

### 3<sup>rd</sup> SEMESTER

#### SKILL ENHANCEMENT COURSE

#### PH318S: RENEWABLE ENERGY AND ENERGY HARVESTING

(Credits: Theory: 02)

*The aim of this course is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning wherever possible*

#### UNIT-I

**Fossil fuels and Alternate Sources of energy:** Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean, Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy, tidal energy, Hydroelectricity.

**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 cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.

#### UNIT-II

**Wind Energy harvesting:** Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

**Ocean Energy:** Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.

**Geothermal Energy:** Geothermal Resources, Geothermal Technologies.

**Hydro Energy:** Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

**Piezoelectric Energy harvesting:** Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, piezoelectric parameters and modeling piezoelectric generators, piezoelectric energy harvesting applications.

**Human power Electromagnetic Energy Harvesting:** Linear generators, physics mathematical models, recent applications, Carbon captured technologies, cell, batteries, power consumption. Environmental issues and Renewable sources of energy, sustainability.

#### PRACTICALS (CREDITS: 2)

##### Demonstrations and Experiments

1. Demonstration of Training modules on solar energy, wind energy, etc.
2. Conversion of vibration to voltage using piezoelectric materials
3. Conversion of thermal energy into voltage using thermoelectric modules.

##### Reference Books:

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
5. Dr. P Jayakumar, Solar Energy: Resource Assessment Handbook, 2009
6. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).