SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM NAGAR, KATTANKULATHUR – 603 203

PHYSICS PRACTICALS MANUAL

GE3121 - PHYSICS LABORATORY

(R-23)

(First semester B.E/B.Tech. students for the Academic Year 2024-2025)

Prepared by

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DEPARTMENT OF PHYSICS

Instructions to the students

The following instructions must be followed by the students in their laboratory classes.

1. Students are expected to be punctual to the lab classes. If they are late, they will be considered absent for that particular session.
2. Students should strictly maintain the dress code.
3. Students must bring their observation note, record note (completed with previous experiment) and the calculator to every lab class without fail.
4. Students are advised to come with full preparation for their lab sessions by
   i) Reading the detailed procedure of the experiment from the laboratory manual.
   ii) Completion of observation note book (i.e.) Aim, Apparatus required, Formula (with description), least count calculation, diagrams and the tabular column should be written in the observation note before entering into the laboratory.
5. Data entry in the observation note book must be by pen only.
6. Students must get attestations immediately for their observed readings.
7. Students should complete their calculations for their experiments and get it corrected on the same day of that experiment.
8. Students who miss observation, record note they have to do the experiment once again and get it corrected.
9. Class assessment marks for each experiment is based only on their performance in the laboratory.
10. Record note has to be completed then and there and get corrected when the students are coming for the next lab class.
11. Students must strictly maintain silence during lab classes.
12. If any of the students is absent for the lab class for genuine reasons, he/she will be permitted to do the experiment during the repetition class only.
13. Students are advised to perform their experiments utmost care.

CONTENTS

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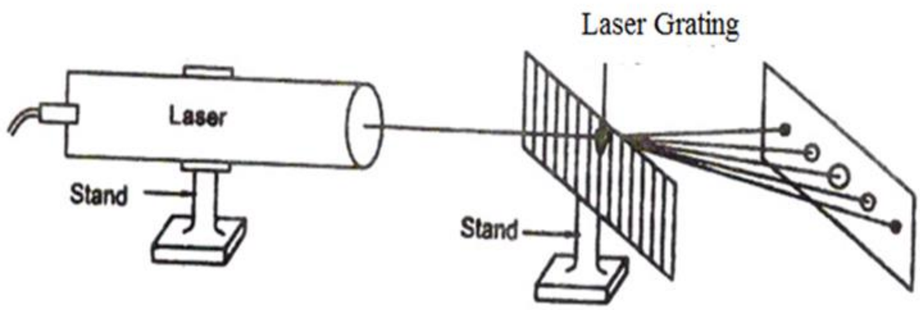

Fig. 1.1 Laser grating experiment

Determination of wavelength of laser

Distance between the grating and the screen (D) = …….cm

Number of lines in grating per metre (N) = 1 x 10^5 lines / metre

S.No	Order of diffraction **n**	Readings of the diffracted image: Distance of different Orders from the center spot – Left side x_L	Right side x_R	Mean $x = \frac{x_L + x_R}{2}$	$\tan\theta = \left(\frac{x}{D}\right)$	$\theta = \tan^{-1}\left(\frac{x}{D}\right)$	$\lambda = \frac{\sin\theta}{nN}$
Unit		cm	cm	cm			(nm)
1	1	x_1 =	x_1 =				
2	2	x_2 =	x_2 =				
3	3	x_3 =	x_3 =				
4	4	x_4 =	x_4=				

Mean λ = nm

1. (a) DETERMINATION OF WAVELENGTH OF THE GIVEN LASER

AIM:

To determine the wavelength of the given laser using grating.

APPARATUS REQUIRED

Diode laser, grating, screen and scale.

PRINCIPLE

The laser light is exposed to the grating and diffraction takes place.

FORMULA

Wavelength of the given laser

$$\lambda = \frac{\sin\theta}{nN} \ meter$$

Symbol	Explanation	Unit
θ	Angle of diffraction	degree
n	Order of diffraction	-
N	Number of lines per meter in the grating	lines/m

PROCEDURE:

Diode laser is kept horizontally and switched on (care should be taken). The grating is held normal to the laser beam. This is done by adjusting the grating in such a way that the reflected laser beam coincides with the beam coming out of the laser. As shown in the Fig.1.1 After adjusting for normal incidence, the laser light is exposed to the grating and it is diffracted by it. On the other side of the grating on the screen, the diffracted laser spots are seen. The distances of different orders from the centre spot are measured. The distance between the grating and screen (D) is measured. Using the formula 'θ' is calculated. The wavelength of the laser light source is calculated using the given formula.

$$\lambda = \frac{sin\ \theta}{Nn} \quad \text{metre}$$

The number of lines in the grating is assumed as ≈ 1×10^5 lines per metre.

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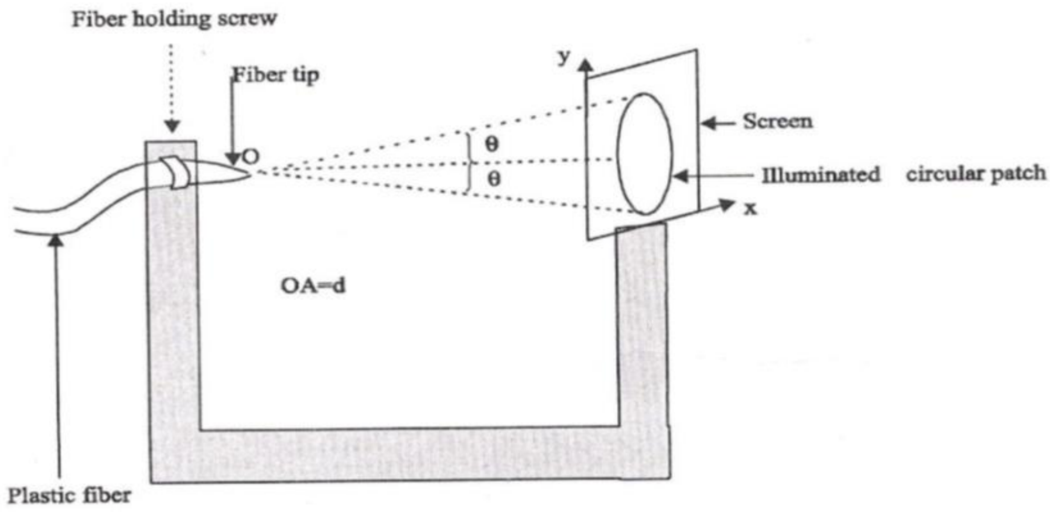

Fig. 1.2. Experimental setup for acceptance angle

To determine acceptance angle

S.No	Distance from the fiber end to circular image 'd'	Radius of the circular image 'r'	Acceptance angle $\theta_a = \frac{r}{d} \times \frac{180}{\pi}$
Unit	cm	mm	deg.
1			
2			
3			
4			

Mean θ_a=

1. (b) DETERMINATION OF ACCEPTANCE ANGLE AND NUMERICAL APERTURE IN AN OPTICAL FIBRE

AIM

To determine acceptance angle of an optical fiber.

APPARATUS REQUIRED

Laser for optical fiber light source, optical fiber, optical fiber connectors and Numerical aperture Jig.

PRINCIPLE

The principle behind the transmission of light waves in an optical fiber is total internal reflection.

FORMULA

Acceptance angle $\theta_a = \frac{r}{d} \times \frac{180}{\pi}$ deg

Numerical Aperture = NA= $\sin\theta_a$

Symbol	Explanation	Unit
r	Radius of the circular image	metre
d	Distance from fibre end to circular image	metre

PROCEDURE

Using laser, we can find the acceptance angle of the fiber optic cable. The given laser source is connected to the optical fiber cable. The other end is exposed to the air medium in the dark place. The emerging light is exposed on a plain paper.

Now, we get illuminated circular patch on the screen.Fig.1.2 shows the experimental setup for acceptance angle measure. The distance from the fiber end to circular image (d) is measured using meter scale. The radius of the circular image is also measured. Thus the acceptance angle is calculated

L

CALCULATION

(a) Wavelength of the laser source,

$$\lambda = \frac{\sin\theta}{nN} \text{ metre}$$

(b) Acceptance angle,

$$\theta_a = \frac{r}{d} \times \frac{180}{\pi} \text{ deg}$$

Numerical Aperture =NA= $\sin\theta_a$

RESULTS

a) Wavelength of the given source λ = ------------------ metre.

b) Acceptance angle θ_a = ---------------- degree.

Numerical Aperture NA = -------------

L

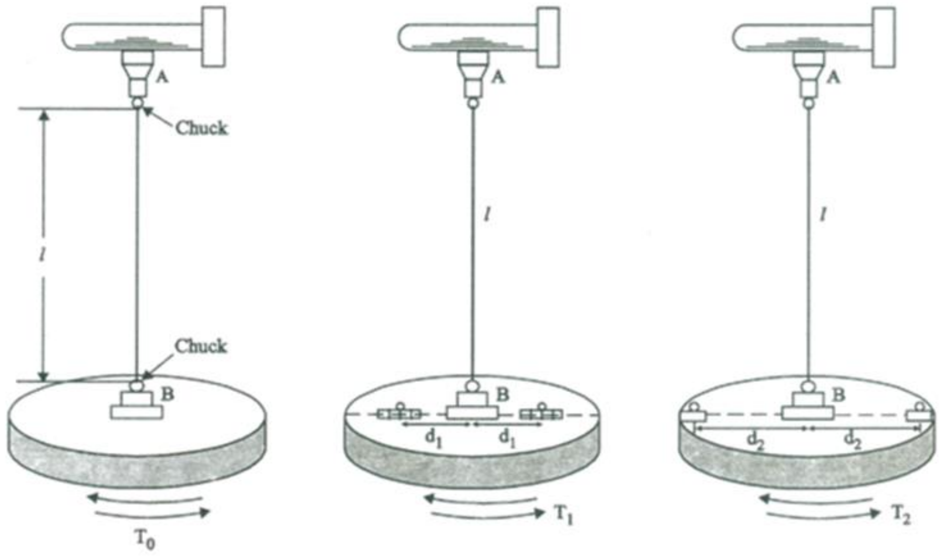

Fig.2.1. Torsional pendulum

To find the time period of oscillations

Length of suspension wire l = ……….cm

Position of equal masses	Time for 10 oscillations			Time period (mean/10)
	Trial 1	Trial 2	Mean	
Unit	second	second	second	second
Without masses				T_o =
Masses at closest distance. d_1 = --------- x 10^{-2} m				T_1 =
Masses at maximum distance. d_2 = ---------- x 10^{-2} m				T_2 =

2. DETERMINATION OF RIGIDITY MODULUS –TORSIONAL PENDULUM

AIM

To determine the moment of inertia of a given disc by Torsional oscillations and the rigidity modulus of the material of the suspension wire.

APPARATUS REQUIRED

Torsional pendulum, Stop clock, Meter scale, Two symmetrical masses and Screw gauge.

PRINCIPLE

The suspension wire is twisted by the circular disc fixed at the bottom of the wire and the wire undergoes shearing strain which leads to torsional oscillations. The angular acceleration of the disc is proportional to its angular displacement and is always directed towards its mean position and the motion of the disc is simple harmonic.

FORMULA

Moment of inertia of the circular disc,

$$I = \frac{2m\left(d_2^2 - d_1^2\right)T_0^2}{T_2^2 - T_1^2} \quad \text{kg.m}^2$$

Rigidity modulus of the wire,

$$n = \frac{8\pi I l}{T_0^2 r^4} \quad \text{N/ m}^2$$

Symbol	Explanation	unit
m	mass of one cylinder placed on the disc (200 gm)	kg
d_1	Closest distance (minimum) between suspension wire and the centre of mass of the cylinder	m
d_2	Farthest distance (maximum) between suspension wire and the centre of mass of the cylinder	m
T_0	Time period of oscillation without any mass on the disc	s
T_1	Time period of oscillation when equal masses are placed on the disc at a distance d_1	s
T_2	Time period of oscillation when equal masses are placed on the disc at a distance d_2	s
l	length of the suspension wire	m
r	Radius of the wire	m

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LEAST COUNT OF THE SCREW GAUGE:

$$\text{Pitch} = \frac{\text{Distance moved by the head scale on the pitch scale.}}{\text{Number of rotations given to the head scale.}}$$

$$\text{Least count (LC)} = \frac{\text{Pitch}}{\text{Total number of divisions on the head scale}}$$

Pitch = 5 mm/ 5 = 1 mm
LC = 1 mm/ 100 = 0.01 mm.

To find the radius (r) of the specimen using screw gauge

LC = 0.01 mm

Zero error = ± ....div.

Zero correction = ∓ ……..mm

S. No.	PSR	HSC	HSR= HSC x LC	Observed Reading = PSR + HSR	Correct Reading = OR + ZC
Unit	mm	div	mm	mm	mm

Mean (d) =------------------------- x 10^{-3} m

Radius of the specimen wire (r) = d/2 = ……. x 10^{-3} m

PROCEDURE

- The Torsional pendulum consists of a circular disc suspended by a thin wire, as shown in Fig. (2.1), whose rigidity modulus is to be calculated. The top end of the wire is fixed by a chuck. The circular disc is attached to the other end of the wire.

- When the suspension wire is twisted by the circular disc fixed at the bottom of the wire, the wire undergoes shearing strain. This is called torsion. Because of this torsion, the disc executes oscillation called torsional oscillation.

Calculation of T_0

- Adjust the wire so that its length is fixed value say 60 cm. Make a vertical chalk mark on the disc when it is rest as a reference. By making a small twist to the circular disc, set up Torsional oscillations. After the first few oscillations, just as the mark on the disc passes the equilibrium positions, a stop clock is started. The time taken for 10 complete oscillations is noted. The experiments are repeated for second trial and mean value is calculated. The value of the time period is noted as T_0.

Calculation of T_1

- The two identical cylindrical masses are placed at equal distance on either side of the central chuck as close as possible. The distance d_1 is measured between the wire and the centre of the cylindrical mass. By twisting the disc, the time taken for 10 complete oscillations is noted. The experiments are repeated for second trial and mean value is calculated. The value of the time period is noted as T_1.

Calculation of T_2

- The identical masses are arranged symmetrically as far away from the axis of the rotation as possible. The distance d_2 is measured between the wire and the centre of the cylindrical mass. The time taken for 10 complete oscillations is noted. The experiments are repeated for second trial and mean value is calculated. The value of the time period is noted as T_2.

Calculation of Moment of Inertia and Rigidity Modulus

- The mean value of the radius and length of the wire is measured accurately by a screw gauge and meter scale respectively. The moment of the inertia of the circular disc and the rigidity modulus of the suspension wire are calculated by substituting the values in the equations respectively.

- Moment of Inertia can also be determined theoretically $I = MR^2/2$, where M= Mass of the Disc, R= radius of the Disc.

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CALCULATION

Mean radius of the wire r = ...m

Length of the wire l = ... m

Mass of the identical cylinder m = ... kg

Closest distance between suspension wire & the centre of symmetrical mass d_1=…….m

Farthest distance between suspension wire & the centre of symmetrical mass d_2 =……m

Period of oscillations (without masses) T_0 =............ sec

Period of oscillations with masses at 'd_1' distance T_1 = ...sec

Period of oscillations with masses at 'd_2' distance T_2 =..............sec

The moment of inertia of the circular disc,

$$I = \frac{2m\left(d_2^2 - d_1^2\right)T_0^2}{T_2^2 - T_1^2} \text{ kg.m}^2$$

I =.............................kg.m^2

R

Rigidity modulus of the wire,

$$n = \frac{8\pi I l}{T_0^2 r^4} \quad N/m^2$$

n = ...N/m^2

RESULT

(i) Moment of inertia of the circular disc I = _______ kg m^2

(ii) Rigidity modulus of the given wire n = _____ N/m^2

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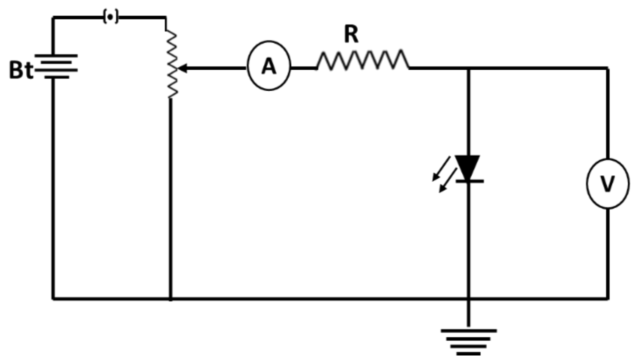

Fig.3.1. Circuit diagram for determination of Planck's constant

S.NO	Colour of LED	Wavelength (λ) nm	Knee voltage (V) volt	V × λ	$h = \frac{e\lambda V}{c}$
	Red	625			
	Yellow	586			
	Green	565			
	Blue	460			

3. DETERMINATION OF PLANCK'S CONSTANT USING LED

AIM

To determine the Planck's constant h using an LED

APPARATUS

Planck's constant kit, 0-3 v power supply, digital milli ammater, digital voltmeter,1K resistor and 4 different known wavelength LED.

PRINCIPLE

When LED is forward biased, the height of potential barrier across the p-n junction is reduced. In forward biased condition electrons crossing the junction are exicited, and when they return to tier normal state, energy is emitted. At a particular voltage the height of potential barrier becomes very low and LED starts glowing.

FORMULA

The light energy emitted during forward biasing is given

$$E = \frac{hc}{\lambda} \text{ Ev}$$

$$h = \frac{e\lambda V}{c} \text{ joule –second}$$

EXPLANATION

Symbol	Explanation	unit
h	Planck's constant	Js
e	Charge of an electron	C
V	Knee voltage	volt
c	Velocity of light	m/s
λ	Wavelength of LED	nm

PROCEDURE

Connections are made as shown in the circuit diagram. (Fig.3.1). The rheostat is adjusted still the LED starts glowing. Corresponding voltage across the LED is measured using voltmeter, which is the Knee voltage.by changing the LED, corresponding knee voltage is noted. The value of Planck's constant found using the formula.

L

CALCULATION

$$h = \frac{e\lambda V}{c} \text{ J-s}$$

i) Colour of LED –RED
Wavelength –λ – 625 nm

ii) Colour of LED –YELLOW
Wavelength –λ – 586 nm

iii) Colour of LED –GREEN
Wavelength –λ – 565 nm

iv) Colour of LED –BLUE
Wavelength –λ –460 nm

RESULT

Colour of LED	Planck's constant (h)
Red	
Yellow	
Green	
Blue	

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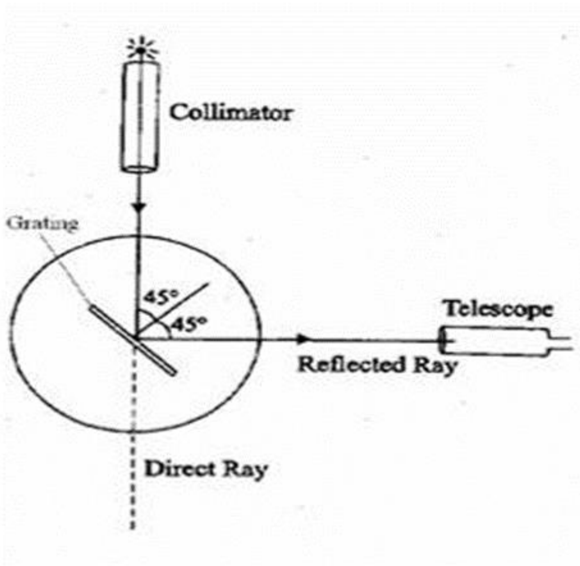

Fig. 4.1. To set for normal incidence position

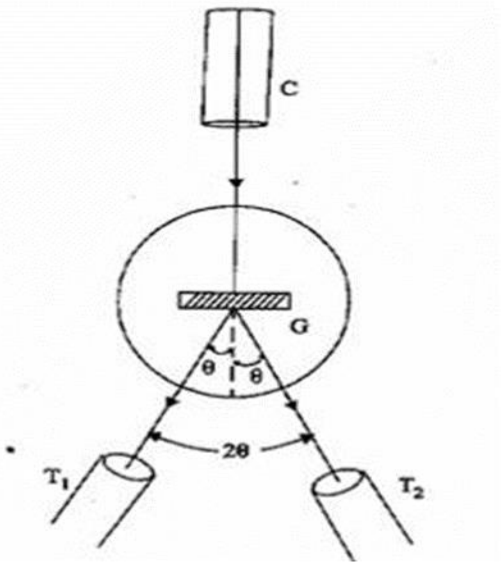

Fig. 4.2. Diffracted ray from grating

DETERMINATION OF LEAST COUNT

2MSD = 1°

1MSD = 1/2° = 0.5° = 30′

LC = 1 MSD – 1 VSD

Number of divisions in vernier scale = 30

30 VSD = 29 MSD

1 VSD = 29/30 x MSD = 29/30′ x30′ =29′

LC = 30′ – 29′

LC = 1′ (One minute)

4. SPECTROMETER - DETERMINATION OF WAVELENGTH OF MERCURY SPECTRUM

AIM

To determine the wavelength of the mercury (Hg) spectrum using the plane transmission grating.

APPARATUS REQUIRED

Spectrometer, Sodium vapour lamp, Plane transmission grating, spirit level, Mercury vapour lamp, and reading lens.

PRINCIPLE

A plane sheet of transparent material on which a large number of equidistant opaque rulings are made with a diamond point forms grating. The space between the rulings and transparent area constitute a parallel slit. When light passes through such a grating, diffraction takes place. Angle of diffraction depends upon the wavelength of the light and number of lines per metre on the grating. So the number of lines per metre in grating and wavelength of the source can be calculated.

FORMULA

The wavelength of the spectral lines of mercury spectrum

$$\lambda = \frac{sin\,\theta}{n\,N}\ metre$$

Symbol	Explanation	Unit
θ	Angle of diffraction	degree
N	Number of lines/ metre on the grating	lines/ metre
n	Order of spectrum	-

To determine the wavelength(λ) of the prominent lines of the mercury spectrum

Least count = 1′ Order of the spectrum n = 1

N= ……………………………….lines/meter TR = MSR + (VSC x LC)

Spectral lines (colours)	Readings for diffracted image												Difference between Vernier A and Vernier B		Mean 2θ	Mean angle of diffraction θ	$\lambda = \frac{\sin\theta}{nN}$
	Left Side						Right side										
	Vernier A (A_1)			Vernier B (B_1)			Vernier A (A_2)			Vernier B (B_2)			$2\theta = A_1 \sim A_2$	$2\theta = B_1 \sim B_2$			
	MSR	VSC	TR	MSR	VSC	TR	MSR	VSC	TR	MSR	VSC	TR					
	deg.	div.	deg.	deg.	div.	deg.	deg.	div.	deg.	deg.	div.	deg.	deg.	deg.	deg.	deg.	meter
Violet																	
Blue																	
Green																	
Yellow																	
Red																	

PROCEDURE

(i) Normal Incidence

Preliminary adjustments of the spectrometer are made. The grating is mounted on the grating table with its ruled surface facing the collimator the slit is illuminated by a source of light (sodium vapour lamp). The slit is made to coincide with the vertical cross wires. The vernier scales are adjusted to read 0˚ and 180˚ for the direct ray. The telescope is rotated through an angle of 90˚ and fixed. The grating table is adjusted until the image coincides with the vertical cross wire. Both the grating table and the telescope are fixed at this position as shown in Fig.3.1. Now rotate the vernier table through 45˚ in the same direction in which the telescope has been previously rotated. The light from the collimator incident normally on the grating. The telescope is released and is brought on the line with the direct image of the slit. Now the grating is said to be in normal incidence position

(ii) Determination of Wavelength (λ) of the Source

The sodium vapour lamp is replaced by mercury vapour lamp. The diffracted images of the first order are seen on either side of the central direct image as shown in Fig. 4.2. The readings are tabulated by coincide the vertical cross wire with the first order on the either side of the central direct image prominent lines namely violet, blue, bluish green, green, yellow, red of the mercury spectrum. The difference between the readings give 2θ, from this θ can be found. The wavelength of each spectral line is calculated using the equation, $\lambda = \sin\theta / Nn$ metre.

L

CALCULATION

Order of the spectrum n = 1

1. The wavelength of the spectral lines of mercury spectrum,

$$\lambda = \frac{\sin\theta}{n\,N}\ metre$$

Wavelength for violet,

λ_V =……………….Å

Wavelength for blue

λ_B =……………….Å

Wavelength for green

λ_G=……………… Å

Wavelength for yellow

λ_Y=……………………….Å

Wavelength for red

λ_R =……………….Å

RESULT

Wavelength of various spectral lines

S.No	Colour of the spectrum	wavelength Å
1	Violet	
2	Blue	
3	Green	
4	Yellow	
5	Red	

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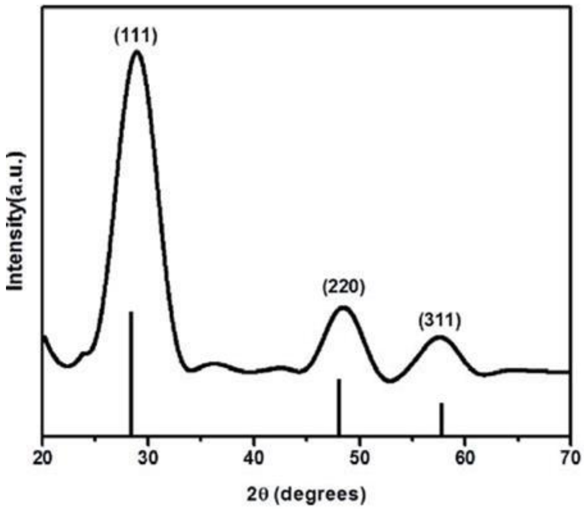

Fig 5.1 XRD pattern

h, k, l	$h^2 + k^2 + l^2$	***h, k, l***	$h^2 + k^2 + l^2$
100	1	300	9
110	2	310	10
111	3	311	11
200	4	322	12
210	5	320	13
211	6	321	14
220	8	400	16
221	9	410	17

Table 5.1 Value of $h^2 + k^2 + l^2$ for different planes

5. CALCULATION OF LATTICE CELL PARAMETER - X-RAY DIFFRACTION METHOD

AIM

To calculate the lattice cell parameters from the powder X-ray diffraction data.

APPARATUS REQUIRED

Powder X-ray diffraction diagram

PRINCIPLE

Crystalline substances act as three-dimensional diffraction gratings for X-ray wavelengths similar to the spacing of planes in a crystal lattice. The interaction of the incident X- rays with the sample produces constructive interference (and a diffracted ray) when conditions satisfy Bragg's Law ($n\lambda=2d \sin \theta$). This law relates the wavelength of electromagnetic radiation to the diffraction angle and the lattice spacing in a crystalline sample.

FORMULA

For a cubic crystal,

The lattice constant $$a = \frac{\lambda}{2\sin\theta}\sqrt{h^2+k^2+l^2} \text{ Å}$$

The interplanar distance $$d = \frac{a}{\sqrt{h^2+k^2+l^2}} \text{ Å}$$

Symbol	Explanation	Unit
a	Lattice constant	Å
d	Interplanner distance	Å
λ	Wavelength of the Cu Kα radiation (1.5405 Å)	Å
(hkl)	Miller indices	-

PROCEDURE

From the 2θ values on a powder photograph, the θ values are obtained. The $\sin^2\theta$ values are tabulated. From that the values of $1 \times \frac{sin^2\theta}{[sin^2\theta]_{min}}$, $2 \times \frac{sin^2\theta}{[sin^2\theta]_{min}}$,$3 \times \frac{sin^2\theta}{[sin^2\theta]_{min}}$ are determined and are tabulated. The values of $3 \times \frac{sin^2\theta}{[sin^2\theta]_{min}}$ are rounded to nearest integer. this gives the value of $(h^2+k^2+l^2)$. From these the values of (hkl) are determined from the Table5.1 .From the (hkl) values, the lattice parameters are calculated using the relation .

L

To find the Value of $(h^2 + k^2 + l^2)$. for different planes

S. No	2θ deg	Θ deg	sin θ	$\sin^2\theta$	$1 \times \frac{sin^2\theta}{[sin^2\theta]_{min}}$	$2 \times \frac{sin^2\theta}{[sin^2\theta]_{min}}$	$3 \times \frac{sin^2\theta}{[sin^2\theta]_{min}}$	$h^2+k^2+l^2$	h k l	a Å	d Å

Lattice determination

Lattice type	Rule for reflection to be observed
Primitive P	None
Body centered I	*hkl* : *h* + *k* + *l* = 2 *n*
Face centered F	*hkl* : *h, k, l* either all odd or all even

Depending on the nature of the *h,k,l* values the lattice type can be determined.

CALCULATION

The lattice parameter

$$a = \frac{\lambda}{2\sin\theta}\sqrt{h^2 + k^2 + l^2} \text{ Å}$$

The interplanar distance

$$d = \frac{a}{\sqrt{h^2+k^2+l^2}} \text{ Å}$$

Result:

The lattice parameters are calculated theoretically from the powder X-ray diffraction

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VIVA QUESTIONS AND ANSWERS

LASER PARAMETERS

1. Define LASER

The term LASER stands for Light Amplification by Stimulated Emission of Radiation. It is a device which produces a powerful, monochromatic collimated beam of light in which the waves are coherent.

2. What is meant by active material in laser?

The material in which the population inversion is achieved is called active material.

3. What is semi conductor diode laser?

Semiconductor diode laser is a specially fabricated pn junction diode. It emits laser light when it is forward biased**.**

4. What are the characteristic of laser radiation?

Laser radiations have high intensity, high coherence, monochromatic and high directionality with less divergence.

5. What is stimulated emission?

The process of forced emission of photons caused by incident photons is called stimulated emission

6. Define acceptance angle

The maximum with which a ray of light can enter through one end of the fiber and still be totally internally reflected is called acceptance angle of the fiber.

7. What is the principle used in fiber optic communication system?

The principle behind the transmission of light waves in an optical fiber is total internal reflection.

RIGIDITY MODULUS- TORSIONAL PENDULUM

1. What is torsional pendulum?

A body suspended from a rigid support by mens of a long and thin elastic wire is called torsional pendulum.

2. What is the type of oscillation?

This is of simple harmonic oscillation type.

3. How will you determine the rigidity of fluids?

As fluids do not have a shape of their own, hence they do not posses rigidity. Hence there is no question of determining it.

4. **What is the rigid body you can use for a torsional pendulum?**
Sphere, cylinder or circular disc

DETERMINATION OF PLANCK'S CONSTANT USING LED

1. **What is Planck's quantum theory?**

   According to Planck's quantum theory, Different atoms and molecules can emit or absorb energy in discrete quantities only. The smallest amount of energy that can be emitted or absorbed in the form of electromagnetic radiation is known as quantum.

2. **What is the SI unit of Planck's constant?**
   The Planck constant is expressed with the unit joule per hertz ($J \cdot Hz^{-1}$) or joule-second ($J \cdot s$).

3. **What is photo electric effect?**

   The photoelectric effect is a phenomenon in which electrons are ejected from the surface of a metal when light is incident on it

4. **What is stopping potential?**

   The value of negative potential lat anode at which photoelectric current current is zero is called stopping potential

5. **What is threshold frequency?**

   The frequency below which no photo electric effects occurs is called threshold frequency.

SPECTROMETER GRATING

1. **What is the use of collimator and telescope?**

   A collimator is a device that narrows a beam of particles or waves. A telescope is an instrument that aids in the observation of remote objects by collecting electromagnetic radiation (such as visible light).

2. **What is plane transmission diffraction grating?**

   A plane transmission diffraction grating is an optically plane parallel glass plate on which equidistant, extremely close grooves are made by ruling with a diamond point.

3. **In our experiment. What class of diffraction does occur and how?**

   Fraunhofer class of diffraction occurs. Since the spectrometer is focused for parallel rays, the source and the image are effectively at infinite distances from the grating.

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4. How are the commercial gratings are made?

A commercial grating is made by pouring properly diluted cellulose acetate on the actual grating and drying it to a thin strong film. The film is detached from the original grating and is mounted between two glass plates. A commercial grating is called replica grating. In our experiment we use plane type replica grating.

X-RAY DIFFRACTION

1. What are the parameters of lattice?

The lattice parameters are the quantities specifying a unit cell or the unit of the periodicity of the atomic arrangement. The lattice parameters (constants) are composed of "a, b, c," lengths of the unit cell in three dimensions, and "α, β, γ," their mutual angles.

2. What is the basic principle of XRD?

XRD techniques are based on the elastic scattering of X-rays from structures that have long range order. The X-rays get diffracted by a crystal because the wavelength of X-rays is similar to the inter-atomic spacing in the crystals.

3. What is the Bragg's law of XRD?

XRD follows Bragg's law in that the reflected X-rays from different crystal layers with long range order undergo constructive interference. This causes high-intensity peaks in the spectrum. For materials without long range order such as amorphous systems, no peaks are observed.

4. What is a lattice point?

A lattice point is a point at the intersection of two or more grid lines in a regularly spaced array of points, which is a point lattice. In a plane, point lattices can be constructed having unit cells in the shape of a square, rectangle, hexagon, and other shapes.

R

DATA OF PHYSICAL CONSTANTS & STANDARD VALUES

Physical Constants	Symbol	Value in SI Unit
Velocity of light	c	3×10^8 m/s
Acceleration due to gravity	g	9.8 m/s^2
Planck's constant	h	6.625×10^{-34} Js
Charge of an electron	e	1.69×10^{-19} C
Avogadro number	N_A	6.023×10^{26} atoms/ k mole
Boltzmann constant	k	1.38×10^{-23} J/K
Modulus of Rigidity of Steel	η	7.9×10^{10} N/m^2
Wavelength of mercury vapour lamp	λ_v λ_B λ_G λ_{YI} λ_R	4047 Å 4358 Å 5461 Å 5770 Å 6234 Å