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Reg. No. :

Code No. : 20558 E Sub. Code : SMPH 22

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2021.

Second Semester

Physics — Core

OPTICS

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL questions.

Choose the correct answer.

1. The condition for minimum spherical aberration for two lenses separated by a distance (a) is
- (a) $a = f_1 + f_2$ (b) $a = f_1 - f_2$
- (c) $a = \frac{f_1 + f_2}{2}$ (d) none

2. An eye-piece forms the final image at _____.
(a) focal point (b) infinity
(c) cardinal point (d) none
3. Colours of thin films is due to
(a) Double refraction (b) Interference
(c) Diffraction (d) Polarization
4. In an air-wedge, fringe width (β) is _____.
(a) constant
(b) increasing from left
(c) increasing from right
(d) none
5. A zone plate has _____ focal length (s)
(a) only one (b) two
(c) several (d) none
6. Grating element is
(a) a (b) b
(c) $\frac{1}{(a+b)}$ (d) $(a+b)$

7. The expression for the resolving power of an instrument is _____.
- (a) $\frac{d\lambda}{\lambda}$ (b) $\frac{\lambda}{d\lambda^2}$
- (c) $\frac{\lambda}{d\lambda}$ (d) None
8. Tourmaline crystal is a
- (a) polarizer alone
- (b) analyser alone
- (c) polarizer and analyser
- (d) doubly refracting crystal
9. If N_1 and N_2 are the number of molecules in lower and upper levels respectively, the for population inversion
- (a) $N_1 = N_2$ (b) $N_2 > N_1$
- (c) $N_1 > N_2$ (d) $N_1 - N_2 = 0$
10. The relation between numerical aperture (NA) and the angle of acceptance (i_m) is
- (a) $NA = \cos ec(i_m)$ (b) $NA = \cos(i_m)$
- (c) $NA = \sin(i_m)$ (d) $NA = \tan(i_n)$

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Derive the expression for the dispersive power of a prism.

Or

- (b) Discuss any two methods of reducing spherical aberration.

12. (a) Explain the testing of planeness of surface.

Or

- (b) Give the application of Michaelson Interferometer.

13. (a) Derive the Rayleigh Criterion for resolution.

Or

- (b) Compare Fresnel and Fraunhofer diffractions.

14. (a) Write short note on quarter wave plates.

Or

- (b) Explain the production of circularly polarised light.

15. (a) Define population inversion. How it is achieved?

Or

- (b) Explain the working of a semiconductor laser.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL the questions, choosing either (a) or (b).

Each answer should not exceed 500 words.

16. (a) Explain any two aberration in lenses. How they are removed?

Or

- (b) Explain deviation without dispersion. How can it be achieved using small angled prisms?

17. (a) Explain the experimental determination of wavelength by Fresnel's biprism.

Or

- (b) Explain interference in thin films due to reflected light.

18. (a) What is a zone plate? Give its theory.

Or

- (b) Describe the theory of Fresnel diffraction due to a circular aperture.

19. (a) Give the construction and theory of
(i) Quarter wave plate, and (ii) Half wave plate.

Or

- (b) What is meant by
(i) Plane
(ii) Circularly and
(iii) Elliptically polarized light. How are they produced and detected?

20. (a) Explain the construction and working of carbon dioxide laser.

Or

- (b) Explain how images are recorded and reproduced using Holography.
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