

GREEN ENERGY SYSTEMS

Course objectives:

- 1) To demonstrate the importance of solar energy collection and storage.
- 2) To understand the principles of wind energy and biomass energy.
- 3) To gain knowledge on geothermal and ocean energy.
- 4) To acquire knowledge about energy efficient systems.
- 5) To understand the concepts of green manufacturing systems.

UNIT – 1	<p>SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells.</p> <p>SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation.</p> <p>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, solar cookers, central power tower concept and solar chimney.</p>
UNIT – 2	<p>WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.</p> <p>BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.</p>
UNIT – 3	<p>GEOHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy.</p> <p>OCEAN ENERGY: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques.</p>
UNIT – 4	<p>ENERGY EFFICIENT SYSTEMS:</p> <p>(A) ELECTRICAL SYSTEMS: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management.</p> <p>(B) MECHANICAL SYSTEMS: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, Environmental friendly and Energy efficient compressors and pumps.</p>
UNIT – 5	<p>GREEN MANUFACTURING SYSTEMS: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing.</p>

TEXT BOOKS:

- 1) Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH.
- 2) Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006.
- 3) Green Manufacturing Processes and Systems - J. Paulo Davim/Springer 2013.

REFERENCES:

- 1) Alternative Building Materials and Technologies - K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Rao/New Age International.
- 2) Principles of Solar Engineering - D.Yogi Goswami, Frank Krieth & John F Kreider /Taylor & Francis.
- 3) Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd.
- 4) Renewable Energy Technologies -Ramesh & Kumar /Narosa.
- 5) Non-conventional Energy Source- G.D Roy/Standard Publishers.
- 6) Renewable Energy Resources-2nd Edition/ J.Twidell and T. Weir/ BSP Books Pvt.Ltd.
- 7) Fuel Cell Technology -Hand Book / Gregor Hoogers / BSP Books Pvt. Ltd.

Course Outcomes: At the end of the course, student will be able to

- CO1: Explain the importance of solar energy collection and storage.
- CO2: Apply the principles of wind energy and biomass energy.
- CO3: Analyze knowledge on geothermal and ocean energy.
- CO4: Learn about energy efficient systems.
- CO5: Discuss the concepts of green manufacturing systems.