



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.OPTM/SEM-2/BO-201/2010**

**2010**

**PHYSICAL OPTICS — II**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

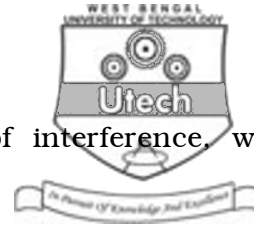
**GROUP – A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for the following :  $10 \times 1 = 10$ 
  - i) Laser is a device to produce
    - a) a beam of white light
    - b) coherent light
    - c) microwaves
    - d) X-rays.
  - ii) Radii of Newton bright rings are
    - a) proportional to the wavelength of light
    - b) proportional to the square of the wavelength of light
    - c) proportional to the square root of the wavelength of light
    - d) inversely proportional to the wavelength of light.

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- iii) To demonstrate the phenomenon of interference, we require
- a) two sources which emit radiation of the same frequency
  - b) two sources which emit radiation of nearly the same frequency
  - c) two sources which emit radiation of the same frequency and have a definite phase relationship
  - d) two sources which emit radiation of different wavelengths.
- iv) In an S.H.M. during the motion
- a) the kinetic energy is conserved
  - b) the potential energy is conserved
  - c) the total energy is conserved
  - d) none of these.
- v) In Fraunhofer diffraction the incident wavefront is
- a) plane
  - b) spherical
  - c) circular
  - d) cylindrical.
- vi) Which one of the following waves cannot be polarized ?
- a) X-rays
  - b) Sound wave
  - c) UV rays
  - d) Radio waves.
- vii) Metastable state is a state where atom exists for
- a)  $10^{-3}$  sec
  - b)  $10^{-8}$  sec
  - c)  $10^{-4}$  sec
  - d)  $10^{-5}$  sec.



- viii) The planes of vibration and polarization are
- a) orthogonal
  - b) parallel
  - c) non-existent
  - d) orthogonal and parallel.
- ix) If grating constant is 0.000324 cm, then number of rulings of grating per cm is
- a) 3085
  - b) 3090
  - c) 3080
  - d) 3086.
- x) The wave theory of light was proposed by
- a) Newton
  - b) Planck
  - c) Huygens
  - d) Brewster.

**GROUP – B**

**( Short Answer Type Questions )**

Answer any *three* of the following.  $3 \times 5 = 15$

2. Write a note on anti-reflection coating.
3. Write a short note on zone plate.
4. Distinguish between Fresnel and Fraunhofer diffractions.
5. Distinguish between —
  - a) positive crystal and negative crystal
  - b) interference and diffraction.

$$2\frac{1}{2} + 2\frac{1}{2}$$

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**GROUP – C**

**( Long Answer Type Questions )**

Answer any *three* of the following.  $3 \times 15 = 45$

6. a) What do you mean by laser ? What are the differences between laser light and normal light ? 1+ 3
- b) Explain the basic principle involved in laser action. 6
- c) Explain how ruby laser is produced. 5
7. a) What do you mean by interference ? Give the condition for the sustained interference. 3
- b) Briefly discuss Young's double slit experiment to find the interference expression & calculate the wavelength for which the constructive & destructive interferences occur. 8
- c) In Newton's ring experiment with a light containing two wavelengths  $\lambda_1 = 589 \text{ nm}$  &  $\lambda_2 = 589.6 \text{ nm}$ . Find the distance ( from the point of contact of planoconvex lens with glass plate ) at which the rings disappear. Take the radius of curvature of the curved surface as 1 m. 4

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8. a) Explain the formation of coherent sources with the help of Fresnel biprism. 3

b) Derive the expression for the bright and dark fringe width found by the biprism. 6

c) The acute angle of biprism of refractive index 1.5 is  $2^\circ$ .  
A slit illuminated by a monochromatic light is placed 10 cm from the biprism. If the distance between the two dark fringes observed at a distance of 1 m from the biprism is 0.18 mm, find the wavelength of light used. 4

d) What is the difference between the fringes observed in Fresnel biprism experiment and Lloyd's single mirror experiment ? 2

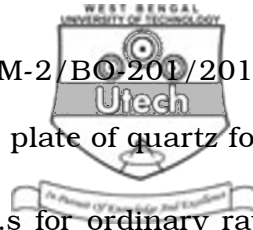
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9. a) Write down Huygens' principle of wavefront. 3
- b) Prove the laws of refraction for a plane surface from Huygens' wave theory. 7
- c) In Young's double slit experiment the slits are 0.589 nm apart and the interference is observed on a screen placed at a distance of 80 cm from the slit. It is found that the 10th bright fringe is at a distance of 9 mm from the dark fringe which is fourth from the fringe pattern. Find the wavelength of light used. 5
10. a) Explain the following terms : 2 + 2 + 3 + 2 + 3
- i) Double refraction
  - ii) Optics axis
  - iii) Positive and negative crystals
  - iv) Principal section of crystal
  - v) *E* rays and *O* rays.

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- b) Calculate the thickness of a half wave plate of quartz for a light of wavelength  $500 \text{ \AA}$  ( the R.I.s for ordinary ray and extraordinary ray are  $1.544$  and  $1.533$  respectively ).

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