GARVIT SHAH
F-24

EXPERIMENT : No. 5

Page No. 15
Date

- **Aim**: Determination of Planck's constant.

- **Apparatus**: Power Supply (0-10V), one way key, a rheostat, a digital milliammeter, a digital voltmeter, a 1KΩ resistor & different known wavelength LED's.

- **Theory**:

The significance of Planck's constant is that 'quanta' (small packets of energy) can be determined by freq. of radiation & Planck's constant. It describes the behaviour of particle & waves at atomic level as well as the particle nature of light.

① - $E = \frac{hc}{\lambda}$ → light energy emitted during forward biasing

For the applied voltage, V

② - $E = eV$ → energy given to e^-

$$\therefore \boxed{V = \frac{hc}{e}\left(\frac{1}{\lambda}\right)}$$

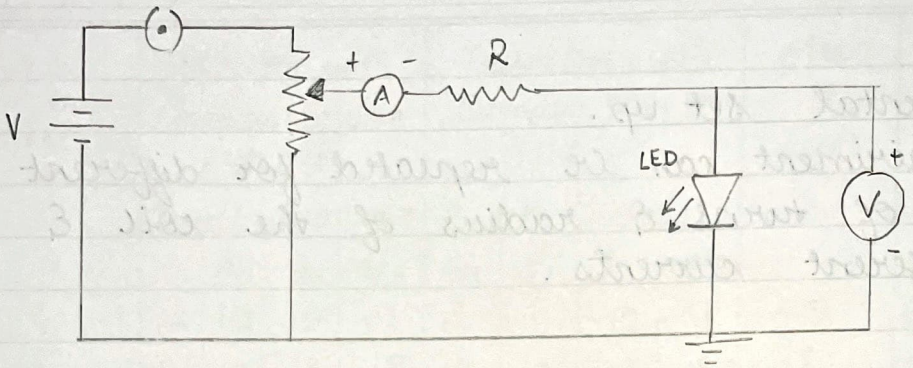
- **Procedure**:

– SIMULATOR –

1. After the connections are completed, click on 'Insert Key' button.
2. Click on the combo box under 'Select LED' button
3. Click on the ~~Rh~~ 'Rheostat value' to adjust the value

Sundaram

Teacher's Sign. : _____



Circuit Diagram :

of rheostat.

4. Corresponding voltage across the LED is measured using a voltmeter, which is the knee voltage.
5. Repeat, by changing the LED & note down the corresponding knee voltage.
6. Calculate 'h' using eq^n $h = \frac{e\lambda V}{c}$
7. The wavelength of infrared LED is calculated by using eq^n, $\lambda = \frac{hc}{eV}$

— REAL LAB —

1. Connections are made as shown in circuit digram.
2. Insert key to start the experiment.
3. Adjust ~~most~~ the rheostat value till the LED starts glowing, or in the case of the IR diode, whose light is not visible, until the ammeter indicates that current has begun to increase.
4. Corresponding voltage across the LED is measured using a voltmeter, which is the knee voltage.
5. Repeat, by changing the LED and note down the corresponding knee voltage.
6. Using the formula given, find the value of the Planck's constant.

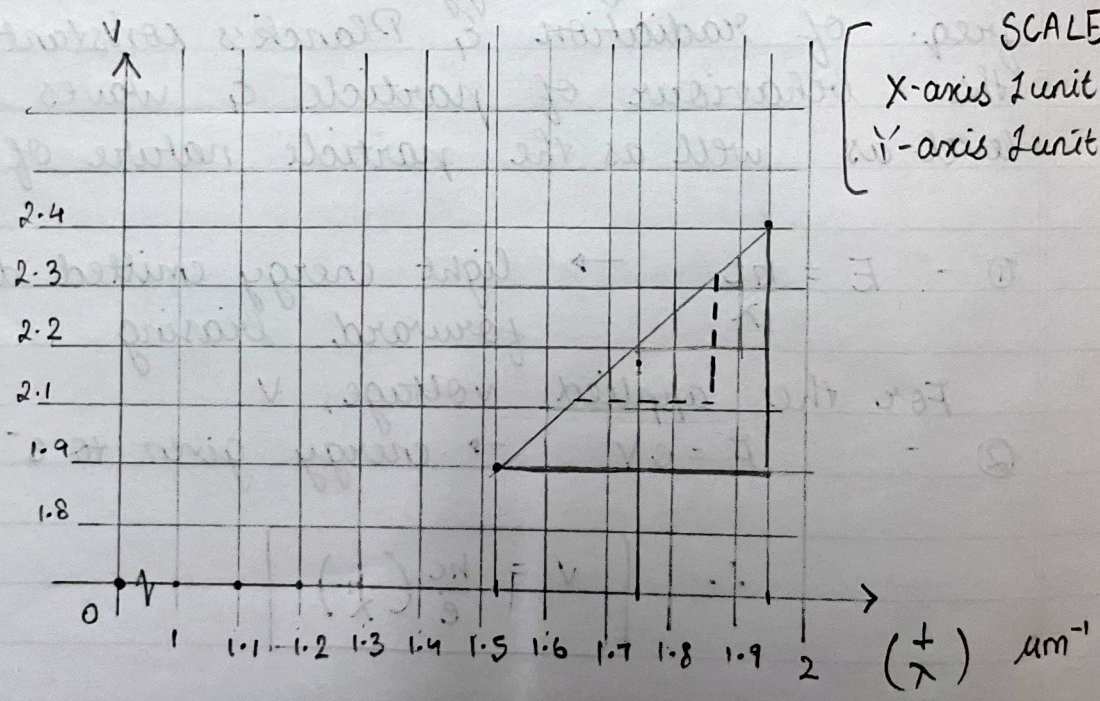
- Results -

Planck's constant = 6.631×10^{-34} Js

$e = 1.6 \times 10^{-19}$ C

$c = 3 \times 10^8$ m/s

Colour of LED	λ (in nm)	Knee Voltage (V)	λV (in 10^{-6} mV)	$h = \frac{e\lambda V}{c}$ (in 10^{-34})
Red.	650	1.908	1.2402	6.614
Green	510	2.448	1.248	6.658
Yellow	570	2.178	1.2414	6.621



SCALE
X-axis 1 unit = 0.1 μm
Y-axis 1 unit = 0.1 V

$$\text{Slope} = \frac{hc}{e}$$

$$\therefore h = 6.631 \times 10^{-34} \text{ Js}$$