

B.E. Semester: VIII
Department of Civil Engineering

Subject Name: Hazardous and Solid Waste Management (CV803-N-B)

Course Category: Program Course Elective – IV (PCE)

A. Objectives of the Course:

- This subject is intended to make students aware about various kind of solid wastes and their general characteristics along with different technologies for treatment of these wastes
- Existing legislation for municipal waste, e-waste & hazardous waste and design criteria for hazardous waste and municipal waste landfill is also an integral part of this course
- To provide a coherent development to the students for the courses in sector of engineering like solid Waste Management and hazardous waste etc.
- To analyze the waste characteristics
- To give an experience in the implementation of engineering concepts which are applied in field of waste management
- To present the foundations of many basic Engineering tools and concepts related Environmental Engineering

B. Teaching & Evaluation Scheme

| Teaching Scheme | | | | Credit | Evaluation Scheme | | | | | Total Marks |
|-----------------|-------|-------|-----------|--------|-------------------|-------|-------|-------|----------|-------------|
| L hrs | T hrs | P hrs | Total Hrs | | Theory | | IE | CIA | Pra/Viva | |
| | | | | | Hrs | Marks | Marks | Marks | Marks | |
| 2 | 2 | 0 | 4 | 4 | 3 | 70 | 30 | 20 | 30 | 150 |

C. Detailed Syllabus

1. **Introduction and Characterization of Solid Waste and Hazardous Waste:**
Municipal Waste, Plastic Waste, Biomedical Waste, E waste, Dairy Wastes, Agricultural

Wastes, Slaughter House Wastes, Industrial Waste and Hazardous Waste

2. **Legislation for Management of Solid Waste:** Municipal Solid Waste Management Rules: 2016, E-waste management and handling rules, 2011, Major Sections of Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008
3. **Solid Waste Management:** Sustainable Waste Management Practices, 4R Principle for Waste Management, Collection, Transportation and Disposal of Solid Waste, Role of Transportation in Solid Waste Management, Equipment Management, Gramin Small Scale Treatment in Rural Area
4. **Solid Waste Treatment:** Physico-Chemical and Biological Methods (Aerobic Composting and Anaerobic Digestion) of Treating Solid Wastes, Thermo-Chemical Methods (Pyrolysis, Gasification and Incineration) of Treating Solid Wastes, Energy Recovery through Refuse Derived Fuel. Solid Waste Management in Industries, E-Waste Processing and Disposal
5. **Solid and hazardous waste disposal:** Guidelines and Landfill Procedure for Disposing Hazardous Waste, Location and Site Selection Criteria for Hazardous Waste Landfill, Site Investigation, Planning and Design of Hazardous Waste Landfill, Waste Acceptance Criteria at Hazardous Waste Landfill

D. Lesson Planning

| Unit No | Title of the Unit | Minimum Hours | Weightage (%) |
|---------|--|---------------|---------------|
| 1 | Introduction and characterization of solid waste and hazardous waste | 07 | 25 |
| 2 | Legislation for management of solid waste | 07 | 25 |
| 3 | Solid waste management/treatment | 08 | 25 |
| 4 | Solid and hazardous waste disposal | 08 | 25 |
| Total: | | 30 | 100 |

E. Assignments:

- Understanding of comprehensive and fingerprint analysis.
- Understanding of various treatment methods for solid waste.
- Design of hazardous waste landfill

F. Instructional Method and Pedagogy (Continuous Internal Assessment Scheme CIA):

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures, practical and Tutorial which carries 05 Marks.
- At regular intervals assignments is given. In all, a student should submit all assignments of 05 marks each.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries 05 Marks.
- Viva Voce will be conducted at the end of the semester of 05 Marks.
- One internal exam of 30 marks is conducted as a part of Mid Semester evaluation.

G. Students Learning Outcomes:

On the successful completion of this course

- The students will be able to understand hazardous waste management
- The students will be able to identify the various technologies for treatment of these wastes.
- The students will be able to analyse the waste characteristics.
- The students will be familiar with solid waste management technique.
- The students will build foundations of many basic Environmental Engineering tools and concepts related Environmental Engineering

H. Recommended Study Materials

a. Text book & Reference Books:

1. Industrial Water Pollution Control, Eckenfelder W.W.; McGraw Hill Book Company 3rd Ed, 2000.
2. Environmental Engineering, Kiely G. McGraw Hill Book Company, 1998.
3. Environmental Pollution Control and Engineering, Rao C.S., New Age International (P) Limited, 1991.
4. Treatment of Industrial Wastes, Besseliere, E and Schwartz. McGraw Hill. 1975.
5. Handbook of Solid Waste Management and Waste Minimization Technologies, N P Cheremisinoff, Butterworth-Heinemann, 2003.
6. Integrated Solid waste Management, F Dougal and P White, John Wiley and Sons, 2001.
7. Solid Waste Engineering, Worrell and Vesilind, Cengage Learning, 2nd Ed., 2001

b. Web Materials:

1. <http://www.epa.gov>
2. <http://www.indiaenvironmentportal.org.in>
3. <http://nptel.iitm.ac.in>
4. <http://www.filtersource.com>

c. Indian Codes of Practice:

1. CPHEEO: Manual for Solid Waste Management
2. IS 5572(2009) Hazardous waste area
3. IS 12647 solid waste management

