KATHMANDU UNIVERSITY
End Semester Examination [C]
April/May 2023

Marks Scored:

Level : B.E./B.Sc./B.Tech.
Year : I
Course : ENVE 101
Semester : II
Exam Roll No. :
Time: 30 mins.
F. M. : 20
Registration No.:
Date 27 APR 2023

SECTION "A"
[20Q. × 1 = 20 marks]

Encircle the most appropriate alternative from each set of choices.

1. If the concentration of Carbon monoxide (CO) measured in a kitchen of KU-Canteen at room temperature 25 degree Celsius and 1 atm pressure is 20 ppm. If the total mass of CO inside the room was found to be 1.03 grams, then the volume of the kitchen is ___ cubic meter.
   a. 45 b. 1260 c. 41.2 d. 1157

2. Which is the correct unit for kilometers?
   a. Km b. Kms c. kms d. km

3. Which of the following is NOT gaseous type cycle?
   a. Water cycle
   b. Nitrogen cycle
   c. Phosphorus cycle
   d. Carbon cycle

4. The main reservoir of nitrogen in the biosphere is:
   a. Ocean b. Rocks c. Atmosphere d. Trees

5. _____ replenishes underground aquifers.
   a. Percolation
   b. Transpiration
   c. Sedimentation
   d. Nitrogen Fixing bacteria

6. For steady state with conservative pollutants:
   a. Transformation rate $\neq 0$
   b. Accumulation rate = Input rate – Output rate
   c. Input rate = Output rate
   d. Transformation rate = Input rate – Output rate

7. Which of the statement is not valid for Continuously Stirred Tank Reactor (CSTR):
   a. Completely mixed
   b. Concentration of pollutant is higher as depth increases
   c. Input flow rate is equal to output flow rate
   d. Concentration of pollutant in the reactor = concentration of pollutant in the Effluent

8. Adsorption of water pollutants on activated carbon is an example of ____ mass transfer.
   a. solid-liquid b. solid-solid c. gas-liquid d. liquid-solid

9. Which of the following is NOT true for colloidal particles?
   a. Electrically charged
   b. Always in motion
   c. Particle size ranging from 1 micron to 1 mili micron
   d. Can be removed with filtration

10. Which of the following does not contain human faeces or urine:
    a. Black water
    b. Grey water
    c. Night Soil
    d. Sewage

11. Which of the following sewer is largest is size?
    a. Main b. Lateral c. Branch d. Outfall

12. Skimming tank refers to the removal of _____ from the wastewater.
    a. fats, oils and grease
    b. Biological Oxygen Demand
    c. Pathogens
    d. Sludge

13. PM10 does NOT refers to
    a. Dust, dirt, soot
    b. Ultrafine particles
    c. Particulate matter less than 10 microns
    d. Coarse particles

14. In cyclone separators, the velocity of an inlet gas stream is transformed into a confined vortex from which _____ forces tends to drive the suspended particles to the wall of the cyclone body.
    a. gravitational b. electrostatic c. centrifugal d. magnetic

15. What sound power level results from combining 450 dB and 450 dB?
    a. 453 dB b. 450 dB c. 900 dB d. 903 dB

16. The least preferred method of Solid waste management is ____ of waste.
    a. Disposal b. Reduction c. Recovery d. Recycling

17. The dirty liquid that extracts solutes from other refuses as it passes through different layers of landfill is _____.
    a. Lechate
    b. Faecal sludge
    c. Sewage
    d. Sewerage

18. Every day 715 metric tons of organic waste is generated from Kathmandu Valley which is 65% of the total waste generation. If per capita waste generation is 0.4 kg/day, what is the population of Kathmandu Valley?
    a. 2.75 million b. 2.5 million c. 1.8 million d. 1.16 million

19. Which of the following is NOT the goal of Life Cycle Assessment (LCA)?
    a. Identify Alternative Product
    b. Minimize Pollution
    c. Reduce the cost of the production
    d. Maximize recycling of materials and waste

20. Which has the lowest degree of freedom?
    a. Incrementalism
    b. Re-defining the problem
    c. Re-defining the system boundary
    d. Re-engineering the system

KATHMANDU UNIVERISTY
End Semester Examination [C]
April/May 2023

27 APR 2023

Level : B.E./B.Sc./B.Tech.
Year : I
Time : 2 hrs. 30 mins.

Course : ENVE 101
Semester : II
F.M. : 55

SECTION "B"

Attempt ***ALL*** questions. Assume necessary data wherever required with logical explanation.

1. Explain in brief about role of Environmental Impact Analysis in making any engineering decisions. [3]

2. A stream can have a concentration of suspended solids up to **0.02%** in the rainy season. The stream water has been diverted using a dam and is supplied to a treatment plant. The **tapped flow is 25 lps** (liters per second).
   a. Find the mass loading rate of the sediment in the *influent* pipe (in kg/day). [2]
   b. If the treatment plant can *remove 90% of the suspended solids*. Find the concentration of sediments in the *effluent* of treatment plant? Draw a mass balance diagram for the above system. [1+1]

3. Explain the role of the major anthropogenic activities altering the nitrogen cycle. [3]

4. According to Department of Hydrology and Meteorology (DHM), a hydrological system with surface area of 120 ha has average monthly precipitation (P) of 1.3 in., runoff toward the system (R_{in}) is 0.42 m^3/s and runoff away from the system (R_{out}) is 0.36 m^3/s. The net change in water storage in the system (ΔS) is 20,000 m^3 in a month. Assume that there is no seepage from the system.
   a. Draw a mass balance diagram for the above system [1]
   b. Express P, R_{in}, R_{out} and ΔS in m/month [2]
   c. Determine the average monthly evaporation (E) in meters on the same system [2]

5. A lake having volume 3.12×10^7 m^3 is fed by a stream having flow rate of 1.2 m^3/s and pollutant concentration of 0.045 ppm. The apartment nearby releases the same pollutant which is mixing at the lake at an average rate of 2.6 g/s. The degradation rate of the pollutant in the lake is 0.36 day^{-1}. A river flow from the lake at a flowrate of 1.2 m^3/s.
   a. Draw a mass balance diagram for the above system. [1]
   b. What is the steady state concentration of the pollutant (in mg/L) in the lake? [4]

6. A bar with volume 500 m^3 has 50 smokers in it, each smoking 3 cigarettes per hour. An individual cigarette emits, among other things, about 1.0 mg of formaldehyde (HCHO). Formaldehyde converts to carbon dioxide with a reaction rate coefficient $k = 10$ day^{-1}. Fresh air enters the bar at the rate of 1,000 m^3/h, and stale air leaves at the same rate.
   a. Draw a mass balance diagram for the above system. [1]
   b. Assuming complete mixing, estimate the steady-state concentration of formaldehyde in the air. [4]
   c. At 25°C and 1 atm of pressure, how does the result compare with the threshold for eye-irritation of 0.1 ppm? [1]

7. The annual average precipitation in a city is 2000mm. The city has a projected population of 0.5 million, spread over an area of 5 km^2 and provided with water supply of 125 lpcd. Find the design discharge for combined sewer. (Take peak factor = 2 and impermeability factor = 0.6) [4]

8. Draw a schematic diagram of typical drinking water treatment plant and fill the table below. [2+3]

S.N.	Unit/Process	What are being removed?	Principle of removal?
1.			
2.			
3.			

9. Write short note on Cyclone separators with schematic diagram. [1.5+1.5]

10. A flue gas discharging from a coal fired power plant at the rate of 200 m^3/s is treated with an electrostatic precipitator (ESP). The effective drift velocity of the particles approaching the collector plate of ESP are 0.117 m/s.
    a. Calculate the area of the collector plate required to achieve the efficiency of 98%. [2]
    b. If you reduce the area of the collector plate as calculated in Q.10 (a) by half, what will be the efficiency achieved? Discuss your answer. [2]

11. Define e-waste. What are the characteristics of hazardous waste? [1+2]

12. The population of 5,000 is residing at the slum area located at Thapathali, Kathmandu and generates solid waste at the rate of 0.8 kg/capita/day. In order to maintain proper sanitation and hygiene, Kathmandu Metropolitan City (KMC) is planning to purchase a truck dedicated to collect the waste generated on a regular basis (every day). They can purchase one of three possible trucks that have the following capacity: Truck A: 8 m^3, Truck B: 6 m^3, Truck C: 4 m^3.
    a. If the typical density of the solid waste at the source is 800 kg/m^3, and the truck will have to make only one trip per day to the landfill, which truck or trucks will have sufficient capacity (Note: there is no compaction facility at the truck) ? [2]
    b. At the landfill site, the solid waste is compacted up to 1000 kg/m^3. Determine the required area of landfill in anna (1 anna=31.79m^2) to deposit the annual waste generated from the slum area providing the landfill depth of 3m. [2]

13. Define Functional unit in Life Cycle Assessment with appropriate examples. [3]

14. Air quality index of Kathmandu and other major cities in Nepal are getting worse day by day. Increase in number of vehicles is identified as one of the major sources of air pollution. In order to improve the air quality of Kathmandu and other major cities, what solutions will you give in terms of incrementalism, reengineering the system and redefinition of the system boundary? [3]