

B Sc

B Sc	Semester V (Skill Enhancement Course -Elective)	Credits: 4
Course: 7B	Solar Energy and Applications	Hrs/Wk: 4

Learning Outcomes: After successful completion of the course, the student will be able to:

- 1. Understand Sun structure, forms of energy coming from the Sun and its measurement.
- 2. Acquire a critical knowledge on the working of thermal and photovoltaic collectors.
- 3. Demonstrate skills related to callus culture through hands on experience
- 4. Understand testing procedures and fault analysis of thermal collectors and PV modules.
- 5. Comprehend applications of thermal collectors and PV modules.

Syllabus: (Total Hours: 90 including Teaching, Lab, Field Training, Unit tests etc.)

UNIT I: BASIC CONCEPTS OF SOLAR ENERGY

Spectral distribution of solar radiation, Solar constant, zenith angle and Air-Mass, standard time, local apparent time, equation of time, direct, diffuse and total radiations. Pyrheliometer - working principle, direct radiation measurement, Pyrometer-working Principle, diffuse radiation measurement, Distinction between the two meters.

UNIT II: SOLAR THERMAL COLLECTORS

Solar Thermal Collectors-Introduction, Types of Thermal collectors, Flat plate collector – liquid heating type, Energy balance equation and efficiency, Evacuated tube collector, collector overall heat loss coefficient, Definitions of collector efficiency factor, collector heat-removal factor and collector flow factor, Testing of flat-plate collector, solar water heating system, natural and forced circulation types. Concentrating collectors, Solar cookers, Solar dryers, Solar desalinators.

UNIT III: FUNDAMENTALS OF SOLAR CELLS

Semiconductor interface, Types, homo junction, hetero junction and Schottky barrier, advantages and drawbacks, Photovoltaic cell, equivalent circuit, output parameters, conversion efficiency, quantum efficiency, Measurement of I-V characteristics, series and shunt resistance, their effect on efficiency, Effect of light intensity, inclination and temperature on efficiency

UNIT IV: TYPES OF SOLARCELLS AND MODULES

Types of solar cells, Crystalline silicon solar cells, I-V characteristics, poly-Si cells, Amorphous silicon cells, Thin film solar cells-CdTe/CdS and CuInGaSe2/CdS cell configurations, structures, advantages and limitations, Multi junction cells – Double and triple junction cells. Module fabrication steps, Modules in series and parallel, Bypass and blocking diodes

UNIT V: SOLAR PHOTOVOLTAIC SYSTEMS

Energy storage in PV systems, Energy storage modes, electrochemical storage, Batteries, Primary and secondary, Solid-state battery, Molten solvent battery, lead acid battery and dry batteries, Mechanical storage – Flywheel, Electrical storage – Super capacitor

Electronics

(10HRS)

(10Hrs)

(**10hrs**)

(10 hrs)

(10hrs)