

B.Sc. PHYSICS SYLLUBUS UNDER CBCS

w.e.f. 2015-16 (Revised in April 2016)

For Mathematics Combinations

Semester - VI

Cluster Elective Paper –VIII-C-2 :Wind, Hydro and Ocean Energies

No. of Hours per week: 04

Total Lectures:60

UNIT-I

- 1. Introduction:** Wind generation, meteorology of wind, world distribution of wind, wind speed variation with height, wind speed statistics, Wind energy conversion principles; General introduction; Types and classification of WECS; Power, torque and speed characteristics.
- 2. Wind Measurements:**Eolian features, biological indicators, rotational anemometers, other anemometers, wind measurements with balloons.

UNIT-II

- 3. Wind Energy Conversion System:**Aerodynamic design principles; Aerodynamic theories; Axial momentum, blade element and combine theory; Rotor characteristics; Maximum power coefficient; Prandtl's tip loss correction.
- 4. Design of Wind Turbine:** Wind turbine design considerations; Methodology; Theoretical simulation of wind turbine characteristics; Test methods.

UNIT-III

- 5. Wind Energy Application:** Wind pumps: Performance analysis, design concept and testing; Principle of wind energy generation; Standalone, grid connected and hybrid applications of wind energy conversion systems, Economics of wind energy utilization; Wind energy in India; Environmental Impacts of Wind farms.

UNIT-IV

- 6. Small Hydropower Systems:** Overview of micro, mini and small hydro systems; Hydrology; Elements of pumps and turbine; Selection and design criteria of pumps and turbines; Site selection; Speed and voltage regulation; Investment issues load management and tariff collection; potential of small hydro power in India. Wind and hydro based stand-alone hybrid power systems.

UNIT-V

- 7. Ocean Thermal, Tidal and Wave Energy Systems:**Ocean Thermal - Introduction, Technology process, Working principle, Resource and site requirements, Location of OCET system, Electricity generation methods from OCET, Advantages and disadvantages, Applications of OTEC,
- 8. Tidal Energy -** Introduction, Origin and nature of tidal energy, Merits and limitations, Tidal energy technology, Tidal range power, Basic modes of operation of tidal systems. Wave Energy – Introduction, Basics of wave motion, Power in waves, Wave energy conversion devices, Advantages and disadvantages, Applications of wave energy.

Reference Books:

1. Dan Charis, Mick Sagrillo, Lan Woofenden, "Power from the Wind", New Society Pub., 2009.
2. Erich Hau, "Wind Turbines-Fundamentals, Technologies, Applications, Economics", 2nd Edition, Springer Verlag, Berlin Heidelberg, NY, 2006.
3. Joshue Earnest, Tore Wizelius, "Wind Power and Project Development", PHI Pub., 2011.

4. T. Burton, D. Sharpe, N. Jenkins, E. Bossanyi, Wind Energy Handbook, John Wiley Pub., 2001.
5. Paul Gipe, "Wind Energy Basics", Chelsea Green Publications, 1999.
6. Khan, B.H., "Non-Conventional Energy Resources", TMH, 2nd Edition, New Delhi, 2009.
7. Tiwari, G.N., and Ghosal, M.K, Renewable Energy Resources – Basic Principles and applications, Narosa Publishing House, 2007.

Cluster Elective Paper- VIII-C-2 Practical: Wind, Hydro and Ocean Energies 2hrs/Week

Minimum of 6 experiments to be done and recorded

1. Estimation of wind speed using anemometer.
2. Determination of characteristics of a wind generator
3. Study the effect of number and size of blades of a wind turbine on electric power output.
4. Performance evaluation of vertical and horizontal axes wind turbine rotors.
5. Study the effect of density of water on the output power of hydroelectric generator.
6. Study the effect of wave amplitude and frequency on the wave energy generated.