



# HUBANDHRA UNIVERSITY

## TRANS-DISCIPLINARY RESEARCH HUB

### RENEWABLE ENERGY TECHNOLOGIES

1. Solar thermal energy and applications – Review of solar radiation data and measurement – Solar water heater types - Flat plate collectors – Efficiency of heat removal – Active and Passive solar systems - Thermo siphon and forced circulation - Evacuated collectors - Basics of solar concentrators - Solar air heaters – Solar Chimney - Crop driers - Water desalination - Solar still – Principle of solar ponds.
2. Wind Energy – Power in wind - Availability – Types of wind turbines - Aerodynamics of Wind turbine – Momentum theory – Construction features of wind turbines (Number of blades, Solidity, Blade profile, Upwind/Downwind, Yaw system, Tower, Braking system) - Rotor design considerations – Annual energy output – Synchronous and asynchronous generators and loads – Integration of wind energy converters to electrical networks – Inverters – Control system – Requirement and strategies – Noise – Applications of wind energy
3. Biomass energy - Bio fuel – Conversion of biomass – Thermo-chemical (Pyrolysis, charification and gasification) – Biological conversion - Different digesters (Anaerobic and Aerobic digestion) – Digester sizing - Energy farming – Direct combustion for heat – Process heat and electricity – Applications of Biogas – Use of biogas and producer gas in IC Engines
4. Wave and Tidal Energy - Concept of energy and power from waves – Wave characteristics – period and wave velocities - Different wave energy conversion devices (Saltor duck, oscillating water column and dolphin types) – operational experience - Principles of tidal power generation - components of power plant – Single and two basin systems – Turbines for tidal power - Estimation of energy – Maximum and minimum power ranges - Tidal powerhouse.
5. Ocean and Geothermal Energy - OTEC Principle - Lambert's law of absorption - Open cycle and closed cycle - Heat exchanger calculations (elementary treatment) – Major problems and operational experience - Classification of geothermal resource - Fundamentals of geophysics - Availability and estimation of thermal power - Extraction techniques.

#### Reference Books:

- a. Renewable Energy Resources / John Twidell and Tony Weir / E & F.N.Spon
- b. Renewable Energy Resources Basic Principles and Applications / G.N.Tiwari and M.K.Ghosal / Narosa
- c. Solar Energy - Principles of thermal collection and storage/ S.P. Sukhatme /TMH
- d. Solar Energy Thermal Processes,/Duffie & Beckman
- e. Solar Heating and Cooling / Kreith & Kreider
- f. Wind Energy Handbook / Tony Burton, David Sharpe, Nick Jenkins and Ervin Bossanyi / Wiley
- g. Wind Electrical Systems / S.N.Bhadra, D.Kastha and S.Banerjee / Oxford
- h. Biogas Technology - A Practical Hand Book / K.Khendelwal & S.S. Mahdi /McGraw-Hill
- i. Power Plant Technology / El Wakil/ Mc Graw Hill



# ANDHRA UNIVERSITY

## TRANS-DISCIPLINARY RESEARCH HUB

### MODEL QUESTION PAPER

### RENEWABLE ENERGY TECHNOLOGIES.

Answer any five questions.

Each question carries 20 marks

Max. Marks:100

1. (a) What are different types of solar plates ? Explain them in briefly.  
(b) Explain in detail about the solar cell mismatch in a module and effect of shadowing on a solar module.
2. (a) Derive an expression for energy available in the wind.  
(b) What are the different types of wind turbines? Explain them in briefly.
- 3.(a) Define the following terms.  
(i) Pyrolysis (ii) Charification (iii) Gasification.  
(b) Explain in detail different stages in bio-mass energy generation.
4. (a)Write about different wave energy conversion devices.  
(b)Write about single and two basin systems.
5. (a)Explain in detail Lambert's law of absorption.  
(b)Write differences between open and closed cycle
- 6.(a) Write about construction features of wind turbines.  
(b)What are the factors affecting the location of a wind power plant?.
7. (a)What are the different solar water heaters ? Explain them briefly.  
(b)Write the principles of tidal power generation.
8. (a) Explain the significance of MPPT in a Solar PV System and how it can be achieved.  
(b) Evaluate the environmental aspects of geothermal energy in detail.