KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
PHYSICS DEPARTMENT
PHYS 201- Term 112 QUIZ #6 – CHAPTER 36

Tuesday 17 April 2012
Name: Key ID#:

1. (a) How many bright fringes appear between the first diffraction-envelope minima to either side of the central maximum in a double slit pattern if λ = 540 nm, d = 0.390 mm, and a = 60 μm?
(b) What is the intensity ratio of the second bright fringe to the intensity of the central fringe?

a) $a \sin\theta = \lambda$ and $d \sin\theta = m\lambda$ $\Rightarrow \frac{d}{a} = m = 6.5$, m integer $\Rightarrow m = 6$

There are 6 on each side + central = 13 bright fringes.

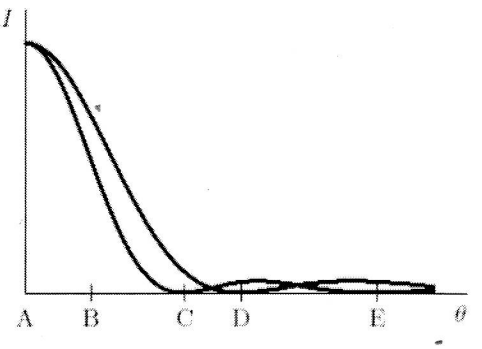
b) $I_p = I_m \cos^2\beta \frac{\sin^2\alpha}{\alpha^2}$ $\beta = \frac{\pi d}{\lambda}\sin\theta$ $\alpha = \frac{\pi a}{\lambda}\sin\theta$

2nd bright fringe $\Rightarrow d\sin\theta = 2\lambda \Rightarrow \sin\theta = \frac{2\lambda}{d}$

$\Rightarrow \beta = \frac{\pi d}{\lambda} \times \frac{2\lambda}{d} = 2\pi$ rad $\alpha = \frac{\pi a}{\lambda}\frac{2\lambda}{d} = \frac{2\pi a}{d} = 0.3\pi$ rad

$\frac{I_p}{I_m} = \cos^2(2\pi)\ \frac{\sin^2(0.3\pi)}{(0.3\pi)^2} = 0.736 \Rightarrow \boxed{\frac{I_p}{I_m} = 74\%}$

2. Two wavelengths, 800 nm and 600 nm, are used separately in single-slit diffraction experiments. The diagram shows the intensities on a far-away viewing screen as function of the angle made by the rays with the straight-ahead direction. If both wavelengths are then used simultaneously, at which angle is the light on the screen purely 800-nm light?



(a) A
(b) B
(c) C
(d) D
(e) E