

RENEWABLE ENERGY TECHNOLOGY

Course Code	19ME4602A	Year	III	Semester	II
Course Category	Program Elective-III	Branch	ME	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		Levels
Upon successful completion of the course, the student will be able to		
CO1	Classify Solar collectors and Solar energy storage methods.	L2
CO2	Explain the basic concepts of Wind Energy and Biomass Energy.	L2
CO3	Summarize fuel cell construction and working principles	L2
CO4	Generalize the fundamentals of Geothermal Energy and Ocean Energy.	L2
CO5	Illustrate different energy conversion Techniques	L2

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H: High, M: Medium, L: Low)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		2		3	3					2	2	2
CO2	2					3	3					2	2	2
CO3	2	2	2	1	2	3	3					2	2	2
CO4	2					3	3					2	2	2
CO5	3	2	2	1	1	3	3					2	2	2

Syllabus		
Unit No	Contents	Mapped CO
I	ROLE AND POTENTIAL OF NEW AND RENEWABLE SOURCES. Solar Energy: introduction- Solar Energy option, Solar energy collection-Flat plate collectors, Evacuated Tube Collectors, and concentrating collectors, classification of concentrating collectors-, Compound parabolic Collectors, Parabolic Throughs, Fresnel lens collector, Paraboloid dish collector. SOLAR ENERGY STORAGE- Different methods, sensible, latent heat and stratified storage, solar ponds: working principle. Solar applications- solar heating/cooling techniques, solar distillation and drying	CO1
II	WIND ENERGY: Sources and potentials, classification of wind mills- horizontal and vertical axis wind mills, effect of wind speed on power generation, considerations for site selection, BIO MASS ENERGY: Properties, principles of production, classification- fixed dome-floating type, comparison, site selection, Plant models in India: floating gas holder- KVIC, fixed dome - Janata type, pragati model, deenbandhu model, constraints for implementation, Factors effecting biomass digestion.	CO2

III	FUEL CELLS: Principle of fuel cells, Faraday's laws, thermodynamic aspects. Performance limiting factors of fuel cells-reactivity-invariance, electrode losses-chemical polarization-concentration polarization-resistance polarization, TYPES OF FUEL CELLS: hydrogen-oxygen fuel cells: Proton exchange membrane fuel cell (PEMFC), Redox fuel cell (RFC), Phosphoric acid fuel cell (PFC); biochemical cells- depolarization or concentration cell, product cell, and redox cell; Regenerative cells	CO3
IV	GEOTHERMAL ENERGY: Origin and Distribution of Geothermal Energy, Types of Geothermal Resources- Hydrothermal Resources, Geopressed Resources, Hot Dry Rock Resources, Magma Resources, Types of wells, , potential in India. OCEAN ENERGY OTEC: Principles, utilization, setting of OTEC plants, thermodynamic cycles. Tidal Energy: Origin and Potential, conversion techniques: types of basins Wave Energy: Origin and Potential, conversion techniques: Heaving Float type, pitching type, Heaving and Pitching type, Oscillating water column type, Surge devices.	CO4
V	DIRECT ENERGY CONVERSION: Need for DEC, limitations, principles of DEC. Thermoelectric generators, Seebeck, Peltier and Joule Thompson effects, figure of merit, materials, applications, Thermionic Generator. MHD POWER CONVERSION: MHD generators- principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator- construction and working, Advantages and limitations.	CO5

Learning Recourse(s)

Text Book(s)

1. G.D.Rai , Non-Conventional Energy Sources, Khanna publishers.
2. B. H. Khan, Non-Conventional Energy Sources, Tata Mc Graw Hill-2009

Reference Book(s)

1. S. Rao, Energy Technology – Non-Conventional, Renewable & Conventional, Khanna publishers.
2. S. P. Sukhame, Solar Energy- Principles and Applications, Tata Mc Graw Hill- 2006
3. G.N Tiwari and M.K Ghosal, Renewable energy resources, Narosa Publishing House-2005
4. M.P. Agrawal, Future Sources of Electrical Power, 1st edition, S. Chand & Co., 1999.

e-Resources & other digital material

1. <https://nptel.ac.in/courses/121/106/121106014/>
2. <https://nptel.ac.in/courses/112/105/112105050/>
3. <https://nptel.ac.in/courses/108/108/108108078/>