

COURSE TITLE	RENEWABLE ENERGY ENGINEERING
COURSE CODE	01ME1732
COURSE CREDITS	4

Objective:

- 1 REE course is designed to provide knowledge of various renewable energy sources, systems and applications in the present situation

Course Outcomes: After completion of this course, student will be able to:

- 1 Assess renewable energy sources and perform basic economic analysis.
- 2 Evaluate solar thermal and photovoltaic system performance.
- 3 Examine wind energy conversion and turbine performance factors.
- 4 Assess bioenergy, ocean, energy systems.
- 5 Analyze Tidal, geothermal and MHD power systems and their economics.

Pre-requisite of course: Fluid Mechanics, Heat Transfer

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Scenario of Renewable Energy Sources Needs of renewable energy, benefits and limitations of Renewable Energy, present energy situation of conventional and Renewable Energy sources	3
2	Solar Energy 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 photovoltaic, types of solar cell, advantages and disadvantages of solar systems	14
3	Wind Energy 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	7

Contents : Unit	Topics	Contact Hours
4	Bio Energy 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	4
5	Ocean Energy and Geothermal energy : 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 limitations, wave energy, devices for wave energy conversion, advantages and disadvantages of ocean thermal energy, Introduction, vapor and liquid dominated systems, binary cycle, hot dry rock resources, magma resources, advantages and disadvantages, applications Magneto Hydro Dynamic Power generation: concept and working principle	8
6	Economic Analysis: Basic definitions of various costs 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	6
Total Hours		42

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	To determine and analyze the different solar angle for the given particular day and month To determine and analyze the different solar angle for the given particular day and month	2
2	To analyze different angle for single and dual axis tracking system To analyze different angle for single and dual axis tracking system	2
3	To measure the solar radiation with solar meter To measure the solar radiation with solar meter	2
4	To analyze the performance of the photovoltaic cell To analyze the performance of the photovoltaic cell	2
5	To simulate the performance of the photovoltaic cell in MATLAB To simulate the performance of the photovoltaic cell in MATLAB	2
6	To analyze the performance of solar water heater To analyze the performance of solar water heater	2
7	To analyze the performance of solar air heater To analyze the performance of solar air heater	2
8	To analyze the performance of biogas plant To analyze the performance of biogas plant	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
9	To analyze the performance of wind energy To analyze the performance of wind energy	2
10	Economic analysis of the renewable energy system Economic analysis of the renewable energy system	2
11	To conduct case study on renewable energy system (Solar, wind, Biogas) To conduct case study on renewable energy system (Solar, wind, Biogas)	2
12	To conduct case study on power generation of different countries of the globes To conduct case study on power generation of different countries of the globes	2
Total Hours		24

Textbook :

- 1 Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, McGraw-Hill Education, 2001
- 2 Solar Engineering of Thermal Processes, John A. Duffie, William A. Beckman, John Wiley, New York, 2005

References:

- 1 Non-conventional energy resources, Non-conventional energy resources, Shobh Nath Singh, Pearson India, 2005
- 2 Solar Energy Engineering, Solar Energy Engineering, Soteris Kalogirou, Elsevier/Academic Press, 2006
- 3 Principles of Solar Energy, Principles of Solar Energy, Frank Krieth & John F Kreider, John Wiley, New York, 2012
- 4 Renewable Energy: Power for a Sustainable Future, Renewable Energy: Power for a Sustainable Future, Stephen Peake and David Elliott, Oxford University Press, 2017
- 5 Renewable Energy Resources, Renewable Energy Resources, John Twidell and Tony Weir, Routledge, 2015

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
10.00	20.00	30.00	20.00	20.00	0.00

Instructional Method:

- 1 PPT and Video

Supplementary Resources:

- 1 https://onlinecourses.nptel.ac.in/noc22_ch27/preview