



**Tulsiramji Gaikwad-Patil College of Engineering and Technology**

Wardha Road, Nagpur-441 108

**NAAC Accredited (A+ Grade)**

**An Autonomous Institute affiliated to RTMNU Nagpur**



**Second Year (Semester-III) M.Tech. Integrated Power System**

**MIPXX04: Waste to Energy**

Teaching Scheme		Examination Scheme	
Lectures	3 Hrs/week	CT-1	15 Marks
Tutorial	0 Hrs/week	CT-2	15 Marks
Total Credit	3	TA	10 Marks
		ESE	60 Marks
		Total	100 Marks
		Duration of ESE: 02 Hrs 30 Min.	

**Course Outcomes (CO)**

Students will be able to


1	<b>Illustrate</b> the classification of waste and its conversion to different types of fuels.
2	<b>Apply</b> the concept of biomass pyrolysis for fuel extraction.
3	<b>Analyze</b> different types of biomass gasifier for thermal heating.
4	<b>Explain</b> different types of biomass combustion techniques.
5	<b>Categorize</b> the properties of biogas with respect to different types of fuel generation.

Course Contents		Hours
<b>Unit I</b>	Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors	(9)
<b>Unit II</b>	Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.	(9)
<b>Unit III</b>	Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.	(9)
<b>Unit IV</b>	Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.	(9)
<b>Unit V</b>	Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.	(9)

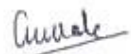
**Text Books**

1	Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2	Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I

	& II, Tata McGraw Hill Publishing Co. Ltd., 1983.
<b>Reference Books</b>	
1	Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
2	Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996
<b>Useful Links</b>	
1	<a href="https://www.digimat.in/nptel/courses/video/103107125/L01.html">https://www.digimat.in/nptel/courses/video/103107125/L01.html</a>
2	<a href="https://www.youtube.com/watch?v=tuUhQ62_dik">https://www.youtube.com/watch?v=tuUhQ62_dik</a>

  
**HOD**  
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