WIND AND SOLAR ENERGY SYSTEMS

Course Code	19EE4702A	**Year**	IV	**Semester**	I
Course Category	Program Elective V	**Branch**	EEE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

COURSE OUTCOMES	
Upon successful completion of the course, the student must be able to	
CO1	**Understand** the basics of wind energy, wind turbines, solar energy and grid integration.
CO2	**Explain and classify** wind turbines**,** instruments for measuring solar radiation, solar collectors, solar cell and solar MPPT techniques
CO3	**Analyze** different types of wind generators, solar cell and solar collectors
CO4	**Outline** about integration of solar and wind energy systems

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1		2			3					2	3	2
CO2	3	2		3			3					2	3	2
CO3	3	1		3			3					2	3	2
CO4	3	1		3			2					2	3	2
CO5	3	1		2			3					2	3	2

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**Wind energy Basics** History of wind power, Indian and Global statistics, Characteristics of Wind, principles of wind energy conversion, components of wind energy conversion system, classification of wind turbines- horizontal axis and vertical axis, Betz limit ratio, advantages and disadvantages of wind energy system.	**CO1** **CO 2**
II	**Wind turbine technologies** Review of modern wind turbine technologies, Fixed and Variable speed wind turbine, Squirrel-cage Induction generator, Wound rotor motor induction generators, Doubly Fed Induction Generator, Synchronous Generators, Permanent Magnet Synchronous Generators and their characteristics.	**CO 1** **CO 3**

III	**Solar Thermal** Physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.	**CO 2** **CO 3**
IV	**Solar photovoltaic** Photovoltaic energy conversion, solar cell fundamentals, solar cell classification- Amorphous, mono-crystalline, polycrystalline, performance of solar cell, V-I characteristics of a PV panel, Maximum Power point Tracking (MPPT) algorithm	**CO1** **CO2** **CO 3**
V	**Integration of solar and wind** Wind power integration into grid-power system stability, economics of grid network, codes and standards for grid integration, grid connected PV systems, control scheme used for single stage grid connected PV system, case study on hybrid system(PV-Wind)	**CO 1** **CO 4**

Learning Resources
Text Books:
1. Non-Conventional Energy Sources by G.D. Rai, Khanna publishers, 5th edition,2014. 2. Wind Energy Theory and Practice by Siraj Ahmed publisher PHI learning Pvt Ltd ,3rd edition, 2016 3. Renewable Energy Sources and Emerging Technologies by D.P Kothari, K.C Singal, RakeshRanjan , PHI learning Pvt Ltd, 2nd edition ,2012
Reference Books:
1. Renewable Energy resources byTiwari and Ghosal, publisher Narosa,2005 2. Solar Photo Voltaics Fundamentals, Technology and application by Chetan Singh Solanki, publisher PHI learning Pvt Ltd, 3rd edition,2019 3. Renewable Energy Resources by John Twidell and Tony Weir , publisher Taylor and Francis, 2nd edition 2006