KATHMANDU UNIVERSITY
End Semester Examination
June/July, 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 07 JUL 2023

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Encircle the most appropriate answer

1. The most common type of plastic pipe used for rural water supply in context of Nepal is
   a. LDPE b. HDPE c. PVC d. UPVC

2. Carbonate hardness present in water induces _____ in water.
   a. turbidity b. colour c. alkalinity d. odour

3. Out of 5 test tubes used for the *E-Coli* test, 4 results are negative and 1 is positive. Each tubes contains 10 ml of sample. Then, the most probable number (MPN) per 100 ml of sample is
   a. 2.24 b. 4.47 c. 8.94 d. 17.89

4. In order to prevent entry of plastics and other floating debris in the sewer, street inlets are provided with
   a. flap gates b. catch pits c. clean outs d. leaping weir

5. The conversion of nitrate into molecular nitrogen (N_2) which escapes into atmosphere under anoxic conditions for the removal of nitrogen from wastewater is called
   a. denitrification b. nitrification c. ammonification d. stripping

6. If the influent flow to the WWTP is 50 L/s and nitrogen load is of 110 kgN/d. The concentration of nitrogen in influent water is
   a. 39.3 mgN/L b. 33.9 mgN/L c. 21.5 mgN/L d. 25.5 mgN/L

7. The service reservoirs should be designed for
   a. balancing storage
   b. balancing and breakdown storage
   c. balancing, breakdown and fire storage
   d. balancing and fire storage

8. The primary manmade water facility that finds a mention in the history is
   a. canal b. stone spout c. aqueduct d. well

9. The water conveyance system in which characteristics of sewage remains uniform is
   a. separate system
   b. partially separate system
   c. combined system
   d. partially combined system

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

11. In wet river intake
    a. outer shell is always filled with water
    b. inner shell is always filled with water
    c. outer shell consists of openings with gates
    d. inner shell consists of openings without gates

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

13. A town with population of 10,000 was supplied with 219 million litre water over a year. Then the rate of demand was
    a. 18.3 lpcd b. 21.9 lpcd c. 60 lpcd d. 219 lpcd

14. In which of the treatment unit, the pollutants in wastewater is removed mainly due to the symbiotic relationship between bacteria and algae,
    a. trickling filter b. oxidation ditch c. facultative pond d. detritus tank

15. The population forecasted for any town by incremental increase method will be
    a. less than population forecasted by arithmetical method
    b. greater than population forecasted by arithmetical method
    c. greater than population forecasted by geometrical increase method
    d. have no relation with population forecasted by arithmetical and geometrical increase method

16. Low COD to BOD_5 ratio indicates _____ in wastewater.
    a. high inert fraction
    b. low biodegradable and inert fraction
    c. equal biodegradable and inert fraction
    d. high biodegradable fraction

17. For disinfection of water, the dose of chlorine which leaves_____ of free residual chlorine is taken as the optimum dose of chlorine.
    a. 22 ppm b. 2 ppm c. 0.2 ppm d. 0.02 ppm

18. The change in concentration of pollutant with time in natural stream is due to
    a. advection and dispersion
    b. advection, dispersion and conversion
    c. dispersion and conversion
    d. advection and conversion

19. The detention period and overflow rate respectively for a sedimentation with coagulation as compared to plain sedimentation are generally
    a. more and less b. less and more c. less and less d. more and more

20. The cleaning of slow sand filter after clogging is done by
    a. backwashing the filter sand
    b. changing the filter sand
    c. adding the filter sand to existing layer
    d. scraping top layer of filter sand

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Level : B.E.
Year : III
Time : 2 hrs. 30 mins.

Course : CIEG 313
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 key objectives of any water supply system. [2]

   b. The population of a locality as obtained from census report is as follows: [3]

Census year	1970	1980	1990	2000	2010	2020
Population	75,000	86,000	1,15,000	1,35,000	1,54,000	2,20,000

   Estimated the domestic water requirement of this locality in the year 2040 AD by projecting the population by arithmetic increase and incremental increase method.

2. a. A sedimentation 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 the kinematic viscosity of water at temperature of 25°C is 0.01 cm^2/s. [2]

   b. Briefly explain how you would divert the water from the irrigation canal for a water supply scheme with the help of appropriate figure. [3]

3. a. Briefly explain the break point chlorination during disinfection process. [3]

   b. Explain the working mechanism of nephelometer in determining the turbidity of water. [2]

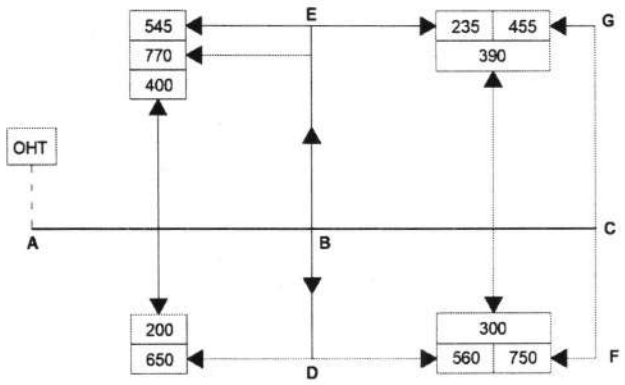
4. a. Explain the process for determining the total dissolved solid present in the water. [1]

   b. A village has design year demand of water 25,000 litres per day. The demand is met by a continuous system of supply from spring source with measured yield of 0.30 lps. The consumption pattern is as follows. [4]

Time	Demand
7 am to 8 am	25 % of Day's Supply
8 am to 5 pm	35 % of Day's Supply
5 pm to 8 pm	30 % of Day's Supply
8 pm to 7 am	10 % of Day's Supply

   Is balancing storage tank necessary? Calculate it capacity if necessary. Justify your answer.

5. Design the sizes of pipes AB and BC for a branch system as shown in figure below. The average water supply = 145 lpcd. RL of bottom of storage tank = 122 m, RL of A = 110.5 m, RL of B = 100.5 m and RL of C = 95.6 m, Length of AB = 420 m, Length of BC = 510 m, Minimum pressure to be maintained at any point = 12 kg/cm^2, Hazen William constant, C = 110, Peak factor = 2.5. 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. Briefly explain how you would connect the high level branch sewer to a low level main sewer with the help of appropriate figure. [3]

   b. Briefly explain the demerits of combine sewerage system. [2]

7. a. Briefly explain how we can determine the stage of pollution of wastewater by determining the nitrogen in wastewater. [2]

   b. For a wastewater sample, BOD_5 for 30°C is 150 mg/l and is 86% of the ultimate BOD. What proportion of ultimate BOD remain unoxidised after 15 day at 20°C. [3]

8. a. A stream with 80 % saturated DO has a flow of 1.65 m^3/s, BOD_5 of 5 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 32 mg/l, DO 4.5 mg/l and deoxygenation constant 0.13 per day (base 10). The average velocity of flow of the stream is 0.20 m/s. Calculate the DO level at point 30 km downstream. Assume that the temperature is 20°C throughout. Take saturation DO at 20°C as 9.17 mg/l. [3]

   b. Briefly explain the key problems that may arises during the disposal of wastewater in the sea water. [2]

9. a. Briefly explain the working principle of biological wastewater treatment with the help of appropriate figures. [2]

   b. Explain how the contact stabilization activated sludge process works during the secondary treatment of wastewater. [3]

10. a. Why is it necessary to treat the sludge before final disposal? Explain it in brief. [2]

    b. Explain the working mechanism of sludge drying beds with the help of appropriate figures. [3]