EN673 Fundamental of Energy Engineering (3-0-0-6)

Course Content:

Fundamentals of Thermo-Fluid and electrical systems

Thermodynamics: Review of 1st, 2nd and 3rd law of thermodynamics; properties of pure substance; phychrometrics; throttling process; refrigeration cycles; reactive systems; gas power cycles.

Fluid mechanics: Review of fundamental concepts; scale of pressure measurement; barometer; manometer; mass, momentum and energy equations and its applications; boundary layer concepts; analysis of turbo machines: compressors, fans and blowers.

Heat and Mass Transfer: Modes of heat transfer: conduction, convection and radiation; boiling and condensation; heat exchangers and its performance parameters; basics principles of mass transfer.

Basic electrical engineering: Fundamentals of electrical engineering; Kirshoff's law; amperes law; power factor; electrical machines: motor (DC, induction, synchronous), generators, transformers.

Renewable Energy Systems

Energy conservation: First law efficiency; second law efficiency; vapour power cycles: Rankine cycle, binary cycle, cogeneration, combined cycle; energy savings; carbon footprint; greenhouse gas; energy audit.

Energy conversion: Solar energy conversion: Solar thermal and Photovoltaic, bioenergy conversion: biochemical, electrochemical and thermochemical; biofuels; wind energy conversion; principles of fuels and combustion; combustion devices; principles of drying; hydro-electric power; fuel cells; fission and fusion reaction; comparison of energy conversion processes.

Texts/References:

1. P. K. Nag, *Engineering Thermodynamics,* Tata McGraw Hill, 2nd Edition, 1996.
2. G. N. Tiwari, *Solar Energy, Fundamentals, Design, Modeling and Applications*, Narosa, 2002.
3. S. P. Sukhatme and J. K. Nayak, *Solar Energy: Principles of Thermal Collection and Storage*, Tata McGraw Hill, 2006.
4. C. S. Solanki, *Solar Photovoltaics: Fundamentals, Technologies and Applications,* Prentice Hall India, 2nd Edition, 2011.

5. H. P. Garg and J. Prakash, *Solar Energy: Fundamentals and Applications*, Tata McGraw Hill, 1997.
6. S. K. Som, Gautam Biswas, and Suman Chakraborty, *Introduction to Fluid Mechanics and Fluid Machines*, McGraw Hill, 3rd Edition, 2012.
7. M. Necati Ozisik, *Heat Transfer A basic Approach*, McGraw Hill International Editions, 1985.
8. Samir Sarkar, Fuels and Combustion, Universities Press, 3rd Edition, 2009.
9. C.L. Wadhwa, Basic Electrical Engineering, New Age International, 4th edition, 2007.

Preamble

Basic knowledge on thermodynamics, heat and mass transfer, energy conversion mechanism is of utmost important in order to understand the fundamental physical concepts of energy science and engineering. The course content is designed to provide the fundamentals of physical systems and brief information about various energy conversion devices and processes.

Concepts will be illustrated with schematics and block diagrams wherever required. Sufficient number of numerical examples with solutions will be discussed in the course. This course is specifically designed for post graduate students of Energy Engineering. Further, the course will be very much useful for students and researchers from varied academic backgrounds for synthesis of novel energy conversion devices and processes.