

3 SEM TDC PHY M 1

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(November)

PHYSICS

(Major)

Course : 301

(Optics)

Full Marks : 60

Pass Marks : 24/18

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. Choose the correct answer from the following :

1×6=6

- (a) The distance of the first focal point from the field lens in Huygens' eyepiece is

(i) $\frac{3f}{2}$

(ii) $\frac{2f}{3}$

(iii) $\frac{f}{2}$

(iv) $\frac{4f}{3}$

- (b) Spherical aberration of a lens may be minimized by designing the lens so that the deviation of rays is
- (i) minimum
 - (ii) minimum at first surface
 - (iii) minimum at second surface
 - (iv) equal at both surfaces
- (c) In Young's double-slit experiment, when the separation between the slits is halved and the distance between the slits is doubled, then the fringe width is
- (i) unchanged
 - (ii) halved
 - (iii) doubled
 - (iv) quadrupled
- (d) The intensity of principal maxima of grating having N slits is proportional to
- (i) $\frac{1}{N}$
 - (ii) N
 - (iii) N^2
 - (iv) \sqrt{N}

- (e) The dispersive power of a grating in diffraction is
- (i) directly proportional to the order of the spectrum
 - (ii) inversely proportional to the order of the spectrum
 - (iii) directly proportional to the square root of the spectrum
 - (iv) inversely proportional to the square root of the spectrum
- (f) The Babinet's compensator may be used for production and analysis of
- (i) linear polarized light
 - (ii) circular polarized light
 - (iii) elliptical polarized light
 - (iv) All of the above

2. Answer any six from the following : $2 \times 6 = 12$

- (a) Explain briefly the defect astigmatism in a lens.
- (b) Explain why a thick film shows no colour in white light.
- (c) Newton's rings are formed by reflection of light of wavelength 600 nm. The diameter of 10th dark ring is 0.4 cm. Calculate the radius of curvature of the lens used.
- (d) Why is the central fringe of Newton's rings arrangement dark?
- (e) How can a plane polarized light be converted into circularly polarized light?
- (f) Explain the phenomenon of double refraction in uniaxial crystals.
- (g) What is meant by spherical aberration? What is its cause?

3. (a) Find the condition of achromatism of two thin lenses separated by a finite distance. Is such a combination perfectly achromatic? Explain. $2+1+1=4$
- (b) Give the construction and theory of Huygens' eyepiece and show that it is free from chromatic aberration. $2+2+1=5$
- (c) Describe Fresnel's biprism method for the determination of wavelength of light. 4

Or

An object is placed at 20 cm from a zone plate and the brighter image is situated at 20 cm from zone plate. The wavelength of light wave is $\lambda = 4000 \text{ \AA}$. Find the number of Fresnel's zones in a radius of 1 cm of the plate.

- (d) Discuss the theory of Newton's rings formed by the reflected or transmitted light. 5

4. (a) What is Fraunhofer diffraction? Discuss the method of constructing the half-period zones on the screen in the case of diffraction at a circular aperture. $1+5=6$
- (b) Obtain an expression for the resolving power of a plane transmission grating. 6

Or

What is a plane diffraction grating? In a plane diffraction grating, the angle of diffraction for the 2nd order maximum for wavelength 5×10^{-7} cm is 30° . Calculate the number of lines/cm of the grating. If the total number of slits in the grating is N , what is the total number of secondary maxima and minima between any two principal maxima? $1+3+2=6$

- (c) If the distance between the rulings of a grating is made very large, what will be the effect observed? 2

5. (a) State and explain Malus' law. 1+2=3
- (b) Write short notes on any *two* of the following : 3½×2=7
- (i) Fresnel's half-period zones
 - (ii) Lloyd's mirror
 - (iii) Optic axis and the 'principal section' of a crystal

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