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Reg. No. :

Code No. : 20602 E Sub. Code : EMPH 41

B.Sc. (CBCS) DEGREE EXAMINATION,
APRIL 2025.

Fourth Semester

Physics — Core

OPTICS AND LASER PHYSICS

(For those who joined in July 2023 onwards)

Time : Three hours

Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL questions.

Choose the correct answer :

1. The inability of a lens to form a white image of a white object is known as
 - (a) spherical aberration
 - (b) chromatic aberration
 - (c) monochromatic aberration
 - (d) coma

2. Huygen's eyepiece is also known as _____.
 - (a) spherical eyepiece
 - (b) positive eyepiece
 - (c) negative eyepiece
 - (d) double eyepiece
3. Which of the following does not show any interference pattern?
 - (a) Wedge shaped film
 - (b) Excessively thin film
 - (c) A thick film
 - (d) Soap bubble
4. The shape of the fringes observed in interference is
 - (a) straight
 - (b) circular
 - (c) hyperbolic
 - (d) elliptical
5. The zone plate behaves like a
 - (a) concave lens with multiple foci
 - (b) convex lens with multiple foci
 - (c) convex lens with single foci
 - (d) concave lens with single foci

6. In a single slit diffraction pattern intensity and width of fringes are
- unequal width
 - equal width
 - equal width and equal intensity
 - unequal width and unequal intensity
7. A plate which induces the desired amount of phase difference between two rays is known as
- polaroid
 - phasor plates
 - quartz plates
 - retardation plates
8. If the phase difference between two rays is $\frac{\pi}{2}$ and the angle of incidence is equal to $\frac{\pi}{4}$ the emergent light is
- Linearly polarized
 - Elliptically polarized
 - Circularly polarized
 - Non polarized

9. An example of optical pumping
- Ruby laser
 - Helium-Neon laser
 - Semiconductor laser
 - Dye laser
10. In the CO₂ molecular gas laser, transition takes place between the
- molecular states
 - atomic states
 - vibrational states
 - energy states

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Describe about spherical aberration. How can spherical aberration defect be removed?
- Or
- (b) Explain construction and working of Huygen's eyepiece.

12. (a) Explain the testing of plainness of a glass surface using air-wedge.

Or

- (b) Describe Michelson interferometer and show how it can be used for measuring the wavelength of any line in a spectrum.
13. (a) What is a zone plate? Explain the theory of construction of a zone plate.

Or

- (b) Explain the resolving power and dispersive power of a grating.
14. (a) Explain the working of a Half wave plate.

Or

- (b) Write about optical activity of a substance and Fresnel's explanation of optical rotation.
15. (a) Explain with neat diagram absorption, spontaneous emission and stimulated emission of radiation.

Or

- (b) Explain the principle and working of CO₂ laser.

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Explain the methods of minimizing spherical aberration and chromatic aberration.

Or

- (b) Explain refraction through a thin prism.
17. (a) Obtain the path difference and the condition for maxima and minima for thin film interference due to reflected light.

Or

- (b) What are Newton's rings and how are they formed? Explain.
18. (a) Explain the rectilinear propagation of light using Fresnel's assumption.

Or

- (b) Write differences between a zone plate and a convex lens.

19. (a) Give an account of double refraction in uniaxial crystals.

Or

- (b) Explain the production and detection of plane and circularly polarized light.

20. (a) Establish the relation between Einstein's coefficients.

Or

- (b) Explain the principle and working of a He-Ne laser.
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