

5 JAN 2009

University, Sri Lanka

EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE - 2007/2008

FIRST SEMESTER (PROPER/REPEAT/ RE-REPEAT)

(DECEMBER 2008)

PH 203 PHYSICAL OPTICS II

Time: 01 hour.

Answer ALL Questions

1. The intensity distribution for Fraunhofer diffraction by multiple slit is given by,

$$I = A_0^2 \left(\frac{\sin \beta}{\beta} \right)^2 \left(\frac{\sin N\gamma}{\sin \gamma} \right)^2$$

- (i) Obtain the intensity distribution for Fraunhofer diffraction for double slit and identify the interference and diffraction terms in the intensity distribution.
- (ii) State the conditions for maxima and minima for interference and diffraction in the intensity distribution.
- (iii) Write the condition for the missing order and hence find a relation between the slit width and the slit separation.
- (iv) A transmission grating having a slit separation $2 \times 10^{-4} \text{ cm}$ is illuminated with normal incidence by a light of wavelength $\lambda = 6000 \text{ \AA}$.
 - (a) What is the angle of direction of the first order maxima?
 - (b) If the 4th order maximum is missing, what is the width of the slit of the grating?

You may assume, $\beta = \frac{1}{2} kb \sin \theta$ and $\gamma = \frac{1}{2} kd \sin \theta$, where the symbols have their usual meaning.

2. What do you mean by Resolving Power? Briefly explain the Rayleigh's criteria of resolution in calculating the resolving power of any optical instrument. Write down an expression for the resolving power of a telescope.

A ruby laser ($\lambda = 694.3 \text{ nm}$) is aimed in free space at a target 10000 km away. If the laser beam initially is 14 mm in diameter, find the diameter of the beam on the target?