22MEHO108	DESIGN OF SOLAR AND WIND SYSTEMS				
	CATEGORY	L	T	P	C
	PE	3	0	0	3

COURSE OBJECTIVES

1	To learn and study the radiation principles with respective solar energy estimation.
2	To understand PV technology principles and techniques of various solar cells / materials for energy conversion
3	To understand the fundamentals of wind energy and its conversion system.
4	To understand the aerodynamics and types of loads, generators in wind turbines
5	To learn and study the radiation principles with respective solar energy estimation.

UNIT I	**SOLAR RADIATION AND COLLECTORS**	**9**	**0**	**0**	**9**

Sun angles–Radiation-extra-terrestrial characteristics -estimation on horizontal and tilted surfaces - flat plate collector thermal analysis –evacuated tubular collectors-concentrator collectors–classification-design and performance parameters - compound parabolic concentrators - parabolic trough concentrators -Heliostats.

UNIT II	**SOLAR THERMAL TECHNOLOGIES**	**9**	**0**	**0**	**9**

Principle of working, types, design and operation of- Solar heating and cooling systems – Thermal Energy storage systems – Solar Desalination – Solar cooker: domestic, community – Solar Pond – Solar drying.

UNIT III	**SOLAR PV SYSTEM DESIGN**	**9**	**0**	**0**	**9**

Solar cells - p-n junction- Solar cell array system analysis and performance prediction-solar cell array design concepts- PV system design- design process and optimization–detailed array design- storage autonomy- voltage regulation-centralized and decentralized SPV systems – hybrid and grid connected system.

UNIT IV	**WIND ENERGY FUNDAMENTALS AND WIND MEASUREMENTS**	**9**	**0**	**0**	**9**

Wind Energy Basics, Wind Speeds and scales, Terrain, Roughness, Wind Mechanics, Power Content, Class of wind turbines, Atmospheric Boundary Layers, Instrumentation for wind measurements, wind data analysis, tabulation ,Betz's Limit, Turbulence Analysis.

UNIT V	**AERODYNAMIC THEORY AND WIND TURBINES**	**9**	**0**	**0**	**9**

Air foil terminology, Blade element theory, Blade design, Rotor performance and dynamics, Balancing technique (Rotor & Blade), Types of loads, Sources of loads Vertical Axis, Horizontal Axis, Constant Speed Constant Frequency, Variable speed Variable Frequency, Stall Control, Pitch Control, Gear Coupled Generator type, Direct
Generator Drive systems.

TOTAL(45L) : 45 PERIODS

REFERENCE BOOKS:

1	Sukhatme S.P.,. Nayak.J.P, 'Solar Energy – Principle of Thermal Storage and collection", Tata McGraw Hill, 2008.
2	Solar Energy International, "Photovoltaic – Design and Installation Manual" – New Society Publishers, 2006.
3	DuffieA. And Beckmann W.A., "Solar EngineeringofThermalProcesses,JohnWiley,1991.
4	JohnDSorensenandJensNSorensen,"WindEnergySystems",WoodheadPublishing

COURSE OUTCOMES: Upon completion of this course, the students will be able to:		Bloom Taxonomy Mapped
CO1	Classify and describe solar radiation and collectors.	Understand
CO2	Describe the principle and design the solar heating, cooling and other solar applications.	Understand
CO3	Explain the principle, working, design optimization of PV system for different applications.	Understand
CO4	Describe the basics and measurements of wind energy.	Understand
CO5	Explain the aerodynamic constructional details of wind turbine.	Understand

COURSE ARTICULATION MATRIX

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	0	0	0	0	0	0	0	0	0	3	1	0
CO2	3	1	2	1	0	0	0	0	0	0	0	0	3	2	0
CO3	3	2	2	0	1	0	0	0	0	1	0	0	3	2	2
CO4	3	2	0	1	0	1	0	0	0	0	0	0	3	2	0
CO5	3	2	0	0	1	1	0	0	0	0	0	0	3	2	0
Avg	**3**	**1.8**	**1**	**0.6**	**0.5**	**0.4**	**0**	**0**	**0**	**0.2**	**0**	**0**	**3**	**1.8**	**0.4**

3/2/1 – indicates strength of correlation (3 – high, 2- medium, 1- low)