DEPARTMENT OF CHEMICAL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY,
TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	**BIOENERGY**		
Course Code	**CLOE16**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**NONE**		
Session	**January, 2021**	**Section (if, applicable)**	**A / B**
Name of Faculty	**Dr. Sourav Poddar**	**Department**	**Chemical Engineering**
Email	**spoddar@nitt.edu**	**Telephone No.**	**9674655842**
Name of Course Coordinator(s) (if, applicable)	**Dr. (Mrs.) P. Kalaichelvi**		
E-mail	**kalai@nitt.edu**	**Telephone No.**	**0431-2503109**
Course Type	☐ **Core course** ☐ **Elective course** ✓ **Open Elective course**		

Syllabus (approved in BoS)

Biomass characteristics & preparation: Biomass sources and classification. Chemical composition and properties of biomass. Energy plantations. Size reduction, briquetting of loose biomass, Drying, Storage and handling of biomass**.**

Biogas technology: Feedstock for producing biogas. Aqueous wastes containing biodegradable organic matter, animal residues sugar rich materials. Microbial and biochemical aspects and operating parameters for biogas production**,** Kinetics and mechanism. Dry and wet fermentation, Digestors for rural application-High-rate digesters for industrial waste water treatment.

Pyrolysis and thermos-chemical conversion: Thermo-chemical conversion of lignocellulose biomass. Incineration for safe disposal of hazardous waste, Biomass processing for liquid fuel production, Pyrolysis of biomass-pyrolysis regime, effect of particle size, temperature, and products obtained.

Gasification of biomass: Thermochemical principles: Effect of pressure, temperature and of introducing steam and oxygen. Design and operation of Fixed and Fluidised Bed Gasifiers, Safety aspects.

Combustion of biomass and cogeneration systems: Combustion of woody biomass-theory, calculations and design of equipment, Cogeneration in biomass processing industries. Case studies: Combustion of rice husk, Use of bagasse for cogeneration.

Reference Books

1. A.Chakraverthy, Biotechnology and Alternative Technologies for Utilisation of Biomass or Agricultural Wastes, Oxford & IBH publishing Co., New Delhi, 1989.

2. K.M.Mital, Biogas Systems: Principles and Applications, New Age International Publishers (p) Ltd., 1996.

3. P.VenkataRamana and S.N.Srinivas, Biomass Energy Systems, Tata Energy Research Institute, New Delhi, 1996.
4. D.L. Klass and G.M. Emert, Fuels from Biomass and Wastes, Ann Arbor Science publ. Inc. Michigan, 1985.
5. George J Banward, Basic Food Microbiology, CBS Publishers, New Delhi, 1987.
6. Lindsay, Biotechnology challenges for the flavour and food industry, Elsevier Applied Science,
1988.
7. H.G.Muller, An Introduction to Tropical Food Science, C L P Edition, Cambridge University Press, 1989.

COURSE OBJECTIVES

Gain a comprehensive understanding of the principle of generation of energy from biomass.

COURSE OUTCOMES (CO)

Course Outcomes	**Aligned Programme Outcomes (PO)**
1. Understanding of availability of biomass feedstocks and their potential attributes to biofuels production.	**PO2, PO3, PO4, PO8, P010, P012**
2. Evaluation of methodologies for biomass preparation.	**PO1, PO2, PO3, PO4, PO5, P011, PO12,**
3. Cconcepts of the second and third generation of bioenergy, and the conversion processes of biomass feedstock to biofuels.	**PO1, PO2, PO3, PO4, PO5, PO8, PO10, PO11**

COURSE PLAN – PART II

COURSE OVERVIEW

Bioenergy provides an understanding of foundational information on 1st, 2nd, and 3rd generation biofuels. Coverage spans from feedstock production of key energy sources such as grasses, canes, and woody plants through chemical conversion processes and industrial application. Each chapter provides a thorough description of fundamental concepts, definitions of key terms, case studies and practical examples and exercises.. This course is offered in Fourth semester to engineering students of all streams. This course has three credits.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	**Week/ Contact Hours**	**Topic**	**Mode of Delivery**
1	10	Biomass characteristics & preparation: Biomass sources and classification. Chemical composition and properties of biomass. Energy plantations. Size reduction, briquetting of loose biomass, Drying, Storage and handling of biomass**.**	Online PPT
2	7	Biogas technology: Feedstock for producing biogas.	Online

		Aqueous wastes containing biodegradable organic matter, animal residues sugar rich materials. Microbial and biochemical aspects and operating parameters for biogas production**,** Kinetics and mechanism. Dry and wet fermentation, Digestors for rural application-High-rate digesters for industrial waste water treatment.	PPT
3	7	Pyrolysis and thermos-chemical conversion: Thermo-chemical conversion of lignocellulose biomass. Incineration for safe disposal of hazardous waste, Biomass processing for liquid fuel production, Pyrolysis of biomass-pyrolysis regime, effect of particle size, temperature, and products obtained.	Online PPT
4	7	Gasification of biomass: Thermochemical principles: Effect of pressure, temperature and of introducing steam and oxygen. Design and operation of Fixed and Fluidised Bed Gasifiers, Safety aspects.	Online PPT
5	7	Combustion of biomass and cogeneration systems: Combustion of woody biomass-theory, calculations and design of equipment, Cogeneration in biomass processing industries. Case studies: Combustion of rice husk, Use of bagasse for cogeneration.	Online PPT

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	First Assessment	After 15th contact hours	1 hour	25
2	Second Assessment	After 30th contact hours	1 hour	25
3	Assignment	After second assessment		20
6	Final Assessment *		2 hours	30

***mandatory; refer to guidelines on page 4**

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

Feedback from students at the end of each assessment

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, academic honesty and plagiarism etc.)

MODE OF CORRESPONDENCE (email/ phone etc), Students may be contacted to my mail id (spoddar@nitt.edu) WhatsApp (9674655842) for queries related to subjects.

ATTENDANCE

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

COMPENSATION ASSESSMENT

All Assessments are compulsory. If a student fails to attend any one assessment due to genuine reasons, He/She may be permitted to appear for compensation assessment. If the students absent in both assessment I & 2, He/She may not be permitted in compensation assessment.

ACADEMIC HONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION

Apart from the books mentioned in the syllabus, students may follow any other resources such as NPTEL and etc. to boost their knowledge in Bioenergy

FOR APPROVAL

(24/02/2021)

Dr. Sourav Poddar
Course Faculty

[Dr.Nagajyothi Virivinti]
CC-Chairperson _____ **HOD** _____