EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE - 2009/2010

FIRST SEMESTER (PROPER/REPEAT)

(June/July 2011)

PH 203 PHYSICAL OPTICS - II

LIBRARY
30 DEC 20
Eastern University, Sri

Time: 01 hour.

Answer ALL Questions

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1. Distinguish Fraunhofer diffraction from Fresnel diffraction.

When a parallel monochromatic beam of light of wavelength λ is illuminated normally on a double slit having slit width b and slit separation d, the Fraunhofer diffraction pattern is given by $I_P = 4I_0\left(\frac{\sin\beta}{\beta}\right)^2 \cos^2\gamma$, where $\beta = \frac{\pi b}{\lambda}\sin\theta$, $\gamma = \frac{\pi d}{\lambda}\sin\theta$ and θ is the diffraction angle.

a) Obtain the conditions for principal maxima and minima of the diffraction term $\left(\frac{Sin\,\beta}{\beta}\right)^2$.

b) Obtain the condition for maxima of the interference term $Cos^2\gamma$.

c) By explanation obtain the condition for the first missing order in terms of b and d.

d) In a Fraunhofer diffraction arrangement, a double slit is illuminated normally by a light of wavelength $\lambda = 6000\,Å$ and the 3rd order bright fringe was measured to be at $\theta = 0.1^o$ (0.1 degrees). The intensities of bright fringes were observed to decrease starting from the central brightest to 4th, and the 5th bright fringe was missing. Find the values of d and b.

2.

i. Optical instruments may be categorized as 'instruments for object observing' and 'apparatus for observing light spectra'. Name three instruments for each of these categories.

ii. Explain the meaning of resolution and define *Resolving Power* of these two categories of instruments.

iii. Introduce *Raleigh criterion* for just-resolved, not-resolved and well-resolved limits.

iv. The two blinking lights on both wings of an aeroplane are 8 meters apart. When the aeroplane is flying very far, these two lights are seen as one. Explain why? What should be the limiting distance for the observer to differentiate these two lights? Assume the pupil diameter of the human eye when looking at night sky is 3 mm and the wavelength of light of aeroplane bulbs is 6×10^{-5} m.