

DEPARTMENT OF MECHANICAL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the programme and specialization	B.Tech / Mechanical Engineering		
Course Title	BIOFUELS		
Course Code	MEPE14	No. of Credits	3
Course Code of Pre-requisite subject(s)	-		
Session	Jan 2022	Section (if, applicable)	A & B
Name of Faculty	Dr. R. Anand	Department	Mechanical Engineering
Email	anandachu@nitt.edu	Telephone No.	0431 2503423
Name of Course Coordinator(s) (if, applicable)	-		
E-mail	-	Telephone No.	-
Course Type	<input type="checkbox"/> Core course <input checked="" type="checkbox"/> Elective course		
Syllabus (approved in BoS)			
<p>Importance of bioenergy and biofuels in solving energy crisis and global warming. Introduction to various biomass types – constituents, characterization. Biogas & bio-electricity, Bio-heat; clean sustainable bioenergy, bio-electricity and biogas production from Dairy manure and Food Waste streams.</p> <p>Biomass pre-treatment: Acid/alkali treatment, steam explosion, ammonia fibre expansion, enzymatic, ball milling, other non-conventional techniques, choice of pre-treatment based on biomass types. Pellets made from wood or grass biomass are commercially available at stores for heating homes, schools, businesses.</p> <p>Seed-based biodiesel, bioethanol, conversion of waste oil to biodiesel, advanced biofuels including algae-biofuel, microbial biofuel, Conversion of waste vegetable oil into biodiesel, and advanced innovations in enzymatic conversion of non-food feed-stocks. Fuel properties, engine applications.</p> <p>Biomass conversion technologies for biofuel. Thermochemical processes: Combustion, gasification, pyrolysis, hydrothermal liquefaction, hydrolysis, torrefaction, choice of thermal process based on biomass type and product requirement.</p> <p>Biofuels/energy related environmental, economics, & social issues. The source, processing, and social impacts of biofuel utilization.</p> <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Filemon A. Uriarte Jr., Biofuels from plant oils, National Academy of Science and Technology, 2010. 2. Anju Dahiya, Bioenergy: Biomass to Biofuels, Elsevier, 2015 			

<ol style="list-style-type: none"> 3. Sunggyu Lee and Y.T. Shah, Biofuels and Bio-energy Processes and Technology, CRC Press, Taylor and Francis Group, 2013. 4. Pandey, A., Larroche, C., Ricke, S.C., Dussap, C.-G., Gnansounou, E., Biofuels: Alternative feedstocks and conversion processes, Academic Press, U.S.A., 2011. 5. Brown, R.C. (Ed.) Thermochemical processing of biomass into fuels, chemicals and power, Wiley, 2011. 6. Clark, J., Deswarte, F. (Ed.) Introduction to chemicals from biomass, John Wiley and Sons, U.K., 2008. 7. Understanding clean energy and fuels from biomass, H. S. Mukunda 										
COURSE OBJECTIVES										
<ul style="list-style-type: none"> ➤ To characterize different biomass feedstock's based on its constituents and properties & understand the analytical techniques to characterize biomass. ➤ To Understand and evaluate various biomass pre-treatment and processing techniques in terms of their applicability for different biomass types. ➤ To provide students with the basic principles of biofuels and bioenergy systems design. ➤ To identify biofuels and bioenergy sources; describe biofuels and bioenergy technologies, ➤ To distinguish applications and efficiency; analyze biofuels and bioenergy manufacturing, distribution and integration issues. 										
COURSE OUTCOMES (CO)										
<table border="1"> <thead> <tr> <th>Course Outcomes</th> <th>Aligned Programme Outcomes (PO)</th> </tr> </thead> <tbody> <tr> <td colspan="2">At the end of the course student will</td> </tr> <tr> <td>1. Describe the nature and principle of different biomass energy extraction systems and know how to choose the suitable biomass fuels for different bio-energy applications;</td> <td>1, 2, 3, 5, 6, 7</td> </tr> <tr> <td>2. Address the desirable features of these biomass energy sources and their advantages over traditional fuels such as coal and oil</td> <td>1, 2, 3, 5, 6, 7</td> </tr> <tr> <td>3. Identify their limited scope in terms of suitable sites, dependence on the elements, capital costs, and cost effectiveness compared with traditional sources</td> <td>1, 2, 3, 5, 6, 7</td> </tr> </tbody> </table>	Course Outcomes	Aligned Programme Outcomes (PO)	At the end of the course student will		1. Describe the nature and principle of different biomass energy extraction systems and know how to choose the suitable biomass fuels for different bio-energy applications;	1, 2, 3, 5, 6, 7	2. Address the desirable features of these biomass energy sources and their advantages over traditional fuels such as coal and oil	1, 2, 3, 5, 6, 7	3. Identify their limited scope in terms of suitable sites, dependence on the elements, capital costs, and cost effectiveness compared with traditional sources	1, 2, 3, 5, 6, 7
Course Outcomes	Aligned Programme Outcomes (PO)									
At the end of the course student will										
1. Describe the nature and principle of different biomass energy extraction systems and know how to choose the suitable biomass fuels for different bio-energy applications;	1, 2, 3, 5, 6, 7									
2. Address the desirable features of these biomass energy sources and their advantages over traditional fuels such as coal and oil	1, 2, 3, 5, 6, 7									
3. Identify their limited scope in terms of suitable sites, dependence on the elements, capital costs, and cost effectiveness compared with traditional sources	1, 2, 3, 5, 6, 7									

COURSE PLAN – PART II			
COURSE OVERVIEW			
This course provides an overview about the production process of different biomass, biomass pre-treatment processes, advanced innovations in converting waste to fuel, biomass conversion technologies to biofuel, Biofuel policies and social economic issues			
COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	Week/Contact Hours	Topic	Mode of Delivery
1.	1 st Week	Importance of bioenergy and biofuels in solving energy crisis and global warming	Presentations
2.	2 nd Week	Introduction to various biomass types – constituents, characterization.	Presentations
3.	3 rd Week	Biogas & bio-electricity, Bio-heat; clean sustainable bioenergy, bio-electricity and biogas production from Dairy manure and Food Waste streams.	Presentations

4.	4 th Week	Biomass pre-treatment: Acid/alkali treatment, steam explosion, ammonia fibre expansion,	Presentations
5.	5 th Week	Biomass pre-treatment: enzymatic, ball milling, other non-conventional techniques, choice of pre-treatment based on biomass types.	Presentations
6.	6 th Week	Pellets made from wood or grass biomass are commercially available at stores for heating homes, schools, businesses	Presentations
7.	7 th Week	Seed-based biodiesel, bioethanol, conversion of waste oil to biodiesel, advanced biofuels including algae-biofuel, microbial biofuel,	Presentations
8.	8 th Week	Conversion of waste vegetable oil into biodiesel, and advanced innovations in enzymatic conversion of non-food feed-stocks.	Presentations
9.	9 th Week	Fuel properties, engine applications.	Presentations
10.	10 th Week	Biomass conversion technologies for biofuel. Thermochemical processes: Combustion, gasification, pyrolysis,	Presentations
11.	11 th Week	Biomass conversion technologies for biofuel: hydrothermal liquefaction, hydrolysis, torrefaction,	Presentations
12.	12 th Week	Choice of thermal process based on biomass type and product requirement.	Presentations
13.	13 th Week	Biofuels/energy related environmental, economics, & social issues.	Presentations
14.	14 th Week	The source, processing, and social impacts of biofuel utilization	Presentations

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	Cycle test I	6 th Week	60 minutes	20
2.	Cycle test II	12 th Week	60 minutes	20
3.	Assignment/Seminar Presentation	10 th Week		10
4.	Compensation Assessment	Before end semester	60 minutes	20
5.	End Semester	27 Apr 2022 ~ 13 May 2022	180 minutes	50

COURSE EXIT SURVEY

- Students feedback in the class after every 4 weeks and also through class committee meetings.
- Feedback from students on the course outcomes shall be obtained at the end of the course.

COURSE POLICY

MODE OF CORRESPONDENCE (email/ phone etc)

- All the communication (schedule of assessment/ course material/any other information regarding this course) will be intimated through the class representative.
- All assessment of a course will be done on the basis of marks.
- The Faculty is available for consultation after contact hours with prior appointment through email: anandachu@nitt.edu

COMPENSATION ASSESSMENT POLICY

- Attending all the assessments (1, 2, 3, 5) are mandatory for every student. Flexibility is given to the students to fix the date for each mode of evaluation convenient to majority of the students.
- If any student fails to attend the cycle test due to genuine reason like medical emergency, the student may be permitted to appear for the compensation assessment (CPA) on submission of appropriate documents as proof. (Not valid for students having attendance lag).
- Students not having 75 % minimum attendance at the end of the semester and also didn't attend cycle test will be awarded 'V' Grade and have to REDO the course.
- In any case, compensation assessment (CPA) is not considered as an improvement test.
- The minimum marks for passing this course and grading pattern will adhere to the regulations of the institute.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- All the students are expected to attend all the contact hours. Students should maintain 75% minimum physical attendance by the end of the course to attend the end semester examination.
- Absence due to medical reason and institutional activities will be considered when the student falls below 75% of physical attendance and it should be supported by a letter (in professional letterhead) from the concerned authorities. Any preparatory works in view of institution activities should not be taken up in class contact hours.
- Students not having 75% minimum attendance at the end of the semester will be awarded 'V' Grade and have to REDO the course.

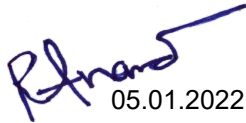
ACADEMIC DISHONESTY & PLAGIARISM

- 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.

FOR APPROVAL


05.01.2022
Dr. R. Anand
Course Faculty


CC-Chairperson


Head of the Department

Guidelines:

- a) The number of assessments for a course shall range from 4 to 6.
- b) Every course shall have a final assessment on the entire syllabus with at least 30% weightage.**
- c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered. Details of compensation assessment to be specified by faculty.**
- d) The passing minimum shall be as per the regulations.
- e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.**
- f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.**
- g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective .