"Education for Knowledge, Science and Culture"
-Shikshanmaharshi Dr. Bapuji Salunkhe
Shri Swami Vivekanand Shikshan Sanstha, Kolhapur

Vivekanand College, Kolhapur (Empowered Autonomous).

Department of Physics

B.Sc. Part-II SEM III Examination (2023-24)
Thermal and statistical Mechanics I

Date : Total Marks: 15
Day : Time :

Instructions:-

1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of log table and calculator is allowed.

Q.1) Select correct alternative **(3)**

1. According to kinetic theory of gases, all gas molecules are ... in terms of shape and size.

a) Identical
b) Different
c) Double
d) None of above

2. Which of the following is monoatomic gas..?

a) H gas
b) N2 gas
c) CH4 gas
d) O2 gas

3. Mean free path of gas molecule is..... to pressure of gas molecule

a) directly proportional
b) inversely proportional
c) is equal to
d) two times

Q.2 Attempt any THREE **(12)**

1. Write a short note on postulates of kinetic theory of gases
2. Derive the relation for mean free path of gas molecule
3. Derive the relation for the coefficient of diffusion of the gas molecule using kinetic theory of gases.
4. Derive the relation for the coefficient of diffusion of the gas molecule using kinetic theory of gases.

SET I

"Education for Knowledge, Science and Culture"
-Shikshanmaharshi Dr. Bapuji Salunkhe
Shri Swami Vivekanand Shikshan Sanstha, Kolhapur

Vivekanand College, Kolhapur (Autonomous).

Department of Physics

B.Sc. Part-II SEM IV Examination (2023-24)

Optics

Paper IV Section II (Paper code: **DSC-1001D2**)

Date : Total Marks: 15

Day : Time :-

Instructions:-

1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of log table and calculator is allowed.

Q.1) Attempt the following

A] Choose the correct alternative (3)

1. In a wave getting reflected from a denser medium, the additional phase difference introduced is .....

   a) 0 b) $\pi/2$ c) π d) 2π

2. Two sources are said to be coherent if they have .....

   a) same wavelength b) constant path difference
   c) constant phase difference d) all the above

3. In parallel faced thin film, the path difference between successive bands is .....

   a) $2\mu t\sin(r)$ b) $2\mu t\cos(r)$
   c) $\mu t\sin(r)$ d) $\mu t\cos(r)$

OR

A] Choose the correct alternative (3)

1. In Newton's ring experiment the diameter of the 15^{th} ring was found to be 0.59cm and that of 5^{th} ring was 0.336cm. If the radius of plano convex lens is 100 cm, calculate the wavelength of light used.

Q.2 Attempt any ONE (08)

1. How Newtons rings are formed? Obtain an expression for the radius of n^{th} dark ring.
2. Discuss the conditions to obtain interference due to reflection of light from thin, parallel film.

Q.3 Attempt any ONE (04)

1. Explain Lloyd's single mirror experiment to measure the wavelength of monochromatic source used.
2. Describe Newton's ring experiment for the determination of wavelength of the light used.
3. Describe Newton's ring experiment to determine the refractive index of the given liquid.

Internal Attendance

Thermal & Statistical Mechanics - I.

B.Sc. II

2023 - 24.

Sr. No.	Name of student	Seat No.	Sign.
1)	Sakshi Raju Biranje	7726	SRBiranje
2)	Ritu R. Nishad	7731	Rlishad
3)	Tanishq Anil Mude	7730	
4)	Prasad P. Gurav	7729	
5)	Vedant M. Mangaonkar	7718	
6)	Shivaji R. Jadhav	7939	
7)	R.Vrushabh R. chougule	7727	
8)	Sahil C. Patnekar	7733	
9)	Sanika J. Kalamkar	7708	
10)	Aprita J. Patil	7714	
11)	Riya D. Patil	7732	
12)	Shridhar S. Jadhav	7706	

VIVEKANAND COLLEGE KOLHAPUR (Empowered Autonomous) ESTD JUNE 1964

।। ज्ञान, विज्ञान आणि सुसंस्कार यांसाठी शिक्षण प्रसार ।।
– शिक्षणमहर्षी डॉ. बापूजी साळुंखे

06887

Shri Swami Vivekanand Shikshan Sanstha Kolhapur's

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Thermal & statistical

Suppliment No. :

Roll No. : 7781

Class : B.Sc. SY

Signature of Supervisor

Subject : Physics.

Test / Tutorial No. :

Div. :

06/10

Q.1 1) b) different. ✗

2) a) H gas. ✓

3) b) inversely proportional. ✓

2

VIVEKANAND COLLEGE KOLHAPUR (Empowered Autonomous) ESTD JUNE 1964

Q.2 1) Postulates of kinetic theory of gases.

1) Molecules

A gas is composed from a small indivisable particle is called molecules the same gases of molecules are alike & differ from other gas

three types of molecules.

1) monoatomic - He gas Ne gas.
2) diatomic : H_2 gas O_2 gas.
3) Polyatomic : CH_4 gas

2) the same gas molecules are identical in all aspects they have same mass shape & size but different gas molecules having diff properties.

3) Volume.

The volume of gas molecule are negligible compared the vassel volume.

4) Molecules have no inter molecular force of attraction of ripelction.

5) Pressure is not depends upon the no. of Particles it is depends on force or area.

$$P = \frac{f}{A}.$$

Kinetic energy does not depends upon the no. of molecules.

।। ज्ञान, विज्ञान आणि सुसंस्कार यांसाठी शिक्षण प्रसार ।।

– शिक्षणमहर्षी डॉ. बापूजी साळुंखे

06888

Shri Swami Vivekanand Shikshan Sanstha Kolhapur's

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor	

Suppliment No. :

Roll No. : 7732

Class :

Subject : Thermal & Statistical

Test / Tutorial No. : Internal Exam.

Div. :

07/10

Q.1

1) a) Identical.

2) a) Hgas.

3) b) Inversely Proportional.

3

2)

1) Molecules : Molecules are ~~ident~~ indivisible small particles, These particles are called molecules.
There are 3 types of molecules - Mono, Dia & Poly.

(2) The molecules of the same gases are identical in shape & size while they differe from other gas molecules.

(3) Intermolecular forces : The intermolecular force b/w the gas molecules is negligible.

(4) Volume : Volume occupies by gas in neglible to that of the container.

(5) Pressure - Gas exerts pressure on the walls of the container.

$$P = \frac{F}{A}.$$

(6) Elastic collision - The molecules of the gas undergo Elastic collision i.e. there is no loss or gain of energy during collision.

(7) K.E - The kinetic energy of the gas depends on the absolute temperature & not on the nature of the gas.

2)

2) Mean free Path :

Consider n no. of molecules per c.c. The total mass of the gas is divided into infinitesimal ~~parallel~~ parallel layers whose thickness is same as that of a single molecules.

Shri Swami Vivekanand Shikshan Sanstha, Kolhapur's

Vivekanand College, Kolhapur

(Empowered Autonomous)

Department of Physics

B. Sc. / M.Sc. Part – II, Semester – IV, PHYSICS Paper - IV Section II

Title of the Paper: Optics

Name of Teacher: Dr. Sumayya I. Inamdar

Attendance Sheet

Sr. No.	Name of the Student	Seat No.	Sign
1)	Sakshi Raju Birange	7726	S.R.Birange
2)	Ritu. R. Nishad	7731	R.Nishad.
3)	Tanishq Anil Mude	7730	
4)	Prasad. P. Gurav	7729	
5)	Vedant M. mangamkar	7718	
6)	Shivaji R. Jadhav	7939	
7)	Vrushabh R. chougule	7727	
8)	Sahil. C. Pathekar	7733	
9)	Sanket. J. kalamkar	7708	
10)	Arpita. J. Patil.	7714	
11)	Riya D. Patil	7732	
12)	Shridhar. S. Jadhav	7706	
13)	Ritesh. S. Sawtekar	7725	
14)	Abhijeet. A. Kalake	7707	
15)	Aditya. A. Ardalkar.	7701	
16)	Ganesh V. Khot	7943	
17)	Omkar S. Misal	7722	
18)	~~Avishkar J. Kamble~~	7709	
19)	Atharv N. Kognolikar	7721	
20)	Aditya Y. Kaundade	7719	

VIVEKANAND COLLEGE KOLHAPUR (Empowered Autonomous) ESTD JUNE 1964

21)	Kirti. V. Mudshinge	7713					
22)	Prachiesha T. Shinde	7715					
23)	Gaurav. A. Dadarne	7717					
24)	Vikrant R. Surve	7716					
25)	Chougule Bateek A	7703					
26)	Tejas Santosh Ganbavale	7720					
27)	Harshvardhan D. Patil	7932					
28)	Gauri Tanaji Dalvi	7704					
29)	Vishakha M. chougule	7928					
30)	Krushna Petkar	7710					
31)	Janhavi Mane	7712					
32)	Ananya Desai	7705					
33)	Samruddhi S. Ranmale	7934					
34)	surekha T. Desai	7728					
35)	Sandhya k Vadichorla	7581					
36)	Sujata k Bhojam	7702					
37)	Manee Mariya M.	7929					
38)							
39)							
40)							
41)							
42)							
43)							
44)							
45)							
46)							
47)							
48)							
49)							

VIVEKANAND COLLEGE KOLHAPUR (Autonomous) ESTD JUNE 1964

॥ ज्ञान, विज्ञान आणि सुसंस्कार यांसाठी शिक्षण प्रसार ॥
- शिक्षणमहर्षी डॉ. बापूजी साळुंखे

Shri Swami Vivekanand Shikshan Sanstha Kolhapur's 51273

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor: 15/15

Riya Dattatray Patil
Suppliment No. : 1+2 = 3
Roll No. : 7732
Class : B.Sc II

Subject : Physics section II
Test / Tutorial No. : Internal examination
Div. :

Q.1 A)

1) → c) π

2) → d) all of the above.

3) → b) $2\mu t\cos(r)$

B) B) Given:-

→ $D_m = 0.59$ cm, $D_n = 0.336$ cm ; $m = 15$, $n = 5$, $R = 100$

$$\therefore \lambda = \frac{D_m^2 - D_n^2}{4(m-n)R} = \frac{(0.59)^2 - (0.336)^2}{4 \times (15-5) \times 100}$$

$$= \frac{0.3481 - 0.1128}{4 \times 10 \times 100}$$

$$= \frac{0.2313}{4 \times 10^3}$$

$$= 0.0578 \times 10^{-3}$$

$$\lambda = 5780 \times 10^{-8} \text{ cm}$$

(3)

Q.2

2]

→

*** conditions to obtain interference due to reflection of light from thin, parallel film.**

1] consider a thin film of uniform thickness (t) i.e. parallel film made up of transparent material of refractive index (μ)

2] Let AB be ray of monochromatic light having wavelength (λ) incident on thin film with an angle of incidence (i) so that it get partly reflected and along BF and remaining transmitted along BC with angle of refraction (r).

3] The ray BC also partly reflect along CD and remaining transmitted.

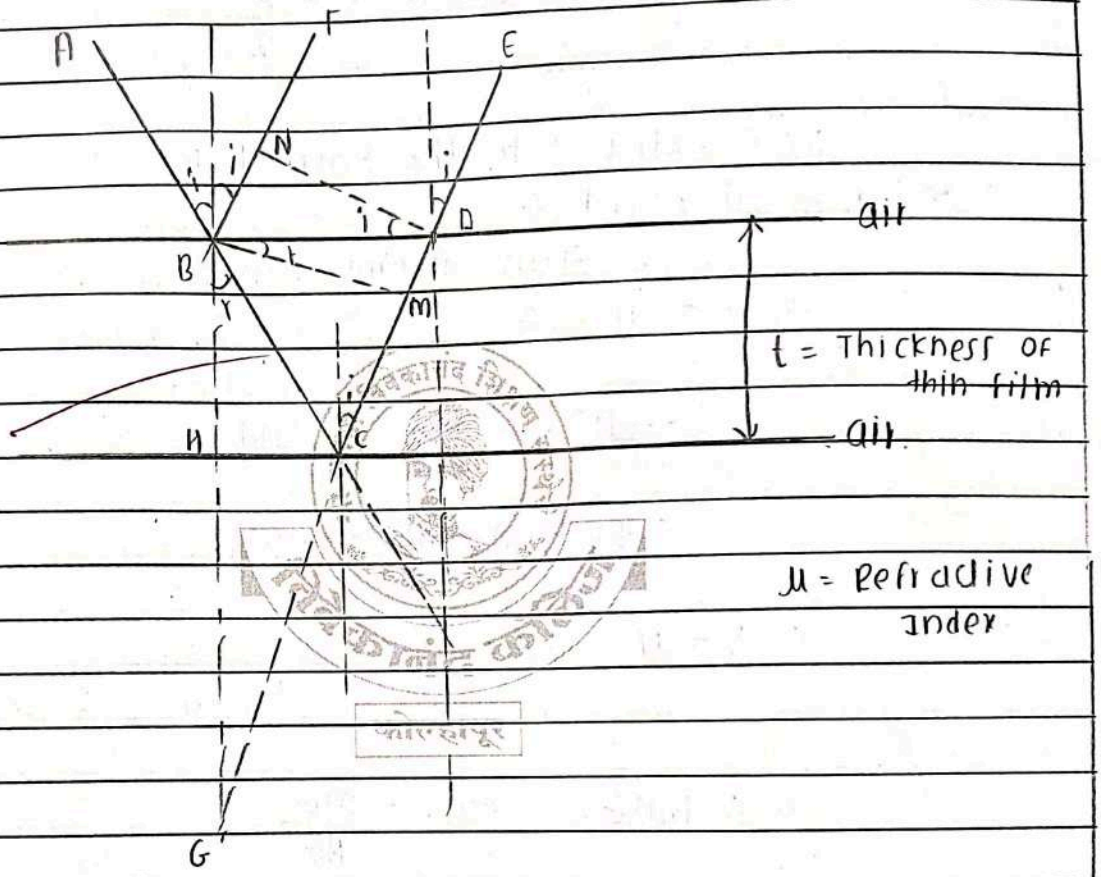
4] The ray DE also shows partly reflection and transmission.

5] Thus, a ray suffers multiple internal reflection so we get a set of parallel beam like BF and DE.

6] Ray BF and DE interfere. The intensity at point B is obtained by path difference between BF and DE.

7] If we draw perpendicular DN to ray BF and perpendicular BM on ray CD, then N.D. represents plane wavefront and optical path difference is given by,

$$\Delta = \mu(BC + CD) - \left(BN + \frac{\lambda}{2}\right) \quad \text{---(1)}$$



Now, by using simple geometry we can write,

$\angle BDN = \angle i$ and $\angle MBD = \angle r$

$$\therefore \mu = \frac{\sin i}{\sin r} = \frac{BN/BD}{MD/BD}$$

$$\therefore \mu = \frac{BN}{MD}$$

$\therefore BN = \mu(MD)$

$\therefore \Delta = \mu(BC+CD) - \left(\mu MD + \frac{\lambda}{2}\right)$

$\therefore \Delta = \mu(BC+CD-MD) - \frac{\lambda}{2}$ ——②

Now extrapolate the normal BN and ray DC to meet at point G

From figure

$\therefore BC = CD = CG$ and

$\therefore DG = BC+CD$ and

$\therefore BC + CD - MD = MG$

$\therefore \Delta = \mu(MG) - \frac{\lambda}{2}$

In $\triangle BMG$, $\cos r = \frac{MG}{BG}$

$\therefore MG = \cos r\, BG$

$\therefore \Delta = \mu \cos r\, BG - \frac{\lambda}{2}$

Here $BG = 2BH = 2t$ ---- (t = thickness of thin film)

$\therefore \Delta = \mu \cos r\, 2t - \frac{\lambda}{2}$

॥ ज्ञान, विज्ञान आणि सुसंस्कार यांसाठी शिक्षण प्रसार ॥
– शिक्षणमहर्षी डॉ. बापूजी साळुंखे
Shri Swami Vivekanand Shikshan Sanstha Kolhapur's 51326
VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)
SUPPLIMENT
Signature of Supervisor
Suppliment No. : 1
Roll No. : 7732
Class : B.Sc II
Subject : physics.
Test / Tutorial No. :
Div. :

$$\therefore \Delta = 2\mu t\cos r - \frac{\lambda}{2} \quad \text{---(3)}$$

case I : For point B to bright, i.e. constructive interference.

$$\therefore 2\mu t\cos r - \frac{\lambda}{2} = n\lambda$$

where, $n = 0, 1, 2, 3 \cdots$

$$\therefore 2\mu t\cos r = n\lambda + \frac{\lambda}{2}$$

$$\therefore 2\mu t\cos r = (2n+1)\frac{\lambda}{2} \quad \text{---(4)}$$

case II :- For poi similary for destructive interferena.

$$\therefore 2\mu t\cos r - \frac{\lambda}{2} = (2n-1)\frac{\lambda}{2}$$

where $n = 1, 2, 3 \cdots$

$\therefore 2\mu t \cos(r) = n\lambda$ ——— (5)

Case III :- †

The conditions for maxima and minima in eqn (4) and (5). These are called cosine laws.

Case III : For infinitesimal $t << \lambda$ hence 1st term is neglected

$\Delta = 2\mu t \cos(r) = \frac{\lambda}{2}$

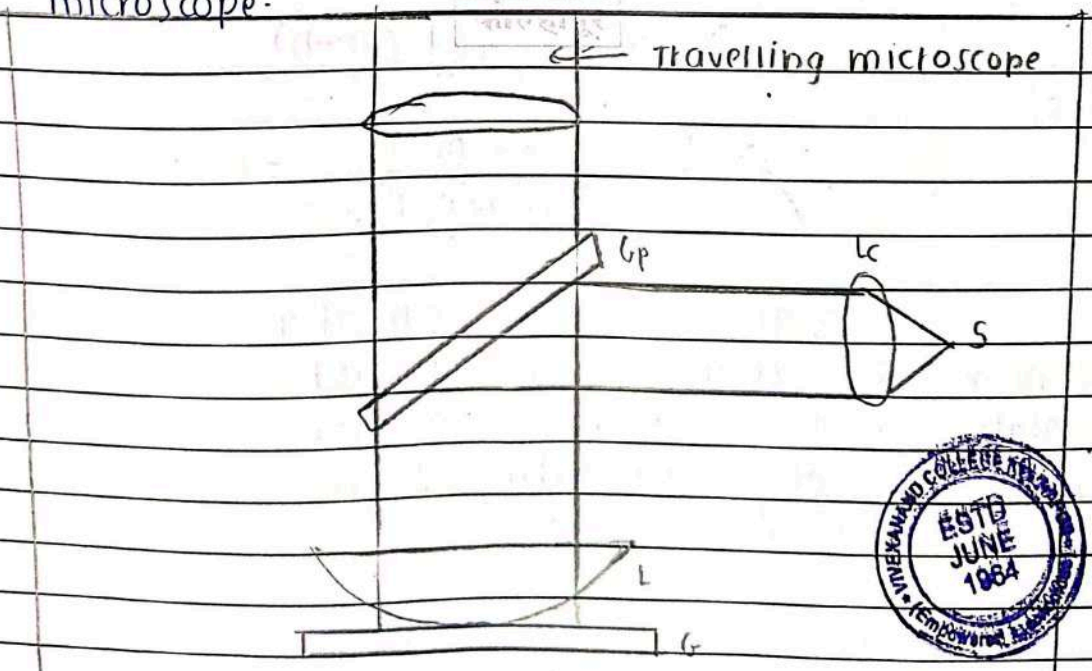
$\therefore \Delta = \frac{\lambda}{2}$ --- This is essential condition for dark fringe.

→ * Determination of wavelength of the light used :-

1) The monochromatic source like sodium lamp which emits wavelength (λ) is placed at a focus of collimating lense (Lc) to produce parallel beam of light.

2) This parallel beam of light incident on glass plate (Gp) inclined at an angle of 45° with horizontal so that it partly reflected and incident normally on plano-convex lense which placed on plane glass ~~plate~~ (G)

3) Thus, the reflected beam from top and bottom surface of air film partially transmitted through Gp and finally observed through travelling microscope.



Set up for newton's ring experiment

4) The observed fringe pattern i.e. concentric circular dark and bright fringes with dark centre.

5) Now measure diameter D_m and D_n of m^{th} and n^{th} rings.

$$\therefore r_n^2 = \frac{D_n^2}{4}$$

$$\therefore r_n^2 = nR\lambda$$

$$\therefore D_n^2 = 4nR\lambda$$

similary for m^{th} ring

$$\therefore D_m^2 = 4mR\lambda$$

$$\therefore D_m^2 - D_n^2 = 4mR\lambda - 4nR\lambda$$

$$\therefore D_m^2 - D_n^2 = 4R\lambda(m-n)$$

$$\therefore \lambda = \frac{D_m^2 - D_n^2}{4(m-n)R} \quad \text{---} (1)$$

6) The radius of curvature R of the conver lens which is in contact with plane glass plate can be obtained from spherometer. The wavelength of illuminating source can be measured by using eqn (1)

।। ज्ञान, विज्ञान आणि सुसंस्कार यांसाठी शिक्षण प्रसार ।।
– शिक्षणमहर्षी डॉ. बापूजी साळुंखे
Shri Swami Vivekanand Shikshan Sanstha Kolhapur's 51338
VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

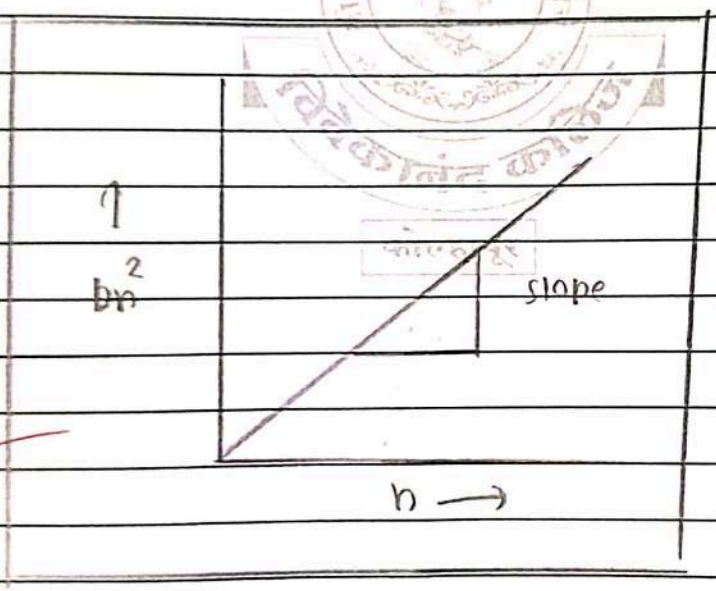
SUPPLIMENT

Signature of Supervisor

Suppliment No. : 2
Roll No. : 7732
Class : B.Sc II

Subject : physics.
Test / Tutorial No. :
Div. :

7) If diameter D_n of large number of rings will be measured then graph of D_n^2 vs n will be straight line as shown.



$\therefore$ slope $= 4R\lambda$

$\therefore \lambda = \frac{\text{slope}}{4R}$

।। ज्ञान, विज्ञान आणि सुसंस्कार यांसाठी शिक्षण प्रसार ।।

– शिक्षणमहर्षी डॉ. बापूजी साळुंखे

Shri Swami Vivekanand Shikshan Sanstha Kolhapur's 51293

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor: 15/15

Name:- Avishkar Sudesh Kamble

Suppliment No. :

Roll No. : 7709

Class : B.Sc -II

Subject : Physics [Optics]

Test / Tutorial No. :

Div. : A

Q.1.

A)

(1) c) π

(2) d) all of the above

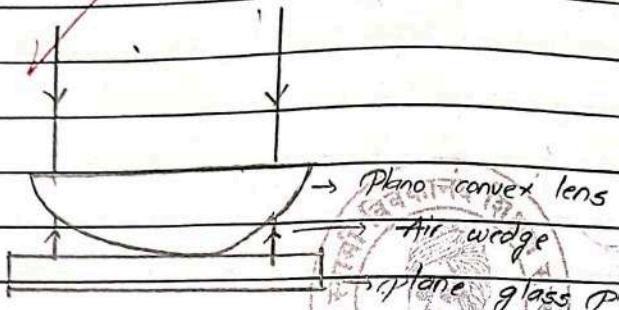
(3) b) $2\mu t \cos(r)$

03

Q. 2.

1. Air wedge is formed when a plano-convex lens placed on optically plane glass plate. When a monochromatic light incident on air film (wedge) the get reflected & observed a set of concentric circular fringes with dark centre corresponding to equal thickness of air film (wedge). And this rings is known as Newton's rings.

Formation of Newton's rings.



Formation of Newton's ring

When a monochromatic light of wavelength (λ) is incident on air wedge it get reflected from top and bottom surface of air film (wedge). The reflected ray suffers a phase change of π / i.e path difference $\lambda/2$ introduced due to reflection light reflects from denser surface i.e surface of glass plate. The reflected rays interfere to produce circular fringes at point of contact of glass plate and lens.

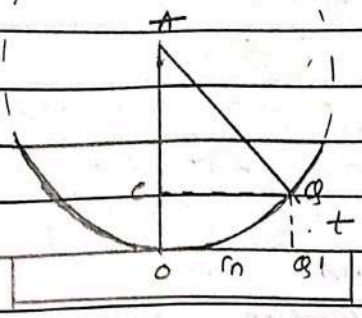
For dark fringe

path difference,

$$\Delta = 2\mu t \cos(r+\lambda) + \lambda/2 = (2n+1)\lambda/2$$

The thickness of air film at point of contact is $t=0$

$\therefore$ The above condition is satisfied and centre is dark.



Consider plano - convex lens with large radius of curvature R placed on plane glass plate to form air wedge.

When a monochromatic light incident on the air wedge the light get reflected from top & bottom surface of air film (wedge). The ray suffers a phase change of π since the light reflected from the surface of denser medium i.e surface of glass plate. And reflected rays produce circular fringes with dark centre.

The total path difference is

$$\Delta = 2\mu t \cos(r+i) + \frac{\lambda}{2} = \frac{(2n+1)\lambda}{2}$$

$$\Delta = 2\mu t \cos(r+i) = n\lambda \quad \text{---------- (1)}$$

Condition for bright band.

$$2\mu t \cos(r+i) + \frac{\lambda}{2} = n\lambda$$

$$\therefore 2\mu t \cos(r+i) = \frac{(2n-1)\lambda}{2}$$

Similarly, for dark band

$$2\mu t \cos(r+i) + \frac{\lambda}{2} = \frac{(2n+1)\lambda}{2}$$

$$2\mu t \cos(r+i) = n\lambda$$

Consider for thin air film & normal incidence of light

$\mu = 1 \quad r = 0 \;\&\; \alpha \approx 0$

$\therefore \quad \cos(r+\alpha) = 1$

$\therefore \quad 2t = n\lambda$ ——— (2)

eqn (1) $\quad 2\mu t \cos(r+\alpha) = n\lambda$

where r is angle of refraction α is wedge angle. The thickness of air film is t from the point of contact i.e $OQ = r_n$ & $QQ' = t$

for $t = 0$ (in eqn (2)) the condition is satisfied and thickness of air film is $t = 0$ at point of contact

$\therefore$ centre is dark.

For ~~$OQ = r_n$~~ $QQ' = t$ the condition is satisfied & the radius of n^{th} dark ring.

In $\triangle ACQ$

$AQ^2 = AC^2 + CQ^2$

$AQ^2 = (AO - CO)^2 + CQ^2$

$R^2 = (R - t)^2 + r_n^2$

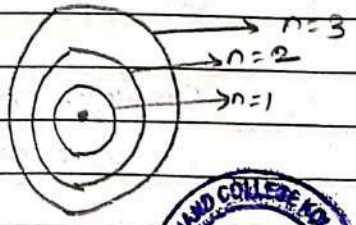
$R^2 = R^2 + t^2 - 2Rt + r_n^2$

$0 = t^2 - 2Rt + r_n^2$

since, $t << R$

$\therefore \quad 0 = -2Rt + r_n^2$

$\therefore \quad r_n^2 = 2Rt$



from the eqn (2)

The radius of nth dark ring is

$r_n^2 = n\lambda R$

$\therefore \quad r_n = \sqrt{n\lambda R}$

॥ ज्ञान, विज्ञान आणि सुसंस्कार यांसाठी शिक्षण प्रसार ॥
– शिक्षणमहर्षी डॉ. बापूजी साळुंखे
Shri Swami Vivekanand Shikshan Sanstha Kolhapur's 51334
VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

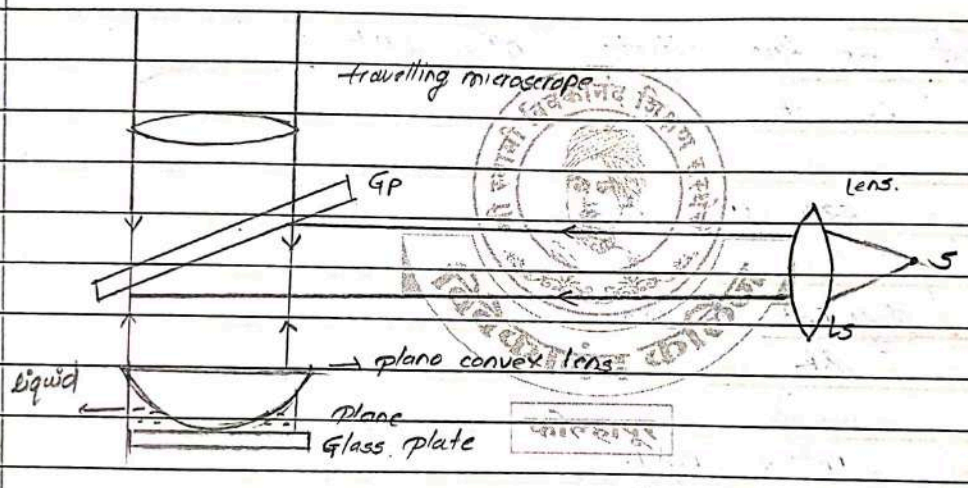
Signature of Supervisor

Avishkar Sudesh Kamble
Suppliment No. :
Roll No. : 7709
Class : B.Sc -II

Subject : Physics [Optics]
Test / Tutorial No. :
Div. : A

Q.8.

(3)



Setup of Newton's ring

In Newton's ring setup few drops of liquid placed on plane glass plate whose refractive index (liquid) to be determined : on which plano-convex lens is placed. In this air wedge is replaced by liquid.

A monochromatic source like Sodium lamp is placed on focus of lens (LS) shown in fig. the lens produce parallel rays. The rays incident on inclined placed glass plate & rays partly reflect normly & incident on plano convex lens and liquid and reflected through

glass plate and observed in travelling microscope. In the surface of liquid clear fringes are obtaind.

Condition for n^{th} dark fringes.

$$2\mu t \cos(r+\alpha) = n\lambda$$

For normal incidence of light

$r = 0$ $\alpha \approx 0$

$$\therefore \quad 2\mu t = n\lambda \quad \text{——— (1)}$$

but we know that $r_n^2 = 2Rt$

$$\therefore \quad t = \frac{r_n^2}{2R}$$

eqn (1) becomes

$$\frac{2\mu r_n^2}{2R} = n\lambda$$

$$r_n^2 = \frac{n\lambda R}{\mu}$$

$$r_n^2 = \frac{D_n^2}{4} = \frac{n\lambda R}{\mu}$$

For n^{th} dark ring diameter.

$$\therefore \quad D_n^2 = \frac{4n\lambda R}{\mu}$$

Similarly, For m^{th} dark ring diameter

$$\therefore \quad D_m^2 = \frac{4m\lambda R}{\mu}$$

$$\therefore \quad D_m^2 - D_n^2 = \frac{4(m-n)\lambda R}{\mu}$$

$$\therefore \quad \boxed{\mu = \frac{4(m-n)\lambda R}{D_m^2 - D_n^2}}$$

Radius of curvature can be measured using ~~spherometer~~ spherometer attachment.

15/15 Pratiksha Shinde

॥ ज्ञान, विज्ञान आणि सुसंस्कार यांसाठी शिक्षण प्रसार ॥
– शिक्षणमहर्षी डॉ. बापूजी साळुंखे

07068

Shri Swami Vivekanand Shikshan Sanstha Kolhapur's

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor:

Suppliment No. :

Roll No. : 7715

Class : B.Sc II

Subject : Physics

Test / Tutorial No. :

Div. :

Optics

Q. 1

1) (c) π

2) (d) all the above

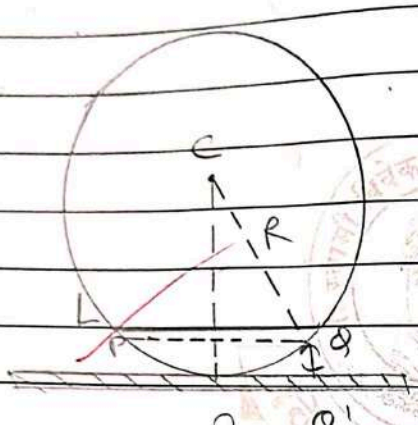
3) (b) $2\omega t\cos(\gamma)$

VIVEKANAND COLLEGE KOLHAPUR (Autonomous) ESTD JUNE 1964

.2

1)

In newton's ring plano-convex lens (L) having large radius curvature (R) for curved surface in air film is the replaced in glass plate 'G'. It is given by,



$QQ' = t$, thickness of air film

$OQ' = R_n$

When a monocromatic light of wavelength (λ) is inde incidence of air wedge, it is reflected from top to bottom surfaces of air films. A phase changes occures for the ray which gets reflection in the air film. The total path difference between the wedge of air film is given by,

$$\Delta = 2\mu t \cos(r+\alpha) + \frac{\lambda}{2}$$

Where (r) is radius of of the air film wedge and (d) is the small air wedge. it is reflected by from top to bottom

surfaces of curve in a glass plate 'G'. The total fringes are obtained. therefore the condition for n^{th} ring of bright band is given by,

$$2\mu t \cos(r+\alpha) + \frac{\lambda}{2} = n\lambda \quad \text{where, } n = 1, 2, 3 - -$$

$$\therefore 2\mu t \cos(r+\alpha) + \frac{\lambda}{2} = (2n-1)\frac{\lambda}{2} \quad \text{---(1)}$$

Also, condition for dark band is given as,

$$2\mu t \cos(r+\alpha) + \frac{\lambda}{2} = (2n-1)\frac{\lambda}{2} \quad \text{---where, } n = 0, 1, 2 - -$$

$$\therefore 2\mu t \cos(r+\alpha) + \frac{\lambda}{2} = n\lambda \quad \text{---(2)}$$

But the air film $t = t$ and $\alpha \approx 0$ then the surface of air film is,

$$2\mu t \cos(r+\alpha) = n\lambda$$

condition for dark band becomes,

$$\therefore 2t = n\lambda \quad \text{---(3)}$$

Since, $QQ' = t$ and it is above equation is satisfied the equation and $OQ' = r_n$

If, we get then its above equation

satisfied for this and the air film is given by. of traingle is of $\triangle AQ'$ is,

$$CQ^2 = CA^2 + AQ^2$$

$\therefore$ $CA = CO - OA = (R-t)$ and
$AQ = r_n^2$

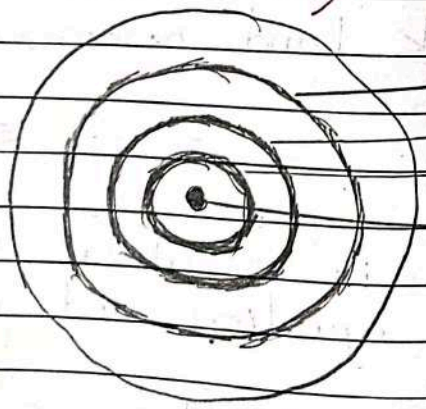
Then,

$$CQ^2 = R^2 = (R-t)^2 + r_n^2$$
$$= R^2 - 2Rt + t^2 + r_n^2$$
$$= R^2 - 2Rt + r_n^2 \quad \text{------}$$

$(\because t << R)$

$$r_n^2 = 2Rt \quad \text{——— from 3rd eq.}$$
$$\therefore r_n^2 = nR\lambda$$
$$\therefore r_n = \sqrt{nR\lambda}$$

This equation is shows that with increasing number with newtons ring is given by



n=3
n=2
n=1, First Fringer
n=0, centre is dark

Pratiksha Shinde.

॥ ज्ञान, विज्ञान आणि सुसंस्कार यांसाठी शिक्षण प्रसार ॥
– शिक्षणमहर्षी डॉ. बापूजी साळुंखे
Shri Swami Vivekanand Shikshan Sanstha Kolhapur's
51413
VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

SUPPLIMENT

Signature of Supervisor

Suppliment No. : 1
Roll No. : 7715
Class : B.Sc II

Subject : Physics
Test / Tutorial No. :
Div. :

Optics

Q. 3

3) ——

→ In Newton's ring experimental setup. few drop's of liquid, it is ~~rep~~ whose refletive is (w) is to be determined is put on the glass plate 'G' over the surface. therfore the condition for n^{th} dark ring is given by.

$$2\mu t \cos(r+\alpha) = n\lambda \quad \text{--- where, } n = 1, 2, 3 \text{ ---}$$

$$2\mu t = n\lambda$$

for the light furm of is,

$$t = \frac{r_n^2}{2R}$$

$$\therefore \frac{1}{2}\frac{\mu \omega n^2}{2R} = n\lambda$$

$$\therefore \mu = \frac{nR\lambda}{r_n^2}$$

$$\therefore D_n^2 = \frac{4n\lambda R}{R^2 \mu}$$

Similarly,

$$D_m^2 = \frac{4m\lambda R}{R.\mu}$$

$$\therefore D_m^2 - D_n^2 = \frac{4(m-n)\lambda R}{R.\mu}$$

$$\mu = \frac{4(m-n)\lambda R}{D_m^2 - D_n^2}$$

This is equation of newton's ring is showing to measure the refractive index of the given liquid.