



FACULTY OF ENGINEERING & TECHNOLOGY

First Year Master of Technology

Semester I

Course Code: 102450102

Course Title: SOLAR ENERGY

Type of Course: Core Course II

Course Objectives: To recognize the basic physics about solar engineering, origin, related devices used to collect solar energy and solar energy utilization systems.

Teaching & Examination Scheme:

| Contact hours per week | | | Course Credits | Examination Marks (Maximum / Passing) | | | | |
|------------------------|----------|-----------|----------------|---------------------------------------|---------|----------|---------|----------|
| Lecture | Tutorial | Practical | | Internal | | External | | Total |
| | | | | Theory | J/V/P* | Theory | J/V/P* | |
| 3 | 0 | 2 | 4 | 30 / 15 | 20 / 10 | 70 / 35 | 30 / 15 | 150 / 75 |

* J: Jury; V: Viva; P: Practical

Detailed Syllabus:

| Sr. | Contents | Hours |
|-----|---|-------|
| 1 | SOLAR RADIATION MEASUREMENT AND DATA ESTIMATION: Solar energy measuring equipments-classification, Pyrheliometers, Pyranometers, Sun-shine recorder, Solar radiation data, Estimation of average solar radiation, Estimation of Direct and Diffused radiation-during no cloudy days-during cloudy days, Ratio of Beam radiation on tilted surface to horizontal surface, Ratio of total radiation on tilted surface to a horizontal surface. | 7 |
| 2 | SOLAR COLLECTORS: Flat plate - Evacuated tube - Concentrated - Pool and Air collectors Construction - Function - Suitability - Comparison - Storage Tank - Solar Fluids | 7 |
| 3 | SOLAR WATER HEATING SYSTEMS: Integral Collector Storage System - Thermosyphon System - Open Loop, Drain Down, Drain Back, Antifreeze Systems - Refrigerant Solar Water Heaters - Solar Heated Pools - Solar Heated Hot Tubs. | 7 |
| 4 | SOLAR SPACE CONDITIONING SYSTEMS: Liquid Type Solar Heating System With / Without Storage - Heat Storage Configurations - Heat Delivery Methods - Air-Type Solar Heating Systems - Solar Refrigeration and Air Conditioning. | 6 |
| 5 | OTHER SOLAR APPLICATIONS: Solar Cooking - Distillation - Desalination - Solar Ponds - Solar Passive Architecture - Solar Drying - Solar Chimney. | 6 |



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|----------|---|----------|
| 6 | SOLAR ECONOMICS: Application of economic methods to analyze the feasibility of solar systems to decide project / policy alternatives - Net energy analysis - and cost requirements for active and passive heating and cooling - for electric power generation - and for industrial process-heating. | 6 |
|----------|---|----------|

Suggested Specification table with Marks (Theory) (Revised Bloom’s Taxonomy):

| Distribution of Theory Marks | | | | | | R: Remembering; U: Understanding; A: Application, N: Analyze; E: Evaluate; C: Create |
|------------------------------|----|----|----|----|----|---|
| R | U | A | N | E | C | |
| 10 | 20 | 20 | 20 | 20 | 10 | |

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

| | |
|---|---|
| 1 | Physics and Technology of Solar Energy- Volume I: Solar Thermal Applications,H P Garg, M Dayal, G Furlan, Springer |
| 2 | Solar Energy: Principles of Thermal Collection and Storage,Sukhatme and Nayak, Tata McGraw.Hill. |
| 3 | Solar Water Heating,Bob Ramlow& Benjamin Nusz, New Society Publishing. |
| 4 | Solar Thermal Energy, John Canivan, Sunny Future Press. |
| 5 | Concentrated Solar Thermal Energy, Charles Christopher Newton, VDM Verlag |
| 6 | Solar Thermal Energy Storage, H.P.Garg, S.C.Mullick, A.K.Bhargava, D.Reidal, Springer |
| 7 | Solar Energy Houses: Strategies, Technologies Examples, Anne Grete Hestnes, Robert Hastings, Bjarne Saxhof. Earthscan Publications. |

Course Outcomes (CO):

| Sr. | Course Outcome Statements | %weightage |
|------|--|------------|
| CO-1 | The impression of various solar thermal energy collectors were clarified. | 24 % |
| CO-2 | The other applications and the devices used to collect solar energy were incorporated. | 16 % |
| CO-3 | The basic economics of solar energy collection system was understood. | 16 % |
| CO-4 | Economic analysis of solar system for feasible projects. | 16 % |
| CO-5 | Students able to demonstrate to solar heating system and collectors. | 28 % |

List of Practicals / Tutorials:

| | |
|---|--|
| 1 | Measurement of solar radiation using solar measuring . |
| 2 | Heating and cooling tests on a paraboloid concentrator solar cooker to determine its F'_{η} and F'_{UL} . |
| 3 | To determine the top heat loss factor of a box type solar cooker. |
| 4 | Performance evaluation of solar still. |
| 5 | Determination of thermal efficiency of Solar Water Heater. |
| 6 | Performance the solar water heating system |
| 7 | Performance evaluation of solar air dryer. |
| 8 | Study of solar refrigeration system. |



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|----|---|
| 9 | Performance analysis of PV cell with increasing the temperature. |
| 10 | Performance evaluation of concentrating solar collector. |
| 11 | Study of solar power plant. |
| 12 | To study the I-V Characteristics of a Si solar cell with varying temperature at constant irradiation. |

Supplementary learning Material:

Curriculum Revision:

| | |
|--------------------------------|--------|
| Version: | 1 |
| Drafted on (Month-Year): | Apr-20 |
| Last Reviewed on (Month-Year): | Jul-20 |
| Next Review on (Month-Year): | Apr-22 |