KATHMANDU UNIVERSITY
End Semester Examination [C]
April, 2023

Marks scored:

Level : B.Sc.
Year : IV
Course : ENVS 431
Semester : I

Exam Roll No.:
Time: 30 mins.
F.M. : 20

Registration No.:
Date : 06 APR 2023

SECTION "A"
[20Q. × 1 = 20 marks]

Encircle the most appropriate alternative from each set of choices.

1. The formal waste management system in Kathmandu Valley was introduced on .....
   a. 1970 A.D b. 1980 A.D c. 1990 A.D d. 2000 A.D

2. The value of Pc + Uc for the hoist truck is taken as
   a. 0.067 hr/trip b. 0.67 hr/trip c. 0.077 hr/trip d. 0.072 hr/trip

3. The percentage of the organic waste in Kathmandu Valley is approximately .....
   a. 50 b. 55 c. 60 d. 65

4. Transfer station is consider when haulage distance is .....
   a. Greater than 7 km b. Greater than 10 km
   c. Less than 10 km d. Less than 7 km

5. FC of commingled MSW is found to be .....
   a. 30~40% b. 40~50% c. 55~65% d. 50~60%

6. Landfill for the individual waste is ..... landfill.
   a. monofill LFS b. landfill for shredded waste
   c. commingled LFS d. sanitary LFS

7. Limbs, organs, blood, tissues are referred as ..... waste.
   a. surgical b. municipal c. clinical d. pharmaceutical

8. ..... analysis of SW is also known as the elemental analysis of the SW.
   a. Proximate b. Ultimate c. Duglung's d. Unit

9. Bench is provided where the height of the landfill exceeds to ..... meters.
   a. 5 b. 20 c. 25 d. 30

10. Which of the following convention is related to SWM?
    a. UNFCC convention b. Basel Convention
    c. Kyoto convention d. Copenhagen Convention

11. Which of the following physical property of MSW is not important in its transportation?
    a. Specific weight or unit weight b. Heating value
    c. Moisture content d. Particle size and size distribution

12. Which of the following factors does not affects the composting process?
    a. C:N Ratio b. Moisture
    c. Particle Size d. None of the above

13. Biological reactions in landfills occur in four stages: 1. Methanogenesis (steady), 2. Acid Phase, 3. Aerobic Phase, 4. Methanogenesis (unsteady). Which of the following is correct order?
a. 1-2-3-4 b. 2-3-1-4 c. 3-2-4-1 d. 3-2-1-4

14. Hazardous waste could be incinerated in .....
a. Pulp and paper industry
b. Electroplating industry
c. Cement industry
d. Petrochemical industry

15. A colony having a population of 50000 generates solid waste at a rate of 3 Kg/capita/day. The compacted specific weight of the solid waste in landfill is 500 Kg/m^3 and average depth of compacted solid waste in landfill is 6 m. Determine the required area of landfill per annum in ha?
a. 1.8 b. 2 c. 2.5 d. 3

16. Which one of the following is not a bio-chemical characteristic of solid waste?
a. Carbohydrates
b. Leachates
c. Protein
d. Natural fibre

17. ..... refers to the action of crushing and grinding heavier solids into the lighter solids.
a. Pulverization
b. Windrow composting
c. Mechanical incineration
d. Shredding in LFS

18. C/N ratio of the digestive material should be between ..... for optimum digestion.
a. 15 to 25 b. 25 to 35 c. 30 to 50 d. 45 to 60

19. The heat value for C_2H_5OH is ..... KJ/Kg.
a. 15000 b. 20000 c. 25000 d. 30000

20. The most serious environmental effect posed by hazardous wastes is .....
a. air pollution.
b. contamination of groundwater.
c. increased use of land for landfills.
d. destruction of habitat.

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SECTION "B"

Attempt *ALL* questions. Assume necessary data with explanation.

1. Calculate the length (L), breath (B) and height (H) (if L:B = 3:1) of the rectangular shaped landfill of Dhulikhel Municipality if the per capita waste generation is 250gm and average projected population is 15,00,000 for one decade. Calculate the area required if 10% of the waste produced per capita is added for commercial and other wastes and 75% of the waste is expected to reach the landfill site. It is estimated that there will be 5 cells in 1 lift of 5 m including daily cover height of 15 cm and intermittent cover of 30 cm. The landfill allows maximum of 5 lifts. [7]

2. What are the basic information needed for the design of ISWM in your city? [7]

OR

Explain ISSWM. Identify and discuss briefly the issues that you feel will be important in the field of solid waste management in the 21st century. [2+5]

3. What is the compactor size required to haul waste from a residential community with following details: [7]
   - Container size (c) = 0.24 m^3
   - Container utilization factor = 0.75
   - Avg. no. of container in each station= 2
   - Collection vehicle compaction ratio = 2.5
   - Container unloading time U_c= 5 min/container
   - Two-way haul distance x = 30 km
   - Speed limit = 40 km/hr
   - Length of workday H = 8 hr.
   - Average driving time between the containers = 6 mins
   - t_1 and t_2 are 30 mins.

OR

What are the major physical properties of Solid wastes? Explain in brief about any three of them? [7]

4. Permeability depends on pore size distribution, surface area, porosity and properties of the waste materials. To determine permeability we use, $\mathbf{K = C\ d^2\ (\gamma/\mu) = k\ (\gamma/\mu)}$. Define all the dimensions of the above equation. Calculate the heat value of ethanol in KJ/Kg. [3+4]

5. Explain the methods of on-site management of low, medium and high rise buildings. [7]

6. With a neat sketch draw a section of a landfill and explain its major parts. Explain the biological decomposition process of organic waste. [4+3]

7. Define proximate analysis of solid waste. Estimate the total MC, total dry mass, overall density and volume from the waste sample given below. [3+4]

Components	**% by mass**	**MC %**	**Density kg/m^3**
food waste	14	70	290
paper	46	6	85
cardboard	10	5	50
plastics	10	2	65
Agriculture waste	10	60	105
wood	4.5	20	240
tin cans	6.5	3	90

8. Write short notes on (*ANY TWO*): [2×3=6]
   a. Incineration
   b. Composting(bin or windrow or in-vessel)
   c. Design consideration of transfer station
   d. Total Operating Cost of Collection ,transfer and transport