RENEWABLE ENERGY RESOURCES

Course Code	23EE4501B	Year	III	Semester	I
Course Category	Professional Elective-I	Branch	EEE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Power Systems - I
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 classification, significance, and advantages of various renewable energy sources. (L2)
CO2	Apply principles of solar and wind energy systems to explain their components, energy conversion processes, and practical applications under varying environmental conditions. (L3)
CO3	Apply concepts of biomass, geothermal, and hydel energy systems to describe their working mechanisms and evaluate their use in sustainable energy production. (L3)
CO4	Apply principles of ocean, waves, tides, hydrogen, fuel cell, and MHD energy technologies to illustrate their operation and assess their relevance in modern power generation.(L3)
CO5	Analyze the performance characteristics of solar, wind, and wave energy systems by evaluating output parameters and interpreting system efficiency curves (L4)

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

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**SOLAR ENERGY** Overview of Solar Energy – Classification and significance of renewable energy sources, solar radiation at the Earth Surface – Equivalent circuit of a Photovoltaic (PV) Cell – I-V & P-V Characteristics – Solar Energy Collectors: Flat plate Collectors, concentrating collectors – Solar Energy storage systems and Applications: Solar Pond – Solar water heating.	**CO1 CO2 CO5**
II	**WIND ENERGY** Introduction – basic Principles of Wind Energy Conversion, the nature of Wind – the power in the wind – Site selection considerations – basic	**CO1 CO2 CO5**

	components of Wind Energy Conversion Systems (WECS) – Classification – Applications, Advantages and disadvantages of WECS.	
III	**BIOMASS, HYDEL AND GEOTHERMAL ENERGY** **Biomass:** Introduction – Biomass resources– Biomass conversion technologies- Factors affecting Bio digestion. **Hydro plants:** Basic working principle – Classification of Small Hydropower Stations– Advantages and disadvantages of small hydro plants. **Geothermal Energy**: Introduction, Geothermal Sources – Applications – operational and Environmental problems.	**CO1** **CO3**
IV	**ENERGY FROM OCEANS, WAVES & TIDES:** **Oceans:** Introduction - Ocean Thermal Electric Conversion (OTEC) – methods – prospects of OTEC in India. **Waves:** Introduction – Energy and Power from the waves– Advantages and disadvantages of Wave energy – Wave Energy conversion devices. **Tides:** Basic principle of Tide Energy – Components of Tidal Energy– Advantages and limitations of tidal power generation.	**CO1** **CO4** **CO5**
V	**CHEMICAL ENERGY SOURCES** **Fuel Cells**: Introduction – Fuel Cell Equivalent Circuit - operation of Fuel cell – types of Fuel Cells – Applications. **Hydrogen Energy:** Introduction – Methods of Hydrogen production – Storage and Applications. **Magneto Hydro Dynamic (MHD) Power generation:** Principle of Operation – Types.	**CO1** **CO4**

Learning Resources
Text Books:
1. G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2011. 2. John Twidell& Tony Weir, Renewable Energy Sources, Taylor & Francis, 2013.
Reference Books:
1. S.P.Sukhatme&J.K.Nayak, Solar Energy-Principles of Thermal Collection and Storage, TMH, 2011. 2. John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2nd edition, 2013. 3. ShobaNath Singh, Non- Conventional Energy Resources, Pearson Publications, 2015.
E-Resources: 1. https://archive.nptel.ac.in/courses/103/103/103103206 2. https://archive.nptel.ac.in/courses/103/107/103107157