

Branch Name:	Mechanical Engineering
Semester/Year:	Semester VI / Third Year
Subject Title:	Alternative Energy Sources
Subject Code:	1ET1010606
Pre-requisite:	Engineering Thermodynamics, Heat Transfer

Course Objectives:

1. To provide introduction to Alternative (Renewable) Energy Sources and their technological applications.
2. To focus on technological aspects of solar, biomass, wind power and geothermal energy conservation methods.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	01	00	04	70	30	00	20	120

Subject Contents			
Sr. No	Topic	Total Hours	Weightage (%)
1	Introduction: Basics of energy, Types of energy and its utilization/availability (Requirement of AES), Global energy scenario, India energy scenario, Environmental aspects of energy utilization, Public health issues related to environmental Pollution.	3	6
2	Solar Radiation: Solar constant, Solar radiation outside the earth's atmosphere, Solar radiation at earth's surface, Solar radiation data, Solar radiation geometry, Instruments for measuring solar radiation and sun shine, Estimation of average solar radiation, Solar radiation on tilted surfaces. Solar Energy Collectors: Conversion of solar radiation into heat, Flat plate collector, Transmissivity, Thermal analysis and heat gain by flat plate collector, Concentrating collector, Classification of concentrating collectors, Performance analysis of cylindrical parabolic concentrating collector.	10	24
3	Solar Energy Storage and Applications: Different methods of storage, Sensible heat, latent heat and stratified storage, Solar ponds, Solar water heating, Space heating & cooling, Solar distillation, Solar dryer, Solar cooking, Solar furnace. Solar Photo-Voltaic: Solar cells, Different types of PV Cells, Mono-poly	8	18

	crystalline and amorphous silicon solar cells, Design of PV array, Efficiency and cost of PV systems & its applications.		
4	Wind Energy: Principle of wind energy conversion, Basic components of wind energy conversion systems, Wind mill components, Various types and their constructional features, Design considerations of horizontal and vertical axis wind machines, Analysis of aerodynamic forces acting on wind mill blades and estimation of power output, Wind data and site selection considerations.	10	24
5	Energy from Biomass: Sources of biomass, Different species, Conversion of biomass into fuels, Energy through fermentation, Pyrolysis, gasification and combustion, Aerobic and anaerobic bio-conversion, Properties of biomass, Biogas plants, Types of plants, Design and operation, Properties and characteristics of biogas.	6	14
6	Geothermal Energy: Estimation and nature of geothermal energy, Sources and resources, Applications, Geothermal energy in India. Ocean Energy: Ocean thermal electric conversion (OTEC) systems like open cycle, close cycle & hybrid cycle. Energy from tides, Basic principle of tidal power, Single basin and double basin tidal power plants, Advantages, Limitation and scope of tidal energy. Wave energy and power from wave, Wave energy conversion devices, Advantages and disadvantages of wave energy.	6	14

Course Outcomes:

The student will be able to understand

1. Requirement of Alternative Energy Sources based on present energy scenario of conventional energy sources.
2. Working and applications of different alternative (solar, biomass, wind power and geothermal) energy sources.

List of Reference Books:

1. Sukhatme, S. P. Solar Energy: Principles of Thermal Collection and Storage. Tata McGraw Hill.
2. Kothari, D. P. Renewable Energy Sources and Emerging Technologies. Prentice Hall of India Pvt. Ltd.
3. Mukherjee and Chakrabarti. Fundamentals of Renewable Energy systems. New age International Publishers.
4. Rai, G. D. Non-conventional sources of energy. Khanna Publishers.
5. Mittal, K. M. Non-conventional Energy Systems-Principles, Progress and Prospects. Wheeler Publications.

List of Tutorial:

Students are required to carry various tutorials based on the above subject contents. It is desirable to demonstrate the various equipments/instruments to the students like, (a) Solar water heater (b) Solar air heater (c) Pyranometer (d) Pyrheliometer (e) Solar PV system (f) Wind mill (g) Biogas plant (h) Gasifier (i) solar cooker, in-house or through industrial visits:

E-Resources:

1. <http://nptel.ac.in/courses/121106014/>