

KATHMANDU UNIVERSITY
End Semester Examination
May/June, 2022

Marks Scored:

Level : B.Sc.

Year : II

Exam Roll No. :

Time: 30 mins.

Registration No.:

Course : ESEE 221

Semester : II

F.M. : 20

Date :

SECTION 'A'
[20Q × 1 = 20 marks]

Mark [√] for the right option in a bracket.

- Environmental monitoring is the _____ sampling of air, water, soil and biota.
[] systematic [] conceptual [] population [] small
- Which of the following is **NOT** the objectives of Environmental monitoring:
[] To establish a base-line exposure
[] To confirm and reconfirm the success of the pollution control measures
[] To evaluate pollution interactions and patterns
[] To ensure the cost effectiveness of the project
- _____ are chosen for systematic observation of key environmental conditions.
[] tap water [] indicators [] special ecosystems [] pesticide
- Diffusion is _____.
[] motion with respect to the carrying fluid by random molecular collision
[] motion with respect to carrying fluid by chaotic fluid motion
[] passive entrainment of substance by the carrying fluid
[] motion with respect to moving particles by random molecular collision
- Which of the following is **NOT** related with the flux?
[] amount of substance/ (area × time) [] $\text{kg s}^{-1} \text{m}^{-2}$
[] mass flow rate per unit area [] volume per unit time
- Which of the following components is **NOT** relevant in a typical rural water supply system in Terai Area?
[] Overhead reservoir [] Break Pressure Chamber
[] Sedimentation tank [] Transmission mains
- Design year is :
[] Base year + Base period [] Design period – Base year
[] Survey year + Base year [] Base year + Design period
- The concentration of Ca^{++} , Mg^{++} and Na^{++} in a given water sample is: 20 mg/L, 24.4 mg/L and 44 mg/L. Then, the total hardness of the sample is:
[] 50 mg/L [] 100 mg/L [] 150 mg/L [] 250 mg/L
- During the physical examination of water sample, occurrence of black color may indicate the presence of:
[] copper leaching [] algal blooms
[] Manganese oxide [] aquatic microorganisms

10. Settling of biomass in a Secondary Sedimentation unit of wastewater treatment plant is the example of :
 Discrete Flocculent Zone Compression

(For Q.11 & Q.12) A source of average discharge 2 lps was identified for a village water supply scheme. Sedimentation tank of 14.5 m³ for purification before distribution is designed.

11. What is the Hydraulic retention time (HRT) of the sedimentation tank:
 2 h 11.92 h 0.08 h 0.5 h
12. If the Surface overflow rate (SOR) of the sedimentation tank is 172.8 m³/m²/day, the depth of the tank is:
 10 m 0.7 m 17.28 m 14.5 m
13. For alum, optimum range of pH is:
 4-6 6-8 8-10 < 4
14. Coagulant aid _____.
 increases the amount of coagulant dosage
 is a coagulant
 increase the density of floc
 No effect in density of floc
15. Which of the following is not related with slow sand filter?
 Backwashing
 Manually scrapping the top layer of sand
 Cleaning every 1-3 months
 schmutzdecke layer or dirty skin layer
16. The time required for the microorganisms to acclimate to their new environment is represented by ___ phase.
 lag phase log-growth stationary Endogeneous
17. Which of the following is NOT suspended growth process?
 Activated sludge Aerated lagoons
 Trickling filters Oxidation ditch
18. The sufficient amount of air pollutant must be collected to meet the ____ of the analytical procedure.
 sample size sampling standard
 Lower limit of detection temperature
19. Which of the following technology is used to control the gaseous pollutants?
 Electrostatic precipitator Adsorption
 Cyclone Fabric filters
20. Which of the following is secondary air pollutant?
 NO_x SO_x CO O₃

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F.M. : 55

SECTION "B"

[3Q × 7 = 21 marks]

Attempt *ANY THREE* questions.

1. Studies have shown that a white surface becomes noticeably soiled when 0.2% of its area is covered by black particles, such as soot. Estimate the time required for an initially clean, horizontal surface to appear soiled if it is exposed to an atmosphere containing $10 \mu\text{g}/\text{m}^3$ of soot particles of diameter $5 \mu\text{m}$. Assume that the particles are spherical and have a density of $2.5 \text{g}/\text{cm}^3$. Take dynamic viscosity of fluid = $1.8 \times 10^{-4} \text{g}/\text{cm}/\text{s}$; density of fluid = $1.2 \times 10^{-3} \text{g}/\text{cm}^3$.

$$\text{Use, } V_p = \frac{gd_p^2(\rho_p - \rho_f)}{18\mu}; \quad J = CV_p$$

2. Draw a neat and clean diagram of typical drinking water treatment plant and label all the unit operation and process. List out the impurities removed by each unit operation/process. Explain in brief about the first unit operation, i.e. Screening.
3. Explain on attached film growth process as biological treatment of municipal wastewater.
4. Kathmandu has been listed among the top 10 most polluted cities in the world. Suppose, newly elected mayor of Kathmandu Metropolitan City (KMC) has invited you in a personal meeting as a field expert. In the meeting, what are the pollution prevention or minimization strategies that would you like to suggest in order to minimize the impacts related to air pollution? What could be the pollution prevention strategies that you would like to suggest in order to control the PM emissions from different stationary sources?

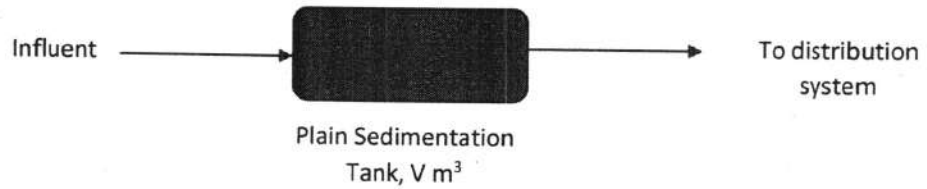
SECTION "C"

[5Q × 5 = 25 marks]

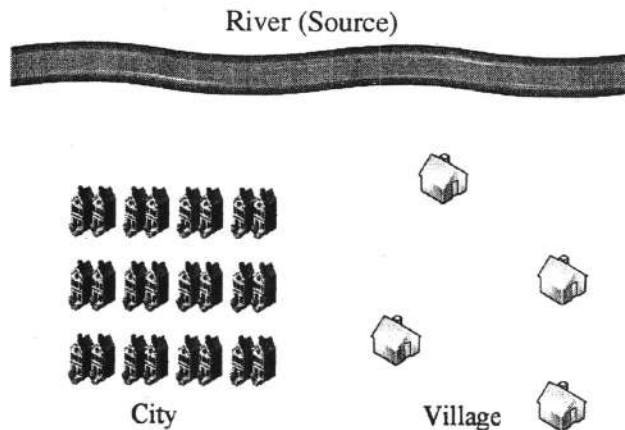
Attempt *ANY FIVE* questions.

5. What are the meteorological parameters that affects the transport of pollutants emitted due to anthropogenic activities? Explain any two in brief.
6. Pollutants (especially solid particles) are removed from raw water using different filtration techniques. What are the different ways that solids are trap in those filters? Explain in brief.
7. What do you understand by Coagulation and Flocculation? Explain the double layer compression theory on destabilization of colloids.
8. $Q \text{ m}^3/\text{s}$ of water is being drawn from a Ground water source to fulfill the drinking water demand of Indrapur town, Morang. A small sedimentation tank, $V \text{ m}^3$ (LBH) has been constructed to remove the suspended and settleable solids in the raw water. Discuss on the following:
 - a. Additional $Q \text{ m}^3/\text{s}$ from a surface source is added to fulfill the growing demand in the town. What is its impact on the hydraulic retention time the tank?
 - b. The surface water added is likely to increase the load of Suspended Solids (SS) in the influent. Discuss on how the size of SS in the influent affects the efficiency of the sedimentation tank?

- c. What do you suggest to increase the efficiency of the sedimentation tank after the addition of the surface source?



9. A perennial river source is passing by near a City and a Village as shown below. River is very close to but at lower elevation than both city and village. City is at plain area and village is at hilly area where houses are sparsely populated. Both the city and the village can be served by a common intake, treatment works and service reservoir. Draw the neat and clean schematic diagram of water supply scheme with the provided information and label all the required components. Discuss the importance of each components in brief.



10. Environmental monitoring often requires systematic measurement of indicators to distinguish the impacts of the activity from other factors. Explain with examples.

SECTION "D"

11. Write short notes on (*ANY THREE*): [3Q × 3 = 9 marks]
- Self-purification of natural streams.
 - Electrostatic precipitator (ESP)
 - Ideal sedimentation tank
 - Feeding the Coagulant