

<b>B. E. CIVIL ENGINEERING</b>			
<b>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)</b>			
<b>SEMESTER - VI</b>			
<b>SOLID WASTE MANAGEMENT</b>			
Course Code	<b>18CV642</b>	CIE Marks	40
Teaching Hours/Week(L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
<b>Course Learning Objectives:</b> This course will enable students to			
<ol style="list-style-type: none"> <li>1. Study the present methods of solid waste management system and to analyze their draw backs comparing with statutory rules.</li> <li>2. Understand different elements of solid waste management from generation of solid waste to disposal.</li> <li>3. Analyze different processing technologies and to study conversion of municipal solid waste to compost or biogas.</li> <li>4. Evaluate landfill site and to study the sanitary landfill reactions.</li> </ol>			
<b>Module -1</b>			
<p><b>Sources:</b> Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems.</p> <p><b>Collection:</b> Collection of solid waste- services and systems, equipments,</p> <p><b>Transportation:</b> Need of transfer operation, transfer station, transport means and methods, route optimization. Solid waste management 2000 rules with, 2016 amendments.</p>			
<b>Module -2</b>			
Processing techniques: Purpose of processing, Volume reduction by incineration, Process description, Mechanical volume reduction (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods).			
<b>Module -3</b>			
<p><b>Composting Aerobic and anaerobic method</b> - process description, process microbiology, design consideration, Mechanical composting, Vermi composting, Numerical Problems.</p> <p><b>Sanitary land filling:</b> Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Design of sanitary landfill. Numerical Problems.</p>			
<b>Module -4</b>			
<b>Sources, collection, treatment and disposal:-</b> Biomedical waste, E-waste, construction and demolition waste.			
<b>Module -5</b>			
Incineration -3Ts factor affecting incineration, types of incinerations, Pyrolysis, Energy recovery technique from solid waste management. Hazardous waste.			
<b>Course outcomes:</b> After studying this course, students will be able to:			
<ol style="list-style-type: none"> <li>1. Analyse existing solid waste management system and to identify their drawbacks.</li> <li>2. Evaluate different elements of solid waste management system.</li> <li>3. Suggest suitable scientific methods for solid waste management elements.</li> <li>4. Design suitable processing system and evaluate disposal sites.</li> </ol>			
<b>Question paper pattern:</b>			
<ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question will be for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub- questions) from each module.</li> <li>• Each full question will have sub- question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module.</li> </ul>			
<b>Textbooks:</b>			

1. George Tchobanoglous, Hilary Theisen , Samuel A Vigil, “Integrated Solid Waste Management : Engineering principles and management issues”, M/c Graw hill Education . Indian edition
2. Howard S Peavy, Donald R Rowe and George Tchobanoglous, “Environmental Engineering”, Tata Mcgraw Hill Publishing Co Ltd.,

**Reference Books:**

1. Municipal Solid Wastes (Management and Handling) Rules, 2000.Ministry of Environment and Forests Notification, New Delhi, the 25th September, 2000. Amendment – 1357(E) – 08-04-2016
2. Municipal Solid waste management manual, Part II published under Swachh Bharat Mission, Central Public Health and Environmental Engineering Organization (CPHEEO), 2016, Ministry of Urban Development, Government of India.
3. Handbook of Solid waste management, second edition, George Tchobanoglous, Frank Kreith, published by M/c Graw hill Education, 2002, ISBN-13 978-0071356237 ISBN -10 0071356231