

**20EE2701A - NON-CONVENTIONAL ENERGY SOURCES**

<b>Offering Branches</b>	EEE		
Course Category:	Open Elective -IV	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practical:	3-0-0
Prerequisites:		Continuous Evaluation:	30
		Semester End Evaluation:	70
		Total Marks:	100

**Course Outcomes**

Upon successful completion of the course, the student will be able to:

<b>CO1</b>	<b>Understand</b> the process of energy collection, quantification, storage, conversion and applications of non-conventional sources.	K2
<b>CO2</b>	<b>Apply</b> the knowledge of energy conversion by harvesting energy from different natural sources like light, heat, wind, water etc.	K3
<b>CO3</b>	<b>Apply</b> basic laws of physics for the production of energy from Solar, wind, ocean, biomass, geothermal, fuel cell	K3
<b>CO4</b>	<b>Analyze</b> the theory and designing wind mills, MHD, Fuel cells.	K4
<b>CO5</b>	<b>Examine</b> the performance of solar and wind generating units and economic aspects of MHD biomass and Ocean energy sources.	K4
<b>CO6</b>	<b>Ability</b> to apply the various energy generation techniques and to measure the basic parameters and <b>submit a report.</b>	K3

**Contribution of Course Outcomes towards achievement of Program Outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>														
<b>CO2</b>	3						3						2	1
<b>CO3</b>	3						3						2	1
<b>CO4</b>		3											2	1
<b>CO5</b>		3					3						2	1
<b>CO6</b>								3	2			3	2	1
<b>Avg.</b>	<b>3</b>	<b>3</b>					<b>3</b>		<b>3</b>	<b>2</b>		<b>3</b>	<b>2</b>	<b>1</b>

**1- Low**

**2-Medium**

**3-High**

**Course Content**

<b>UNIT-1</b>	<p><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.</p> <p>Measurement of Solar Radiation: Pyrometer, shading ring pyrheliometer, sunshine recorder, schematic diagrams and principle of working.</p>	CO1 CO2 CO3 CO6
<b>UNIT-2</b>	<p><b>SOLAR ENERGY COLLECTION AND STORAGE:</b></p> <p>Solar Light Energy: Photovoltaic effect, characteristics of photovoltaic cells, conversion efficiency, solar batteries and applications of photovoltaic energy conversion.</p> <p>Solar Heat Energy: Sensible, latent heat of Heat storage, solar ponds. Applications- solar heating/cooling technique, solar distillation and drying.</p>	CO1 CO2 CO3 CO5 CO6
<b>UNIT-3</b>	<p><b>WIND ENERGY:</b> Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria</p> <p><b>OCEAN ENERGY:</b> OTEC, types of OTEC plants, mini-hydel power plants</p>	CO1 CO2 CO3

		CO4 CO5 CO6
<b>UNIT-4</b>	<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
<b>UNIT-5</b>	<b>MHD Generators:</b> Basic principles of MHD generator and Hall Effect, different types of MHD generators. <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.	CO1 CO3 CO4 CO6
<b>Learning Resources</b>		
<b>Text Books</b>	1. G.D. Rai, Non-Conventional Energy Sources, Khanna publishers, 5th edition, 2014. 2. S. Rao and B. B. Parulekar, Energy Technology- Non conventional, Renewable and Conventional, Khanna Pub, 3rd Edition, 1999.	
<b>Reference Books</b>	1. Ashok V Desai, Non-Conventional Energy, New age publishers, 1st edition 1990. 2. B.H.Khan, Non-Conventional Energy Sources, Tata Mc Graw-hill Publishing Company, 2nd edition, 2013. 3. B.T. Nijaguna, Biogas Technology, New Age International Pub, First edition 2002. 4. Tiwari and Ghosal, Renewable Energy resources, Narosa, 2nd edition 2005	
<b>E-Resources &amp; other digital material</b>	1. <a href="https://www.coursera.org/learn/renewable-energy-technology-fundamentals">https://www.coursera.org/learn/renewable-energy-technology-fundamentals</a> 2. <a href="https://nptel.ac.in/courses/121106014">https://nptel.ac.in/courses/121106014</a>	