SUSTAINBLE ENERGY TECHNOLOGIES

(Open Elective-I)

Course Code	23ME2502	Year	III	Semester	I
CourseCategory	Open Elective-I	Branch	Mechanical	Course Type	Theory
Credits	3	L-T-P	3-0-0	Pre-requisites	NIL
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		Level
CO1	Illustrate the importance of solar radiation and solar PV modules.	L3
CO2	Discuss the storage methods in PV systems	L3
CO3	Explain the solar energy storage for different applications	L3
CO4	Understand the principles of wind energy, and bio-mass energy.	L2
CO5	Attain knowledge in geothermal energy, ocean energy and fuel cells.	L2

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO-1	2			1		3		1			3	2	2
CO-2	2			1		3		1			3	2	2
CO-3	2			1		3		1			3	2	2
CO-4	2			1		3		1			3	2	2
CO-5	2			1		3		1			3	2	2

SYLLABUS

UnitNo.	Contents	Mapped CO
I	**SOLAR RADIATION**: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extra terrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems. **SOLAR PV MODULES AND PV SYSTEMS:** PV Module Circuit Design, Module Structure, Packing Density, Interconnections, Mismatch and Temperature Effects, Electrical and Mechanical Insulation, Lifetime of PV Modules, Degradation and Failure, PV Module Parameters, Efficiency of PV Module, Solar PV Systems-Design of Off Grid Solar Power Plant. Installation and Maintenance.	CO1, CO2,

II	**STORAGE IN PV SYSTEMS:** Battery Operation, Types of Batteries, Battery Parameters, Application and Selection of Batteries for Solar PV System, Battery Maintenance and Measurements, Battery Installation for PV System.	**CO1, CO2**
III	**SOLAR ENERGY COLLECTION**: Flat plate and concentrating collectors, classification of concentrating collectors, orientation. **SOLAR ENERGY STORAGE AND APPLICATIONS**: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.	**CO1, CO3**
IV	**WIND ENERGY**: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement. **BIO-MASS**: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.	**CO1, CO4**
V	**GEOTHERMAL ENERGY:** Origin, Applications, Types of Geothermal Resources, Relative Merits **OCEAN ENERGY:** Ocean Thermal Energy; Open Cycle & Closed Cycle OTEC Plants, Environmental Impacts, Challenges **FUEL CELLS:** Introduction, Applications, Classification, Different Types of Fuel Cells Such as Phosphoric Acid Fuel Cell, Alkaline Fuel Cell, PEM Fuel Cell, MC Fuel Cell.	**CO1, CO5**

Learning Recourse(s)

Text Books:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH
2. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006
3. Green Manufacturing Processes and Systems - J. Paulo Davim/Springer 2013

References:

1. Principles of Solar Engineering - D.YogiGoswami, Frank Krieth& John F Kreider / Taylor &Francis
2. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd
3. Renewable Energy Technologies -Ramesh & Kumar /Narosa
4. Non-conventional Energy Source- G.D Roy/Standard Publishers