Choice Based Course

SEMESTER VI

PH6B05.3U – Renewable Energy Technology

Credits – 3

No. of contact hours – 90

Scope: This course is designed to make the students aware of challenging energy crisis and alternative energy solutions.

Prerequisites: Concepts of work- power- energy, heat energy- Modes of energy transfer- Heat engines, Concepts of Physical optics, Fundamental of Electricity.

Module I

Introduction to Energy Sources (6 hours)

Energy consumption as a measure of Prosperity – World energy futures – Energy sources and their availability – New energy technologies – Renewable energy sources

Non-conventional Sources of Energy - G D Rai Chapter 1

Solar Energy (20 hours)

Solar radiation geometry – Solar radiation measurements – Principles of the conversion of solar radiation in to heat – Flat plate collectors – Energy balance equation and collector efficiency – Concentrating collector: Focusing type – Performance analysis of a parabolic collector – Selective absorber coatings – Solar energy storage systems – Solar pond – Principle of operation and extraction of thermal energy – Solar heating and solar cooling of buildings – Solar electric power generation: Solar photo-voltaic cells

Non-conventional Sources of Energy - G D Rai Chapters 2,3,4&5

Module II

Wind Energy (14 hours)

Basic principles of wind energy conversion – site selection considerations – Classification of wind energy conversion systems – types of wind machines – Performance analysis of wind machines – Schemes for electric generation – Applications of wind energy – Environmental aspects.

Non-conventional Sources of Energy - G D Rai Chapter 6

Geothermal Energy (14 hours)

Nature of geothermal fields - Geothermal resources – Hot dry rock resources – Magma resources – Geothermal exploration – Advantages and disadvantages of geothermal energy – Applications of geothermal energy – Operational and environmental problems.

Non-conventional Sources of Energy - G D Rai Chapter 8

Energy from Biomass (11 hours)

Biomass conversion technologies – Biomass as a source of energy – Energy plantation – Methods for obtaining energy from biomass – Biogas generation – Biodegradation – Biogas plants – Biogas from waste – Community biogas plants – Thermal gasification of biomass.

Non-conventional Sources of Energy - G D Rai Chapter 7

Module III

Energy from the Oceans (15 hours)

Ocean thermal electric conversion (OTEC) – Introduction – Open cycle OTEC system – Closed cycle OTEC system – Hybrid cycle – Prospects of OTEC in India.

Energy from Tides – Basic principle of tidal power – Operation methods of utilization of tidal energy – Single cycle and double cycle systems – Advantages and limitations of tidal power generation - Prospects of tidal energy in India.

Ocean waves – Energy and power from the waves – Wave energy conversion devices - Advantages and limitations of wave energy.

Non-conventional Sources of Energy - G D Rai Chapter 9

Energy storage (10 hours)

Fuel cells – Design and principle of operation of a fuel cell – Classification of fuel cells – Conversion efficiency of fuel cells – Applications of fuel cells.

Non-conventional Sources of Energy - G D Rai Chapter 10

Hydrogen energy – Hydrogen production (Electrolysis, thermochemical methods) – Hydrogen storage – hydrogen as an alternative fuel for motor vehicles.

Non-conventional Sources of Energy - G D Rai Chapter 11

References:

1. Non – Conventional Energy Sources: G D Rai (Khanna Publishers)
2. Renewable Energy Technologies : Solanki C S (Prentice-hall Of India Pvt Ltd)
3. Renewable Energy Sources & Their Environmetal Impact : Abbasi (Prentice-hall of India Pvt Ltd)
4. Renewable Energy Sources for Sustainable Development N.S.Rathore N.L.Panwar (New India Publishing Agency)
5. Renewable Energy : Ulrich Laumanns And Dieter Uh Dirk Abmann (James & James Science Publishers)
6. Understanding Renewable Energy Systems : Volker Quaschning (James & James Science Publishers)
7. Renewable Energy: Global Perspectives : Azmal Hussain (Icfai University Press)
8. New And Renewable Energy Technologies For Sustainable Development : Naim Hamdia Afgan, Da Graca Carvalho Maria, Maria Da Graca Carvalho (Taylor & Francis Group)
9. Renewable Energy from the Ocean : Avery, William H.; Wu, Chih; Craven, John P. (Oxford University Press)
10. Fundamentals of Renewable Energy Systems : Mukherjee D (New Age International (p) Limited)
11. Renewable Energy Sources & Emerging Tech., : Kothari D P (Prentice-hall Of India Pvt Ltd)
12. Energy From Biomass : Willeke Palz, D. Pirrwitz (Springer)
13. Understanding Renewable Energy Systems : Volker Quaschning (James & James

Science Publishers)

14. Ocean, Tidal, And Wave Energy: Power From The Sea : Lynn Peppas (Crabtree Publishing Company)
15. Fuel Cells, Geothermal Energy And Tidal Power: Emerging Scenario In Alternate Energy : Sameer A Zodgekar (Icfai University Press)