Faculty of Engineering & Technology
Master of Technology (M. Tech)
(W. E. F.: 2023-24)

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Name of Faculty	:	Faculty of Engineering & Technology
Name of Program	:	Master of Technology (M. Tech)
Course Code	:	1MPS03
Course Title	:	Renewable Energy System
Type of Course	:	Programme Elective (PE)
Year of Introduction	:	2023-24

Prerequisite	:	Knowledge of conventional energy sources
Course Objective	:	Power System is a very complicated field of Electrical Engineering. The objective of this course is to provide basic understanding of the upcoming technology of renewable energy systems and to have an overall understanding of energy systems. To provide exposure to different aspects like policy, design control and grid integration of renewable energy systems. The students will be able to find the reasonableness of the use of renewable energy after comparing the available resources This subject covers the different types of contingency situations, methods to increase security, efficiency & to eliminate Bad data from the system.
Course Outcomes	:	At the end of this course, students will be able to:
	CO1	**To Understand** and evaluate different types of renewable energy sources.
	CO2	**To Analyse** energy technologies from a systems perspective.
	CO3	**To Understand** the technical challenges for each of the renewable sources
	CO4	**To Evaluate** economic, technical, and sustainability issues involved in the integration of renewable energy systems to the grid
	CO5	**To Analyse** the performance and compare it from a design viewpoint.

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	SEE	CIA	SEE	CIA	
3	0	2	4	70	30	30	20	150

*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	Mapping with CO
1	**Introduction** Energy Use Reserves of Energy Resources, Environmental Aspects of Energy Utilization Renewable Energy Seasonal Variations and Availability, Scenario In Gujarat, India and Around The World – Potentials, Achievements / Applications, Resources, and Features. Hybrid energy systems Distributed energy systems and dispersed generation.	11	25%	CO1, CO2
2	**Solar Energy** Solar radiation spectrum. Radiation measurement. Technologies. Applications: Heating, Cooling, Drying, Distillation, Power generation Solar Photovoltaic Systems Operating principles. Photovoltaic cell concepts. Cell, module, array. Series and parallel connections. Maximum power point tracking.	10	20%	CO1, CO4
3	**Wind Energy** Types of Wind Energy Systems, Comparison of Performance Site Selection, Wind Data and Energy Estimation Details Of Wind Turbine Generator and comparison Safety and Environmental Aspects Grid Connection issues Governmental Incentives/policies Wind energy Potential and Installation in India.	10	20%	CO1, CO3
4	**Other Renewable Energy Sources** Tidal Energy, Wave Energy, Open And Closed OTEC Cycles Small Hydro Geothermal Energy Hydrogen And Storage Fuel Cell Systems	07	15%	CO5
5	**Hybrid System** Need for Hybrid Systems Range and type of Hybrid systems Case studies of Diesel-PV, Wind-PV, Micro hydel PV, Biomass-Diesel systems, electric and hybrid electric vehicles	07	20%	CO5

Suggested Distribution of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyse	Evaluate	Create
Weightage	**40**	**20**	**10**	**15**	**10**	**05**

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	Scenario of different renewable energy system in Gujarat and india.	04
2	Modelling of Solar PV sub-systems	04
3	Modelling of wind generation sub-systems Control of Power generation from various renewable energy systems	04
4	Energy management strategies for grid integration and exchange of power between renewable energy sources and grid.	04
5	Simulation of power electronics converter/inverter used for grid integration of wind and solar	04
6	Design examples related to Energy Efficiency.	04
7	Create hybrid system model in software.	04

Major Equipment/ Instruments and Software Required

Sr. No.	Name of Major Equipment/ Instruments and Software
1	MATLAB Simulink
2	Pyranometer
3	Sunshine recorder
4	Solar power meter
5	Solar liquid flat plate collector
6	Cylindrical Parabolic Collector
7	Compound parabolic collector
8	Box type solar cooker
9	Solar drier
10	wind mill

Suggested Learning Websites

Sr. No.	Name of Website
1	https://vlab.amrita.edu/
2	https://nptel.ac.in/courses/112105051
3	https://nptel.ac.in/courses/108105058
4	https://nptel.ac.in/courses/121106014
5	https://ocw.mit.edu/collections/energy/

Reference Books

Sr. No.	Name of Reference Books
1	Tiwari. G.N., Solar Energy – "Fundamentals Design, Modelling & Applications", Narosa Publishing House, New Delhi, 2002.
2	L.L. Freris, "Wind Energy Conversion Systems", Prentice Hall, 1990.
3	Renewable Energy Engineering and Technology, Kishore VVN, Teri Press, New Delhi
4	Alternative Energy Sources, Veziroglu, T.N., Vol 5 and 6, McGraw-Hill, 1990
5	Godfrey Boyle, "Renewable Energy, Power For A Sustainable Future", Oxford University Press, U.K., 1996