FACULTY OF ENGINEERING & TECHNOLOGY

First Year Master of Technology

Semester II

Course Code: 102450201

Course Title: BIOFUEL AND BIOENERGY SYSTEMS

Type of Course: Core Course III

Course Objectives: To impart knowledge on bio energy and facilitate feasibility evaluation.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Internal		External		Total
Lecture	Tutorial	Practical		Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	30 / 15	20 / 10	70 / 35	30 / 15	150 / 75

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	ANALYSIS OF BIOMASS: Biomass resources and biomass properties, biomass classification, availability, estimation of availability, consumption and surplus biomass; energy plantations, proximate analysis, ultimate analysis, thermo gravimetric analysis and summative analysis of biomass and briquetting.	10
2	BIOMASS COMBUSTION: Biomass combustion, fixed bed combustors, inclined grate combustors fluidized bed combustors, design, construction and operation and operation of all the above biomass combustors, biomass stoves, improved challahs, types.	9
3	BIOMASS ENERGY RESOURCES AND CONVERSION PROCESSES: Introduction, Origin of Biomass, Hydrocarbon Family, Biomass Energy Resources, Biomass Conversion Process, Direct Combustion of Biomass (Incineration), Thermo chemical Conversion of Biomass, Biochemical Conversion, Fermentation, Gaseous Fuels from Biomass, Applications of Biomass Energy Conversion Processes	9

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4	PLANTS FOR URBAN WASTE AND RURAL WASTE TO ENERGY: Introduction, Raw Biomass materials for Conversion to Biogas, Agriculture waste and Agriculture Crops, Fruit Farms, Aquatic Biomass, Raw materials for Biogas Production, Significance of Biogas Plants, Average Composition of Biogas, Anaerobic Fermentation and Digestion Process used in Biogas Plants, Biogas Plants and its Types, Technical data Calculation for Biogas Plant, Large Biogas Plants, Uhde-Schwarting Process of Two Stage Wet Fermentation, Dry Anaerobic Digestion Process of MSW, Ocean Biomass energy Conversion, Principal Marine Bio energy Resources, Kelp Bio energy Conversion Process.	**11**

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						**R**: Remembering; **U**: Understanding; **A**: Application, **N**: Analyze; **E**: Evaluate; **C**: Create
R	**U**	**A**	**N**	**E**	**C**	
10	20	20	20	20	10	

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	Nonconventional energy sources, Domkundwar, Dhanpat rai & Co.
2	Biomass- Application, technology & production, N.C. Cheremenisoff, P.N. Cheremenisoff& F. Ellurbrush, Marcel Dekker, New York
3	Biomass for Renewable Energy, Fuels, and Chemicals, Donald L. Klass, Reed, Elsevier India Private Limited.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	To know the various biomass analysis methods.	**30 %**
CO-2	Understand the biomass combustion technologies.	**30 %**
CO-3	Understand the urban waste and rural waste energy conversion system.	**40 %**

List of Practicals / Tutorials:

1	Study of resources, properties, classification and availability of biomass.
2	Study of proximate analysis, ultimate analysis, thermo gravimetric analysis and summative analysis of biomass and briquetting.
3	Study of biomass combustion.
4	Study of fixed bed combustors, inclined grate combustors and fluidized bed combustors.
5	Study of biomass stoves and improved chullahs.
6	Study of Direct Combustion of Biomass (Incineration).
7	Study of Thermo chemical Conversion of Biomass.
8	Study of Applications of Biomass Energy Conversion Processes.
9	Study of Anaerobic Fermentation and Digestion Process used in Biogas Plants.
10	Study of Kelp Bio energy Conversion Process.

Supplementary learning Material:

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Curriculum Revision:	
Version:	**1**
Drafted on (Month-Year):	Apr-20
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