SOLAR ENERGY

Course Code: 15ME2314

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Course Outcomes:

At the end of the course, student will be able to

CO1: Know the basic relation between sun and earth and utilization of solar energy.

CO2: Design various devices by utilization of solar energy to generate power.

CO3: Explain various solar storing methods.

CO4: know the various solar devices and its applications.

CO5: calculate economic analysis over solar energy.

UNIT I (10-Lectures)

INTRODUCTION: Solar energy option, specialty and potential – sources of radiation, measurement of beam and diffuse – estimation of average solar radiation on horizontal and tilted surfaces – problems – Applications.

UTILISATION OF SOLAR RADIATION: physical principles of collection – types – liquid flat plate collectors – construction details – performance analysis – concentrating collection – flat plate collectors with plane reflectors – cylindrical parabolic collectors – Orientation and tracking – Performance Analysis.

UNIT II (10-Lectures)

SOLAR WATER HEATING SYSTEM: Design of solar water heating system and layout.

POWER GENERATION: solar central receiver system – Heliostats and Receiver – Heat transport system – solar distributed receiver system – Power cycles, working fluids and prime movers.

UNIT III (10-Lectures)

THERMAL ENERGY STORAGE: Introduction – Need for – Methods of sensible heat storage using solids and liquids – Packed bed storage – Latent heat storage – Thermo chemical storage solar pond – working principle – construction – application and limitations.

DIRECT ENERGY CONVERSION: Solid-state principles – semiconductors, Photovoltaic cell – characteristics- cell arrays-power electric circuits for output of solar panels-choppers inverters-batteries-charge regulators, Construction concepts.

UNIT IV (10-Lectures)

OTHER SOLAR DEVICES: Stills, ponds, air heaters, dryers.

Solar thermal systems applications to power generation, heating and cooling.

UNIT – V (10-Lectures)

Economics – Principles of Economic Analysis – Discounted cash flow – Solar system – life cycle costs – cost benefit analysis and optimization – cost based analysis of water heating and photo voltaic applications.

TEXT BOOKS:

1. Duffie J.A. and Beckman W.A. - Solar engineering of thermal processes
2. Sukhatme S.P. - Solar energy, TMH, 2nd edition,1997
3. G.D. Rai - Solar energy utilization, Khanna Publishers, 2nd edition,1997

REFERENCES:

1. S.K.Dubey, S.K.Bhargava - Non conventional Energy resources
2. D.Y.Goswami,F.Kreith and J.F.Kerider - Principles of solar engineering , 2nd edition,1999 Taylor & Francis
3. Edward E.Anderson - Fundamentals of solar energy conversion, 1983, Addison wesley Pub.