

Course Description & Objective:

To acquaint with the knowledge on various energy sources like biofuels, wind and solar systems, their use, design and applications in different farming activities.

Course outcomes:

After completion of the course, students will be able to:

- 1. describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.*
- 2. explain the technological basis for harnessing renewable energy sources*
- 3. recognize the effects that current energy systems based on fossil fuels have over the environment and the society*
- 4. describe the main components of different renewable energy systems*
- 5. compare different renewable energy technologies and choose the most appropriate based on local conditions*
- 6. perform simple techno-economical assessments of renewable energy systems*
- 7. perform and compare basic environmental assessments of renewable energy systems and conventional fossil fuel systems*
- 8. design renewable/hybrid energy systems that meet specific energy demands, are economically feasible and have a minimal impact on the environment*
- 9. suggest the best combination of technological solutions to minimize the emission of greenhouse gases and increase the sustainability of the energy system in specific areas/regions*
- 10. discuss how to utilize local energy resources (renewable and non-renewable) to achieve the sustainable energy system.*

UNIT I

Introduction to alternative energy sources-Types, advantages, disadvantages, conventional energy sources, World energy scenario, Applications of renewable energy in agriculture

UNIT II

Solar radiation and its measurement, Solar energy collectors, solar energy storage, applications of solar energy, Design of solar energy operated systems for heating, cooling, distillation, drying, water pumping and power generation for application in agriculture.

UNIT III

Wind energy, Types of wind mills and their characteristics. Mechanics of wind mills, Design of wind mills Applications, Utilization of wind energy for generation of electricity and mechanical power.

UNIT IV

Biomass conversion and biogas generation, types of biogas plants- construction and working, digester design considerations, Factors affecting biogas production, Design of biogas systems for heating, lighting and running IC engines, Economics of biogas utilization.

UNIT V

Thermo-chemical conversion of biomass, direct combustion, Pyrolysis and gasification, chemical combustion process, carbonization , briquetting, pelletization and densification of biomass, bioconversion into alcohols, methyl and ethyl esters, organic acids, solvents of amino acids, bio-fuels.

Practicals

1. Measurement of direct and diffuse radiation,
2. Study of solar cooker.
3. Study of solar water heater.
4. Study of solar sprayer.
5. Design problems on solar photovoltaic cell.
6. Design problems on collection of solar radiation.
7. Design problems on wind mill.
8. Design of biogas plant.
9. Briquetting.
10. Study of bio-fuel.

Suggested readings

James F. Manwell, Jon G. McGowan, Anthony L. Rogers. 2009. Wind Energy Explained: Theory, Design and Application, 2nd Edition, Wiley Publishers.

V V N Kishore. 2010. Renewable Energy Engineering And Technology: Principles And Practice, The Energy and Resources Institute

John A. Duffie, William A. Beckman. 2013. Solar Engineering of Thermal Processes, John Wiley & Sons.

Hemant Pathak. 2013. A Hand Book of Energy Conservation and Management, CreateSpace Independent Publishing Platform.

1. Solanki Chetan Singh. 2011. Solar Photovoltaics: Fundamentals, Technologies and Applications, PHI; 2 edition.
2. Sameer A Zodgekar . 2008. Biofuels: Introduction and Country Experiences, ICFAI University Press.
3. Walter Eshenaur . 1985. Understanding Agricultural Waste Recycling, Vita Publications.