

Course Code ESE 821	Credit Hours (Th-Pr) 3.0	Energy Resources and Technologies	Contact Hrs/Week (Th-Pr) 3.0	Total Contact Hrs (Th-Pr) 45
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**Course Outline:**

Reserves, production and consumption of oil, coal and gas, technologies for conversion; fundamental principles, applications and status of solar energy, biomass energy, wind energy, hydro-power, geothermal energy, wave energy, tidal energy, and ocean thermal energy; outlook of fossil and renewable energy

**Eligibility Criteria:** B.E (Chemical, Mechanical, Electrical, Environmental and Materials)

**Recommended Books:**

S. No.	Title	Author(s)	Assigned Code	Remarks
1.	Renewable Energy: Power for a Sustainable Future	<u>Godfrey Boyle</u>	GB	Text
2.	Fundamentals of Renewable Energy Processes	Aldo V. Da Rosa	RD	Reference
3.	Sustainable Energy,	J.W. Tester, E.M. Drake	DT	Reference
4	Renewable Energy and the Environment	Robert Foster, Majid Ghassemi	MR	Reference

**Course Objectives:**

Considering that energy is a critical need of the society, it is important that energy graduates should have an understanding of: i) the reserve position of fossil energy resources in quantitative terms as well as in terms of its lifetime, ii) the importance of renewable energy and its availability, iii) the working principles of different renewable energy technologies, and (iv) applications of energy technologies in the economic sectors.

**Learning outcome:**

The student will be abreast of the various energy options and resource types available for exploitation with special emphasis on renewable energy resources and their use in the light of environmental implications such as green house effect and its mitigation methodologies. The students will be able to evaluate the potential of the project incentives offered by CDM.

**Topics Covered:**

No.	Topics	Text Book	Contact Hours
1.	Energy and its Types, Thermal Energy, Chemical Energy, Electromagnetic Energy, Nuclear, Energy, Mechanical Energy	GB and RD	8
2.	Law of Energy conversion, Energy conservation and Energy Efficiency, Conventional and Renewable Energy Resources, Energy Mix of the world, Energy Mix of Pakistan and south Asia, Fossil Energy Resources and Technologies	GB and RD	8
3.	<b>Renewable Energy Resources</b> Definition and types of Renewable Energies Resource availability, technologies and applications (from international and local prospective Solar Energy (thermal and photovoltaics) Wind Energy (resources, turbines and applications) Hydropower (resources, turbines, small hydro power systems and applications) Biomass Energy (resources, thermal and non thermal applications of biomass, and biofuels) Geothermal Energy (resources, heat and electricity applications) Other Renewable Energy Resources (Tidal, Wave and	GB and RD	14

	Ocean Thermal Energy Conversion)		
4.	<p><b><u>Greenhouse Gases and Climate Change</u></b></p> <p>Energy Use and the Greenhouse Effect</p> <p>Greenhouse Gases: Types, Inventory and Sources</p> <p>Climate Change Impacts</p> <p><b><u>Technology Options for GHG Emission Mitigation</u></b></p> <p>Renewable Energy</p> <p>Energy Efficient Technologies by Sector AND End-Use</p> <p>Cleaner Production</p> <p><b><u>International Climate Change Conventions, Protocols and Perspectives</u></b></p> <p>Developing vs. Developed Country Perspectives on GHG Mitigation</p> <p>United Nations Framework Convention on Climate Change (UNFCCC) and Conference of the Parties</p> <p>The Kyoto Protocol and Flexible Mechanisms: Clean Development Mechanism (CDM), Emission Trading, Joint Implementation</p>	GB and RD	15