List of Experiments:

1. To calibrate two thermocouples by comparing induced voltages measured and temperatures measured with a thermometer
2. To plot the V-I Characteristics of the solar cell
3. To analyze the total solar radiation in total climatic condition
4. To find the velocity of the wind
5. To determine the Plank's constant using photo cell and verify the value so attained with respect to the standard value

Experiment No.1 Date.

Calibration of thermocouple

Objective:

To calibrate two thermocouples by comparing induced voltages measured and temperatures measured with a thermometer.

Apparatus:

Glass thermometer, 24-gage type J (red/white wire) and type T (red/blue wire) thermocouples Thermos, "hot hands" mitt, Ammeter.

Procedure

1. Make an ice bath by filling the Thermos with crushed ice and water.

2. You are given two thermocouples, each made from 24-gage wire: one type J (Iron-Constantan) and one type T (Copper-Constantan). **For both thermocouples the Constantan wire is the wire with the red stripe, and for both it is the negative lead.** Connect these thermocouples to the voltage terminals on the DAQ system labeled Channel 5 and Channel 6. **WARNING: Record which type thermocouple (type J or T) is connected to which channel**

3. Place the two junctions leading from the positive terminals in the ice bath. Wrap the remaining two junctions together with the bulb of the thermometer and place them in the beaker of water.

4. Using the chemistry stand so that all three are approximately 2 inches above the bottom of the beaker. None of the three sensors should touch the side or bottom of the beaker, and **make sure the bare wires of the thermocouples do not touch each other: otherwise they will short out.** Finally, make sure that the water level reaches the solid line on the thermometer, about an inch or two above the bulb; this line is called the calibration line, and will ensure the accuracy of your temperature readings.

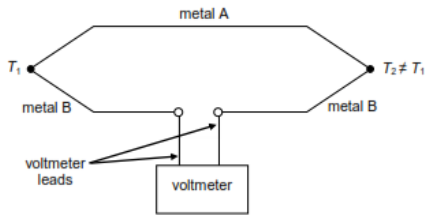

Figure . Thermocouple circuit connected to a voltmeter

Table.

Temperature	DC

Result:

The given CuFe thermocouple has been calibrated.

Experiment No.2 Date.

The V-I Characteristics of the solar cell

Objective: To plot the V-I Characteristics of the solar cell

Apparatus: Variable resistance, solar cell, ammeter, multimeter.

Procedure:

1. Place the solar cell and the light source (100 watt lamp) opposite to each other on a wooden plank. Connect the circuit as shown by dotted lines through patch chords.
2. Select the voltmeter range to 2V, current meter range to 250 µA and load resistance (RL) to 50Ω.
3. Switch ON the lamp to expose the light on Solar Cell.
4. Set the distance between solar cell and lamp in such a way that current meter shows 250 µA deflections. Note down the observation of voltage and current in Table 1.
5. Vary the load resistance through band switch and note down the current and voltage readings every time in Table 1.
6. Plot a graph between output voltage vs. output current by taking voltage along X-axis and current along Y-axis.

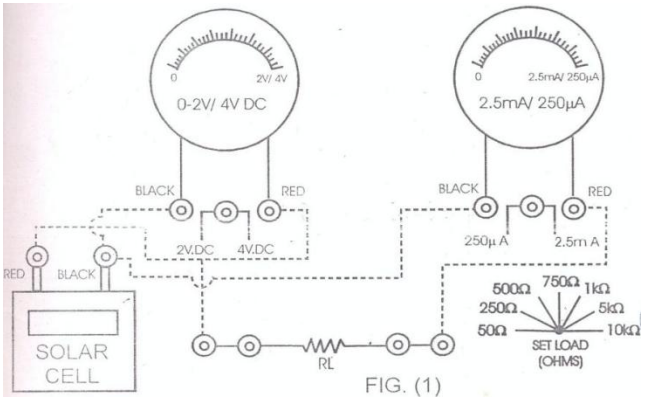

Figure. Solar Cell Characteristics Apparatus

Table:

Voltage (V)	Current (I)	Load Resistance (R_L) Ohm

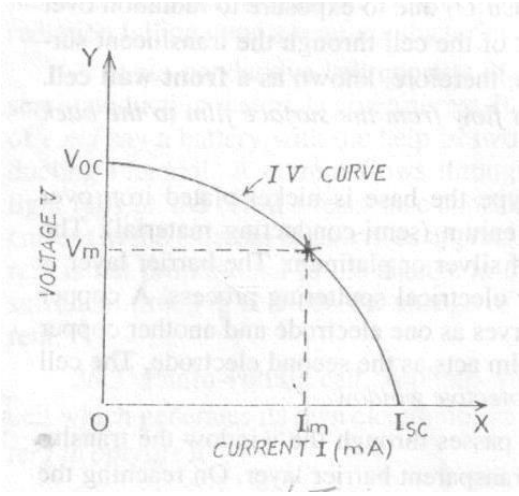

Figure: V-I Characteristics

Result: The V-I characteristics of solar cell has been drawn.

Experiment No.3 Date.

Analyze of solar radiation

Objective: To analyze the total solar radiation in total climatic condition

Apparatus:

Solar radiation, monitor, sensor

Procedure:

1. Connect the solar radiation monitor with the sensor and power supply
2. Place the sensor in a open space, so that the solar radiation falls directly on it.
3. Observe the readings on the monitor for every ten minutes.
4. Tabulate the reading and plot the graph.

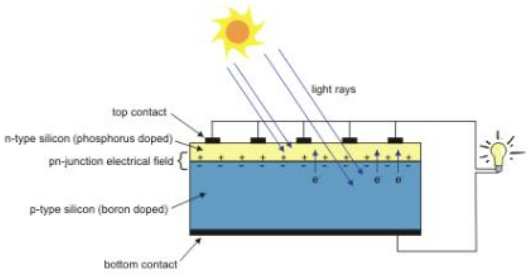

Fig. Working principle of solar radiation

Table.

Time (Min)	Solar radiation (W/m2)

Result: The total solar radiation in total climatic condition has been analyzed.

Experiment No.4 Date.

Wind Velocity

Objective: To find the velocity of the wind.

Apparatus: Anemometer, cup counter

Procedure:

1. Place anemometer in a open with the flow of air and fix it on the ground and leave it undisturbed.
2. When the wind flows, the cups fixed with anemometer rotates along with the wind speed.
3. Observe the readings in anemometer for every 5 or 10 minutes.
4. Tabulate the reading

Table:

Time (sec)	Kilometer

Result:
The total wind velocity has been determined.

Experiment No.5 Date.

Plank's Constant

Objective:

To determine the Plank's constant using photo cell and verify the value so attained with respect to the standard value.

Apparatus:

Photo cell, monochromatic source, colour filter, connecting wires and constant apparatus.

Formula:

Plank's constant is given by

$h = e (v_2 - v_1)\lambda_1\lambda_2 / C (\lambda_1 - \lambda_2)$ Joule/ sec

Where e – electric charge (Coulomb)

v_2 – stopping potential corresponds to first wavelength

v_1 - stopping potential corresponds to second wavelength

c – velocity of light m/s

Procedure:

1. The electric connections are made and the lamp and scales arrangement is adjusted to get the well focused spot on the zero mark of the scale.
2. The photo cell is mounted at one end of optical bench.
3. Now the suitable filter of known wave length is placed in the path of ray of photo cell.
4. The negative anode potential is gradually increased inn small step and each ammeter reaches zero.
5. Draw negative anode potential on x-axis and corresponding deflection on y – axis.

Calculation:

Red- green filter

$$h = e\,(v_2 - v_1)\lambda_1\lambda_2 / C\,(\lambda_1 - \lambda_2) \text{ Joule/ sec}$$

Green blue filter

$$h = e\,(v_2 - v_1)\lambda_1\lambda_2 / C\,(\lambda_1 - \lambda_2) \text{ Joule/ sec}$$

Blue – Red filter

$$h = e\,(v_2 - v_1)\lambda_1\lambda_2 / C\,(\lambda_1 - \lambda_2) \text{ Joule/ sec}$$

Result: The value of Plank's constant is h =

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Any 5 Experiments

1. Fuel value of wood/charcoal.
2. Study of sensible heat storage using liquid.
3. Selective and Non-selective coatings – Determination of Selectivity ratio.
4. Thermal efficiency of liquid – flat plate collector.
5. Study of box type solar cooker.
6. Determination of instantaneous thermal efficiency of parabolic collector.
7. Efficiency and fill factor of solar cells.

Reference Books:

1. Non conventional Energy sources, G. D. RAI (4th edition), Khanna Publishers, Delhi.
2. Solar Energy, S.P. Sukhatme (second edition), Tata Mc.Graw Hill Ltd, New Delhi.
3. Solar Energy Utilisation, G. D. RAI (5th edition), Khanna Publishers,Delhi.