

## NON-CONVENTIONAL ENERGY SOURCES

<b>Course Code</b>	20EE2701A	<b>Year</b>	IV	<b>Semester</b>	I
<b>Course Category</b>	OE – III	<b>Branch</b>	Offered by EEE	<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

CO1	<b>Understand</b> the process of energy collection, quantification, storage, conversion and applications of non-conventional sources. <b>(L2) 1 2 3 4 5</b>
CO2	<b>Apply</b> the knowledge of energy conversion by harvesting energy from different natural sources like light, heat, wind, water etc. <b>(L3) 1 2 3</b>
CO3	<b>Apply</b> basic laws of physics for the production of energy from Solar, wind, ocean, biomass, geothermal, fuel cell <b>(L3) 1 2 3 4 5</b>
CO4	<b>Analyze</b> the theory and designing wind mills, MHD, Fuel cells. <b>(L4) 3 5</b>
CO5	<b>Examine</b> the performance of solar and wind generating units and economic aspects of MHD biomass and Ocean energy sources. <b>(L4) 2 3 4 5</b>
CO6	<b>Ability</b> to apply the various energy generation techniques and to measure the <b>basic</b> parameters and <b>submit a report. 1 2 3 4 5</b>

### 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.	Syllabus	Mapped CO's
1	<b>PRINCIPLES OF SOLAR RADIATION:</b> Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extra-terrestrial and terrestrial solar radiation, solar radiation on tilted surface. Measurement of Solar Radiation: Pyrometer, shading ring pyrheliometer, sunshine recorder, schematic diagrams and principle of working.	CO1, CO2, CO3, CO6
2	<b>SOLAR ENERGY COLLECTION AND STORAGE:</b> Solar Light Energy: Photovoltaic effect, characteristics of photovoltaic cells, conversion efficiency, solar batteries and applications of photovoltaic energy conversion. Solar Heat Energy: Sensible, latent heat of Heat storage, solar ponds. Applications- solar heating/cooling technique, solar distillation and drying.	CO1, CO2, CO3, CO5, CO6
3	<b>WIND ENERGY:</b> Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria <b>OCEAN ENERGY:</b> OTEC, types of OTEC plants, mini-hydel power plants	CO1 – CO6
4	<b>BIO-MASS:</b> Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters. <b>GEOTHERMAL ENERGY:</b> Resources, methods of harnessing the energy.	CO1, CO3, CO5, CO6

5	<p><b>MHD Generators:</b> Basic principles of MHD generator and Hall Effect, different types of MHD generators.</p> <p><b>Fuel Cells:</b> Introduction, principle of fuel cells, thermodynamic analysis of fuel cells, types of fuel cells, fuel cell batteries, applications of fuel cells.</p>	CO1, CO3, CO4,CO6
<b>Learning Resources</b>		
<b>Text Books :</b>		
<ol style="list-style-type: none"> <li>1. G.D. Rai, Non-Conventional Energy Sources, Khanna publishers, 5th edition,2014.</li> <li>2. S. Rao and B. B.Parulekar, Energy Technology- Non conventional, Renewable and Conventional, Khanna Pub ,3rd Edition, 1999.</li> </ol>		
<b>Reference Books</b>		
<ol style="list-style-type: none"> <li>1. Ashok V Desai, Non-Conventional Energy, New age publishers, 1st edition 1990.</li> <li>2. B.H.Khan,Non-Conventional Energy Sources, Tata Mc Graw-hill Publishing Company, 2nd edition,2013.</li> <li>3. B.T. Nijaguna, Biogas Technology, New Age International Pub, First edition 2002.</li> <li>4. Tiwari and Ghosal, Renewable Energy resources, Narosa, 2nd edition 2005</li> </ol>		
<b>Web links</b>		
<p><a href="https://www.coursera.org/learn/renewable-energy-technology-fundamentals">https://www.coursera.org/learn/renewable-energy-technology-fundamentals</a></p> <p><a href="https://nptel.ac.in/courses/121106014">https://nptel.ac.in/courses/121106014</a></p>		