

BACHELOR OF SCIENCE (B.Sc.)**Term-End Examination****December, 2005****PHYSICS****PHE-9 : OPTICS**

Time : 2 hours

Maximum Marks : 50

Note : *All questions are compulsory. The marks for each question are indicated against it. You can use log tables and calculator.*

1. Attempt any **eight** of the following : $8 \times 2 = 16$

- (i) Under what condition can light waves be idealized as rays ?
- (ii) Mention any two unique features of a laser and state how these can be exploited in various applications.
- (iii) Give one example each of a uniaxial crystal and a biaxial crystal.
- (iv) Which are the two classes of diffraction ? How do you distinguish them ?

- (v) What is the difference between hue and colour ?
- (vi) Explain why the sunlight reflected from a soap film appears coloured.
- (vii) Is it possible to obtain Newton's rings with a bright centre ? Explain.
- (viii) A ray of light is incident on the surface of a glass plate of refractive index 1.5 at the polarising angle. What is the angle of refraction ?
- (ix) How is spatial coherence ensured in double slit interference experiment ?
- (x) What is a step-index fibre ?

2. Attempt any **two** of the following : 2×5=10

- (a) Explain how the Michelson interferometer can be used to determine the refractive index of a gas.
- (b) Explain, with the help of a diagram, how a holographic microscope functions. How is it different from a conventional high power microscope ?
- (c) List the processes involved in image formation by human eye. Describe any two of these.

3. Attempt any **three** of the following : 3×5=15

- (a) A plano-convex lens of radius 2 m is placed on an optically plane glass plate. The system is illuminated by monochromatic light and in the transmitted system, the radius of the 7th ring is observed to be 0.52 cm. Calculate the wavelength of the monochromatic light.
- (b) Plane waves from a He - Ne laser with wavelength 6300 Å are incident on a circular aperture of diameter 0.5 mm. What is the angular location of the first minimum in the diffraction pattern ? Also calculate the diameter of Airy disc on a screen 10 m behind the aperture.
- (c) Sodium light is incident normally on a grating of width 3.5×10^{-3} m. The total number of lines on the grating is 2000. Determine the angular separation between the sodium D-lines ($\lambda_1 = 5890$ Å and $\lambda_2 = 5896$ Å) in the first order spectrum.
- (d) In an experiment with Michelson's interferometer, the scale readings for a pair of positions of maximum indistinctness were found to be 0.6939 mm and 0.9884 mm. The mean wavelength of the two components of the sodium D-light used in the experiment is 5893 Å. Deduce the difference between the wavelength of the components.