

15EE251E	Sustainable Energy		L	T	P	C
			3	0	0	3
Co-requisite:	NIL					
Prerequisite:	NIL					
Data Book / Codes/Standards	NIL					
Course Category	E	PROFESSIONAL ELECTIVE	POWER SYSTEMS			
Course designed by	Department of Electrical and Electronics Engineering					
Approval	32 nd Academic Council Meeting , 2016					

PURPOSE	To understand the different types of non-conventional energy resources like solar, wind, biomass, ocean, tidal and wave sources and their conversion techniques						
INSTRUCTIONAL OBJECTIVES				STUDENT OUTCOMES			
At the end of the course, the student will be able to							
1.	Understand the concept of various non-conventional energy resources			a			
2.	Acquire in-depth knowledge on the conversion of non-conventional energy resources into Electrical power			a			
3.	Become intellectual in new developments of renewable energy studies			a	e		
4.	Attain knowledge in green energy technologies			a			

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
	UNIT I: SOLAR ENERGY	09			
1.	Various solar energy systems and their applications	1	C	1	1
2.	Solar spectra-latitude and longitude, Declination angle, solar window, cosine law, seasonal variations, daily variation, hour angle	2	C	1,2	2
3.	Calculation of angle of incidence	1	C	3	2
4.	Principle of photovoltaic conversion of solarenergy - Types of solar cells and fabrication	2	C	4	3
5.	Photovoltaic - battery charger, domestic lighting, street lighting, water pumping etc	2	C	4	3
6.	Solar Photovoltaic power plant – Net metering concept	1	C	3	2
	UNIT II: WIND ENERGY	09			
7.	Nature of the wind – wind power– factors influencing wind	2	C	1	1
8.	Wind data and energy estimation - wind speed monitoring - wind resource assessment - Betz limit - site selection	2	C	2	1
9.	Types of wind turbines – Various control-Tip Speed Ratio – Solidity	2	C	3	3
10.	Torque on wind-wind thrust calculations	2	C	2	3
11.	Repowering concept	1	C	1	2
	UNIT III: BIO-ENERGY	09			
12.	Energy from Biomass - Biomass as Renewable Energy Source - Types of Biomass Fuels - Solid, Liquid and Gas	2	C	1	1
13.	Biomass Conversion Techniques- Wet Process, Dry Process-Photosynthesis - Biogas Generation	2	C	1,2	1
14.	Factors affecting Bio-digestion –Different digesters – Digesters sizing - Advantages and Disadvantages	2	C	1,2	2
15.	Digesters power generated and problems	1	C	2	3
16.	Energy Forming –Pyrolysis	2	C	1,3	1
	UNIT IV: ENERGY FROM OCEANS	09			
17.	Ocean Thermal Energy Conversion (OTEC); Principle- Lambert Law of absorption - Open and closed OTEC Cycles -.Major problems and operational experience	2	C	1	1,4
18.	Tidal energy: Tide – Spring tide, Neap tide – Tidal range – Tidal Power – Types of Tidal power plant	2	C	1,4	2

Session	Description of Topic	Contact hours	C-D-I-O	IOs	Reference
19.	Single and dual basin schemes- Requirements in tidal power plant	2	C	2	2
20.	Wave Energy – Wave Characteristics	1	C	1,3	1
21.	Different wave energy convertors -Saltor Duck , Oscillating water column and dolphin types	2	C	2	1,4
	UNIT V: GEOTHERMAL ENERGY	09			
22.	Geothermal Energy – Classification	2	C	1	1
23.	Fundamentals of geophysics	1	C	1	1
24.	Dry rock and hot aquifers energy analysis	3	C	1,2	3
25.	Estimation of thermal power , Extraction techniques	3	C	3	3
	Total hours	45			

LEARNING RESOURCES

Sl. No.	TEXT BOOKS
1.	Rai , G.D.,” <i>Non Conventional sources of Energy</i> ”, Khanna Publishers ,5 th Edition 2016.
2.	Khan. B.H, “ <i>Non-Conventional Energy Resources</i> ”, The McGraw Hills, 2 nd Edition, 2016.
REFERENCE BOOKS / OTHER READING MATERIAL	
3.	Rao. S. & Pamlekar Dr.B.B. “ <i>Energy Technology</i> ”, Khanna Publishers, 3rd Edition 2016
4.	John W Twidell and Tony D Weir, “ <i>Renewable Energy Resources</i> ”, Taylor and Francis, 2 nd Edition 2006

Course nature				Theory			
Assessment Method (Weightage 100%)							
In-semester	Assessment tool	Cycle test I	Cycle test II	Cycle Test III	Surprise Test	Quiz	Total
	Weightage	10%	15%	15%	5%	5%	50%
End semester examination Weightage :							50%