Date 10/8/15
Page

Experiment - 1

Aim: To compare the wavelength of a laser source measured by diffraction pattern from a single slit and a plane diffraction grating

Apparatus: He-Ne laser, diffraction grating, screen (graph paper), slit (100 lines/mm), scale

Observations:

Zero error in vernier scale = +10

Zero correction = −10

L.C. of main scale = 0.5mm

No. of divisions on vernier scale = 50

L.C. of vernier scale = $\frac{0.5}{50}$ = 0.01 mm

1) Diffraction by slit

Width of the slit

MSR	VSR	Total Reading	Corrected Reading
0 mm	0.30 mm	0.30 mm	0.30 - 0.10 = 0.20 mm

Distance of the screen from slit = 2m

S.No	order of Minima (n)	Pos. of minima (x_n) (cm)	Wavelength
1.	1	0.6	600nm
2.	2	1.3	652 nm
3.	3	1.9	633nm
4.	4	2.6	650nm

2) Diffraction by grating

No. of lines on the grating (N) = 100 lines/mm

Distance from grating to screen = 2m

Date _____
Page _____

S.No	Order of Diffraction Spot (n)	Pos. of spot (yn)	Wavelength
1.	1	12.9 cm	598 nm
2.	2	25.8 cm	612 nm
3.	3	39.8 cm	633 nm
4.	4	52.7 cm	640 nm

10/8/15

17/8/15

Experiment - 2

Aim: To determine the focal length of a combination of two convergent lenses seperated by a distance d using nodal slide assembly and to verify the relation

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 f_2}$$

Apparatus: Nodal slide arrangement, two convex lens, uprights, light source

Observations:

Light incident on	Lens L_1		$f_1 = a - b$	Mean f_1
	Pos. of cross slit (a)	Pos. of lens (b)		
One face	25	43	18	
Other face	25	43	18	18 cm

Light incident on	Lens L2		$f_2 = a-b$	Mean f2
	Pos. of slit (a)	Pos. of lens (b)		
One face	25	45	20	
Other face	25	45	20	20 cm

Table for focal length of combination

S.No	Light on	Distance b/w lens	Pos. of slit (a)	Pos. of upright (b)	F = a-b	Calculated value of F
1.	One face	3.2	26.3	37.1	10.8	10.5
2.	Other face	3.2	26.3	37.1	10.8	10.5

Difference = 0.3 cm

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Experiment 3

Aim: To determine the wavelength of green and violet line of mercury light using spectrometer

Observation:

Least Count of Spectrometer (L.C)

$$1\ M.S = \frac{10}{20} = \frac{1}{2}$$

$$L.C. = \frac{1\ M.S}{\text{Total V.S}} = \frac{1}{2 \times 60} = \frac{1}{120}^{\circ}$$

Order of Spectrum(n)	Color of spectral lines	Left spectrum		Right spectrum	
		a	b	c	d
1	green	$341.5 + \frac{20}{120}$	$161.5 + 0$	$289.5 + \frac{30}{120}$	$228.5 + \frac{20}{120}$
	Violet	$342 + \frac{40}{120}$	$162 + \frac{20}{120}$	$289.5 + \frac{40}{120}$	$214.36 + \frac{60}{120}$

Date
Page 5

Order of spectrum (n)	Color of spectral lines	Left spectrum a	Left spectrum b	Right spectrum c	Right spectrum d
2	green	$338 + \frac{40}{120}$	$157 + \frac{60}{120}$	$359.4 + \frac{40}{120}$	$180.83 + \frac{60}{120}$
				361.49	180.5
	Violet	$336 + \frac{15}{120}$	$155 + \frac{20}{120}$	$+ \frac{15}{120}$	$+ \frac{1}{120}$

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Experiment 4

Aim: To determine the dispersive power of the material of a prism using spectrometer

1 MSD = 0.5°

Observations: Total No. of vernier divisions = 30

LC of Vernier = $\frac{0.5^\circ}{30} = 1'$

S.No	Vernier	Reflected from face AB			Reflected from face AC			2A(a-b)	A
		M.S	V.S	Total (a) in degree	M.S	V.S	Total (b) in degree	in degrees	in degrees
1.	V_1	242.5°	2'	242.53°	361.5°	5'	361.59°	119.36°	59.69°
	V_2	62.5°	0'	62.5°	182°	19'	182.3°	118.8°	59.4°

2. ——— ?

For minimum deviation

S.NO	Colour	Dispersed image telescope in minimum deviation position			Telescope reading for direct image		
		M.S Reading	V.S Reading	Total Reading (a)	M.S Reading	V.S Reading	Total Reading (b)
1.	VIOLET	V_1 125°	V_1 36'	125.30°	V_1 165.5°	V_1 20'	165.51°
		V_2 304°	V_2 24'	304.2°	V_2 345.5°	V_2 25'	345.7°
2.	YELLOW	V_1 129°	V_1 12'	129.1°	V_1 165.5°	V_1 20'	165.51°
		V_2 308.5°	V_2 45'	308.9°	V_2 345.5°	V_2 25'	345.7°
3.	RED	V_1 129°	V_1 25'	129.21°	V_1 165.1°	V_1 20'	165.7°
		V_2 309.5°	V_2 36'	309.8°	V_2 345.7°	V_2 25'	345.7°

ue AC	2A(a-b)	A
Total(b) in degree	in degrees	in degrees
361-59°	119.36°	59.69°
182.3°	118.8°	59.9°

ding for direct

s ding	Total Reading (b)	(a-b) = S	Mean deviation Sm (in degrees)
20'	165.51°	40.2°	40.8°
25'	345.7°	41.5°	
0'	165.51°	36.4°	36.6°
25'	345.7°	36.8°	
20'	165.7°	36.3°	36.1°
25'	345.7°	35.9°	

Experiment 5

Aim: To observe Newton's rings formed by the interference produced by a thin air film and to determine the wavelength of sodium light

Observation Table:

A) Determination of least count of ~~microscope~~ spherometer

Pitch of screw = 1mm

No. of circular divisions = 100

Least count of spherometer = $\frac{1}{100}$ = 0.01mm = 0.001cm

B) Height of plano-convex lens (h)

MSR	VSR	Total	h(mm)
0	28	0.28	0.28
0	29	0.29	0.29
0	27	0.27	0.27

Avg height = $\frac{0.28 + 0.29 + 0.27}{3}$ = 0.28mm

RING NUMBER	Left (R1)			Right (R2)			D(mm) (R1~R2)	D^2(mm) $(mm)^2$
	MSR	VSR	Total	MSR	VSR	TOTAL		
22	2	69	2.69	2	63	2.63	5.32	28.30
20	2	58	2.58	2	52	2.52	5.06	26.01
18	2	46	2.46	2	41	2.41	4.87	23.71
16	2	32	2.32	2	26	2.26	4.63	20.98
14	2	16	2.16	2	9	2.09	4.66	21.26
12	1	90	1.90	1	91	1.91	3.89	15.52
8	1	67	1.67	1	72	1.72	3.39	11.49
6	1	50	1.50	1	52	1.52	3.02	9.12
4	1	26	1.26	1	30	1.30	2.56	6.55
2	0	91	0.91	0	91	0.91	1.02	3.31
0	0	0	0	0	0	0	0	0

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7/10/15

Experiment 6

Aim: To investigate resonance in forced oscillator

Theory: When the natural frequency matches the driving force's frequency, resonance occurs

OBSERVATION TABLE:

	Frequency (f) Hz	Angular freq (ω)	Displacement (y)	Amplitude (cm) (y/2)
1.	0.2	1.256	4	2
2.	0.4	2.513	4.4	2.2
3.	0.6	3.769	4.6	2.3
4.	0.8	5.026	5.6	2.8
5.	1.0	6.283	6.8	3.4
6.	1.2	7.539	10	5.0
7.	1.4	8.796	12.2	6.1
8.	1.6	10.053	10.6	5.3
9.	1.8	11.309	9.4	4.7
10.	2.0	12.566	5	2.5
11.	2.2	13.823	4	2

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19/10/15

Date
Page

Experiment 7

Aim: To find the numerical aperture of an optical fibre

Apparatus: He-Ne Laser, Optical fibre, Microscopic objective, multimeter

Zero Error = 58 mV

S.No	Angular deflection	Detector Reading (mV)	Corrected Detector reading (mV)
1.	-40°	70	12
2.	-36°	82	24
3.	-32°	100	42
4.	-28°	134	76
5.	-24°	160	102
6.	-20°	197	139
7.	-16°	209	151
8.	-12°	247	189
9.	-8°	266	208
10.	-4°	273	215
11.	0°	275	217
12.	4°	274	216
13.	8°	270	212
14.	12°	267	209

Date
Page

S.NO	Angular Deflection	Detector Reading (mV)	Corrected Reading
15.	16°	256	198
16.	20°	237	139
17-	24°	192	134
18.	28°	129	71
19-	32°	90	32
20	36°	67	9

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Date
Page

26/10/15

Experiment 8

AIM: To determine the resolving power of Telescope fitted with a variable rectangular aperture

APPARATUS: A telescope, Sodium Light source, micrometer slit, travelling microscope, glass plate containing 2 parallel lines

Observations: $\lambda = 5893\ A^\circ$

Least count of Main Scale $= \frac{1}{20} = 0.05$ cm

L.C. of Vernier Scale $= 0.1$ mm

S.No	At left hand edge of II line			Right hand edge of II line			Dist. b/w II lines (a-b)
	MS (cm)	VS (cm)	Total (cm)	MS (cm)	VS (cm)	Total (cm)	(cm)
1.	1.7	16	1.716	2.2	34	2.234	0.518
2.	1.7	17	1.717	2.2	35	2.235	0.518
3.	1.7	15	1.715	2.2	34	2.234	0.519

Page

L.C of slit = 0.1mm
Zero error = 0

Table 2 Aperture width

S.No	Distance b/w 11 lines and objective (u) (cm)	Minimum width slit for resolution		
		M.S (cm)	V.S (cm)	Total (cm)
1.	95	0	13	0.013
2.	112	0	15	0.015
3.	138	0	18	0.018

Table 3 Determination of resolving power

S.NO	Distance b/w 11 lines and objective (u)	Min. width of slit for resolution (d)	Distance b/w 2 linear sources OO'	Theoritical resolving power d/d	Empirical resolving power OO'/u
1.	95 cm	0.013 cm	0.518 cm	1/220.6 = 0.004	0.005
2.	112 cm	0.015 cm	0.518 cm	1/254.5 = 0.003	0.004
3.	138 cm	0.018 cm	0.519 cm	1/305.4 = 0.003	0.003

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26/10/15

Experiment 9

Aim: To determine the compressibility of a liquid (eg. Kerosene oil) by ultrasonic diffraction method

Order of diffraction minima	Vernier	Right (a) Degrees	Left (b) degrees	2θ V1 |a-b|	2θ V2 |a-b|	Mean 2θ degrees	Mean θ degree	sinθn	λ = nλ / sinθn Units ?
2	V1	121·127°	121·135°	0·008°	0·008°	0·008°	0·004°	0·004	1.47×10^{-2}
	V2	300·864°	300·872°						
1	V1	121·239°	121·239°	0·012°	0·012°	0·012°	0·006°	0·006	1.86×10^{-2}
	V2	121·859°	300·859°						

$\nu = 4.3\ MHz$ $\quad \rho = 810\ kg/m^3$

$MS = \frac{20}{60} = \frac{1}{3}^\circ$

$LC = 1\ \frac{MS\ div}{Total\ div} = \frac{1}{3 \times 60} = \frac{1}{180}^\circ$

Velocity of ultrasonic wave = 1337 m/s

Bulk Elasticity $(E) = \rho V^2 = 1.4 \times 10^9\ N/m^2$

Compressibility $= 0.71 \times 10^{-9}\ N/m^2$

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Aim: To determine the specific rotation of cane sugar using polarimeter.

Apparatus: Polarimeter attached with a sodium lamp, cane sugar, distilled, measuring cylinder (100ml), beaker and digital, pipette

Observation:

Least count of analyser = 0.1° = $\frac{1 \text{ MS div}}{\text{Total div.}}$

Length of the tube = 20.6 cm

(A) Observation with distilled water

First position of analyser			Second position of analyser					
			Clockwise rotation			Anticlockwise rotation		
MSR (degrees)	VSR	Total (degrees)	MSR (degrees)	VSR	TR (degrees)	MSR (degrees)	VSR	TR (degrees)
69	8	69.8	249	8	249.8	249	8	249.8

(B) With sugar solution

Page	First position of analyser			Second Position of analyser					
				Clockwise Rotation			Anticlockwise Rotation		
	MSR (degrees)	VSR	Total (degrees)	MSR (deg)	VSR	Total (deg)	MSR (deg)	VSR	Total (deg)
10%	84	7	84.7	264	7	264.7	264	7	264.7
5%	66	8	66.8	242	6	242.6	242	6	242.6
2.5%	61	9	61.9	246	8	246.8	246	8	246.8