

Branch Name:	Mechanical Engineering
Program Code:	ET101
Course Name:	Renewable Energy Engineering
Course Code:	2ET1010605T
Pre-requisite Course:	Fluid Mechanics, Heat Transfer

Course Objectives:

1. To acquire knowledge of technical competency combined with research to generate innovative solutions in Energy engineering.
2. To be acquainted with a variety of options in energy sources.
3. To prepare the students to exhibit a high level of professionalism, integrity, environmental and social responsibility, and life-long independent learning ability with environment in mind.

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	SEE		CCA		SEE		CCA						
	L	T	P	Total	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Subject Contents

Sr. No	Topic	Total Hours	Weightage (%)
1.	Introduction: Basic concepts of energy; Introduction to Renewable Energy Technologies; Energy and Environment – global warming, acid rains, depletion of ozone layer; Global and Indian Scenario of renewable energy sources; Energy storage - necessity and energy storage methods.	4	15
2.	Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Measurement of solar radiation data.	6	20
3.	Solar Thermal Systems: Introduction; Basics of thermodynamics and heat transfer; Flat plate collector; Evacuated Tubular Collector; Solar air collector; Solar concentrator; Solar distillation; Solar cooker; Solar refrigeration and air conditioning; Thermal energy storage systems.	8	15
4.	Solar Photovoltaic Systems: Introduction; Solar cell Fundamentals; Characteristics and classification; Solar cell: Module, panel and Array construction; Photovoltaic thermal systems.	4	10
5.	Wind Energy: Introduction; Origin and nature of winds; Wind turbine siting; Basics of fluid mechanics; Wind turbine aerodynamics; wind turbine types and their construction; Wind energy conversion systems.	6	10
6.	Fuel cells: Overview; Classification of fuel cells; Operating principles; Fuel cell thermodynamics.	4	10
7.	Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies; Urban waste to energy conversion; Biomass gasification.	4	10
8.	Other forms of Energy: Introduction: Nuclear, ocean and geothermal energy applications; Origin and their types; Working principles.	6	10

List of Reference Books:

1. S. P. Sukhatme and J. K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, McGraw Hill Education, 2009
2. B. H. Khan, Non-conventional Energy Resources, Tata McGraw Hill, 2017
3. V.V.N. Kishore, "Renewable Energy Engineering and Technology: Principles and Practice," Routledge, 2019.
4. N. Jenkins and J. Ekanayake, "Renewable Energy Engineering," Cambridge University Press, 2017.
5. G. Boyle, "Renewable Energy," OUP Oxford, 2nd Edition, 2009.
6. Shobh Nath Singh, Non-conventional energy resources, Pearson India, 2015.
7. G. S. Sawhney, Non-Conventional Resources of Energy, PHI, 2012

Note: Students are required to submit tutorials based on the above subject contents. It is desirable to visit solar and wind plant.

E-Resources:

- <http://vlab.amrita.edu/>
- https://onlinecourses.nptel.ac.in/noc25_ch40/preview

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Define basic energy concepts, environmental impacts, and renewable energy technologies.	1 Remembering
CLO2	Explain principles of solar energy, solar radiation estimation, and measurement methods.	2 Understanding
CLO3	Analyze different solar thermal and photovoltaic systems for energy applications.	4 Analyze
CLO4	Describe wind energy fundamentals, turbine types, and wind energy conversion systems.	2 Understanding
CLO5	Evaluate biomass energy resources, biofuel production, and waste-to-energy conversion technologies.	5 Evaluating
CLO6	Summarize the working principles of fuel cells, nuclear, ocean, and geothermal energy systems.	2 Understanding

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Program Outcomes(POs)												Program Specific Outcomes(PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CLO1	H					M						L		M
CLO2		H	M	H	M								M	
CLO3	M	H			M	L							H	
CLO4	M					M		L				L		L
CLO5		M	M		M								M	
CLO6	M	H										L		M

H: High, M: Medium, L: Low