

<b>Program: Diploma in Electrical and Electronics Engineering</b>	
Course Code: <b>5039C</b>	Course Title: <b>Solar Energy Technology Lab</b>
Semester: <b>5</b>	Credits: <b>1.5</b>
Course Category: <b>Programme Elective</b>	
Periods per week : <b>3 (L:0 T:0 P:3)</b>	Periods per semester: <b>45</b>

### Course Objectives:

- To familiarize with various types of solar appliances
- To Identify the installation of solar electric gadgets
- To know about specifications of solar panels and their installations

### Course Outcomes:

On completion of the course, the students will be able to:

<b>CO<sub>n</sub></b>	<b>Description</b>	<b>Duration (Hours)</b>	<b>Cognitive level</b>
CO1	Identify different solar energy appliances used in solar thermal system	6	Applying
CO2	Familiarize the classification of solar panels and identify PV system installations.	12	Applying
CO3	Apply various interconnections of solar PV systems.	9	Applying
CO4	Identify the measurement of various solar energy parameters	12	Applying
	Lab Exam	6	

## CO-PO MAPPING

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1				3			
CO2				3			
CO3				3			
CO4				3			

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

### Course Outline:

Module Outcomes	Name of Experiment	Duration (Hours)	Cognitive Level
CO1	<b>Identify different solar energy appliances used in solar thermal system</b>		
M1.01	Familiarize the construction and operation of different solar energy appliances in solar thermal system (a)Solar Cooker (b)Solar Water Heater (c) Solar Dryer (d)Solar Distillation	6	Applying
CO2	<b>Familiarize the classification of solar panels and identify PV system installations.</b>		
M2.01	Identify the parts of solar cells/ solar panel	1	Applying
M2.02	Identify various types of solar cells (a)Polycrystalline Solar Panel (b) Monocrystalline Solar Panel (c) Thin film solar cells	2	Applying
M2.03	Observe the data sheet of a solar panel and collect major specifications such as : ( a) Rated Power at STC (b)Rated power tolerance (c)Temperature coefficient (d)Open circuit voltage	3	Applying

	(e)Short circuit current (f)Voltage at MPP (g)Current at MPP (h)Efficiency (i)Module dimensions (j)Operating Temperature or similar		
M2.04	Identify the installation of following Solar Photovoltaic Systems  (a)Solar Lantern (b)Solar Street Light (c)Solar Fencing (d)Solar Pumping	6	Applying
	Lab Exam	3	
<b>CO3</b>	<b>Apply various interconnections of solar PV systems.</b>		
M3.01	Construct a PV array using series connected solar panels and check the output.	3	Applying
M3.02	Construct a PV array using parallel connected solar panels and check the output.	3	Applying
M3.03	Construct a PV array using a series -parallel combination of solar panels and check the output.	3	Applying
<b>CO4</b>	<b>Identify the measurement of various solar energy parameters</b>		
M4.01	Utilize various instruments to measure solar radiation and related solar data (a) pyranometer (b) solarimeter (c) Pyrheliometer (d) sunshine recorder (e) solar pathfinder	6	Applying
M4.02	Assemble a solar PV plant to produce electric power  Dismantle the solar PV plant.	6	Applying
	Lab Exam	3	

**Text / Reference:**

<b>T/R</b>	<b>Book Title/Author</b>
R1	The Complete Lab Manual For Renewable Energy - Cutter , Ammond - Delmar Cengage Learning
R2	Christopher Kitcher ,A Practical Guide to Renewable Energy: Power Systems and their Installation: Microgeneration systems and their Installation
R3	Solanki, Chetan Singh, Renewable Energy Technologies: A Practical Guide for Beginners , PHI Learning
R4	Michael Boxwell, Solar Electricity Handbook - 2021 Edition: A simple, practical guide to solar energy - designing and installing solar photovoltaic systems.

**Online Resources**

<b>Sl.No</b>	<b>Website Link</b>
1	<a href="https://vlab.amrita.edu/index.php?sub=77&amp;brch=298">https://vlab.amrita.edu/index.php?sub=77&amp;brch=298</a>
2	<a href="https://renewablelab.niu.edu/experiments/seriesParallelSolarCells">https://renewablelab.niu.edu/experiments/seriesParallelSolarCells</a>
3	<a href="https://web.iitd.ac.in/~pmvs/courses/mcl241/laboratory-manual-RES.pdf">https://web.iitd.ac.in/~pmvs/courses/mcl241/laboratory-manual-RES.pdf</a>
4	<a href="https://www.coursera.org/lecture/photovoltaic-systems/module-components-skzP1">https://www.coursera.org/lecture/photovoltaic-systems/module-components-skzP1</a>
5	<a href="https://electrical-engineering-portal.com/photovoltaic-module-interconnections">https://electrical-engineering-portal.com/photovoltaic-module-interconnections</a>
6	<a href="https://www.bbau.ac.in/dept/Physics/TM/LabExperiments%20_SOLAR%20CELL%20CHARACTERISTICS-2-6.pdf">https://www.bbau.ac.in/dept/Physics/TM/LabExperiments%20_SOLAR%20CELL%20CHARACTERISTICS-2-6.pdf</a>
7	<a href="http://solardat.uoregon.edu/download/Lessons/Experiments_with_PV_Cells.pdf">http://solardat.uoregon.edu/download/Lessons/Experiments_with_PV_Cells.pdf</a>

8	<a href="https://www.old.iitr.ac.in/departments/PH/uploads/Teaching%20Laboratory/Thermal/2.%20solar%20cell.pdf">https://www.old.iitr.ac.in/departments/PH/uploads/Teaching%20Laboratory/Thermal/2.%20solar%20cell.pdf</a>
9	<a href="http://www.jnkvv.org/PDF/30042020142936304201343.pdf">http://www.jnkvv.org/PDF/30042020142936304201343.pdf</a>
10	<a href="https://www.livguard.com/pdf/LG-Solar-Panels-Datasheet.pdf">https://www.livguard.com/pdf/LG-Solar-Panels-Datasheet.pdf</a>
11	<a href="https://www.hydesource.com/post/understanding-the-parameters-in-a-solar-panel-data-sheet">https://www.hydesource.com/post/understanding-the-parameters-in-a-solar-panel-data-sheet</a>
12	Renewable Energy and Green Technology - A Laboratory Manual <a href="https://eternaluniversity.edu.in/docs/RenewableEnergyandGreenTechnology.pdf">https://eternaluniversity.edu.in/docs/RenewableEnergyandGreenTechnology.pdf</a>
13	<a href="https://docplayer.net/214615129-Practical-1-title-familiarization-with-renewable-energy-gadgets.html">https://docplayer.net/214615129-Practical-1-title-familiarization-with-renewable-energy-gadgets.html</a>
14	<a href="https://electricalacademia.com/renewable-energy/solar-panel-data-sheet-specification-parameters/">https://electricalacademia.com/renewable-energy/solar-panel-data-sheet-specification-parameters/</a>
15	<a href="https://loopsolar.com/datasheet/adani-solar/datasheet-adani-solar-72-cell-300-330-Wp-India.pdf">https://loopsolar.com/datasheet/adani-solar/datasheet-adani-solar-72-cell-300-330-Wp-India.pdf</a>
16	<a href="https://renewablelab.niu.edu/experiments/seriesParallelSolarCells">https://renewablelab.niu.edu/experiments/seriesParallelSolarCells</a>
17	<a href="https://naturalscience.ku.edu.tr/wp-content/uploads/Efficiency-of-a-Solar-Cell.pdf">https://naturalscience.ku.edu.tr/wp-content/uploads/Efficiency-of-a-Solar-Cell.pdf</a>

### **Student Activity**

#### **Suggested Open-ended Experiments:**

Students can do open ended experiments as a group of 3-5. There is no duplication in experiments in between groups. This is mainly for the purpose of continuous internal evaluation. Students should prepare a separate report on an open ended experiment of their choice.

Example 1: Model a simple product using solar power

2. Assemble a solar PV plant for a real site