

20PE018 - SOLAR ENERGY CONVERSION

UNIT – I

L- 08

Solar Radiation and Measurement: Solar radiation on the earth surface - Extraterrestrial radiation characteristics, Terrestrial radiation, solar isolation, spectral energy distribution of solar radiation. Depletion of solar radiation - Absorption, scattering. Beam radiation, diffuse and Global radiation. Measurement of solar radiation – Pyranometer, pyr heliometer, Sunshine recorder. Solar time - Local apparent time (LAT), equation of time (E)

UNIT – II

L- 08

Solar Radiation Geometry and Calculations: Solar radiation geometry - Earth-Sun angles – Solar angles. Calculation of angle of incidence - Surface facing due south, horizontal, inclined surface and vertical surface. Solar day length – Sun path diagram – Shadow determination. Estimation of Sunshine hours at different places in India. Calculation of total solar radiation on horizontal and tilted surfaces. Prediction of solar radiation availability

UNIT – III

L- 08

Solar Thermal Energy Conversion: Solar thermal power plants - Parabolic trough system, distributed collector, hybrid solar-gas power plants, solar pond based electric power plant, central tower receiver power plant, Liquid based solar heating system; Natural and forced circulation systems, Solar Thermal Energy Storage - Sensible storage; Latent heat storage; Thermo-chemical storage. Solar still; solar cooker; Solar passive heating and cooling systems: Trombe wall; Solar drying.

UNIT – IV

L- 08

Solar photovoltaic energy conversion: Photovoltaic effect - Principle of direct solar energy conversion into electricity in a solar cell, semiconductor properties, energy levels, basic equations. Solar cell, p-n junction, structure and operation of solar cells. Classification of solar PV systems, Solar cell energy conversion efficiency, I-V characteristics, effect of variation of solar insolation and temperature, losses. Concept of maximum power point, cell efficiency, fill factor effect of irradiation and temperature, Solar PV power plants.

UNIT – V

L- 08

PV system components and applications: System components - PV arrays, inverters, batteries, charge controls, net power meters. PV array installation, operation, costs, reliability, Design of a PV system. Central Power Station System, Distributed PV System, Stand alone PV system, grid Interactive PV System, small system for consumer applications, hybrid solar PV system,

TEXT BOOKS:

1. Chetan Singh Solanki., Solar Photovoltaic: “Fundamentals, Technologies and Application”, PHI Learning Pvt., Ltd., 2009.
2. S.P. Sukhatme, J.K.Nayak., “Solar Energy”, Tata McGraw Hill Education Private Limited, New Delhi, 2010.

REFERENCES:

1. Garg H.P., Prakash J., “Solar Energy Fundamentals and Applications”, Tata McGraw-Hill, 2005.
2. Yogi Goswami D., Frank Kreith, Jan F. Kreider, “Principles of Solar Engineering”, Second Edition, Taylor & Francis, 2003.
3. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K., 2012.
4. Chauhan D.S., Srivastava S.K. “Non-Conventional Energy Resources”, New Age, 2009.
5. Georgiadis M.C., “Energy Systems Engineering”, Wiley-VCH, 2008.