GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Chemical Engineering
Minor Degree: Waste Treatment Technology
Subject Code: 115AB02
Semester – V
Subject Name: Waste Heat and Energy Recovery

Type of course: Minor Degree Course

Prerequisite: A good understanding about environmental science and thermodynamics is required.

Rationale: The main objective of this subject is to gather knowledge about the techniques involved in the generation of energy from the waste produced by different sources.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	1	0	4	70	0	30	0	100

Content:

Sr. No.	Content	Total Hrs	%Weightage
1	**Introduction to Energy from waste:** Classification of waste as fuel – Agro based, Forest residue, Industrial waste – MSW, Waste heat and its recovery, Thermodynamics concepts based on thermodynamics.	**12**	**27**
2	**Energy production from waste:** Energy production through gasification, incineration, anaerobic digestion and fermentation of organic wastes, pyrolysis of plastic waste.	**12**	**27**
3	**Energy recovery:** Heat pump, heat recovery from incinerators, rotary and piston driven devices, energy storage.	**10**	**21**
4	**Valorization and transforming of waste:** Introduction, electro-coagulation, combustion, recycling and reuse based industrial processes	**11**	**25**

Suggested Specification table with Marks (Theory):

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Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**20**	**20**	**10**	**10**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Environmental Pollution Control Engineering – C. S. Rao, New Age International Publishers, 2018.
2. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990
3. Environmental and Pollution Science – Mark Brusseau, Ian Pepper, Charles Gerba, Academic Press, 2019.
4. Wastewater Engineering: Treatment and Reuse – Metcalf and Eddy Inc., McGraw Hill Education, 2017.

Course Outcomes:

Sr. No.	CO statement	Marks % Weightage
CO-1	Understanding the waste classification and energy generation from the waste.	**27**
CO-2	Application of different methods for the energy generation from waste.	**27**
CO-3	Analyzing the energy recovery by different devices.	**21**
CO-4	Understanding the concept of valorization and transformation of waste.	**25**

List of Open Source Software/learning website:

Reference to NPTEL lectures can be made for a better understanding regarding energy conservation and waste heat recovery and municipal solid waste management.