

## ALTERNATIVE SOURCES OF ENERGY

<b>Course Code</b>	20ME4701C	<b>Year</b>	IV	<b>Semester</b>	I
<b>Course Category</b>	Professional Elective- III	<b>Branch</b>	ME	<b>Course Type</b>	Theory
<b>Credits</b>	3	<b>L – T – P</b>	3 – 0 – 0	<b>Prerequisites</b>	Nil
<b>Continuous Internal Evaluation</b>	30	<b>Semester End Evaluation</b>	70	<b>Total Marks</b>	100

**Course Outcomes;** Upon successful completion of the course, the student will be able to

		<b>Skill</b>	<b>Levels</b>	<b>Units</b>
CO1	Demonstrate Different alternate sources of Energy and energy conversion methods.	Understand, Communication	L2	1,2,3,4,5
CO2	Illustrate Solar energy Principles, various solar collectors, energy storage methods and applications.	Apply, Communication	L3	1
CO3	Summarize various wind energy, biomass energy, Geothermal Energy and Ocean Energy concepts and applications.	Apply, Communication	L3	2,3
CO4	Select suitable fuel cell and energy conversion methods.	Apply, Communication	L3	4,5

**Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (H: High, M: Medium, L: Low)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
<b>CO 1</b>	3					3	3			2		2	3	2
<b>CO 2</b>	3	2				3	3			2		2	3	2
<b>CO 3</b>	3					3	3			2		2	3	2
<b>CO 4</b>	3					3	3			2		2	3	2

**Syllabus**

<b>UNIT</b>	<b>Contents</b>	<b>Mapped CO</b>
<b>I</b>	<b>Role and potential of new and renewable sources: Solar Energy:</b> 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. <b>Solar Energy Storage-</b> Different methods, sensible, latent heat and stratified storage, solar ponds: working principle. Solar applications- solar heating/cooling techniques, solar distillation and drying.	<b>CO1 CO2</b>
<b>II</b>	<b>Wind Energy:</b> Sources and potentials, classification of wind mills- horizontal and vertical axis wind mills, effect of wind speed on power generation, considerations for site selection, <b>Bio Mass Energy:</b> Properties, principles of production, classification- fixed	<b>CO1 CO3</b>

	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.	
III	<p><b>Geothermal Energy:</b> 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.</p> <p><b>Ocean energy</b></p> <p><b>OTEC:</b> Principles, utilization, setting of OTEC plants, thermodynamic cycles.</p> <p><b>Tidal Energy:</b> Origin and Potential, conversion techniques: types of basins</p> <p><b>Wave Energy:</b> Origin and Potential, conversion techniques: Heaving Float type, pitching type, Heaving and Pitching type, Oscillating water column type, Surge devices.</p>	CO1 CO3
IV	<p><b>Fuel cells:</b> 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.</p> <p><b>Types of fuel cells:</b> hydrogen-oxygen fuel cells: Proton exchange membrane fuel cell (PEMFC), Redox fuel cell (RFC), Phosphoric acid fuel cell (PFC); biochemical cells- depolarixatori or concentration cell, product cell, and redox cell; Regenerative cells.</p>	CO1 CO4
V	<p><b>Direct Energy Conversion:</b> Need for DEC, limitations, principles of DEC. Thermoelectric generators, Seebeck, Peltier and Joule Thompson effects, figure of merit, materials, applications, Thermionic Generator.</p> <p><b>MHD Power Conversion:</b> MHD generators- principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator- construction and working, Advantages and limitations.</p>	CO1 CO4

### Learning Resource

#### Text books:

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

#### Reference books

1. Energy Technology – Non-Conventional, Renewable & Conventional, S. Rao, 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. Future Sources of Electrical Power, M.P. Agrawal, 1st edition, S. Chand& Co., 1999.

#### e- Resources & other digital material

<https://nptel.ac.in/courses/121/106/121106014/>

<https://nptel.ac.in/courses/112/105/112105050/>

<https://nptel.ac.in/courses/108/108/108108078/>