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Name.....

Reg. No.....

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2015

(U.G.—CCSS)

Core Course—Physics/Applied Physics

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

(2009—2012 Admissions)

Time : Three Hours

Maximum : 30 Weightage

Section A

Answer all questions.

Each question carries  $\frac{1}{4}$  weightage.

1. Light travels along a path having the \_\_\_\_\_ Optical length :  
(a) Zero. (b) Minimum.  
(c) Maximum. (d) Infinite.
2. Two points which can interchange their positions are known as \_\_\_\_\_.
3. The inverse of the reduced focal length is known as \_\_\_\_\_.
4. The chromatic dispersion of the material of a prism depends on :  
(a) Angle of the prism. (b) Refractive index.  
(c) Both (a) and (b). (d) None of these.
5. In interference there is :  
(a) Creation of energy. (b) Destruction of energy.  
(c) Both (a) and (b). (d) Redistribution of energy.
6. The property of coherence is classified into \_\_\_\_\_.
7. In a bi-prism experiment, if the equal angle of the two component prisms are slightly increased, the fringe pattern will :  
(a) Get enlarged. (b) Shrink.  
(c) Vanish. (d) None of these.
8. To obtain Fraunhofer diffraction from a single slit the wave front of the incident light must be :  
(a) Plane. (b) Cylindrical.  
(c) Elliptical. (d) Spherical.

Turn over

9. A diffraction pattern is obtained using a beam of red light. What happens if it is replaced by blue light ?
- Diffraction bands broaden.
  - Diffraction bands become narrower and crowd together.
  - Diffraction bands disappear.
  - No change.
10. Optical harmonic generation is an example of \_\_\_\_\_ phenomena.
11. One of the following is a non linear optical effect :
- Raman effect.
  - Zeeman effect.
  - Compton effect.
  - Interference.
12. The light gathering ability of the optical fiber is determined by :
- Cladding.
  - Numerical aperture.
  - Grading.
  - Guiding.

(12 × ¼ = 3 weightage)

### Section B

*Answer all questions.  
Each question carries 1 weightage.*

- State Fermat's principle.
- Is it possible to observe interference fringes with light emanating from two independent forces ? Why ?
- What are the conditions for producing interference fringes ?
- Distinguish between temporal coherence and spatial coherence.
- What is diffraction of light? How is it different from interference?
- Will X-rays falling on an optical diffraction grating be diffracted ? Give reason.
- What is double diffraction ?
- Explain the meaning of the terms ASK, FSK and PSK.
- What is a non linear medium ?

(9 × 1 = 9 weightage)

### Section C

*Answer any five questions.  
Each question carries 2 weightage.*

- Derive the laws of reflection using Fermat's principle.
- Derive the equations for the image and magnification of an optical system using the matrix method.

24. Red light from a He-Ne laser  $\lambda = 632.8 \text{ nm}$  is incident on a screen containing very narrow horizontal slits separated by  $0.2 \text{ mm}$ . A fringe pattern appears on a screen held  $1.0 \text{ m}$  away. How far above and below the central axis are the first zeroes of irradiance? How far from the axis is the fifth bright band.
25. How is zone plate made? What is the radius of the first zone in a plate of principal focal length  $0.2 \text{ m}$  for light of wavelength  $512 \text{ nm}$ .
26. Consider a diffraction grating of width  $5 \text{ cm}$  with slit width  $10^{-6} \text{ m}$  separated by a distance of  $2 \times 10^{-6} \text{ m}$ . What is the corresponding grating element? How many orders would be observable if  $\lambda = 5.5 \times 10^{-7} \text{ m}$ .
27. What is the difference between right circularly polarized light and left circularly polarized light?
28. What is a fiber guide? Discuss the working principle of a fiber guide. What do you mean by a graded index fiber and a step index fiber?

(5 × 2 = 10 weightage)

#### Section D

*Answer any two questions.*

*Each question carries 4 weightage.*

29. Explain parametric oscillation. Describe an arrangement for observing parametric oscillation in a non linear medium? What is self focusing of light?
30. Explain the working of a Michelson interferometer. Describe how the difference between two close wavelengths can be determined using the interferometer.
31. Describe the necessary theory how the wave length of a monochromatic source of radiation can be determined using Newton's ring arrangement.
32. What is specific rotation? How is it experimentally determined using Laurent's half shade polarimeter?

(2 × 4 = 8 weightage)