

AMEI-07 ELECTROMECHANICAL ENERGY CONVERSION

UNIT-1 SOLAR ENERGY

- 1.1 Radiation- extra-terrestrial, spectral distribution, solar constant, solar radiation on earth, measurements; solar thermal system- solar thermal power and its conversion, solar collectors, flat plate, solar concentrating collectors,
- 1.2 Types and applications; photovoltaic (PV) technology - photovoltaic effect, efficiency of solar cells, semi-conductor materials, solar PV system, standards and applications, tracking.

UNIT-2 WIND AND SMALL HYDROPOWER ENERGY

- 2.1 Wind data, properties, speed and power relation, power extracted, wind distribution and speed prediction, wind map of India; wind turbines and electric generators. fundamentals
- 2.2 Types of machines and their characteristics, horizontal and vertical wind mills, elementary design principle, wind energy farms, off-shore plants;
- 2.3 Small, mini and micro hydro power plants and their resource assessment, plant layout with major components shown.

UNIT-3 OTHER NON-CONVENTIONAL ENERGY SOURCES

- 3.1 biomass – photosynthesis and origin of biomass energy, resources, cultivated resources, waste to biomass, terms and definitions
- 3.2 Incineration, wood and wood waste, harvesting super tree, energy forest, pyrolysis, thermo-chemical biomass conversion to energy, gasification, anaerobic digester, fermentation, gaseous fuel; geothermal
- 3.3 Resources, hot spring, steam system, principle of working, site selection, associated problems in development; ocean and tidal energy
- 3.4 Principle of ocean thermal energy conversion, wave energy conversion machines, problems and limitations, fundamentals of tidal power, conversion systems and limitations; hydrogen energy
- 3.5 Properties of hydrogen, sources, production and storage, transportation, problems for use as fuel; fuel cells – introduction with types, principle of operation and advantages.

UNIT-4 GRID CONNECTIVITY

- 4.1 Wind power interconnection requirement - low-voltage ride through (LVRT), ramp-rate limitations, supply of ancillary services for frequency and voltage control, load following,
- 4.2 Reserve requirement, impact of connection on steady-state and dynamic performance of power system; interfacing dispersed generation of solar energy with the grid, protective relaying,
- 4.3 Islanding, voltage flicker and other power quality issues; role of non-conventional energy system in smart grid.

References Books:

1. John Twidell, “Renewable Energy Sources”, Taylor and Francis
2. Godfrey Boyle, “Renewable Energy: Power for a Sustainable Future”, Oxford University Press
3. Ewald F. Fuchs, “Power Conversion of Renewable Energy Systems”, Springer