

Course Code	Course Name	Credits
26PH607	RENEWABLE ENERGY AND RESOURCES	04

Course Objectives

- To develop capability to understand the fundamentals of science and energy technology for analyzing the problems futuristic approach.
- To facilitate the students to achieve a clear conceptual understanding of technical and commercial aspects of wind and alternative sources of energy.

Learning Outcomes

Upon successful completion of this course it is intended that a student will be able to:

- Analysis the viability of wind and alternative energy projects.
- Knowledge of using Solar, Biomass energy, Geothermal & Tidal.

Unit 1 – Energy Science & Technology (12 Hrs.)

Forms of Energy – Advantages and Limitations - Mechanical Energy - Chemical Energy and Fuels - Nuclear Energy - Hydro Energy - Renewable Energy – Energy Demand- Comparison of Fuels such as Wood, Charcoal, Coal, Kerosene, Diesel, Petrol, Furnace Oil, LPG, Biogas and Electricity on calorific value and cost basis -Efficiencies of various Energy production.

Unit 2 – Solar Radiation, Collection & Storage (12 Hrs.)

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 titled surface, Instruments for measuring solar radiation and sun shine, solar radiation data. Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors. Solar Energy Storage and Applications: Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications – solar heating& cooling techniques, solar distillation and drying, Photovoltaic energy conversion.

Unit 3 - Wind & Bio-Mass (12 Hrs.)

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics. 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 4 – Geothermal & Tidal (12 Hrs.)

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India. OTEC: Principles, utilization, setting of OTEC plants, thermodynamic cycles. Tidal and Wave Energy: Potential and conversion techniques, mini-hydel power plants, their economics.

Unit 5 - Bio Fuels (12 Hrs.)

Edible –Petro crops – Analysis of Indian non edible oil sources – Example of biodiesel crop – Jatropha curcas – Tree description – Jatropha curcas for rural development – environmental protection – Bio ethanol – production from conventional as well as unconventional sources. - Bio diesel – Technology for production of bio diesel - Transesterification – Process – Usage of Methanol – Glycerine – Storage and Characterisation of biodiesel – Biodiesel engine development – modification – Environmental and health effects of biodiesel – R&D in biodiesel – disposal of cake – value addition of byproducts.

Reference Books:

- Ashok Desai V, Non-Conventional Energy, Wiley Eastern Ltd, 1990.
- Koushika M.D., "Solar Energy Principles and Applications", IBT publications, 1988.
- Mital K.M, "Biogas systems: Principles and Applications", New Age International Publishers
- Mittal K.M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, 1997.
- Ramesh R, Kurnar K.U, Renewable Energy Technologies, Narosa Publishing House, New Delhi, 199

Websites and eLearning Sources:

- <https://nptel.ac.in/courses/103103206>
- <https://youtu.be/jhKejoBqiYc?si=0QR8nxxiRqLXxgUP>
- <https://youtu.be/mh51mAUexK4?si=AsUb6cKPiF0jEj0H>

COs and Bloom's Taxonomy Mapping – 26PH607

Course Outcomes	On successful completion of this course, students will be able to	BTL
CO1	Recall and explain different forms of energy, energy resources, and comparative performance of fuels.	K1, K2
CO2	Apply principles of solar radiation, collection, and storage systems for energy conversion and utilization.	K3
CO3	Analyze renewable energy systems such as wind, biomass, and bioenergy conversion techniques.	K4
CO4	Analyze geothermal, tidal, and ocean energy systems including their working principles and applications.	K5
CO5	Evaluate and design sustainable energy systems including biofuels and hybrid renewable technologies for practical applications.	K6

BTL (Bloom's Taxonomy Level) - K1 – Remembering, K2 – Understanding, K3- Applying, K4 – Analyse, K5- Evaluate and K6 - Create

Relationship Matrix – 26PH607

Course Outcomes	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)						Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	
CO1	3	2	1	1	1	1	3	2	1	1	1	1	1.58
CO2	3	3	2	2	1	1	2	3	2	2	2	1	2.00
CO3	3	3	3	2	1	1	2	3	3	2	2	2	2.25
CO4	3	3	3	2	2	1	2	3	3	2	2	2	2.33
CO5	3	3	3	3	2	2	3	3	3	3	2	2	2.58
Total													2.15

Mean Score: 3- High, 2- Medium/Moderate, 1-Low

