

## **ORO551 RENEWABLE ENERGY SOURCES**

### DETAILED SYLLABUS

#### **OBJECTIVES:**

- To get exposure on solar radiation and its environmental impact to power.
- To know about the various collectors used for storing solar energy.
- To know about the various applications in solar energy.
- To learn about the wind energy and biomass and its economic aspects.
- To know about geothermal energy with other energy sources.

#### **UNIT I PRINCIPLES OF SOLAR RADIATION**

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation and sun shine, solar radiation data.

#### **UNIT II SOLAR ENERGY COLLECTION**

Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

#### **UNIT III SOLAR ENERGY STORAGE AND APPLICATIONS**

Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

#### **UNIT IV WIND ENERGY**

Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria BIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

### **UNIT V GEOTHERMAL ENERGY:**

Resources, types of wells, methods of harnessing the energy, potential in India. OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics. DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, principles of DEC.

### **OUTCOMES:**

- Understanding the physics of solar radiation.
- Ability to classify the solar energy collectors and methodologies of storing solar energy.
- Knowledge in applying solar energy in a useful way.
- Knowledge in wind energy and biomass with its economic aspects. • Knowledge in capturing and applying other forms of energy sources like wind, biogas and geothermal energies.

### **TEXT BOOKS:**

1. Rai G.D. , “Non-Conventional Energy Sources”, Khanna Publishers, 2011
2. Twidell & Wier, “Renewable Energy Resources”, CRC Press (Taylor & Francis), 2011

### **REFERENCES:**

1. Tiwari and Ghosal, “Renewable energy resources”, Narosa Publishing House, 2007
2. Ramesh R & Kumar K.U, “Renewable Energy Technologies”,Narosa Publishing House, 2004
3. Mittal K M, “Non-Conventional Energy Systems”, Wheeler Publishing Co. Ltd, New Delhi, 2003
4. Kothari D.P, Singhal., K.C., “Renewable energy sources and emerging technologies”, P.H.I, New Delhi, 2010