Renewable Energy Resources

Course Code	19EE2701C	**Year**	IV	**Semester**	I
Course Category	Inter Disciplinary Elective-II	**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 solar energy, wind energy, bio mass, geothermal energy, Ocean energy and principles of energy conversion. (L2) **Unit 1,2,3,4,5**
CO2	**Explain and classify** instruments for measuring solar radiation **solar collectors, solar energy storages,** wind turbines**,** geothermal**,** MHD and fuel cell. (L2) **Unit 1,2,3,4,5**
CO3	**Analyze** different types of solar collectors, solar cell, combustion characteristics of bio-gas, thermo dynamic cycles, operating conditions of fuel cell (L4) **Unit 1,2,3,4,5**
CO4	**Outline** about solar radiation, power from solar module, performance characteristics of wind mill, potential and conversion techniques of tidal and wave energy, mini-hydel power plants and their economics. (L2) **Unit 1,2,3,4,5**

Contribution of Course Outcomes towards achievement of Program Outcomes &Strengths of correlations L- Low M-Medium H-High														
	PO1	PO2	PO3	P04	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		3			2	2	1			2	2	3
CO2	3	3		1		3	3	2	1			1	3	2
CO3	3	3		3			2					1	2	2
CO4	3	2		1			1					1	3	3

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	Principles of Solar Radiation and Solar Energy Collection Role and potential of new and renewable source, the solar energy option, environmental impact of solar power, 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 1 CO 2 CO 3 CO 4**
II	Solar Energy Storage, Applications and Photovoltaic Energy Conversion Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications solar heating/cooling technique, solar distillation and drying. Solar cell fundamentals, solar cell classification, performance of solar cell- power from solar module.	**CO 1 CO 2 CO 3 CO 4**
III	Wind Energy and Bio-Mass	**CO 1**

	Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria. Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of bio-gas digesters, gasyield, combustion characteristics of bio-gas, utilization for cooking	**CO 2** **CO 3** **CO 4**
IV	Geothermal Energy and Ocean Energy Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques.	**CO 1** **CO 2** **CO 3** **CO 4**
V	Energy Conversion Principles of energy conversion, MHD generators, principles, MHD power generation systems. Fuel cells, principles, of fuels and operating conditions, merits and demerits of different types of fuel cells, mini-hydel power plants and their economics.	**CO 1** **CO 2** **CO 3** **CO 4**

Learning Resources
Text Books:
1. Non-Conventional Energy Sources by G.D. Rai, Khanna publishers, 5th edition,2014. 2. Renewable Energy Sources and Emerging Technologies by D.P Kothari, K.C Singal, Rakesh Ranjan , PHI learning Pvt Ltd, 2nd edition ,2012
Reference Books:
1. Renewable Energy resources byTiwari and Ghosal, publisher Narosa,2005 2. Renewable Energy Resources by John Twidell and Tony Weir , publisher Taylor and Francis, 2nd edition 2006 3. Solar Photo Voltaics Fundamentals, Technology and application by Chetan Singh Solanki, publisher PHI learning Pvt Ltd, 3rd edition,2019 4. Wind Energy Theory and Practice by Siraj Ahmed publisher PHI learning Pvt Ltd ,3rd edition, 2016