

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

**CLASS: M.TECH  
BRANCH: ENVIRONMENTAL SCIENCE AND ENGINEERING**

**SEMESTER : II  
SESSION : SP/2023**

**SUBJECT: CE534 SOLID WASTE MANAGEMENT**

**TIME: 3 Hours**

**FULL MARKS: 50**

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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|--|--------------------|--------------------|-----------|--------------------|--------------------|------------|----|----|-------|----|---|-----------|---|---|----------|---|---|-------------|----|----|------|---|----|----------|---|---|
| Q.1(a) Explain proximate analysis and its application in solid waste management.   | [5]                | 1 2                |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| Q.1(b) Estimate the moisture content of a solid waste sample that has the following components. Use suitable data. The dry mass of solid waste is 100kg.   | [5]                | 1 5                |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| <table border="1" style="width: 100%; border-collapse: collapse;"><thead><tr><th style="text-align: left;">Component</th><th style="text-align: left;">Percentage by mass</th><th style="text-align: left;">Moisture content %</th></tr></thead><tbody><tr><td>Food waste</td><td>14</td><td>70</td></tr><tr><td>Paper</td><td>40</td><td>6</td></tr><tr><td>Cardboard</td><td>9</td><td>5</td></tr><tr><td>Plastics</td><td>9</td><td>5</td></tr><tr><td>Yard Wastes</td><td>12</td><td>60</td></tr><tr><td>Wood</td><td>5</td><td>20</td></tr><tr><td>Tin cans</td><td>6</td><td>3</td></tr></tbody></table> |                    |                    | Component | Percentage by mass | Moisture content % | Food waste | 14 | 70 | Paper | 40 | 6 | Cardboard | 9 | 5 | Plastics | 9 | 5 | Yard Wastes | 12 | 60 | Wood | 5 | 20 | Tin cans | 6 | 3 |
| Component  | Percentage by mass | Moisture content % |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| Food waste   | 14                 | 70                 |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| Paper  | 40                 | 6                  |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| Cardboard  | 9                  | 5                  |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| Plastics   | 9                  | 5                  |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| Yard Wastes  | 12                 | 60                 |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| Wood   | 5                  | 20                 |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| Tin cans   | 6                  | 3                  |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| Q.2(a) Enlist different types of SWM collection methods.   | [5]                | 2 2                |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| Q.2(b) Discuss the need of transfer stations and its types.  | [5]                | 2 3                |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| Q.3(a) Differentiate between different thermal processing methods of SWM.  | [5]                | 3 4                |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| Q.3(b) Explain the principle and methods of composting.  | [5]                | 3 2                |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| Q.4(a) Estimate the required landfill area required in a year for a community with a population of 50,000. The following conditions apply:<br>Solid waste generation 1.5 kg/capita/day<br>Compacted specific weight of solid wastes in landfill 500 kg/m <sup>3</sup><br>Average depth of compacted solid wastes 5m  | [5]                | 4 6                |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| Q.4(b) Discuss the landfill siting considerations in brief.  | [5]                | 4 3                |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| Q.5(a) Draw a labelled diagram of leachate characteristics and gas composition Vs. time diagram of different phases of landfilling.  | [5]                | 5 5                |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |
| Q.5(b) Prepare environmental monitoring plan for a landfill site.  | [5]                | 5 5                |           |                    |                    |            |    |    |       |    |   |           |   |   |          |   |   |             |    |    |      |   |    |          |   |   |

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