain how sludge drying bed works in dewatering of sludge with the help of a well labelled diagram. [3]