

D 70949

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Name.....

Reg. No.....

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2014

(U.G.-CCSS)

Core Course—Physics/Applied Physics

PH 5B 11/AP 5B 13—PHYSICAL OPTICS AND MODERN OPTICS

Time : Three Hours

Maximum : 30 Weightage

Section A*Answer all questions.*

- The bending of light ray at the corners of opaque obstacles is called :
 - Reflection.
 - Refraction.
 - Interference.
 - Diffraction.
- At polarising angle, the angle between reflected and refracted rays is :
 - π .
 - $\frac{\pi}{2}$.
 - $\frac{\pi}{4}$.
 - $\frac{\pi}{6}$.
- The colours in thin films is due to :
 - Interference.
 - Diffraction.
 - Polarisation.
 - Refraction.
- Polarimeter is a device to measure :
 - Intensity of light.
 - Wavelength.
 - Frequency.
 - Optical rotation.
- For a quarter wave plate, phase difference between ordinary and extraordinary rays is :
 - $\frac{\pi}{2}$.
 - π .
 - $\frac{\pi}{4}$.
 - $\frac{\pi}{6}$.
- Hologram is :
 - One dimensional image of object.
 - Two dimensional image of object.
 - Three dimensional image of object.
 - n dimensional image of object.

Turn over

7. The outer layer of the optical fibre is called :
- (a) Core. (b) Cladding.
(c) Plastic coating. (d) Jacket.
8. Condition for constructive interference is :
- (a) $I_{\max} = a^2$. (b) $I_{\max} = 2a^2$.
(c) $I_{\max} = 3a^2$. (d) $I_{\max} = 4a^2$.
9. The annular area enclosed between first and second circles is called :
- (a) First half period zone. (b) Second half period zone.
(c) Third half period zone. (d) Fourth half period zone.
10. The resolving power of a grating is :
- (a) nN . (b) $\frac{n}{N}$.
(c) \sqrt{nN} . (d) n^2N .
11. Phenomenon of splitting of light ray, when it is passed through calcite crystal is :
- (a) Refraction. (b) Double refraction.
(c) Diffraction. (d) Interference.
12. Diffraction of sound is very easy to observe in day to day life. This is not so with light. This is because :
- (a) $\lambda_s > \lambda_l$. (b) $\lambda_s < \lambda_l$.
(c) $\lambda_s = \lambda_l$. (d) None.

(12 × ¼ = 3 weightage)

Section B*Answer all questions.*

13. What is refraction matrix ?
14. State the conditions for obtaining sustained interference pattern on a screen.
15. Mention any *two* uses of Michelson's interferometer.
16. Define resolving power of a grating.
17. What is a half wave plate ? Why is it called so ?
18. Give *four* applications of holography.
19. Distinguish between step index fibre and graded index fibre.

20. What is meant by parametric oscillation ?
21. Distinguish between Fresnel and Fraunhofer diffraction.

(9 × 1 = 9 weightage)

Section C*Answer any five questions.*

22. The numerical aperture of an optical fibre is 0.24. If the refractive index of the core is 1.48, calculate the refractive index of the cladding.
23. Calculate the thickness of quartz which will rotate the plane of polarisation of sodium yellow by $\frac{\pi}{2}$. Specific rotation is 21.72°/mm.
24. Calculate the velocity of O-ray and E-ray in calcite (a) along the optic axis ; (b) in a plane perpendicular to the optic axis $\mu_o = 1.65, \mu_E = 1.486, c = 3 \times 10^8 \text{ m/s}$.
25. Calculate the minimum number of lines that a grating should have such that it just resolves in the second order, the lines whose wavelength are $5.890 \times 10^{-5} \text{ cm}$ and $5.896 \times 10^{-5} \text{ cm}$.
26. Find the angular width of the central bright maximum in the Fraunhofer pattern of a slit of width $12 \times 10^{-5} \text{ cm}$ when the slit is illuminated by monochromatic light of wavelength 6000 \AA .
27. A zone plate has the radius of the first ring 0.05 cm. If the plane waves ($\lambda = 5000 \text{ \AA}$) fall on the plate, where should the screen be placed so that the light is focused to a bright spot.
28. When one of the mirror in a Michelson's interferometer is moved through a distance of 0.5 mm, calculate the no. of fringes that will cross the field of view ($\lambda = 6000 \text{ \AA}$).

(5 × 2 = 10 weightage)

Section D*Answer any two questions.*

9. Explain how Michelson's interferometer is used to determine the difference in wavelengths very close to each other such as D_1 and D_2 lines of sodium.
10. What is a system matrix ? Derive an expression for the system matrix for a thin lens and hence obtain the formula for a thin lens.
11. What is polarisation ? Explain the production of :
 (i) Elliptically polarised.
 (ii) Circularly polarised light with necessary theory.

(2 × 4 = 8 weightage)