
	SRI VIDYA COLLEGE OF ENGINEERING & TECHNOLOGY COURSE PLAN (THEORY)	
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ACADEMIC YEAR: 2018-2019 ODD

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Subject Code	EN6501			L	P	T	C
Subject Title	MUNICIPAL SOLID WASTE MANAGEMENT			3	0	0	3
Year / Dept / Sem	IV / CIVIL / VII			Regulation Year		2013	
Faculty Name / Desg / Dept	R.AMUTHASELVAKUMAR/ AP / CIVIL						
Course Prerequisite	A. Students must have basic knowledge on municipal solid waste and its sources of generation B. Students must be aware of storage and collection systems of wastes C. Students must have knowledge on various disposal techniques available in India						

EN6501 MUNICIPAL SOLID WASTE MANAGEMENT L T P C
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OBJECTIVES:

- To make the students conversant with different aspects of the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

UNIT I SOURCES AND TYPES**8**

Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes-Public health and environmental effects. Elements of solid waste management –Social and Financial aspects – Municipal solid waste (M&H) rules – integrated management-Public awareness; Role of NGO's.

UNIT II ON-SITE STORAGE AND PROCESSING**8**

On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – waste segregation and storage – case studies under Indian conditions – source reduction of waste – Reduction, Reuse and Recycling.

UNIT III COLLECTION AND TRANSFER**8**

Methods of Residential and commercial waste collection – Collection vehicles – Manpower– Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Field problems- solving.

UNIT IV OFF-SITE PROCESSING**12**

Objectives of waste processing – Physical Processing techniques and Equipments; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.

UNIT V DISPOSAL**9**

Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor– Dumpsite Rehabilitation

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

- an understanding of the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management
- ability to plan waste minimization and design storage, collection, transport, processing and disposal of municipal solid waste

TEXTBOOKS:

1. Tchobanoglous, G., Theisen, H. M., and Eliassen, R. "Solid. Wastes: Engineering Principles and Management Issues". McGraw Hill, New York, 1993.
2. Vesilind, P.A. and Rimer, A.E., "Unit Operations in Resource Recovery Engineering", Prentice Hall, Inc., 1981
3. Paul T Williams, "Waste Treatment and Disposal", John Wiley and Sons, 2000

REFERENCES:

1. Government of India, "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, New Delhi, 2000.
2. Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection", Processing and Disposal, 2001
3. Manser A.G.R. and Keeling A.A., " Practical Handbook of Processing and Recycling of Municipal solid Wastes", Lewis Publishers, CRC Press, 1996
4. George Tchobanoglous and Frank Kreith "Handbook of Solidwaste Management", McGraw Hill, New York, 2002
5. Sasikumar.K, Sanoop Gopi Krishna, "Solid Waste Management", PHI learning, New Delhi, 2009

Course Objectives (CO)	<p>CO1: Understanding of problems of municipal waste, biomedical waste, hazardous waste, e-waste, industrial waste etc.</p> <p>CO2: Knowledge of legal, institutional and financial aspects of management of solid wastes.</p> <p>CO3: Become aware of Environment and health impacts of solid waste mismanagement</p> <p>CO4: Identifying recycling and reuse options (composting, source separation, and re-use of shredded tires, recycled glass, fly ash, etc.).</p>
Expected Course Outcomes (ECO)	<p>At the end of the course, the students will have</p> <p>ECO1: an understanding of the nature and characteristics of municipal solid wastes.</p> <p>ECO2: knowledge on the regulatory requirements regarding municipal solid waste management.</p> <p>ECO3: ability to plan waste minimisation and design storage, collection, transport, processing and disposal of municipal solid waste.</p> <p>ECO4: the ability to design all units of municipal solid waste management.</p>

COURSE OUTCOMES	
CO1	The students will have the ability to plan waste minimization and design storage, collection, transport, processing and disposal of municipal solid waste.
CO2	The students will be able to design all units of solid waste management.
CO3	The students will be able to compute the quantities of waste generated.
CO4	The students will be able to find the type of waste generated and its end use.
CO5	The students will be able to utilize the waste by material recovery sheets.
CO6	The students will be able to identify various laws related solid waste management.
<p align="center">PROGRAM OUTCOMES (Pos)</p> <p>Engineering graduates will be able to:</p> <ol style="list-style-type: none"> 1. ENGINEERING KNOWLEDGE: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. 2. PROBLEM ANALYSIS: identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principals of mathematics, natural sciences and engineering sciences. 3. DESIGN/ DEVELOPMENT OF SOLUTIONS: Design solutions for complex engineering problems and design systems components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural societal, and environmental considerations. 4. CONDUCT INVESTIGATIONS COMPLEX PROBLEMS: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions. 5. MODERN TOOL USAGE: Create, select, and apply appropriate techniques resources, and modern engineering and it tools including production and modeling to complex engineering activities with an understanding of the limitations. 6. THE ENGINEERING AND SOCIETY: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practices. 7. ENVIRONMENT AND SUSTAINABILITY: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. 8. ETHICS: Apply ethical principles and commit to professional and responsibilities and norms of the engineering practices. 9. INDIVIDUAL AND TEAM WORK: Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary setting. 	

10.COMMUNICATION: Communicate effectively on complex engineering activities with the engineering community and with society at large such as being able to comprehend and write effective reports and design documentations, make presentations, and give and receive clear instructions.

11.PROJECT MANGMENT AND FINANCE: Demonstrate knowledge and understanding of the engineering and management principals and apply these to one's own work as a member and leader in a team to manage project and in multidisciplinary environments.

12. LIFE LONG LEARNING: Recognize the need for and have the preparations and ability to engage in independent and lifelong learning in the broadest context of technological change.

Mapping of CO & PO (Specify the PO's) - (Fill the col.s with the legend given below)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	2	-	2		1	2
CO2	3	-	2	-	1	-	2	2	1	-	-	2
CO3	2	1	2	2	-	2	3	-	2	-	1	2
CO4	3	-	2	-	1	-	2	2	1	-	1	2
CO5	2	1	-	-	-	-	3	-	2	-	1	2
CO6	2	1	-	-	-	-	2	-	1	-	1	2

Bridging the Curriculum Gap
(Additional Topics beyond syllabus/Seminars/Assignments)

BCG1: Hazardous waste – treatment and management
BCG2: Treatment of biomedical waste
BCG3: E-waste management

Related Website URLs

W1:<http://nptel.ac.in/courses/120108005/>
W2:http://environmentclearance.nic.in/writereaddata/Form1A/HomeLinks/TGM_%20Comman%20Municipal%20Solid%20Waste%20Management_160910_NK.pdf
W3:http://www.iitk.ac.in/3inetwork/html/reports/IIR2006/Solid_Waste.pdf
W4:www.tezu.ernet.in/denvsc/IDC/Waste%20Management.ppt

Related Video Course Materials
(min. 3 no.s)

V1:<https://www.youtube.com/watch?v=9OCZWIvsUCQ>
V2:<http://study.com/academy/lesson/sanitary-landfills-definition-and-issues.html>
V3:<https://www.youtube.com/watch?v=yWRyBiEyHbM>
V4:<https://www.youtube.com/watch?v=rmFSONXtaqw>

S.No	Topic Name	Book Page no	Mode of delivery	No of hrs	Cumulative hrs
UNIT I SOURCES AND TYPES					
1	Introduction-Handling Of Municipal Solid Wastes-Overview of Syllabus	Xerox	Class room teaching, PPT	1	1
2	Sources and types of municipal solid wastes, waste generation rates and factors affecting generation	T1 Pg.39-45,125-149	Class room teaching, PPT	2	3
3	Characteristics-Methods of sampling and characterization, Effect of improper disposal of solid wastes	T1 Pg.69-90, R5 138-141	Class room teaching, PPT	2	5
4	Elements and social and financial aspects of management, Integrated management	T1 Pg.10-18	Class room teaching, PPT, Video presentation	2	7
5	Municipal solid waste(M&H) rules, Public awareness, Role of NGO's	R5 Pg.37-45, Pg.113-136	Class room teaching, PPT	2	9
UNIT II ON-SITE STORAGE AND PROCESSING					
1	Onsite storage methods, Effect of storage, Materials used for containers	T1 Pg.170-181	Class room teaching, PPT	2	11
2	Onsite segregation of solid wastes	T1 Pg.255-264	Class room teaching, PPT	2	13
3	Public health and economic aspects of open storage	Xerox	Class room teaching, PPT	1	14
4	Waste segregation and storage-case studies under Indian conditions	Xerox	Class room teaching, PPT	1	15
5	Source reduction of waste-reduction, reuse, recycling	T1 Pg.181-190	Class room teaching, PPT	2	17
UNIT III COLLECTION AND TRANSFER					
1	Methods of residential and commercial waste collection	T1 Pg.193-204	Class room teaching, PPT	1	18
2	Collection vehicles-manpower-collection routes	T1 Pg.204-210, 228-237	Class room teaching, PPT	2	20
3	Analysis of collection system, transfer stations	T1 Pg.210-228, 328-343	Class room teaching, PPT	2	22
4	Selection of site location, operation and maintenance	T1 Pg.352-357	Class room teaching, PPT	2	24
5	Field Problems-Solving	Own notes	Class room teaching	1	25

UNIT IV OFF-SITE PROCESSING					
1	Objectives of waste processing	T1 Pg.247-249	Class room teaching, PPT	2	27
2	Physical processing techniques	T1 Pg.543-576	Class room teaching, PPT	2	29
3	Equipments for processing	T1 Pg.543-576	Class room teaching, PPT	2	31
4	Resource recovery from solid waste	R1 Pg.17-22	Class room teaching, PPT	2	33
5	Composting	T1 Pg.302-317	Class room teaching, PPT, Video presentation	2	35
6	Biomethanation	T1 Pg.679-684	Class room teaching, PPT	2	37
7	Thermal processing options	T1 Pg.611-636	Class room teaching, PPT	2	39
8	Case studies	R5 Pg.255-261, 267-271	Class room teaching, PPT	2	41
UNIT V DISPOSAL					
1	Land disposal of solid waste	T1 Pg.362-376	Class room teaching, PPT, Video presentation	1	42
2	Sanitary landfills-site selection	T1 Pg.377-381	Class room teaching, PPT	2	44
3	Design and operation of sanitary landfills	T1 Pg.468-530	Class room teaching, PPT	2	46
4	Landfill liners-Management of leachate and landfill gas	T1 Pg.413-420, 431-443	Class room teaching, PPT	2	48
5	Landfill bioreactor	Xerox	Class room teaching, PPT	2	50
6	Dumpsite rehabilitation	T1 Pg.770-797	Class room teaching, PPT	2	52

	<i>Prepared by</i>	<i>Approved by</i>
Signature		
Name	R.AMUTHASELVAKUMAR	P.SURESHKUMAR
Designation	Assistant Professor / CIVIL	Professor & HOD (Civil)
Signed date		

LEGEND

METHODOLOGY TO MAP OBJECTIVE WITH OUTCOME

Course outcomes are achieved through

- a.** Suitable Analogies.
- b.** Class room teaching.
- c.** Assignments.
- d.** Tutorials
- e.** Weekly, monthly and model exams.
- f.** Brain storming.
- g.** Group discussion and role play.
- h.** Seminars