

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2024

PhD -I Semester (CE/BT &BI)

COURSE CODE (CREDITS): 14M31CE115 (3)

MAX. MARKS: 25

COURSE NAME: Solid Waste Management

COURSE INSTRUCTORS: Dr. Rishi Rana Kalia

MAX. TIME: 1 Hour 30 Minutes

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

| Q.No | Question | CO | Marks | | | | | |
|------------|---|----------------------|------------------------------------|---------------|-------------------|-----|------|-----|
| Q1 | <p>A private solid waste collector wishes to locate MRF near a commercial area. The collector would like to use a hauled container system but fears that the haul costs might be prohibitive. What is the maximum distance away from the commercial area that the MRF can be located so that weekly costs of the hauled container system? Assume that one collector-driven vehicle will be used in each system. For the purpose of this example assume the travel times t_1 and t_2 are included in the off-route factor. Estimate the average pickup time for the hauled container system, Estimate the time required per week (T_w) as a function of the round-trip haul distance for hauled container system, Estimate the weekly operational cost as a function of round-trip haul distance for hauled container system and Estimate the number of containers emptied per trip? Assume the following data</p> <p>a) Quantity of solid wastes = 230 m³/wk b) Container size = 6 m³/trip c) Container utilization factor = 0.67 d) Container pickup time = 0.33h/trip e) Haul time constants: $a = 0.022\text{h/trip}$ and $b = 0.014\text{h/km}$ f) At-site time (s) = 0.053h/trip g) Overhead costs = ₹28464 per week h) Operational Costs = ₹1067 per hour of operation</p> | CO-3 | 5 Marks | | | | | |
| Q2 | Explain in detail with neat and labeled diagram the various landfill operation issues? | CO-4 | 4 Marks | | | | | |
| Q3 | (a) Estimate the moisture content, density, energy content as well as derive the chemical formula of a waste sample (100 Kg) with following composition: | CO-4 | 5 Marks | | | | | |
| Component | Percent by mass | Moisture content (%) | Typical Density, Kg/m ³ | Energy, Kj/Kg | Ultimate analysis | | | |
| | | | | | C | H | N | S |
| Food waste | 10 | 95 | 465 | 5874 | 25 | 6.4 | 73.5 | 0.2 |
| Paper | 40 | 9 | 58 | 82969 | 23 | 6.0 | 44 | 0.2 |

| | | | | | | | | |
|------------|---|----|-----|--------|----|--------|--------------------|-----|
| Cardboards | 6 | 1 | 63 | 30748 | 10 | 5 | 40 | 0.4 |
| Plastic | 6 | 5 | 158 | 25019 | 96 | 6.6 | 44.9 | 6 |
| Garden | 15 | 82 | 392 | 700 | 10 | 10 | 32.1 | 2.2 |
| Wood | 5 | 74 | 110 | 5600 | 5 | 3 | 11.6 | 2.5 |
| Inert | 18 | 20 | 625 | 180419 | 2 | 6.5 | 37.5 | 3.0 |
| | (b) Explain the need of source reduction in waste management? | | | | | CO-2 | 3 Marks | |
| Q4 | Solid waste from a society is to be collected in large container. Based on the traffic studies, it is estimated that the average time to drive from garage to first container and from last container to the garage each day is 35 and 25 minutes respectively. The time required to pick up loaded container and unload empty container is 0.7 h/trip. If the average time required to drive between the containers is 8 minutes and full way journey is 80 km, determine the number of containers that can be emptied per day based on a 9 h workday? Assume the value of a, b and s as 0.016, 0.011 and 0.133 respectively. The off-route factor can be taken as 0.15. | | | | | CO-3 | 4 Marks | |
| Q5 | Explain the difference between compaction and size reduction and their importance in SWM? | | | | | CO-3 | 2 Marks | |
| Q6 | Critically examine the “Chemical Characteristics” of SWM along with their analysis technique? | | | | | CO-3&4 | 2 Marks | |