

KATHMANDU UNIVERSITY  
End Semester Examination [C]  
November/December, 2023

Marks Scored:

Level : B.Sc.

Year : II

Course : ESEE 221

Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date

01 DEC 2023

SECTION "A"

[20Q × 1 = 20 marks]

Choose and mark [X] the most appropriate option.

- Source monitoring is done to evaluate the effectiveness of \_\_\_\_\_ for pollution abatement.  
 mass emission rate                       control devices  
 sampling probe                               sample
- Some stack flume blown by the wind is an example of :  
 Turbulent dispersion                       Gravitational settling  
 Diffusion                                       Advection
- Consider a river flowing with a velocity ( $v$ ) of 2 m/s. The concentration ( $C$ ) of a pollutant in the river is 5 kg/m<sup>3</sup>. Calculate the advection flux ( $J_{adv}$ ) of the pollutant.  
 10 kg/(m<sup>2</sup>.s)     2.5 kg.s/m<sup>4</sup>     0.4 m<sup>4</sup>/(kg.s)     7 kg/(m.s)
- Scour valve is to \_\_\_\_\_.  
 wash out the sediments deposited in the pipeline  
 regulate the flow  
 allow the flow only in one direction  
 release the excessive air pressure
- Design year is :  
 Base year + Base period                       Design period – Base year  
 Survey year + Base year                       Base year + Design period
- What is the term for the process of removing physical impurities such as suspended solids from water?  
 Aeration                       Sedimentation     Coagulation     Disinfection
- The purpose of water softeners in treating hard water is to \_\_\_\_\_.  
 remove dissolved oxygen                       neutralize acidic water  
 remove calcium and magnesium ions     add minerals for taste
- During a routine check, a water treatment plant measures a hydraulic head loss ( $h_L$ ) of 30 cm in a bar screen. If the approach velocity ( $v$ ) is 0.65 m/s and the velocity of flow through the openings ( $V$ ) is observed to be 2.0 m/s, what is the value of empirical discharge coefficient ( $C$ )?  
 0.61 m                       0.607                       0.006                       60 m
- Which of the following statements about Hydraulic Retention Time (HRT) is **CORRECT**?  
 HRT is directly proportional to the size of sedimentation basins  
 Increasing HRT reduces particle removal efficiency  
 HRT has no impact on the sedimentation process

10. In the context of water treatment and bridging mechanisms, how does the molecular weight of bridging agents impact their effectiveness?
- Higher molecular weight decreases the stability of bridges, reducing effectiveness
  - Lower molecular weight promotes the formation of stronger bridges, enhancing effectiveness
  - Molecular weight plays a negligible role in the effectiveness of bridging agents
  - Higher molecular weight contributes to the formation of more stable and effective bridges
11. What can overdosing of activated silica lead to in the water treatment process?
- Faster flocculation
  - Improved filtration
  - Slowed flocculation and filtration problems
  - Higher primary coagulant dose
12. The rate of filtration \_\_\_\_\_ as the thickness of the filter cake increases.
- remains constant
  - gradually decreases
  - increases
  - fluctuates
13. Wash water trough are present in \_\_\_\_\_
- Rapid sand filter
  - Plain sedimentation tank
  - Sedimentation tank after coagulation & flocculation
  - Slow sand filter
14. Which of the following best describes the ultimate first stage BOD?
- The amount of oxygen required for microbial decomposition of nitrogenous matter
  - The initial oxygen equivalent of the organic matter undergoing microbial decomposition
  - The total oxygen demand of the wastewater over an infinite time period
  - The demand for oxygen in the last stage of biochemical oxidation
15. Which of the following is not a desirable characteristic of filter media in trickling filters for wastewater treatment?
- High specific surface area
  - High percentage void space
  - Resistance to chemical corrosion
  - Disintegration during placement
16. Comminution is one of the unit operation in wastewater treatment plants to \_\_\_\_\_.
- grind the coarse solids
  - equalize the flow and mass loading
  - combine the smaller particle into larger one
  - remove fine residual suspended solids
17. What function do plants serve in the treatment process within Constructed Wetlands?
- Oxygenation of water
  - Nutrient removal
  - Mechanical filtration
  - pH adjustment
18. In isokinetic sampling, the sample flow rate is adjusted to match the \_\_\_\_\_.
- velocity of the gas stream being sampled
  - concentration of gaseous pollutants in the air
  - temperature of the sampling equipment
  - pressure inside the sampling chamber
19. What is the general term for the process of reinstating the adsorption capacity of an exhausted adsorbent?
- Rejuvenation
  - Reclamation
  - Restoration
  - Regeneration
20. Which pollution control technology is often preferred for removing fine particulate matter and is suitable for high-temperature applications?
- Wet collector (scrubber)
  - Electrostatic precipitator

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Semester : II  
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SECTION "B"

[3 Q. × 7 = 21 marks]

Attempt *ANY THREE* questions.

1. List out different any five physical unit operations in typical wastewater treatment plant with their application. List at least five conditions that support the direct discharge of untreated domestic wastewater into a natural stream.
2. Define Coagulation, Flocculation and Coagulant Aids. Discuss the usage of Alum and Iron salts as a coagulant.
3. Discuss on different types of water demands. In a city having population of 30,000 inhabitants, find the per capita water demand. Make logical assumptions as required.
4. Describe the operational mechanism of an Electrostatic Precipitator. Highlight both its advantages and disadvantages.

SECTION "C"

[5Q × 5 = 25 marks]

Attempt *ANY FIVE* questions.

5. Discuss characteristics of disinfectant and factors influencing the disinfection process.
6. List out the causes of air pollution in big cities like Kathmandu. Prepare a list of activities to minimize its impact on human health and environment from different mobile sources and stationary sources.
7. Discuss the working mechanism of vertical flow constructed wetland with neat and clean diagram.
8. Explain the first stage demand in determination of Biological Oxygen Demand (BOD). Determine ultimate BOD ( $BOD_{ult}$ ) for a sewage having 5-day BOD at 20°C as 160ppm. Assume the deoxygenation constant as  $0.12 \text{ day}^{-1}$ .
9. What are the most common problems during operation of Rapid Sand Filter? Discuss in brief.
10. Discuss any three factors affecting the hydraulic subsidence of a particle settling in a plain sedimentation tank. Find the settling velocity of settling particles of specific gravity 2.65 at 20°C, if the diameter of the particles is 50 $\mu\text{m}$ .

SECTION "D"  
[3Q × 3 = 9 marks]

Attempt *ANY THREE* questions.

11. Presence of Bicarbonate alkalinity is must for alum to be used as coagulant. Give reason.
12. Differentiate between source monitoring and ambient monitoring.
13. Explain in brief on cleaning of slow sand filter.
14. Write short notes on any three components of water supply system.