Dr. V.S. KRISHNA GOVERNMENT DEGREE COLLEGE (A) , VISAKHAPATNAM

B.Sc. PHYSICS SYLLABUS UNDER CBCS

ELECTIVE – EB-2

RENEWABLE ENERGY AND ENERGY HARVESTING

III Year B.Sc.-Physics, Semester V

Work load:60 hrs per semester **4 hrs/week**

Course Objectives

- To impart knowledge and hands on learning about various alternate energy sources to teach the ways of harvesting energy using wind, solar, mechanical, ocean, geothermal energy etc. To review the working of various energy harvesting systems which are installed worldwide.

Course Learning Outcome

- The students are expected to learn not only the theories of the renewable sources of energy, but also to have hands-on experiences on them wherever possible. Some of the renewable sources of energy which should be studied here are: (i) off-shore wind energy, (ii) tidal energy, (iii) solar energy, (iv) biogas energy and (v) hydroelectricity. All these energy sources should be studied in detail.
- Learn about piezoelectricity, carbon- captured technologies like cells, batteries.
- The students should observe practical demonstrations of (i) training modules of solar energy, windenergy etc., (ii) Conversion of vibration into voltage using piezoelectric materials, (iv) conversion ofthermal energy into voltage using thermoelectric modules.

UNIT I: 1.Global Energy Scenario &Indian energy scenario:

Classification of energy resources, conventional energy resources, advantages, disadvantages, Origin and time scale of fossil fuels, Energy flow diagram to earth, Conventional energy sources, Role of energy in economic development and social transformation. Global Energy consumption in various sectors, projected energy consumption for the next century, Exponential increase in world's energy consumption, impact of exponential rise in energy usage on global economy. energy resources available in India- coal, oil, natural gas, nuclear and hydroelectric power, wind, solar, OTEC etc., Energy as a factor limiting growth, Need for use of renewable energy sources. **(12 hours)**

UNIT II: 2.Solar energy

Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses,Solar power plants, Solar cell, Types of solar cells, photovoltaic effect, Solar module and array, Components of PV system, Applications of solar PV systems. **(12 hours)**

UNIT III: 3.Wind Energy

Introduction, Principle of wind energy conversion, Components of wind turbines, Operation and characteristics of a wind turbine,wind-electric generator power plant, Advantages and disadvantages of wind mills, Applications of wind energy. **(6 hours)**

4. Hydrogen Energy:

History of hydrogen energy - Hydrogen production methods - Electrolysis of water, Hydrogen storage options – Compressed and liquefied gas tanks, Metal hydrides; Hydrogen safety - Problems of hydrogen transport and distribution - Uses of hydrogen as fuel. **(6 hours)**

UNIT IV:

5.Ocean Energy:

Introduction, Principle of ocean thermal energy conversion, Tidal power generation, Tidal energy technologies, Energy from waves, Wave energy conversion, Wave energy technologies, advantages and disadvantages. Closed and open type OTEC -advantages and disadvantages.

(7 hours)

6.Geothermal Energy: Introduction ,Important aspects of geothermal energy Structure of earths interior, Energy of earth-heat flux, Earthquake and volcanoes, geothermal system hot spring structure, geothermal resources, advantages, disadvantages and applications **(6 hours)**

UNIT V:

7.Bio-energy

Energy from biomass – Sources of biomass – Environmental effects of biomass, Conversion of biomass – biomass gasification – Introduction of biogas, Aerobic and anaerobic digestion – bio gas applications, advantages of biogas production, factors affecting generation of biogas, Biogas plants-Floating dome type(KVIC-type)&Fixed dome type(Dinabandhu model),Production of biofuels-ethanol, methanol, biodiesel and producer gas. power generation from land fill gas(LFG)and liquid waste. **(11 hours)**