Name: ___________________________________ USN: ___________________

Branch -------------Section: _____ Batch :_______ Roll No.: _________________

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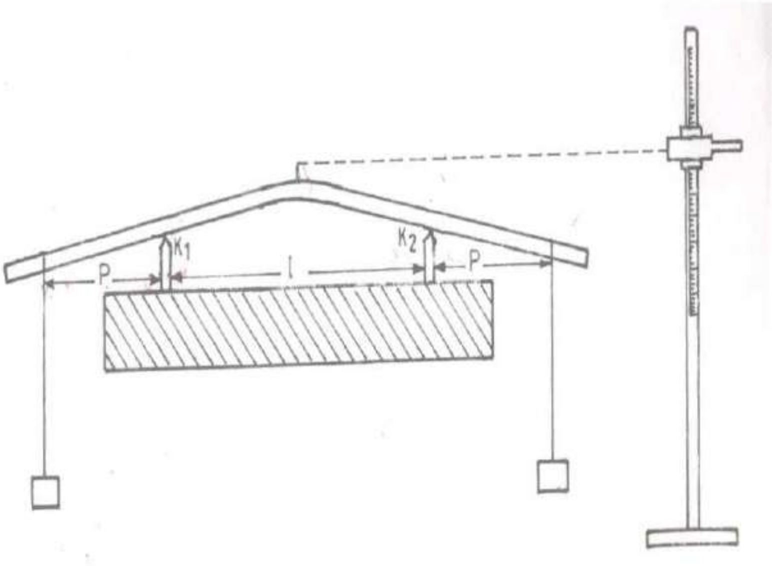
FIGURE



OBSERVATION: To find least count of traveling microscope

Smallest division on the main scale N_1 = ------------------------------ cm.

Number of divisions on the Vernier scale N_2 = ------------------------------div.

Least count of traveling microscope N_1/N_2 = ------------------------------cm.

TR=MSR+ (VSR x LC)

Sl. No.	Load in gms	Microscope reading Load increasing			Microscope reading Load decreasing			Mean TR= (a+b)/2	Elevation X in cm
		MSR	VSR	TR (a)	MSR	VSR	TR (b)		
1	Dead load							a	(a-a)=
2	50							b	(b-a)=
3	100							c	(c-a)=
4	150							d	(d-a)=
5	200							e	(e-a)=
6	250							f	(f-a)=

YOUNG'S MODULUS BY UNIFORM BENDING

EXPT. NO: DATE:

AIM: To determine the Young's modulus of the material of the given bar by uniform bending method.

APPARATUS: The given sample (wooden meter scale), two knife edges, two weight hangers with weights, traveling microscope, venier calipers, screw gauge, etc

PROCEDURE: - The given bar is supported symmetrically on the two knife edges and are loaded on either sides with equal weights. The elevation of the midpoint of the bar is monitored with traveling microscope for different loads. The Young's modulus of the material of the given bar is calculated as

$$Y = \frac{3l^2 pg}{2bd^3} x \left(\frac{m}{X} \right) Nm^{-2}$$

Where X = elevation produced in m.
m = mass for which elevation X is found in kg.
'l' = length of the rod between knife edges in m. =-------------------- cm
b = breadth of the rod in m.
d = thickness of the rod in m.
p = distance of the load hanger from the knife edge in m.= -------------- cm

The given bar (wooden meter scale) is placed on the two knife edges symmetrically. Two weight hangers are suspended on the bar on either side so that they are at equal distance from the knife edge. A pin is fixed at the centre of the bar and the traveling microscope is focused onto the tip of the pin. With no additional weight (apart from the weight w of the hanger itself) initial reading of the microscope is taken. The load is gradually increased in steps of 50 grams on either hanger and the readings of the microscope are taken. Observations are repeated for load decreasing also and tabulated.

The distance between the two knife edges is measured. The distance between the knife edge and the point of application of load is also measured. The breadth of the scale is measured using a slide calipers and the thickness is measured using a screw gauge. The Young's modulus of the material of the scale is calculated using the formula.

$$Y = \frac{3l^2 pg}{2bd^3} x \left(\frac{1}{slope} \right) Nm^{-2}$$

l = -------------- cm -------------------- m

b = -------------- cm -------------------- m

d = -------------- cm -------------------- m

g = 9.8 m/sec^2

TO FIND BREADTH OF THE SCALE (b)

To find least count of slide calipers

Smallest division on the main scale N_1 = ----------------------------- cm.

Number of divisions on the Vernier scale N_2 = -----------------------------div.

Least count of slide calipers N_1/N_2 = -----------------------------cm.**TR=MSR+ (VSRxLC)**

Sl. No.	MSR	VSR	TR	Mean TR	Breadth in m
1					
2					
3					
4					

TO FIND THICKNESS OF THE SCALE (d)

To find least count of screw gauge

Number of rotation given to head scale N_1 =

Distance moved on pitch scale N_2 = -----------------------------mm

Pitch of the screw gauge N_2/N_1 = -----------------------------mm

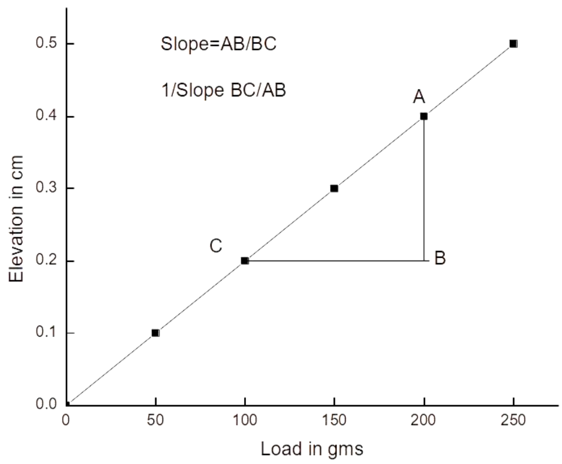
Least count of screw gauge = Pitch/ Total no. of divisions on head scale

=------------------------------------ mm

Zero error =

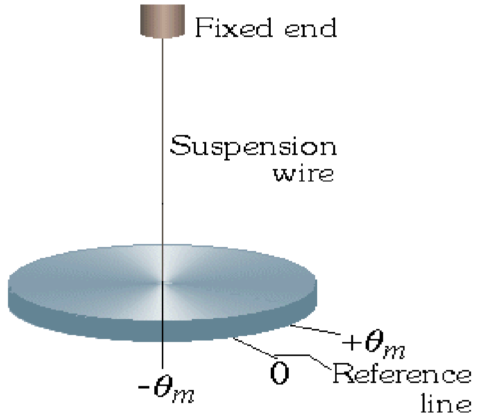
Zero correction =**NATURE OF GRAPH**

TR=PSR+ (HSRxLC)



Result: The Young's modulus of the given Bar or scale (wood): ----------------------N-m^{-2}

DIAGRAM



OBSERVATIONS

i. Circumference of the disc, C= 49x10^{-2}m

ii. Radius of the disc, R=C/2π =7.79x10^{-2} m

iii. Mass of the disc, M = 1.25Kg

iv. Moment of inertia of the disc = I=MR^2/2= _______________ Kg.m^2

v. Radius of the wire r= _________ mm= ____________m

To find time period of torsional oscillations:

Trial No	Length of the wire (l) X10^{-2} m	Time for 10 oscillations in seconds			Period T=t/10 In seconds	(l/T^2)	Mean (l/T^2) In ms^{-2}
		t1	t2	Mean t			
1							
2							
3							
4							

Rigidity modulus of the material of a given wire **η = (8πI/r^4) (l/T^2) mean**

RIGIDITY MODULUS BY TORSIONAL PENDULUM

EXPT.NO: **DATE:**

AIM: To determine Rigidity modulus of the material of a given wire using Torsional pendulum.

APPARATUS: Torsional pendulum, stop watch, screw gauge, Thread, scale, etc.

PROCEDURE:

- The circumference C of the disc is measured using a thread and a scale and the radius R of the disc is calculated using the relation, $R= C/2\pi$.

- ThemassMofthediscisfoundbyusingabalanceandmomentofinertiaofthediscaboutanaxis passing through its center and perpendicular to the disc is calculated using the formula $I=MR^2/2$.

- Least count of the given screw gauge is calculated and its zero error is noted. The radius of the given wire is calculated using the screw gauge and the readings are tabulated.

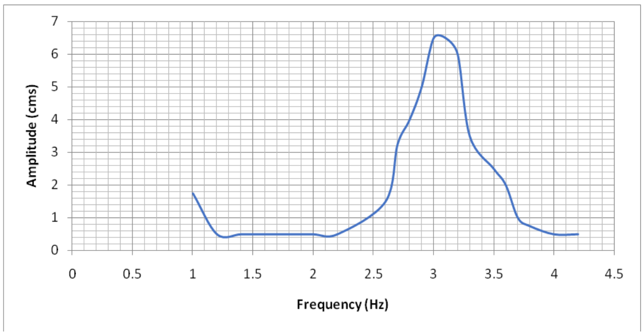
- Suspend the disc using the given wire as shown in the experimental arrangement. Adjust the length "l" of the wire from the torsion head and note its value. Allow the disc to execute torsion oscillations and using a stop watch note the readings in the tabular column. He time period of oscillation T is calculated. The experiment is repeated to find the time period for different lengths and l/T^2 is calculated for each trial. The mean (l/T^2) is calculated.

Finally rigidity modulus η is calculated using the formula,

$$\eta = (8\pi I/r^4)\,(l/T^2)\text{ mean}$$

Result:

Rigidity modulus of the material of a given wire η = ___________ N m^{-2}



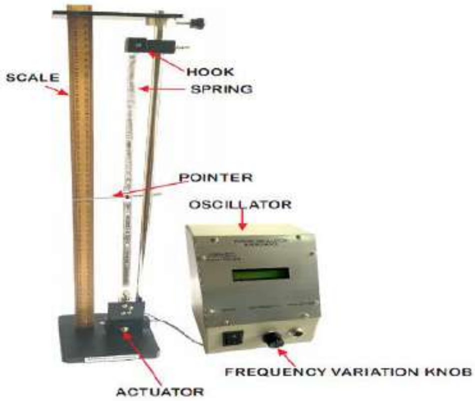


Fig1: Forced oscillation and resonance experimental setup, *Fig 2 : Nature of Graph*

Table1:

Frequency (Hz)	**Pointer position(cms)**		**Peak to peak travel (cms)**	**Amplitude(cms)**
	Upper	**Lower**		
1				
1.2				
1.4				
1.6				
1.8				
2				
2.2				
2.6				
2.7				
2.8				
2.9				
3				
3.1				
3.2				
3.3				
3.5				
3.6				
3.7				
3.8				
4				
4.2				

FORCED OSCILLATIONS & RESONANCE

Aim: To obtain the resonant frequency for a spring undergoing forced oscillations.

Apparatus:

A half meter long stand, which has a suspension hook at its top and an electrical actuator fixed firmly at its bottom. A steel spring of about 50 cm length suspended by the hook and its lower end fixed firmly to the shaft in the actuator. The spring has a pointer fixed at its midpoint whose position can be identified against a centimeter scale fixed in its back.

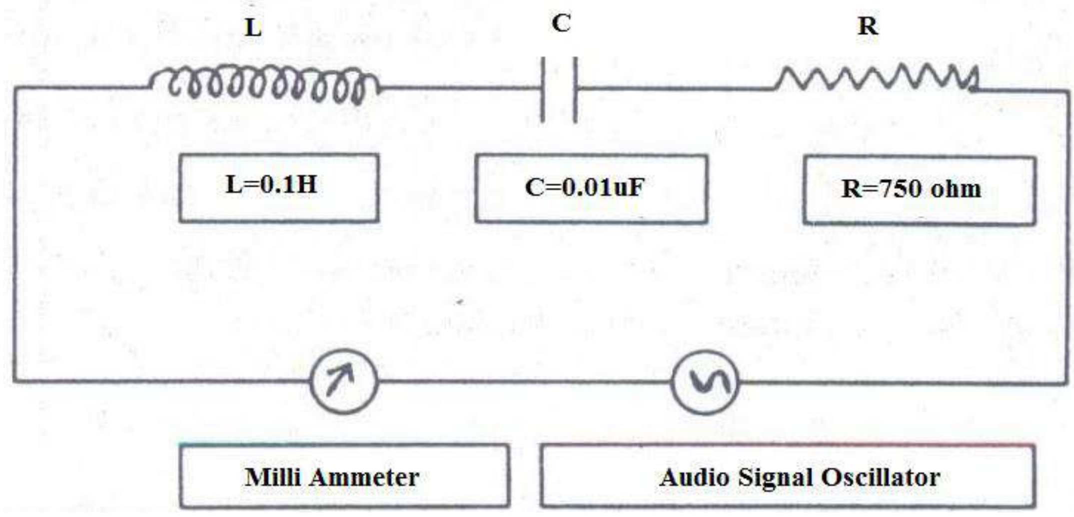
An electrical oscillator with frequency range 0 to 10 Hz variable in steps of 0.1 Hz.

Procedure:

1. The oscillator is connected to the electrical actuator.
2. Before switching ON the oscillator, make sure that the pointer is stable and also not obstructed by any means.
3. The Oscillator is switched ON and the frequency of the oscillator is set to 0.1Hz
4. You may observe that the pointer starts to oscillate parallel to the scale.
5. Note the maximum and minimum points of travel by the pointer over the scale.
6. Amplitude is half the travel of the pointer, calculate amplitude and plot frequency v/s amplitude graph.
7. From the graph, note the frequency at which amplitude is maximum. This value of the frequency is the resonant frequency and also the natural frequency of this system. Note that the natural frequency of the spring is different from natural frequency of the entire system.

Result: The resonance curve is obtained and the resonance frequency of the system is found from the graph as ……………. Hz.

CIRCUIT DIAGRAM



Given: L=0.1H, C= 0.01 μF, R=750Ω

The resonant frequency is also calculated using the equation

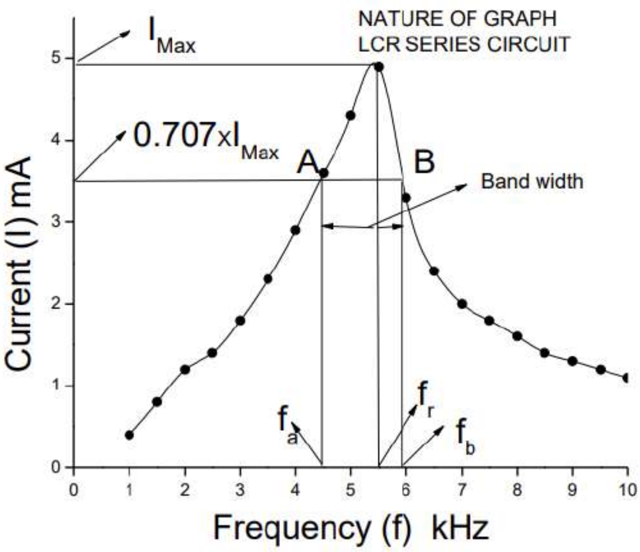
$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

fr =.........................Hz

TABULAR COLUMN

Sl.No.	Frequency (f) in kHz	Current in mA.
1	1.0	
2	1.5	
3	2.0	
4	2.5	
5	3.0	
6	3.5	
7	4.0	
8	4.5	
9	5.0	
10	5.5	
11	6.0	
12	6.5	
13	7.0	
14	7.5	
15	8.0	
16	8.5	
17	9.0	
18	9.5	
19	10	

Nature of the graph



SERIESAND PARALLEL RESONANCE "LCR" CIRCUITS

EXPT.NO: **DATE:**

AIM: To draw frequency response curve of a series and parallel LCR circuits, hence to calculate resonant frequency, Band width and Quality factor.

APPARATUS: An audio signal oscillator, a resistance box, an inductor coil, capacitor, ammeter & connecting wires etc.

PRINCIPLE:

The inductive reactance $X_L=2\pi fL$ and capacitive reactance $X_C=1/(2\pi fC)$varies with the applied frequency of the supply voltage in the circuit. At a particular frequency f_r, the inductive reactance become equal to capacitive reactance in the circuit. The frequency corresponds to this situation is referred to as resonant frequency (f_r). The total impedance of the circuit becomes equal to the resistance i.e Z=R in the circuit, which is minimum. Hence, the maximum current flows through the circuit at resonance due to this reason the series LCR resonance circuit is referred as Acceptor circuit. The resonant frequency is given by the equation $X_L = X_C$.

PROCEDURE:

When LCR connected end to end with AC source they are said to be in series

- The circuit connection is made as shown in the circuit diagram.
- The frequency of audio signal oscillator is set to 1 kHz & the corresponding reading in the milli ammeter is noted.
- The frequency of the audio signal oscillator is increased in steps of 0.5 kHz up to 9.5 kHz & the corresponding milli ammeter readings are recorded.
- A graph is drawn between current (along Y-axis) & frequency (X-axis). From the graph the resonant frequency (f_r) is measured.

The resonant frequency is also calculated using the equation

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

Given L=0.1 H, C= 0.01 μF.

QUALITY FACTOR:

The readings including f_r and I_{max} are plotted in a graph with frequency in KHz along X-axis, and the current in mA along the Y-axis. A resonance curve as shown in graph will be obtained in which f_r and I_{max} are marked .The line is drawn along x-axis at (I_{max} 0.707).

From the above graph find fa and fb and calculate band width (Δf =fb-fa)

Now calculate quality factor using the following equation from graph

Δf = (fb-fa).

Qgraphical = **fr/Δf,**
For Given L = 0.1 H, C = 0.01 µF& R = 750 Ω.

Theoretically quality factor is calculated using the relation

$$Q = \frac{1}{R}\sqrt{\frac{L}{C}}$$

Q_{Theory}= ______________

Given **L = 0.1 H, C = 0.01 µF& R = 750 Ω**

The resonant frequency can calculated using the equation for parallel resonant circuit as follows

$$f_r = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}$$

f_r = _______________KHz

Find fa and fb and calculate band width (Δf =fb-fa), Now calculate quality factor using the following equation from graph **Qgraphical=fr/Δf, where,Δf=(fb-fa).** Verify this theoretically using

the relation

$Q = \frac{1}{R}\sqrt{\frac{L}{C}}$

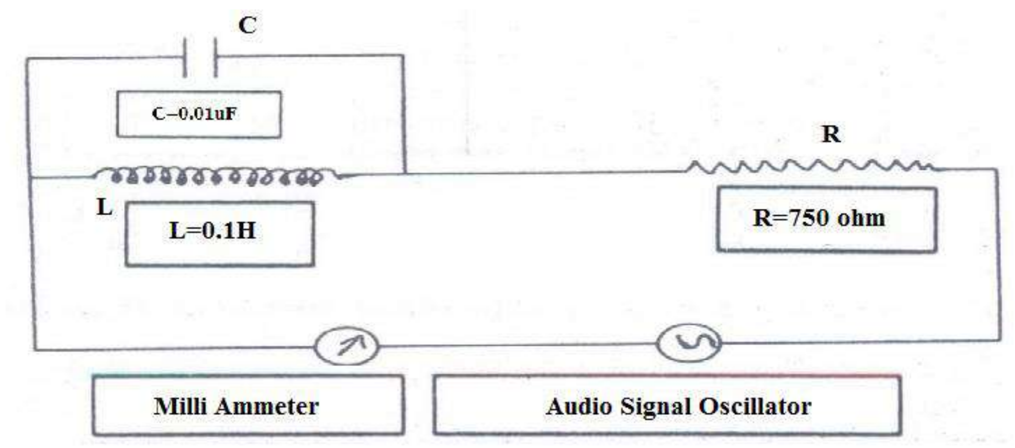
Given L = 0.1 H, C = 0.01 µF& R = 750Ω.

RESULTS:

1. Resonant frequency f_r = _______________kHz (from graph)
2. Resonant frequency f_r=________________kHz (from calculation)
3. Band width of the circuit Δf= ____________(from graph)
4. Quality factor of the circuit Q= ____________(from graph)

5. Quality factor of the circuit Q=____________(from calculation)

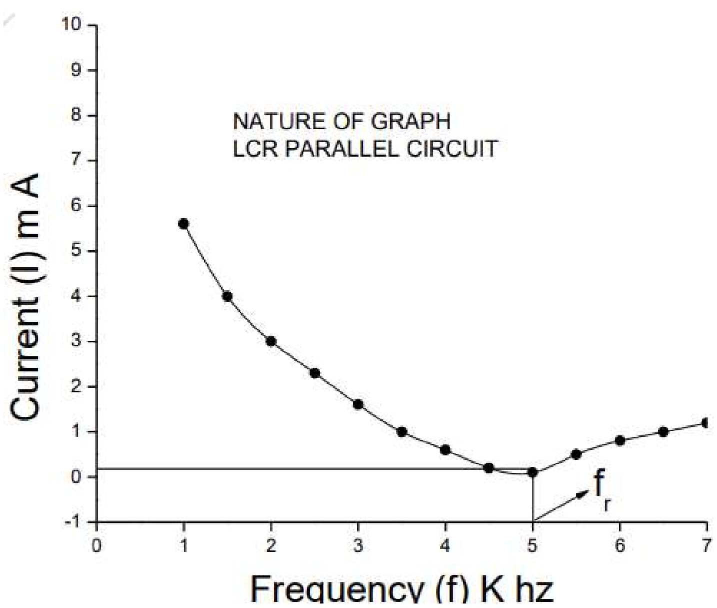
CIRCUIT DIAGRAM



Tabular Column

Sl.No.	Frequency (f) in kHz	Current in mA.
1	1.0	
2	1.5	
3	2.0	
4	2.5	
5	3.0	
6	3.5	
7	4.0	
8	4.5	
9	5.0	
10	5.5	
11	6.0	
12	6.5	
13	7.0	
14	7.5	
15	8.0	
16	8.5	
17	9.0	
18	9.5	
19	10	

Nature of Graph



PARALLEL LCR CIRCUIT

PRINCIPLE:

The inductive reactance & capacitive reactance connected in parallel at resonant frequency the inductive reactance exceeds the capacitive reactance. Hence $X_L > X_C$. Thus, the resultant impedance of the circuit becomes maximum hence the current in the parallel circuit becomes minimum. Due to the above reason the parallel LCR circuit is referred to be rejected circuit.

PROCEDURE:

When L & C are connected in parallel with series resistance & an AC source they are said to be in parallel

- The circuit connections are made as shown in the circuit diagram.
- Thefrequencyofaudiosignaloscillatorissetto1 kHz &the corresponding reading in the milli ammeter is noted.
- The frequency of the audio signal oscillator is increased in steps of 0.5 kHz up to 9.5 kHz & the corresponding milli ammeter readings are recorded.
- A graph is drawn between current (along Y- axis) & frequency (along X-axis). From the graph the resonant frequency f_r is measured.

The resonant frequency is also calculated using the equation

$$f_r = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}$$

Given L=0.1 H, C= 0.01uF & R=750 Ω

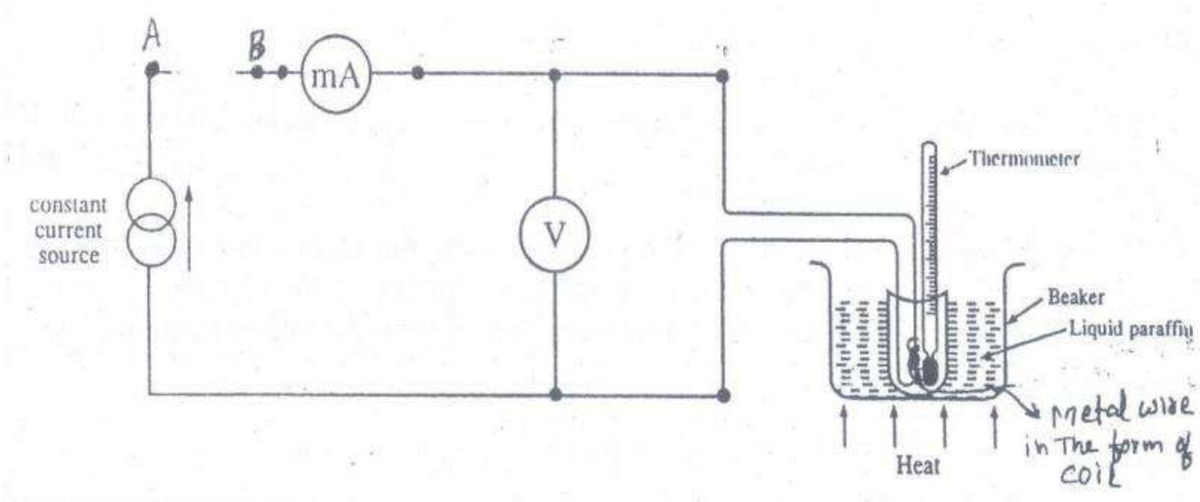
f_r = ________________ KHz

\

RESULTS:

1. Resonant frequency f_r = _______________kHz (from graph)
2. Resonant frequency f_r=________________kHz (from calculation)

CIRCUIT DIAGRAM



Sl. No.	Temperature 't' in ^{0}C	Temperature in ^{0}K T=(t+273)	Voltage (V) in mV	Current (I) in mA	Resistance$(R = \frac{V}{I})$ in Ω
1	85	358			
2	80	353			
3	75	348			
4	70	343			
5	65	338			
6	60	333			
7	55	328			
8	50	323			
9	45	318			
10	40	313			
11	35	308			

FERMI ENERGY OF COPPER

EXPT.NO: **DATE:**

AIM: To determine Fermi energy of a given copper wire.

APPARATUS: Digital voltmeter, digital ammeter, copper wire, heating arrangement, heating coil, connecting wires, etc.

Principle: “Fermi level” is the term used to describe the top of the filled electronic energy levels at absolute zero temperature. Energy of the electron in Fermi level is Fermi energy. The Fermi energies of metals are of the order of few electron volts

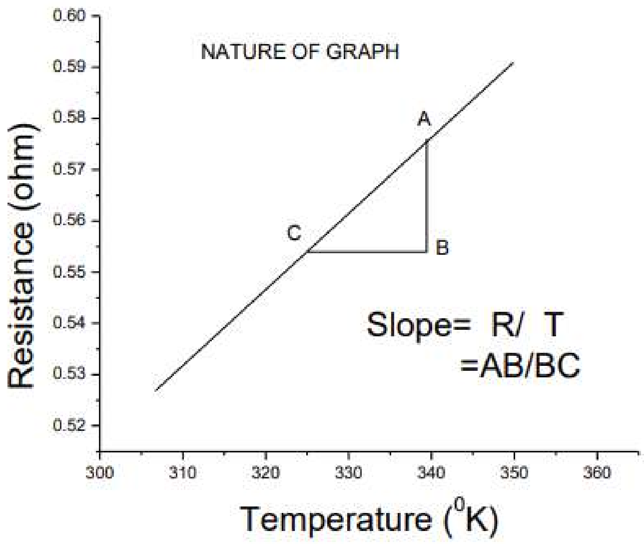
Fermi energy is given by the equation,

$$E_F = \left[\frac{ne^2\pi Ar^2}{L)(2m)}\right]^2 x\left(\frac{\Delta R}{\Delta T}\right)^2$$

Where the constant A = λ_F x T, where T is the reference temperature of the wire in Kelvin, r is the radius of the wire

PROCEDURE:

- About 3.6 meters length copper wire is taken and its radius is determined and cross sectional area is calculated. Its mass number and density are noted from Clark’s table.
- The wire is wound over an insulating tube (20-30mm dia) to form a coil. The coil is immersed in pre heated liquid paraffin as shown in the experimental setup. The two end of the coiled wire is connected to a power supply through a milli ammeter and milli voltmeter is connected across the coil.
- A thermometer is immersed in the beaker containing liquid paraffin and coil. When the thermometer attains steady temperature the temperature is noted.
- The power supply is switched on and voltage and currents are noted in Table. The liquid is allowed to cool and power supply is switched off until another steady temperature is reached.
- Trial is repeated by taking reading in the interval of 5 degree and until the temperature reach 45 degree. At each temperature the voltages and currents measured are noted in Table.
- A graph is drawn by taking temperature T in ^oK along X-axis and resistance R in ohm along Y axis as shown in Figure. The slope of straight line is calculated.



= ______________ ΩK^{-1}

$\frac{\Delta R}{\Delta T}$is the slope of the straight line obtained by plotting resistance of the metal against absolutetemperature of the metal.

Calculations

$$\text{Fermi energy } E_F = \left[\frac{ne^2\pi A r^2}{L(2m)}\right]^2 x \left(\frac{\Delta R}{\Delta T}\right)^2 \text{ J or eV}$$

Where n, A, πr^2, L are constants given below

n= 8.464 x 10^{28}/kg mol, A= 7.4 x 10^{-6}, πr^2 = 0.212 x 10^{-6} m^2, L = 3.58 m, m = 9.1 x10^{-31}kg,
e = 1.602 x 10^{-19} C

$$\mathbf{E_F = 4.99 \times 10^{-13} \, x(slope)^2 \, J}$$

$$\mathbf{E_F = \frac{4.99X10^{-13}\,X(slope)^2}{1.602X10^{-19}}}$$

E_F = ____________________eV

RESULTS:

Fermi energy of copper wire is..eV

CIRCUIT DIAGRAM

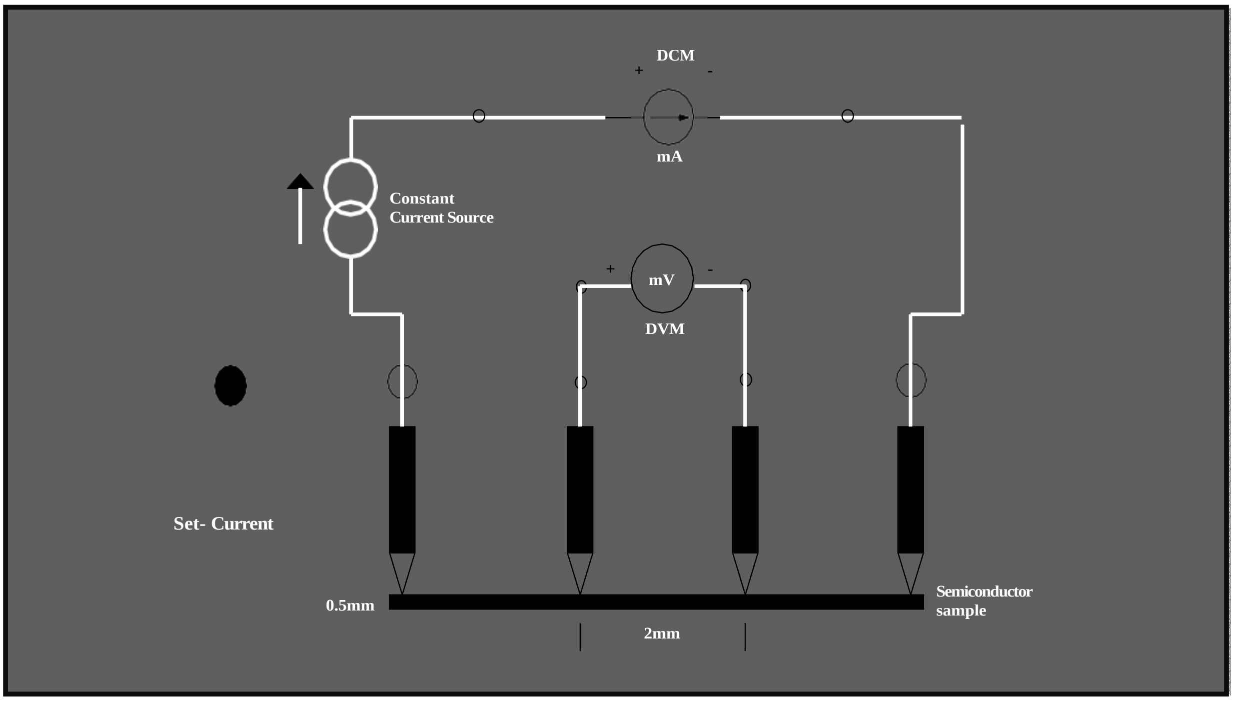


Figure: Four probe circuit connections

Table: Keep, Current (I) = 2mA.

SN	T	T=t+273	V	R=V/I	ρ_0 = (V/I)(2ΠS)	ρ= [ρ_0/f(w/s)]	ρ	1000/T	$\log_{10}$ (ρ)
Unit	°C	°K	mV	Ω	Ω -m	Ω -m	Ω -cm	K^{-1}	
1	35	308							
2	40	313							
3	45	318							
4	50	323							
5	55	328							
6	60	333							
7	65	338							
8	70	343							
9	75	348							
10	80	353							
11	85	358							
12	90	363							
13	95	368							
14	100	373							

RESISTIVITY OF A SEMICONDUCTOR BY THE FOUR-PROBE METHOD

EXPT.NO:

Aim*:* To determine the temperature dependent resistivity of semiconductor by four probe method.

Apparatus: four probe arrangement experimental setup, oven provided with heater to heat the sample, semiconductor sample, connecting wires etc.,

Experimental Procedure:

1. The four probe arrangement is placed on the sample as shown in figure. Care is taken to see that all the four probe touch the sample surface and make contact with the sample. A constant current is passed through the outer probes connecting it to the constant current source of the set-up.
2. The current is set to 2 mA. The voltage developed across the middle two probes is measured using a digital milli-voltmeter. A thermometer is pre fixed on the surface where crystal is mounted, this reads the same temperature as the semiconductor sample is experiencing.
3. Before switching on the heater, Note the voltage and temperature.
4. Now switch on "ON" the heater and note the voltage in mV at an interval of 5^0C upto 100^0C.
5. The distance between the probes and thickness of the crystal (W) are noted as 2mm and 0.5mm respectively ρ_0 is calculated for different values of V. The values of (W/S) are calculated and the value of the *f(W/S)* is calculated using the formula and is equal to 5.54 using these values, ρ is calculated for varies temperatures. For a germanium crystal the (W/S) and corresponding values can be obtained by using the below mentioned equation.
6. The values of (1000/T) and the corresponding values of logρ are plotted. Corresponding values of log ρ plotted on the graph and is found to be a straight line.
7. You may note that the graph may be in I quadrant or in I and II quadrants or only in II quadrant depending on the crystal.

$$f(W/S) = \frac{2S}{W} \log_e 2$$

Nature of Graph:

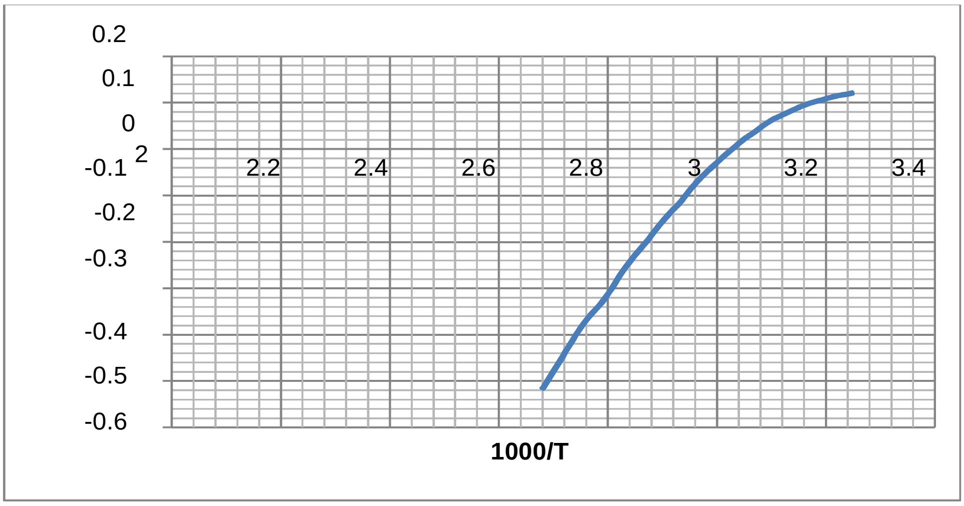
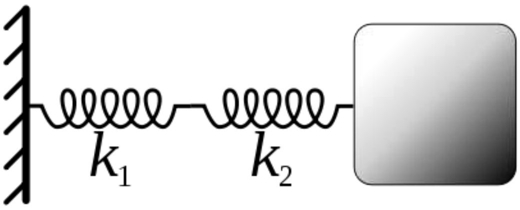


Figure: Variation of $\rho$with temperature

Result: The temperature dependence of the resistivity of semiconductor (germanium) sample is as shown in the table. The dependence of resistivity is exponential with temperature.

Observations

Two springs can be connected in series as shown in fig.



Two springs in parallel connection as shown in fig.

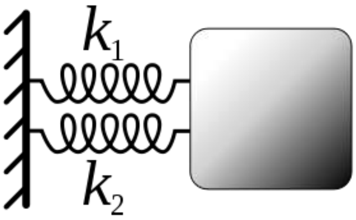


Table-1: Properties of springs and their combinations

Quantity	**Spring parallel**	**Springs in series**
Spring constant	$k_{equ} = k_1 + k_2$	$\frac{1}{kequ} = \frac{1}{k_1} + \frac{1}{k_2}$
Elongation (Extension)	$X_{equ} = x_1 = x_2$	$X_{equ} = x_1 + x_2$
Force	$F_{equ} = F_1 + F_2$	$F_{equ} = F_1 = F_2$
Stored energy	$E_{equ} = E_1 + E_2$	$E_{equ} = E_1 + E_2$

SERIES AND PARALLEL COMBINATIONS OF SPRING

EXPT.NO: **DATE:**

AIM: To determine the spring constants of given springs in series and parallel combination.

APPARATUS: Rigid support, given springs, Slotted weights, Scale etc.

PRINCIPLE: -Hook's law states that strain is directly proportional to stress within elastic limit. i.e.

F=-kx where "k" is spring constant and "x" is the displacement of the spring due to force here force is equal to weight

Experimental procedure:

The experimental procedure is consists of the following steps.

Part-A: Determination of spring constant k1 using spring-1

The spring-A is hooked to the stand and the scale is placed by the side.

- The 0.050 kg slotted weight is hooked to the spring as shown in Figure-2, and when the spring is rest, the reading corresponding to the spring pointer is noted from the vertical scale beside the spring.
- Trial is continued by adding another 0.050kg making total 0.01kg and the when the spring is stand still, the corresponding displacement is noted.
- Trial is continued until the total mass is 0.30kg in steps of 0.050kg each time. The corresponding displacement is noted in Table-1.
- From the table the average displacement for 50gm is calculated and the force acting on the spring is also calculated and presented in Table-1.
- Spring constant of spring-1 is calculated using equation-1.

Part-B: Determination of spring constant k2 using spring-2.

- Experiment is repeated with spring-2 and the corresponding force on the spring and its displacement are tabulated in Table-2 and spring constant k_2 is determined using equation 2.

Table-1: Force acting and spring displacement for Spring-1

Trails	Mass (m) kg	Displacement (x_1) m	Displacement corresponding to .050 kg (x_1)
a	0.05		(a-a) =
b	0.10		(b-a) =
c	0.15		(c-b) =
d	0.20		(d-c) =
e	0.25		(e-d) =
f	0.30		(f-e) =
		Average x_1	

Where a, b, c, d, e, f are the trails or observations.

$$k_1 = \frac{F_1}{x_1} = \_\_\_\_\_\_\_\_\_\_\text{N/m} \qquad (1)$$

F_1=mg

Table-2: Force acting and spring displacement for Spring-2

Trails	Mass (m) kg	Displacement (x_2) m	Displacement corresponding to 0.05 kg(x_2)
a	0.05		(a-a) =
b	0.10		(b-a) =
c	0.15		(c-b) =
d	0.20		(d-c) =
e	0.25		(e-d) =
f	0.30		(f-e) =
		Average x_2	

$F_2 = k_2 x_2$ or

$$k_2 = \frac{F_2}{x_2} \quad = \text{--------------N/m} \qquad (2)$$

F_2=mg

Part-C: Determination of k_{series} using spring-A and spring-1& 2

- Removing all the mass from spring-1, spring-2 is now connected in series with the spring and experiment is repeated by placing 0.050kg slotted weight as shown in Figure-2. The mass and displacement are noted recorded in table 3.
- Trial is continued by increasing the mass in steps of 0.05kg and the corresponding displacements are noted in Table-3. The spring constant of springs in series combination can be calculated using equation3.

Part-D: Determination of $k_{parallel}$ using spring-1 & spring-2

- The masses are removed from the spring and two springs are now connected in parallel as shown in Figure-3.
- The mass is now applied to the small beam holding the spring and with 0.05kg slotted weight connected the displacement is noted on the scale by adjusting the scale to the spring pointer.
- Trial is repeated by increasing the force by adding 0.050kg mass and in each case the displacement is noted and presented in Table-4. Effective Spring constant in the parallel combination is calculated using the equation4.

Note: - Since we used both identical springs with same number of radius, turns and length the spring constant obtained are almost the same

Table-3: Force acting two springs in series and the displacements

Trails	Mass (m) kg	Displacement (x) m	Displacement corresponding to50gm (x_{series})
a	0.05		(a-a) =
b	0.10		(b-a) =
c	0.15		(c-b) =
d	0.20		(d-c) =
e	0.25		(e-d) =
f	0.30		(f-e) =
Average x_{series}			

$F_{series} = k_{series} x_{series}$ or

$$k_{series} = \frac{F_{series}}{X_{series}} \text{------------ N/m} \quad (3)$$

$$F_{series} = mg$$

When the two identical springs are in series then we have

$$\frac{1}{k_{series}} = \frac{1}{k_1} + \frac{1}{k_2} = k_{series} = \frac{k_1 k_2}{k_1 + k_2}$$

Table-4: Force acting two springs in parallel and the displacements

Trails	Mass (m) kg	Displacement (x) m	Displacement corresponding to 50gm ($x_{parallel}$)
a	0.05		(a-a) =
b	0.10		(b-a) =
c	0.15		(c-b) =
d	0.20		(d-c) =
e	0.25		(e-d) =
f	0.30		(f-e) =
	Average $x_{parallel}$		

$F_{parallel} = k_{parallel} x_{parallel}$ or

$$k_{parallel} = \frac{F_{parallel}}{X_{parallel}} = \_\_\_\_\_\_\_\_\_\_\_\_ \text{N/m} \quad (4)$$

$$F_{parallel} = mg$$

For parallel combination of two identical springs,

$P_{parallel} = k_1 + k_2 =$ ____________N/m

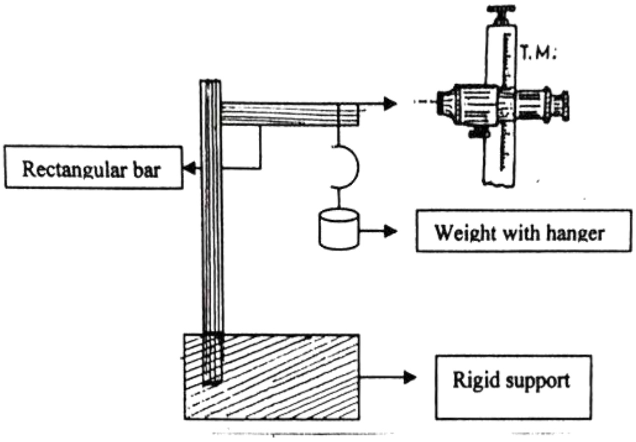
Results:

Spring constant k_1=-------------------------------- N/m

Spring constant k_2=---------------------------------N/m

Spring constant in series = ------------------------------- N/m

Spring constant in parallel=---------------------------------N/m



TO FIND OUT THE L.C OF TRAVELLING MICROSCOPE

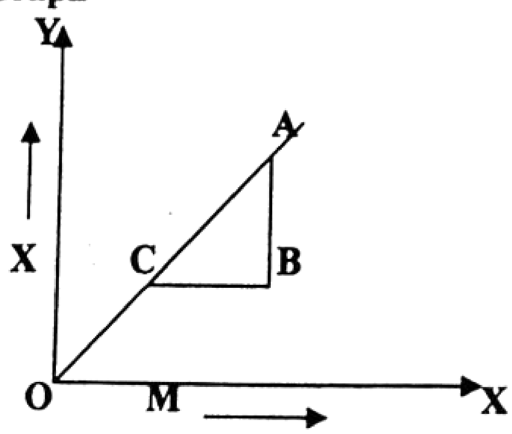
Smallest division on the Main scale N_1 = ………………… Cm

No. of division on the Vernier scale N_2 = ………………. Div

Least count of Travelling Microscope N_1/N_2 = ……………. Cm

Sl. No	Load M in kg	Reading of Travelling Microscope						Mean X $X=\frac{x_1+x_2}{2}$	Depression X in cm	Depression X in m
		Load Increasing			Load Decreasing					
		MSR	VSR	TR. x_1	MSR	VSR	TR. X_2			
1	Dead Load							a =	(a-a)=	
2	0.05							b =	(a-b)=	
3	0.10							c =	(a-c)=	
4	0.15							d =	(a-d)=	
5	0.20							e =	(a-e)=	
6	0.25							f=	(a-f)	

Nature of Graph



Slope = AB/BC

Y BY CANTILEVER

AIM: - To determine the Young's modulus of the given bar by cantilever method.

APPARATUS: - Given bar, clamp pin with wax, weight hanger, weights, traveling microscope, etc.

THEORY: - The property of a body by virtue of which the body tends to regain its original state when the deforming force has been removed is known as elasticity.

HOOK'S LAW: - It states that Stress is directly proportional to strain within elastic limits.

STRESS: -Stress is the force per unit area applied to a body.

STRAIN: -Strain is the ratio of the change in the configuration to the original configuration.]

There are three types of strain: -
1 .Longitudinal strain = change in length/ original length.
2 .Volumetric strain = change in volume/original volume.
3 .Shearing strain = It is the ratio of relative displacement of one plane to its distance from the fixed plane.

YOUNG'S MODULUS: -It is the ratio of longitudinal stress to longitudinal strain

PROCEDURE: - One end of the given bar is fixed horizontally to a rigid support to its free end a weight hanger is hanged as shown in figure. The whole arrangement is called single cantilever. A traveling microscope is focused until a clear image of the tip of the pin is seen. Adjust the horizontal cross wire to tip of the pin. Note down the MSR & CVD. (i.e., dead load reading). Hang the weight hanger, in each step increase the load by0.05 KG up to 0.25 KG. The corresponding readings are noted & tabulated. Now by decreasing load in same steps, & tabulate readings. If the length of the bar, breath & thickness of the bar are known. The young's modulus of the given bar is calculated by using formula.

$$Y = \frac{4gl^3}{bd^3} \times \frac{1}{slope} \; N/m^2 \qquad \textbf{Where} \quad slope = AB/BC$$

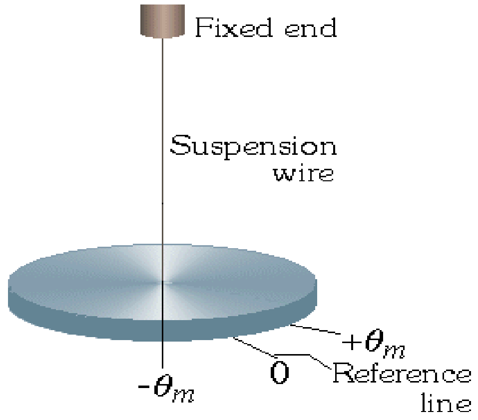
Where

M-mass suspended
g- acceleration due to gravity =
l- length of the bar =
b - breath of the bar =
d -thickness of the bar =
x- depression produced for mass =

RESULTS: -

Young's modulus of the given bar by cantilever method is Y ………….. N/m²

DIAGRAM



OBSERVATIONS

vi. Circumference of the disc, C= 49×10^{-2}m

vii. Radius of the disc, $R = C/2\pi = 7.79 \times 10^{-2}$ m

viii. Mass of the disc, M = 1.25Kg

ix. Moment of inertia of the disc = $I = MR^2/2 =$ _______________ Kg.m^2

x. Radius of the wire r= _________ mm= ____________m

To find time period of torsional oscillations:

Trial No	Length of the wire (l) $\times 10^{-2}$ m	Time for 10 oscillations in seconds			Period T=t/10 In seconds	(l/T^2)	Mean (l/T^2) In ms^{-2}
		t1	t2	Mean t			
1							
2							
3							
4							

Rigidity modulus of the material of a given wire **$\eta = (8\pi I/r^4)\ (l/T^2)$ mean**

RIGIDITY MODULUS BY TORSIONAL PENDULUM

EXPT.NO: **DATE:**

AIM: To determine Rigidity modulus of the material of a given wire using Torsional pendulum.

APPARATUS: Torsional pendulum, stop watch, screw gauge, Thread, scale, etc.

PROCEDURE:

- The circumference C of the disc is measured using a thread and a scale and the radius R of the disc is calculated using the relation, R= C/2π.

- ThemassMofthediscisfoundbyusingabalanceandmomentofinertiaofthediscaboutanaxis passing through its center and perpendicular to the disc is calculated using the formula $I=MR^2/2$.

- Least count of the given screw gauge is calculated and its zero error is noted. The radius of the given wire is calculated using the screw gauge and the readings are tabulated.

- Suspend the disc using the given wire as shown in the experimental arrangement .Adjust the length "l" of the wire from the torsion head and note its value. Allow the disc to execute torsion oscillations and using a stop watch note the readings in the tabular column. He time period of oscillation T is calculated. The experiment is repeated to find the time period for different lengths and l/T^2 is calculated for each trial. The mean (l/T^2) is calculated.

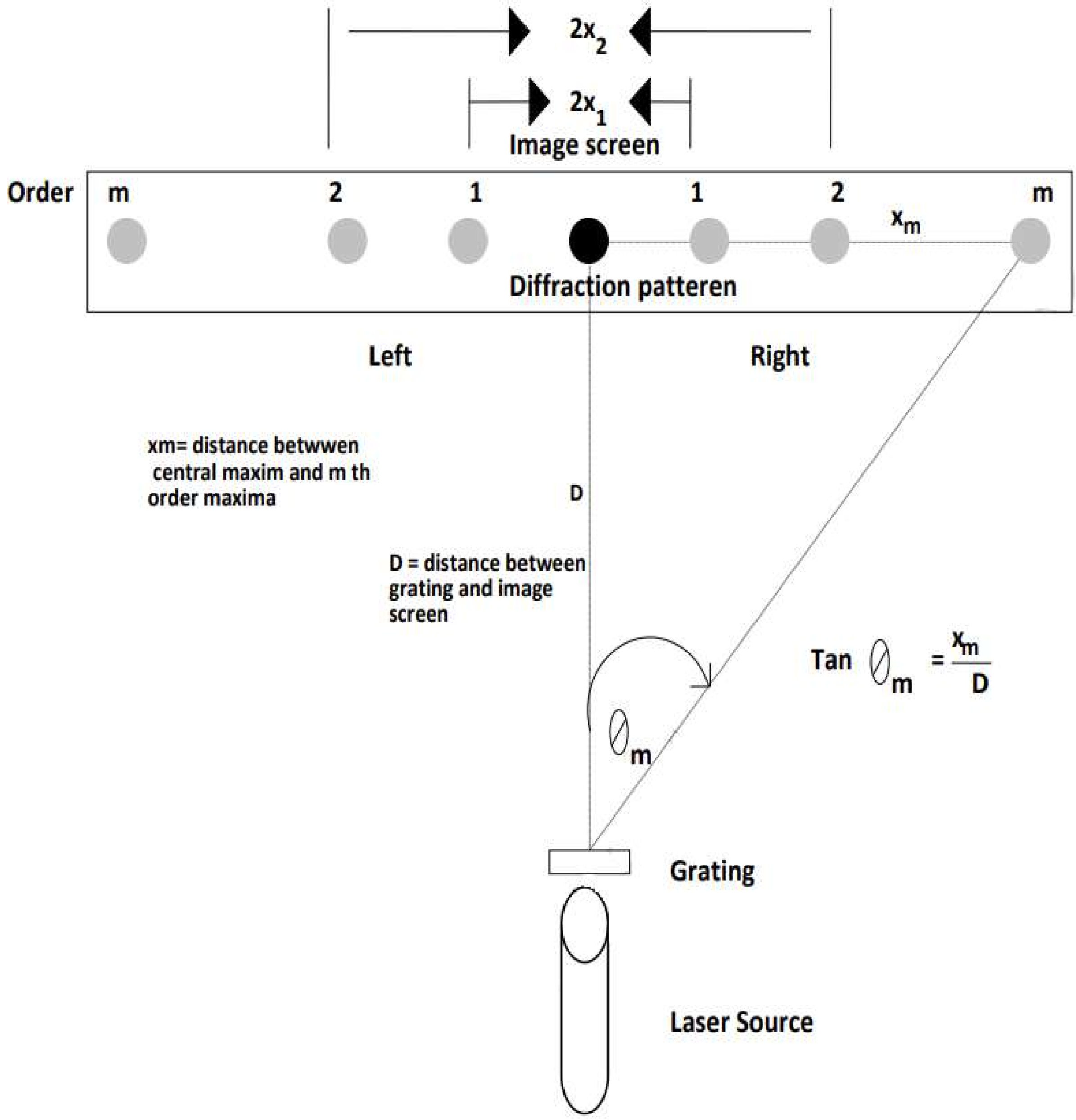
Finally rigidity modulus η is calculated using the formula,

$$\eta = (8\pi I/r^4)\,(l/T^2)\text{ mean}$$

Result:

Rigidity modulus of the material of a given wire η = ___________ $N\,m^{-2}$

RAY-DIAGRAM



2x2
2x1
Image screen
Order
m
2
1
1
2
m
xm
Diffraction patteren
Left
Right
xm= distance betwwen
central maxim and m th
order maxima
D
D = distance between
grating and image
screen
Tan ∅m = xm / D
∅m
Grating
Laser Source

DIFFRACTION GRATING

EXPT.NO: 1 **DATE:**

AIM: To determine the wavelength of LASER source using diffraction grating.

APPARATUS: 625nm diode laser, Indian assembled 100LPI (lines per inch), 250LPI, 500LPI gratings, image screen.

PROCEDURE:

Semiconductor laser, grating stand and screen is kept horizontally on a table and the laser source isswitchedon.Thegratingiskeptonagratingstananditisadjustedsuchthatitisnormaltothe incident laser beam. After adjusting for normal incidence, the laser light is exposed to the grating and it is diffracted by it. The diffracted laser spots are seen on the screen which is kept behind the other side of the grating, The distances of spots of different orders from the centre spot(x_m) are measured.

The wavelength of the laser light is calculated using the formula

$$\mathbf{m\lambda = d\sin\theta}$$

In the above equation all the parameters are known except θ. The angle θ can be found experimentally by measuring accurate distance D between grating and screen and distance between the consecutive maxima (which is nothing but the distance of m^{th} order diffraction pattern from the centre 0^{th}order). Different order of diffraction is the result of different incident angle θ. Hence to specify 'θ' for particular order it has been rewritten as θ_m, which indicate the diffraction angle for m^{th} order. Therefore, the m^{th} order diffraction angle is given by

$$\boldsymbol{\theta_m = \tan^{-1}\left(\frac{x_m}{D}\right)}$$

Number of lines on grating =500 lines per inch.

Number of lines per cm (d) =2.54/500 =5.08x10^{-5} lines per m (1 inch=2.54cm)

TABULAR COLUMN

Distance between grating element and the screen **(D) =55 cm**

<table>
<tr><th rowspan="3">Sl. No</th><th rowspan="3">Order of diffraction (m)</th><th colspan="4">Readings of the diffracted patterns</th><th rowspan="3">Mean θ_m</th><th rowspan="3">λ=dsinθ / m
in A^0</th></tr>
<tr><th colspan="2">Left side</th><th colspan="2">Right side</th></tr>
<tr><th>Distance from central spot x_m</th><th>$\theta_m = \tan^{-1}\frac{x_m}{D}$</th><th>Distance From Central spot x_m</th><th>$\theta_m = \tan^{-1}\frac{x_m}{D}$</th></tr>
<tr><td>1</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>6</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="7" align="right">Mean λ</td><td></td></tr>
</table>

RESULT:

The wave length of the semiconductor laser source calculated using diffraction grating and λ =______________________ A^0

Observations

Diagrams

Figure-2 shows the complete experimental setup. A fixed screen is graduated in millimeter with 2mm pitch, i.e. the distance between two vertical lines on the screen is 2mm. Figure-2 shows the complete experimental set-up.

The X-Y bed consisting of a scale is fitted along the X-axis with zero coinciding with the screen. On this X axis a needle fixed above the scale which moves along with the chuck indicates the distance 'f' between the fixed screen and chuck holding the OFC. The Y motion is used to adjust the spot at the center of the graduated screen. Figure-3 shows the X-Y bed and Figure-4 shows the OFC cable used.
Figure-1 shows the NA and the angle θ.

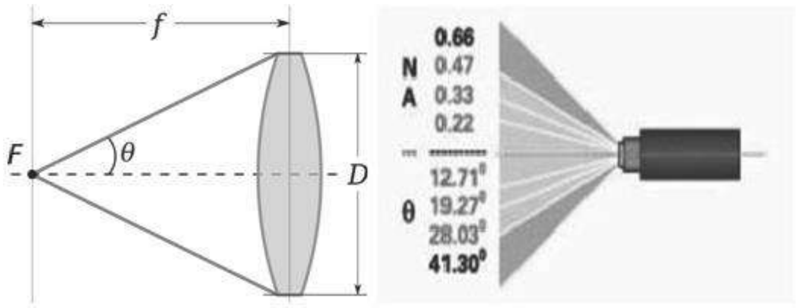


Figure-1: Laser light emerging from the cable and forming a divergent cone of rays

Distance between the chuck and the fixed graduated scale f = cm = m

Diameter of the circular spot =D= --------------------- m

$\tan\theta = D/2f$

The value of **'θ'** is calculated and presented in Table-1. NA can be calculated as follows.

$\theta = \tan^{-1}(D/2f)$

N.A. = $\sin\theta$

NUMERICAL APERTURE OF AN OPTICAL CABLE

EXPT.NO: **DATE:**

AIM: Determination of angle of acceptance and numerical aperture of an optical fiber.

APPARATUS: Optical Fiber Cable (OFC) of length1.5m (IEEE 1394 fire wire cable), semiconductor diode laser- red 625nm, X-Y bed carrying a screen and a movable chuck

PRINCIPLE: - Numerical aperture of a cable is defined as sine of the half angle of the cone generated due to the divergence of signal rays, as shown in Figure 1.

N.A. = Sinθ

In Figure-1, light coming out of an OFC falls on a screen, kept at a *distance 'L'* from it, on which an image of the laser spot is seen. This spot and the emerging light form a cone. If 'D' is the diameter of the circular spot and 'f' is distance between the screen and the OFC then

$$tan\theta = \frac{D/2}{f} = \frac{D}{2f}$$

By measuring D and f, the value of tan θ can be determined; hence the numerical aperture can be calculated from the equation

NA = Sin θ = $\tan^{-1}$(D/2f).

Experimental procedure

- The optical cable is coupled to the laser and it is ensured that the laser light comes out of the other end of the cable. The other end of the cable is tied to the chuck fixed on the X-Y bed.
- The chuck carrying the OFC is brought close to the graduated screen and the laser spot is seen on the graduated screen. By adjusting the fine motion screw of the microscopic bench, the spot size is reduced to 8mm. Spot size = D= 8mm
- The distance between the fixed screen and chuck carrying the OFC is noted on the graduated scale fixed along the X-axis.
- The experiment is repeated by increasing the size of the spot to 10mm, 12mm, 14mm, 16mm, 18mm, 20mm, 22mm, 24mm, 26mm, and the corresponding value of 'f' is noted. This is done until the spot becomes sufficiently bright and clear. The readings obtained are tabulated inTable1.
- The experiment is repeated with another cable of 1m length and the readings obtained are tabulated in Table 1. A graph is plotted D versus f and the variation is a straight line given inFigure-2.

Table-1: Variation of D and f

Sl. No	f in cm	f in mm	D in mm	$\theta^0 = \tan^{-1}(D/2f)$	N.A= Sin θ
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
				Avg. Value of θ = ______	**Avg. Value of N.A = ______**

Note: - Numerical Aperture is constant for a given OFC. It is a fundamental parameter which is required for any communication system employing an OFC. An X-Y bed with heavy bed was found to be ideally suitable for this measurement and we have obtained quite consistent results for the two fibers used.

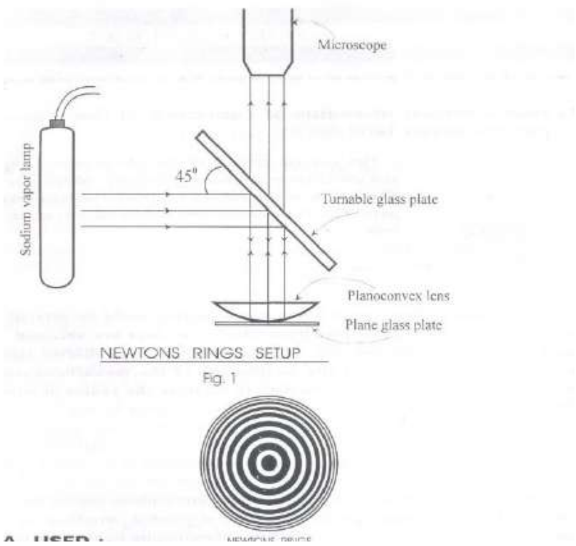
Cable-1, which has smaller value of NA, is of betterquality.Cable-2, with almost double the NA, is of inferior quality. As expected, higher attenuation of sound was found in the case of the second cable (with higher value of NA) compared to the first cable.

Results:-

1. Numerical aperture of the fiber optic cable-1, NA=__________

   Acceptance angle for cable-1, θ^o =__________

Ray diagram



OBSERVATIONS

Smallest division on the main scale N_1 = ------------------------------ cm.

Number of divisions on the Vernier scale N_2 = ------------------------------div.

Least count of traveling microscope ` N_1/N_2 = ------------------------------cm.

TR=MSR+ (VSR x LC)

Ring number	**TRAVELLING MICROSCOPE READINGS**						**Diameter in cm D=(x_1~x_2)**	**Diameter in m D 10^{-2}m**	**D^2**
	LEFT SIDE			**RIGHT SIDE**					
	MSR	**VSR**	**TR (x_1)**	**MSR**	**VSR**	**TR (x_2)**			
10									
8									
6									
4									
2									

NEWTON'S RINGS

AIM: To find the wave length of sodium light by measuring diameter of Newton's rings and radius of curvature of Plano convex lens.

APPARATUS: Traveling microscope, Sodium vapor lamp, Newton's rings apparatus, Magnifying lens,

THEORY: - Superposition of two or more waves is called interference there are two types of interference namely

1. Constructive interference

2. Destructive interference

From the theory of interference at this film

The path difference between the successive reflected rays is P.D**. =2µtCosr**

Where µ is Refractive index, t is Thickness of the film r is angle of refraction for normal incidence r=0

Since the reflection at the point takes place in the denser medium there is a phase change of π or P.D. of λ/2

Therefore **P.D. =2µtCosr+ λ/2**

Newton's rings are formed due to interference between the waves reflected from the top and bottom surfaces of the air film formed between the Plano convex lens and the glass plate.

From the theory of thin film, we have

Path difference between reflected and refracted rays

P.D.=2µtCosr+ λ/2, for air µ=1, and r=0 for normal incidence

P.D.=2t+ λ/2

From the property of the circle if we calculate we get

$t=r^2/2R$ Where t – is thickness of the air film r- radius of particular ring R- radius of curvature of the Plano convex lens

$PD= 2r^2/2R +\lambda/2$

$PD=r^2/R+ \lambda/2$

For bright rings PD=nλ For Dark rings PD=(2n+1) $\lambda/2$

n $\lambda=2r^2/2R+\lambda/2$ but r=D/2 (2n+1) $\lambda/2=2r^2/2R+\lambda/2$

(2n-1) $\lambda/2=D^2/4R$ nλ=r2/R but r=D/2

D2=2λR(2n-1) n$\lambda=D^2/4R$

Dα $D^2=4n\lambda R$ Dα

Diameters of the bright rings are α to the Diameters of the bright rings are α to square roots of odd natural numbers as square roots of natural numbers

(2n-1) is odd no.

PROCEDURE:

The surface of the Plano convex lens and the glass plates are thoroughly cleaned. The Plano-convex lens is placed over the glass plate. The apparatus is set up as shown in the figure.

Light from the sodium vapor lamp is made to fall on the glass plate, which is kept inclined at an angle of 45^0 to the horizontal. The beam gets reflected from the top and bottom surfaces of the thin air film enclosed between the surfaces of the convex-lens and the glass plate due to interference between these two rays, alternate dark and bright rings are formed, a T.M. is kept vertically above the ring system. The T.M. is focused on the ring system. Its position is adjusted so that the point of intersection of the cross wires is at the center of the ring system. The T.M. is moved by means of the tangential screw, from central dark spot to the left hand side, counting the number of dark rings. Vertical cross wire is made to lie on 10^{th} dark ring. The readings of the MSR and VSR are taken. The TM is moved towards the right side of the cross wire is made to lie on 8^{th} ,6^{th} , 4^{th} and 2^{nd} dark rings and the corresponding readings are taken. After reaching the center of the ring system the microscope is moved towards the right side of the center dark spot .Now cross wire is adjusted for 2^{nd}, 4^{th}, 6^{th}, 8^{th} and 10^{th} dark rings and note down the readings. The TM is always moved in the same direction to avoid the error due to back lash, then difference between two readings at left and right of the same rings will gave diameter of the ring. Find out the wave length and radius of curvature of Plano convex lens using the following formulas.

, given R=1m, given $\lambda=5893\text{x}10^{-10}$ m

RESULTS:

1. Wave length of sodium vapor lamp: λ= --------------------------------m.

2. Radius of curvature of given Plano convex lens: = -------------------- m.

VIVA QUESTIONS ON UNIFORM BENDNG

1. **Define Young's modulus**
   Ans It is a ratio of longitudinal stress (Force per unit area) to the longitudinal strain (Change in length per unit length) within elastic limit is called Young's modulus.
   i,e Y= Longitudinal stress/Longitudinal strain

2. What is elasticity?
Ans The property of body by virtue of which it tends to regain its original shape and size after removal of deforming forces.

3. Define stress and write its units.
Ans The restoring force per unit area of the body is called stress. Its unit is Newton/m^2

4. Define strain and write its units.
Ans The ratio of change in any dimension of a body to the original dimension is called strain. It has no units

5 How many types of stress are there?
Ans There are three types of stress 1) Longitudinal stress 2) Volume strain
3) Shearing stress

6. How many types of strain are there define them.
Ans There are three types of strain 1) Longitudinal strain 2) Volume strain
3) Shearing strain
1) Longitudinal strain: When a change of length takes place, the strain is known as longitudinal strain. It is measured by a change in length per unit length.
2) Volume strain: The change in volume per unit volume is called volume strain.
3) Shearing strain: The change in an angle of a body is called shearing strain.

7. State Hook's law.
Ans Hook's law states that within elastic unit the stress is directly proportional to the strain.

8. What is least count?
Ans The smallest value of a physical quantity which can be measured acurately with in an instrument is calles least count.

9 What is meant by elastic limit?
Ans There is maximum value for the deforming forces beyond which the body causes to be elastic. This is maximum value of deforming forces is called elastic limit of the body.

10 Define Rigidity modulus.
Ans The ratio of tangential force per unit area to the angular deformation produced is called rigidity modulus.

11 Define Bulk modulus.
Ans It is the ratio of volume stress to the volume strain. Its unit is N/m^2.

VIVA QUESTIONS ON QUESTIONS:TORSIONAL PENDULUM

1. **What is torsional pendulum?**
   Ans: It is a heavily circular disc suspended from one end of a fine wire attached to it scentre.
2. **Define rigidity modulus.**
   Ans : It is defined as the ratio of the tangential stress to the shearing strain.
3. **What is inertia?**
   Ans: The property of a body due to which it opposes any change in its state of rest or of uniform

4. **What is moment of inertia?**
   Ans: The inability of a body to rotate by itself.
5. **What is torsiona loscillation?**
   Ans: Oscillation of a body under the action of a torque.
6. **What is period?**
   Ans :Time taken for one oscillation.
7. **If the length of suspended wire increased, what happens to period?**
   Ans :Period also increases.
8. **What is the unit of moment o finertia?**
   Ans:g-cm^2 (in CGS system), Kgm^2 (in MKS and SI system

VIVA QUESTIONS ON:SERIES AND PARALLEL "LCR" CIRCUITS

1. What is capacitor? Define capacitance.

Ans Capacitor or condenser:- An electric condenser which can store a charge.
Capacitance:- A capacitance of a conductor is defined as a ratio of charge per volt.i.e.C=Q/V

2. What is an inductor?

Ans Thee.m.f. induced in a circuit due to a changing electric current in thecircuit.

3. What do you mean byresonance?

Ans It is the phenomenon of making a particle to vibrate with its natural frequency under the influence of another vibrating particle with the same frequency is calledresonance.

4. What do you mean by sharpness of resonance?

Ans The sharpness of resonance is a measure of fall of current amplitude from its maximum value at resonant frequency on either side ofit.

5. What is meant by Henry, Ohm &Faraday?

Ans Henry:- It is the S.I. unit of self and mutual inductance, 1 Henry = 1 Weber/Ampere. Ohm:- Itisdefinedastheresistanceofacolumnofmercury106.3cmlonghavingamass144452 Gram&auniformcrosssectionalareaat0^0c.Aresistancehavingap.d.of1voltwhenone ampere of current is passed through it is unit of electrical resistance. Faraday:-It is the quantity of electricity required to liberate or deposit 1 gram equivalent of anion.

6. What is meant by resonance frequency?

Ans The frequency at which both reactance's X_L & X_C becomes equal is called resonant frequency

7. What is Q –factor?

Ans The ratio of V_L or V_C with applied voltage at resonant frequency is called voltage Magnification and denoted by Q – factor, Q=V_L/v = 1/R x √LC

8. What is bandwidth?

Ans Bandwidth = $f_2 - f_1$.

9. How do you obtain cut off frequency in series andparallel?

Ans In series cut off frequency = I_{max} / √2. In parallel cut off frequency = I_{max} x √2

10. Explain the variation of current in twocircuits.

Ans In series:- total impedance of a circuit is equal to resistance Z=R which is minimum, hence maximum current flows through the circuit at resonance. In parallel:- X_L > X_C, so impedance maximum & current minimum.

11. What is impedance?

Ans It is a measure of the resistance offered by a circuit to an a.c.

12. How do you identify the resonance in ac circuit?

Ans The current is maximum at resonant frequency in a series circuit. The Current will be minimum at resonant frequency in parallel circuit.

VIVA QUESTIONS ONFERMI ENERGY

1. Define Fermienergy.

Ans The energy of the highest occupied level at zero degreeabsolute temperature.

2. Define mean freepath.

Ans Itistheaveragedistancetraveledbytheconductionelectronsbetweenanytwosuccessive collisions with the Latticeions.

3. On what factors the Fermi energy depends.

Ans Fermi energy depends on electronconcentration.

4. Define Fermi temperature.

Ans The temperature at which the average thermal energy of the free electron in asolid becomes equal to the Fermi energy at0^0K.

5. Define density of states.

Ans The number of available states per unit volume per unit energy centered at given Ein valenceband.

6. What are valence electrons?

Ans The electrons in the outermost orbit of any atom of any element are calledvalence electrons.

7. Explain the variation of resistivity with temperature.

Ans In case of metal as the temperature increases the resistivity of the metal alsoincreases.

8. What is Fermi factor?

Ans The Fermi function f(E) gives the probability that a given available electron energy state will be occupied at a given temperature.

9. Write the difference between classical and quantum theories.

	Classical free electron theory	Quantum free electron theory
1.	The energy values of free electrons are not quantized and are continuous.	The energy values of the free electrons are quantized and are discreet values.
2.	Classical free electrons obey Maxwell's – Boltzmann Statistics.	Quantum free electrons obey Fermi-Dirac statistics.

VIVA QUESTIONS ONSERIES AND PARALLEL COMBINATIONS OF SPRING

1. **What is meant by periodic motion?**

Ans: Motion which repeats after every regular interval of time. For example motion of the all the planets around the sun and satellites around the planets.

2. **What is an oscillatory or vibratory motion?**

Ans: Bounded periodic motion.

3. **What if the difference between periodic and oscillatory motion?**

Ans:Periodic motion repeats after regular interval of time but oscillatory is repeats after regular interval of time within well-defined limits.

4. **What is simple harmonic motion?**

Ans:Simple harmonic motion is one in which the acceleration of the body is directly proportional to its displacement from the fixed point and always directed towards the fixed point.

5. **What are the characteristics of S.H.M.?**

Ans: The characteristics of S.H.M are Displacement, amplitude, velocity, acceleration, time period, frequency and Phase difference etc.

6. **State Hook's law for vibrating springs.**

Ans: Hook's law states that within elastic limit the tension in the spring is proportional to the extension of spring beyond its length. i.e. $T = -k\,x$ where T is the tension or force in the string, k is known as spring constant and x is known as displacement of the spring .

7. **In how many ways springs arranged?**

Ans: In two ways horizontal and vertical combination.

8. **What is the effective spring constant of springs when connected in series? The equivalent spring constant is givenby**

Ans:$\frac{1}{kequ} = \frac{1}{k_1} + \frac{1}{k_2} \dots\dots\dots = \frac{1}{k_n}$ wheren=1,2,3,4

9. **What the effective spring constant is of springs when connected in parallel? The equivalent spring constant is given by**

Ans: $k=k_1+k_2 \dots\dots\dots + k_n$ where n=1,2,3,4

10. **What is the expression for time period of oscillation of oscillating spring?**

Ans: In both the case $T = 2\pi\sqrt{\frac{mass}{Stiffness\ factor}}$

VIVA QUESTIONS ON:DIFFRACTION GRATING

1. **What do you mean by diffraction of light?**

Ans A beam of a light bends round the corner of the obstacles (edges of opaque lines of the grating) enters into the geometrical shadow. This phenomenon is called diffraction.

2. **What are the differences between the interference &diffraction?**

Ans a) Interference is the result of interaction of light coming from two different wave front originating from the same source whereas diffraction is the result of interaction of light coming from different parts of the same wave front. b) The width of the fringes in interference are always equal where as in diffraction they never be equal.

3. **How many types of diffraction are there? Name them how they are obtained**.

Ans a) Fresnel's diffraction:- Fresnel's diffraction is obtained by placing the source & the screen at finite from the aperture of obstacle having sharp edges. b) Fruanhoffer diffraction:- It is obtained by placing source and screen at infinity.

4. **What is meant by grating constant?**

Ans The distance between any two successive slits is called grating constant.

5. **Mention one of the applications of diffraction grating.**

Ans It is used to measure wavelength of different color.

6. **Whether mercury source is monochromatic?**

Ans No, it is not a monochromatic source.

7. **Whether intensity of diffraction pattern varies? Explain.**

Ans Intensity varies from maximum to minimum. As the order of the spectrum increases the intensity decreases.

8. **What is the condition to have diffraction by grating?**

Ans The width of lines drawn on glass plates should be equal to wave length of used light.

9. **What happens when the number of lines N per inch increased or decreased?**

Ans If N increased we get few order number of bands separated by large angle. IfN decreased we get several order number of bands separated by small angle.

10. **What do you mean by diffraction of light?**

Ans When light passes by the edge of an opaque obstacle it bends slightly in to geometrical shadow.Thispropertyoflightwavesofbendingroundcornersiscalleddiffractionoflight.

VIVA QUESTIONS ON NUMERICAL APERTURE OF AN OPTICAL CABLE

1What is optical fiber?

Ans: Optical fiber is a transparent dielectric media which can able to guide visible or IR light through long distance.

2. On which principle optical fiber works?

Ans: It works on the principle of Total internal reflection.

3. Define critical angle.

Ans: It is the angle of incident for which angle of refraction is equal to 90^o

4. State Snell 'slaw.

Ans: The ratio of angle of incident to angle of refraction is constant and is equal to refractive index

5. What is angle of acceptance?

Ans: It is the maximum angle of a ray surrounding the axis of optical after refraction into the core of an optical fiber under goes total internal reflection.

6. What is acceptance cone in optical fiber?

Ans: Acceptance cone is derived by rotating the ray of light around the axis of optical fiber by keeping angle of acceptance constant. Any signal light ray enters into core of an optical fiber undergoes TIR, and any signal light ray which enters into the core of an optical fiber out the cone of acceptance does not undergoes TIR.

7. What is numerical aperture of an optical Fiber?

Ans: The Numerical Aperture (NA) is a measure of light gathering capability of an optical fiber. The NA is related to the acceptance angle θ_o

N.A. = $\sin\theta_o$ Which indicates the size of a cone of light that can be accepted by the fiber.

8. What are the types of optical fiber?

Ans: There are three types of fiber optical cable viz (1) single mode (2) multimode and (3) graded index multimode optical fiber

9. What if fractional index change?

Ans: It is the ratio of difference of the refractive indices of the core and cladding to the refractive index of core of an optical fiber.

10. What is V number in fiber optics?

Ans: The V number is a dimensionless parameter which is often used to calculate the number of modes of an optical fiber.

11. What is refractive index profile?

Ans: It is the curve which indicates the variation of refractive index of an optical fiber with respect to the radial distance.

12. What is the difference between single and multi-mode optical fiber? The dimensions (Geometry) and ray diagram,

Ans: Only in case of graded index multi-mode optical fiber all the parameters i.e. geometry, refractive Index profile and ray diagram also changes.

13. What is attenuation?

Ans: The loss in the strength of signal light when it is propagating through core of an optical fiber over a long distance in the homogenous medium is known as attenuation.

14. What are the factors which effects the attenuation of an optical fiber?

Ans: The attenuation of an optical fiber is due to: - absorption of signal light due to Impurities (presence of TM Ions such as iron cobalt copper etc in the fiber material), hydroxyl ions, intrinsic absorption, Rayleigh scattering, unburnt starting material, micro crystallites, presence of air bubbles, microscopic and macroscopic radiation.

15. What are the applications of the optical fibers?

Ans: In data link cables, local area network, submarine cables, sensing device etc

16. What are advantages of optical fiber cable over metallic cables?

Metallic cables	**Optical fiber cable**
Diameter = 76mm	Diameter = 13 mm
Twisted copper wires = 900	Fiber strands = 12
Transmission = 21000 channels	Transmission = 3 lakh channels
Weight of 1 m cable = 7 kg/m	Weight of 1 m cable = 0.06 kg/m

VIVA QUESTIONS ON QUESTIONS ON NEWTON'S RNGS

1. **What is the basic principle of Newton's rings experiment?**
   The basic principle of Newton's rings experiment is interference phenomenon.
2. **Define interference phenomena?**
   Interference is a phenomenon in which two or more waves superpose to form a resultant wave of greater or lower amplitude (intensity).
3. **What is constructive interference and destructive interference?**
   When two or more light waves superpose such that the resultant intensity at a point increases then it is called constructive interference, when two or more light waves superpose such that the resultant intensity at a point decreases then it is called destructive interference.
4. **What are Newton's Rings?**
   Alternate dark and bright concentric rings with central dark spot are called Newton's Rings.
5. **Why the rings are circular?**
   The locus of the points having equal thickness of the air film is a circle. Therefore, the rings are circular in nature.
6. **What is the purpose that the glass plate is to be inclined at 45^0 in this experiment?**
   To have normal incidence of light on the arrangement of Plano convex lens and the flat glass plate.
7. **Why the center of the fringe pattern is dark?**
   Because the Plano convex lens and the plane lens are in contact.
8. **Which light do you use in this experiment?**
   Monochromatic light i.e. Sodium light. (For strictly speaking, sodium light consists of two wavelengths $5890A^0$ and $5896A^0$).
9. **What will happen if we use white light in this experiment?**
   Colored fringes will form.
10. **If you replace yellow light with green light, is there any difference in the fringe pattern?**
    No, because both yellow and green are monochromatic light only.