Interdisciplinary Open Course-I (IOC)

IOC 21005 Renewable Energy Teaching scheme

Lectures: 2 hrs/week

Unit 1 Introduction to energy: (5 hrs)

Energy demand growth and supply, Historical perspectives, Fossil fuels: Consumption and Reserves, Environmental impacts of burning fossil fuels, Sustainable development and the role of renewable energy.

Unit 2 Wind and Hydro power systems: (6 hrs)

Atmospheric circulations, factors influencing the winds, wind turbines and types, coefficient of power, torque, Betz limit, Aerodynamic design principle for blades, Introduction to hydro power plant and types, overview of micro, mini and small hydropower plant, types and operational characteristics of hydro turbine

Unit 3 Bio energy and bio-fuels: (6 hrs)

Biomass source and characterization, direct combustion, pyrolysis, mechanism of bio-renewable energy, Gasifiers, updraft gasifier, downdraft gasifier, gasifier-basedelectricity-generating systems, application of biogas slurry in agriculture, bio ethanol for energy generation

Unit 4 Fuel cells: (8 hrs)

Working principle of fuel cells, fuel cell electrochemistry, types of fuel cells: Alkaline fuel, Fuel Cells, Phosphoric acid fuel cell, Solid oxide fuel cell, Molten carbonate fuel cell, Direct methanol Fuel Cell, their applications, relative merits and demerits. Introduction to thermal heat storage.

Unit 5 Tidal energy: (6 hrs)

Tidal power plants: single basin & two basin plants, variation in generation level, Ocean thermal electricity conversion, electricity generation from waves, shortline and floating wave systems.

Unit 6 Geothermal energy: (6 hrs)

Introduction, Geothermal sites in India, high temperature and low temperature sites in India, Conversion technologies, Steam and binary systems, geothermal power plant, open loop and closed loop system.

Text Books

• Godfrey Boyle, Renewable energy, Oxford press, 2012
• Twidell J and Weir T., Renewable energy resources, Taylor and Francis, 2006
• Rai G.D., Non-conventional energy sources, Khanna Publication, 2009
• B.H. Khan, Non-conventional energy sources, Mcgrawhill education, 2006.

Reference Books

• Wind Energy Systems by Johnson G. L., Prentice Hall,1985

• Introduction to Hydro Energy Systems: Basics, Technology and Operation by Wagner H. and Mathur J, Springer, 2009.

• Bio-fuels: biotechnology, chemistry, and sustainable development by DM Mousdale, CRC Press, 2008.
• Fuel Cells: From Fundamentals to Applications by S Srinivasan, Springer, 2006.