RENEWABLE ENERGY RESOURCES

Course Code	20EE4501C	Year	III	Semester(s)	I
Course Category	Professional Elective-I	Branch	EEE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	--
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	**Understand** the process of energy collection, quantification, storage, conversion and applications of non-conventional sources. **(L2)**
CO2	**Apply** the knowledge of energy conversion techniques to harvest energy from different types of renewable sources. **(L3)**
CO3	**Apply** the basic laws of physics to interpret the constraints to efficiently extract energy from renewable sources. **(L3)**
CO4	**Analyze** the theory behind the design of wind mills, MHD, biomass plants. **(L4)**
CO5	**Examine** the performance of OTEC and Fuel cells. **(L4)**
CO6	**Ability** to apply the various energy generation techniques and to measure the **basic** parameters and **submit a report.**

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														
CO2	3						3						2	1
CO3	3						3						2	1
CO4		3											2	1
CO5		3					3						2	1
CO6									3	2		3	2	1

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.	**CO1, CO2, CO3, CO6**

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	**CO1, CO2, CO3, CO6**
III	**Wind Energy and Bio-Mass** Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking.	**CO1, CO2, CO3, CO4, CO6**
IV	**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.	**CO1, CO2, CO3, CO5, CO6**
V	**Energy Conversion** Principles DEC, 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	**CO1, CO2, CO3, CO4, CO5, CO6**

Learning Resources
Text Books
1. Non-Conventional Energy Sources by G.D. Rai, Khanna publishers, 5th edition,2014. 2. Renewable Energy resources, Tiwari and Ghosal, Narosa,2005 3. Science and Technology of Photo Voltaics by Jayarama Reddy, BS publications, 2nd edition,2012
Reference Books
1. Non-Conventional Energy by Ashok V Desai, New age, 2005. 2. Non-Conventional Energy Sources by B.H.Khan, Tata Mc Graw-hill Publishing Company, 2nd edition, 2013.
Web Links 1. https://www.coursera.org/learn/renewable-energy-technology-fundamentals 2. https://nptel.ac.in/courses/121106014