GUJARAT TECHNOLOGICAL UNIVERSITY

ENERGY ENGINEERING (39)

WASTE MANAGEMENT AND ENERGY GENERATION TECHNOLOGY

SUBJECT CODE: 2723917

SEMESTER: II

Type of course: Elective III

Prerequisite: Basic knowledge of Energy resources and Energy Conversions

Rationale: The course provides basic understanding of Waste Management and Energy Generation Technology.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	PA (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
	Module I		
1	**Solid Waste:** Definitions – sources – types – compositions – properties of solid waste – Municipal solid waste - Physical, Chemical and Biological properties – collection – transfer stations – waste minimization and recycling of Municipal waste.	**9**	20%
2	**Waste Treatment and Disposal:** Size Reduction – aerobic composting – incineration – furnace type and design – medical/pharmaceutical waste incineration – environmental impacts – measures to mitigate environmental effects due to incineration Land fill method of solid waste disposal – land fill classifications – types – methods – siting consideration – layout and preliminary design of landfills – composition, characteristics, generation, movement and Control of landfill, Leachate & gases – environmental monitoring system for land fill gases.	**15**	33%

3	**Hazardous Waste Management:** Definition – identification of hazardous waste – sources and nature of hazardous waste – impact on environment – hazardous waste control – minimization and recycling – Assessment of hazardous waste sites – disposal of hazardous waste – underground storage tank construction – installation – closure.	**9**	20%
4	**Energy generation from waste :** Types - biochemical conversion – sources of energy generation – industrial waste – agro residues – anaerobic digestion – Biogas production – types of biogas plant thermo-chemical conversion – sources of energy generation – gasification – types of gasifiers – briquetting – industrial applications of gasifiers – utilization and advantages of briquetting – environment benefits of biochemical and thermo-chemical conversion.	**12**	27%

Reference Books:

1. M. M. EL-Halwagi, Biogas Technology- Transfer and diffusion, Elsevier Applied science Publishers, New York, 1984.
2. Parker, Colin, & Roberts, 1985. Energy from Waste - An Evaluation of Conversion Technologies, Elsevier Applied Science, London.
3. Michael D. Lagrega., et al., "Hazardous Waste Management", Waveland Pr Inc, 2010
4. Paul T. Williams, "Waste treatment and disposal", 2nd Edition, John Wiley and Sons, 2005
5. Manoj Dutta, Waste Disposal in Engineered Landfills, Narosa Publishing House, 1997.
6. Shah, Kanti, 2000. Basics of Solid & Hazardous Waste Management Technology, Prentice Hall.
7. Bhatia S.C., 2007. Solid and Hazardous Waste Management, Nice Printing Press, Delhi.
8. Bhide AD., Sundaresan BB, Solid Waste Management in Developing Countries, INSDOC New Delhi, 1983
9. Mande S., Kishore V.V. N., 2007. Towards Cleaner Technologies-A Process Story on Thermal Gasifiers for Heat Applications in Small and Micro Enterprises, IG Printers Pvt. Ltd., New Delhi.
10. Khandelwal K.C., Mahdi S S, 1986. Biogas Technology - A Practical Handbook, Tata McGraw Hill.

Course Outcome: After learning the course the students should be able:

1. Learn about the minimization and recycling of solid waste.
2. Assess with waste treatment & waste disposal.
3. Understand about control, recycling and disposal of hazardous waste.
4. Learn about types and different ways to generate the energy from the waste.

List of Open Source Software/learning website:
www.nptel.iitm.ac.in/courses/;
http://ocw.mit.edu/courses/energy-courses/

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The

GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.