

INSTRUCTIONS TO PAPER SETTERS:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from question no. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only one question from each unit.

UNIT – I

Sources, Composition & Properties of Municipal solid waste & Hazardous waste. Handling & Separation of solid waste, Municipal Waste (Management & Handling Rules, 2000), Hazardous Waste (Management & Handling Rules, 1989 and amendments), Federal Hazardous Waste Regulations under RCRA, Superfund, CERCLA & SARA and Life cycle analysis of waste.

Integrated solid waste management (SWM) System, Hierarchical approach for SWM.

Solid Waste Collection & Transportation: Types of collection systems (Hauled- container system & Stationary container system), Collection routes & their Layout, Solid waste transfer stations.

[No. of Hours: 11]**UNIT – II**

Methods of Disposal of Municipal Solid Waste & Hazardous waste

Landfills: Classification, Types & methods, Site selection, Site preparation, Composition, Characteristics, Generation, & Control of Landfill gases; Composition, Formation, Movement & control of leachate in landfills; landfill design. Revegetation of closed landfill sites, Long term post closure plan, Groundwater monitoring during & after closure. Hazardous Waste Landfill Remediation.

[No. of Hours: 10]**UNIT – III**

Composting: Theory of composting, Manual and mechanized composting, Design of composting plan, Recovery of bioenergy from organic waste.

Thermal Conversion Technologies: Incineration, Pyrolysis & Gasification Systems. Types & design of Incinerators.

Treatment methods of Hazardous waste management: Air Stripping, Carbon Adsorption, Steam stripping neutralization, Oxidation- Reduction, Precipitation, Solidification and stabilization, Bioremediation.

[No. of Hours: 10]**UNIT – IV**

Bio-medical wastes (Management & Handling) Rules, 1998, Amendments & guidelines, Characterization of biomedical waste & Storage of biomedical waste, Segregation of biomedical waste.

Techniques of Biomedical waste management: Autoclaving, Microwave radiations, Chemical treatments. Introduction to linear programming & transportation problem, Route & cost optimization.

[No. of Hours: 9]**Text and Reference Books:**

1. George Tchobanoglous, Hilary Theisen, Samuel A. Viquel, "Integrated Solid Waste Management: Engineering, Principles & Management issues", McGraw-Hill- International Editions.
2. CPHEEO Manual on Municipal Solid Waste Management.
3. Michael D. LaGrea, Phillip L. Buckingham, Jeffrey C. Evans, "Hazardous Waste Management and Environmental Resource Management", McGraw-Hill- International Edition.
4. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, "Environmental Engineering", McGraw-Hill- International Editions.
5. Mackenzige L. Davis, David A. Cornwell, "Introduction to environmental engineering", McGraw-Hill- International Edition.
6. Arcadio P. Sincero, Gregoria A. Sincero, "Environmental Engineering, A Design Approach", Prentice Hall India.
7. William P. Cunningham, Mary Ann Cunningham, "Principles of Environmental Science", TMH. India.
8. Richard T. Wright, "Environmental Science", Pearson Education.
9. Bala Krishnamoorthy, "Environmental Management, Text Book and Cases", PHI Publication.