EN 308 Solar Energy Lab

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Lab

- 9 experiments, 2 demonstrations
- Two venues: Urja Lab, Terrace behind QIP building (Married Research Scholars Quarters)
- Experiments in groups of **three**, except experiment 1 and the demonstrations
- First experiment for **all** students on 15 Jan 19
- Schedule for the remaining experiments will be updated on Moodle

Experiments

Exp. No.	List of experiments	Venue
1	1a: Measurement of solar radiation and sunshine hours	New Terrace
	1b: Measurement of solar radiation and reflectivity	
2	Solar PV modules and their I-V characteristics	Energy Systems Lab
3	3a: DC to DC and DC to AC conversion set up	New Terrace
	3b: Energy yield analysis of a PV module in fixed and 2D-tracked mode of operation	
	3c: Economic payback period of tracking system retrofitted in a 10 MW solar PV plant	
4	MPPT training system	New Terrace
5	5a: Grid synchronization of solar PV inverter and its performance analysis	Energy Systems Lab
	5b: Spectral response measurement of solar cell	
6	Solar pumping	Energy Systems Lab
7	7a: Performance of box-type solar cooker	New Terrace
	7b: Performance of basin-type solar still	
8	8a: Forced circulation evacuated tube collector	New Terrace
	8b: Natural circulation evacuated tube collector	
9	Natural circulation flat plate collector and demonstration of forced circulation flat plate collector system	New Terrace
10	Demonstration of parabolic trough collector and solar air heater	New Terrace
11	Demonstration of thermal energy storage system	Energy Systems Lab

Evaluation

- Performing all experiments and attending both demonstrations are mandatory to pass the lab
- One **group** report per experiment
- Total 30 marks for the course
  - Viva before experiment (based on manual) – 4 marks
  - Viva after experiment (before the next experiment) – 6 marks
  - Report for the experiment – 10 marks
  - End-sem viva – 10 marks
- Minimum 10 marks our of 30 to pass the lab, absolute grading

Experiment 1

- **1a: Measurement of solar radiation and sunshine hours**
- **1b: Measurement of solar radiation and reflectivity**
- Learn to use pyranometer, pyrheliometer, sunshine recorder, infrared radiometer, ultraviolet radiometer
- All students perform the experiments on the same day, see Moodle for division of groups
- **G1** starts at 13:00; **G2** starts at 14:00; **G3** starts at 15:00

Experiment 2

- **Solar PV modules and their *I-V* characteristics**

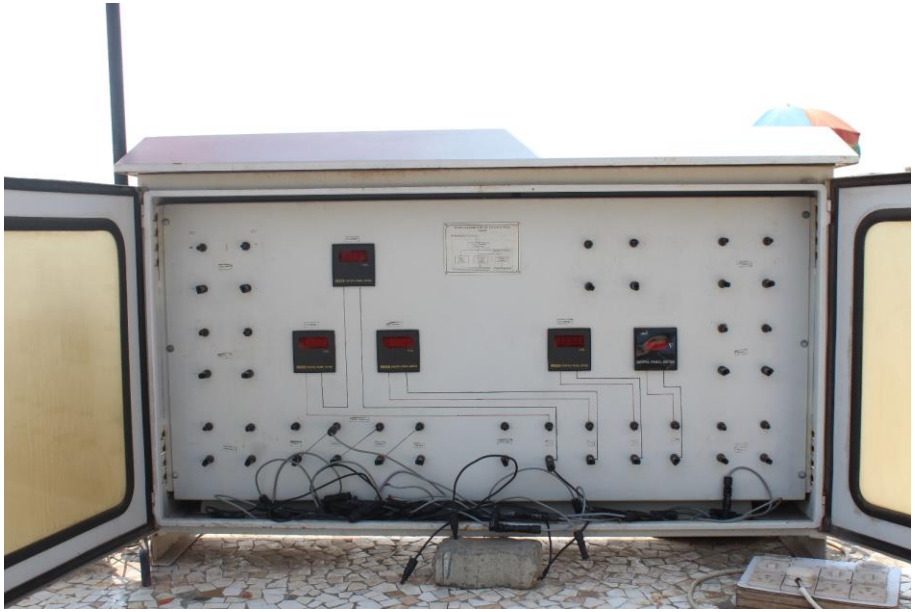
- Plot the *I-V* characteristics for PV panels with cells made of different materials

Experiment 3

- **3a: DC to DC and DC to AC conversion set up**
- **3b: Energy yield analysis of a PV module in fixed and 2D-tracked mode of operation**
- **3c: Economic payback period of tracking system retrofitted in a 10 MW solar PV plant**

- PV systems – conversion, tracking, economics

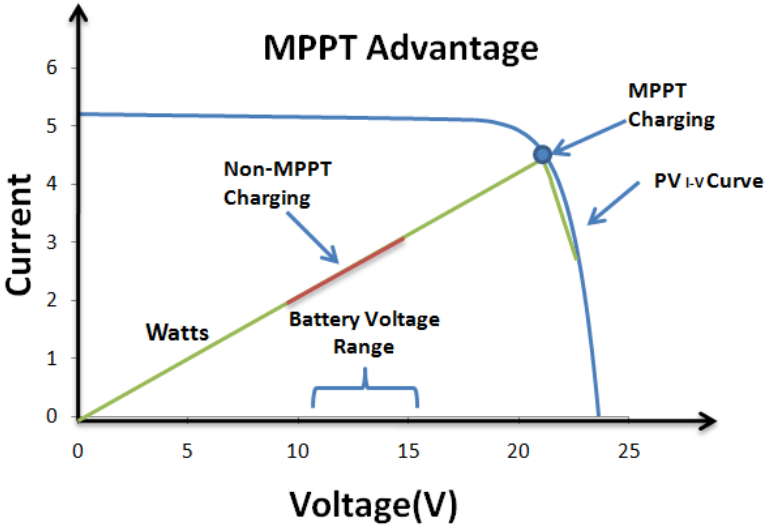
Experiment 3



Experiment 4

- **MPPT training system**

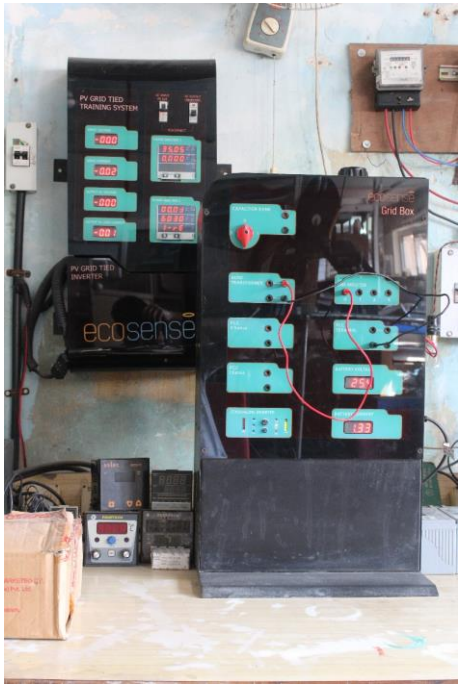
- MPPT = Maximum Power Point Tracking



Experiment 5

- **5a: Grid synchronization of solar PV inverter and its performance analysis**

- **5b: Spectral response measurement of solar cell**

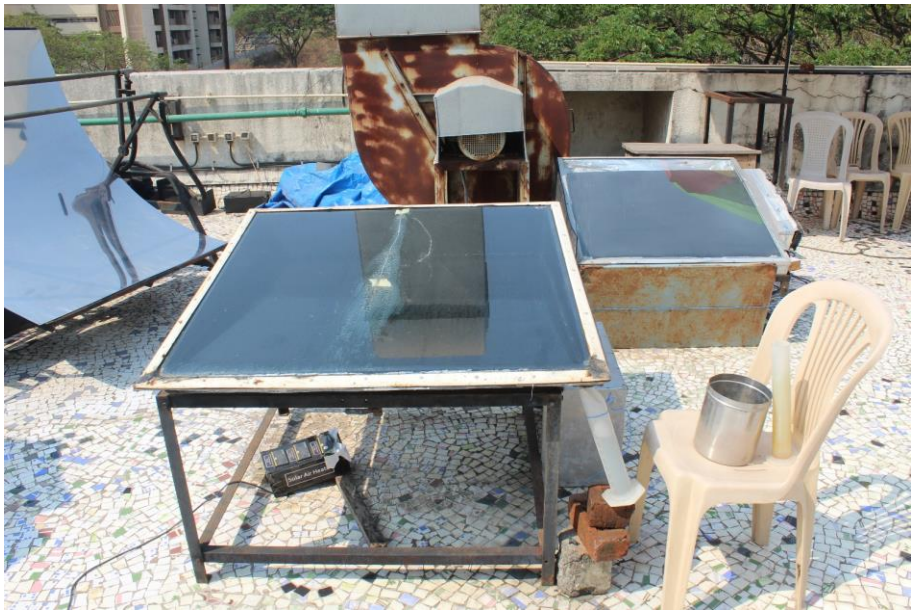


Experiment 6

- **Solar pumping**
- Pumps with DC motor and AC motor with electricity input by PV panels
- Analyse the efficiency of pumping using the two motors

Experiment 7

- **7a: Performance of box-type solar cooker**
- **7b: Performance of basin-type solar still**



Experiment 8

- **8a: Forced circulation evacuated tube collector**

- **8b: Natural circulation evacuated tube collector**

Experiment 9

- **Natural circulation flat plate collector and demonstration of forced circulation flat plate collector system**

Experiment 10

- **Solar air heater**

Experiments 11 and 12

- **11: Demonstration of parabolic trough collector and solar air heater**
- **12: Demonstration of thermal energy storage**
- Concentrating collector and its use in solar thermal applications such as industrial process heat, power, etc.
- Latent heat thermal energy storage systems with different phase change materials

Revise

- Sun-earth geometry and angles (latitude, hour angle, solar azimuth angle, zenith angle)

- Incident radiation on a tilted surface