

(Name of Faculty	:	Faculty of Engineering & Technology
Name of Program	:	Master of Technology (M. Tech)
Course Code	:	1MTE03
Course Title	:	Renewable Energy Engineering
Type of Course	:	PE
Year of Introduction	:	2023-24

Prerequisite	:	Fundamentals of Renewable Energy
Course Objective	:	Understand basic renewable and non-renewable energy source
Course Outcomes	:	At the end of this course, students will be able to:
	CO1	To design and develop solar systems for various applications To estimate solar radiation on the various surfaces and its applications for thermal and photovoltaic system
	CO2	To analyze the performance of various solar collectors
	CO3	To evaluate the potential of wind energy conversion systems
	CO4	To illustrate Bio energy, Wave energy, Ocean energy and Geothermal Energy
	CO5	To evaluate the life cycle cost and carry out economic analysis of renewable energy sources

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
L	T	P		SEE	CIA	SEE	CIA	Total Marks
03	00	02	04	70	30	30	20	

Legends: L-Lecture; T-Tutorial/Teacher Guided Theory Practice; P – Practical, C – Credit, SEE – Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content

Unit No.	Topics	Teaching Hours	Weightage
1	Commercial Energy Scenario: Review of energy sources, present energy consumption/utilization pattern – sector-wise in India, environmental impact of fossil fuels, growth of energy sector and its planning in India	5	5%
2	Solar Energy : Solar radiation at the earth’s surface, solar radiation measurements, estimation of average solar radiation, solar thermal flat plate collectors, concentrating collectors, solar thermal applications;	15	30%

	heating, cooling, desalination, drying, cooking, etc, principle of photovoltaic conversion of solar energy, types of solar cells, photovoltaic applications		
3	Wind Energy: Power in the wind, Betz limit, site selection, wind energy conversion devices, characteristics, applications, offshore wind energy, Hybrid systems, safety and environmental aspects, wind energy potential and installation in India.	10	25%
4	Bio-Energy: Biomass resources and their classification, biomass conversion processes, thermo chemical conversion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, alcohol production from biomass, bio diesel production, urban waste to energy conversion, biomass energy programs in India	10	25%
5	Other Types of Renewable Energy: Principle of ocean thermal energy conversion (OTEC), ocean thermal power plants, ocean wave energy conversion, tidal energy conversion, geothermal energy, geothermal power plants, hydrogen & fuel cell - sources of energy	8	15%

NOTE: This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Suggested List of Experiments/Tutorials

Sr. No.	Name of Experiment/Tutorial	Teaching Hours
1	To study and measure the solar radiation on horizontal and tilted surface using solar radiation measuring instrument	02
2	To evaluate the performance of solar liquid flat plate collector.	02
3	To evaluate the performance of solar air heater.	02
4	To evaluate the performance of concentrating collectors.	02
5	To evaluate the performance of solar still.	02
6	To evaluate the performance of box type solar cooker.	02
7	To study the various types of wind mill and evaluate the performance parameter of wind. mill.	02
8	To study the various types of gasifier and biogas plant.	02
9	To study the ocean energy, wave energy, geothermal energy conversion systems.	02
10	To estimate the economics of the solar energy conversion equipment.	02

Major Equipment/ Instruments and Software Required

Sr. No.	Name of Major Equipment/ Instruments and Software
1	Pyranometer, Sunshine recorder, Solar power meter, Solar liquid flat plate collector, Solar air heater

2	Cylindrical Parabolic Collector, Compound parabolic collector, Box type solar cooker, Solar drier, Solar still, wind mill.
3	Pyranometer, Sunshine recorder, Solar power meter, Solar liquid flat plate collector, Solar air heater, Cylindrical

Suggested Learning Websites

Sr. No.	Name of Website
1	https://nptel.ac.in

Reference Books

Sr. No.	Name of Reference Books
1	Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, McGrawHill education
2	. Non-Conventional Resources of Energy, G. S. Sawhney, PHI
3	Solar Engineering of Thermal Processes, John A. Duffie, William A. Beckman, John Wiley, New York
4	Non-conventional Energy Resources, B. H. Khan, Tata McGraw Hill