



## FACULTY OF ENGINEERING & TECHNOLOGY

### Second Year Master of Engineering

**Branch:** Thermal Engineering

**Course Code:** 102440303

**Course Title:** Solar Engineering

**Type of Course:** Professional Elective Course

**Course Objectives:** To learn and study the radiation principles with respective solar energy. To understand PV technology principles and techniques of various solar cells

#### 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	40 / 16	20/08	60/24	30/12	150 /60

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

#### Detailed Syllabus:

Sr.	Contents	Hours
1	<b>SOLAR RADIATION</b> Solar angles – Sun path diagrams – Radiation - extra-terrestrial characteristics, Instruments for solar radiation measurements, solar constant, solar radiation on tilted surface, solar charts.	9
2	<b>SOLAR COLLECTORS</b> Types of solar collectors, flat plate collector thermal analysis - testing methods- evacuated tubular collectors - concentrator collectors – classification - design and performance parameters - tracking systems - compound parabolic concentrators - parabolic trough concentrators - concentrators with point focus - Heliostats – performance of the collectors	9
3	<b>SOLAR THERMAL APPLICATIONS</b> Selection criteria of storage materials for heating and cooling applications, active and passive solar water heating system, solar space heating, solar cooling with absorption and adsorption refrigeration, solar desalination systems, Solar cooker : domestic, community, Solar pond, Solar drying, Solar furnace	12
4	<b>SOLAR PV FUNDAMENTALS</b> photovoltaic system for power generation, construction concepts, solar cell modules and arrays, solar cell types, power electric circuits for output of solar panels- choppers-inverters-batteries-charge regulators, - figure of merits of solar cell - efficiency limits - variation of efficiency with band-gap and temperature - efficiency measurements, Solar photovoltaic (PV) Power Plants: Working of a typical Solar PV Power plant	9



5	<b>ECONOMIC ANALYSIS OF SOLAR SYSTEM</b> Life cycle analysis, time value of money, description of the life cycle analysis method, economic analysis of solar systems , annual savings, payback period	620
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### 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	30	20	20	00	

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	Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, McGrawHill Education
2	Solar Engineering of Thermal Processes, John A. Duffie, William A. Beckman, John Wiley, New York
3	Solar Photovoltaics – Fundamentals, Technologies and Applications, Chetan Singh Solanki, PHI Learning Private limited, 2011. PHI Learning Private limited, 2011.
4	Solar Energy: Fundamentals and Applications, H P Garg & Jai Prakash, McGraw Hill
5	Principles of Solar Energy, Frank Krieth & John F Kreider, John Wiley, New York

### Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	To know the concept of solar radiation and principle of measuring instruments	20
CO-2	To understand the thermal analysis, thermal efficiency of concentrating and nonconcentrating collectors of solar radiation system	35
CO-3	To know the various applications of solar thermal energy	30
CO-4	To understand the life cycle analysis method in solar economic analysis	15



## List of Practicals / Tutorials:

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<b>1</b>	Measurement of solar radiation using pyranometer
<b>2</b>	Performance evaluation of solar flat plate collector
<b>3</b>	Performance evaluation of solar box type cooker
<b>4</b>	Performance evaluation of solar still.
<b>5</b>	Performance evaluation of solar air dryer
<b>6</b>	Performance evaluation of a solar PV panel
<b>7</b>	Study of concentrating solar collector
<b>8</b>	Study of Solar Pond
<b>9</b>	Study of solar thermal power systems
<b>10</b>	Study of various types of PV cell

## Curriculum Revision:

Version:	<b>1</b>
Drafted on (Month-Year):	Apr-21
Last Reviewed on (Month-Year):	Jul-21
Next Review on (Month-Year):	Apr-23