

**SUBJECT CODE: 01ME0732**  
**RENEWABLE ENERGY ENGINEERING**
**B.Tech. IV Year – (Sem-7) Mechanical Engineering**
**Type of course:** Programe Elective

**Prerequisite:** Fluid Mechanics, Heat Transfer

**Rationale:** REE course is designed to provide knowledge of various renewable energy sources, systems and applications in the present situation.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks					Total Marks
L	T	P		Theory Marks		Practical Marks			
			ESE		Viva	T.W.			
4	0	2	5	50	30	20	25	25	150

**Content:**

Sr. No.	Content	Total Hrs	% Weightage
1	<b>Scenario of Renewable Energy Sources:</b> Needs of renewable energy, benefits and limitations of Renewable Energy, present energy situation of conventional and Renewable Energy sources	2	03
2	<b>Solar Energy:</b> Energy available from the sun, spectral distribution, solar radiation outside the earth's atmosphere and at the earth's surface, solar radiation geometry, Instruments for solar radiation measurements, empirical equations for predicting availability of solar radiation, calculation of radiation on tilted surface  conversion of solar energy into heat, different types of solar collectors, solar air heater : evacuated and non-evacuated , concentrated collectors, liquid flat plate collector: Thermal analysis, cylindrical parabolic collector, thermal storage of solar energy, heating and cooling of buildings, Solar Equipments : pump, cooker, solar still, solar drier, refrigeration & air conditioning, solar pond, furnace, air heater, Solar photovoltaic system for power generation, cell modules and arrays, types of solar cell , material, applications, advantages and disadvantages of solar systems	22	40
3	<b>Wind Energy:</b> Energy available from wind, basics of lift and drag, basics of wind energy conversion system, effect of density, angle of attack and wind speed, windmill rotors, horizontal and vertical axes rotors, drag, lift, torque and power coefficients, tip speed ratio, solidity of turbine, wind turbine performance curves, wind energy potential and site selection, basics of wind farm	12	22
4	<b>Bio Energy :</b> Different Types of biogas plants, biogas generation, factors for biogas generation, advantages and disadvantages, biomass energy, bio energy plantation, gasification, gasifiers types and their applications	03	05
5	<b>Ocean Energy:</b> OTEC principle, open, closed and hybrid cycle OTEC system, Energy from tides, estimation of tidal power, tidal power plants, ocean plants : single and double basin, site requirements, advantages and	08	12

	limitations, wave energy, devices for wave energy conversion, advantages and disadvantages of ocean thermal energy <b>Geothermal energy:</b> Introduction, vapor and liquid dominated systems, binary cycle, hot dry rock resources, magma resources, advantages and disadvantages, applications <b>MHD Power generation:</b> concept and working principle		
6	<b>Economic Analysis:</b> Initial and annual cost, present value calculations, calculation of repayment of loan :annual installments, annual savings, clean development mechanism, cumulative saving and life cycle cost, Solar system Economic analysis, Calculation of payback period,	09	18

Equipments:

- (a) Solar water heater (b) Solar air heater (c) Pyranometer (d) Pyrheliometer  
(e) Solar PhotoVolatic system (f) Wind mill (g) Biogas plant (h) Gasifier (i) Solar cooker

**Suggested Specification table with Marks (Theory):**

Distribution of Theory Marks					
Remembrance	Understanding	Application	Analyze	Evaluate	Create
10	15	25	10	05	05

**Reference Books:**

1. Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, McGraw-Hill Education
2. Solar Engineering of Thermal Processes, John A. Duffie, William A. Beckman, John Wiley, New York
3. Non-conventional energy resources, Shobh Nath Singh, Pearson India
4. Solar Energy Engineering, Soteris Kalogirou, Elsevier/Academic Press.
5. Principles of Solar Energy, Frank Krieth & John F Kreider, John Wiley, New York

**Course Outcome:**

student will be able to understand,

- Importance of Renewale Energy sources
- Applications of different Renewale Energy sources
- Carry our preliminary economic analysis of Renewale Eenergy systems

**List of Open Source Software/learning website:**

<http://nptel.ac.in/courses/112104117/18>

<http://nptel.ac.in/courses/112104117/4>

<http://nptel.ac.in/courses/112104117/17>