

Course No.: ENR 136
 Course title: **Solar Thermal and Solar Photovoltaic Power Generation**
 Core or elective: Elective
 Number of credits: 3
 Number of lectures-tutorial-lab: 33-00-18
 Course coordinator: Prof. R L Sawhney

Course Outline:

This elective course is to develop capability in the students to design solar thermal and solar photovoltaic power generating units in various modes for example: standalone, grid connected, hybridization. Financial and related environmental implications of the two systems, Case studies and actual application of available software for design of solar power systems are also covered.

Evaluation Procedure:

- Assignments: 20%
- Design of a case study: 30%
- Major test: 50%

S. No.	Topic	Allotted time (hrs)		
		L	T	P
1	Solar radiation – Review. Models for radiation analysis and beam radiation calculations.	1		
2	Solar concentrators: Parabolic trough, paraboloidic dish: continuous type and Fresnel type	3		
3	Tracking mechanisms: single axis and double axis trackings	3		
4	Solar thermal technologies: a) Solar Parabolic trough: design considerations, tracking and control systems, thermal design of receivers, b) Solar parabolic dish: design considerations, Sterling engine, Brayton cycle, tracking and control systems, c) Solar tower concepts: tower design, heliostat design, receiver types, tracking and control systems Material and product/technology overview for the above technologies	6		
5	Emerging technologies: Linear Fresnel reflector, Solar chimney	2		
6	Heat transfer fluids and storage systems: Technology overview, design considerations, materials.	3		
7	Solar thermal power plants: Performance study, site selection and land requirement	3		
8	Solar PV power plants: Solar PV technologies overview - stationary and concentrated PV, inverter and control technologies, master slave inverter system design, standalone systems, grid connected systems, hybridization, synchronization and power evacuation, site selection and land requirements	5		
9	Techno-economic analysis of solar thermal and solar PV power plants	2		
10	Environmental considerations, GHG calculations	2		
11	Application of softwares: TRNSYS, RETScreen, Solar advisor Design of one each solar thermal and solar PV power plant			12

S. No.	Topic	Allotted time (hrs)		
		L	T	P
12	Jawaharlal Nehru National Solar Mission, MNRE guidelines. DPR preparation for power plants	1		6
13	Seminar on case studies	2		
	Total	33	0	18

Suggested readings

Text Books:

1. **Renewable Energy Engineering and Technology – A Knowledge Compendium**, ed. VVN Kishore (TERI Press, 2008).
2. CS Solanki: **Solar Photovoltaics – Fundamentals, Technologies and Applications**, (PHI Learning)

Reference Books:

1. JA Duffie and WA Beckman: **Solar Engineering of Thermal Processes**, Third Edition (John Wiley & Sons)
2. S Sukhatme and J Nayak: **Solar Energy: Principles of Thermal Collection and Storage**, Third Edition (Tata McGraw Hill, 2008)

Reviewers:

1. Mr Shirish Garud, TERI, Delhi
2. Dr B D Sharma, Consultant, Delhi
3. Mr Mahesh Vipradas, Suzlon, Delhi