

EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE – 2013/2014

FIRST SEMESTER (February/March 2016)

PH 203 PHYSICAL OPTICS-II



Time: 01 hour.

Answer ALL Questions

(1) Explain how diffraction causes limitation in the resolution of optical instruments and hence introduce *Raleigh criterion* for the limits of resolution. Describe the two categories of optical instruments by defining the resolving power.

Prove that the chromatic resolving power of a prism spectrometer with refractive index μ and ground face length t is given by

$$\text{Resolving power} = t \left[\frac{d\mu}{d\lambda} \right].$$

(2) The Fraunhofer diffraction intensity distribution due to N number of parallel slits, each of width b , and separated by distance d is given by

$$I = I_0 \left(\frac{\sin\left(\frac{\pi}{\lambda} b \sin \theta\right)}{\frac{\pi}{\lambda} b \sin \theta} \right)^2 \left(\frac{\sin\left(\frac{\pi}{\lambda} N d \sin \theta\right)}{\sin\left(\frac{\pi}{\lambda} d \sin \theta\right)} \right)^2,$$

where θ is the diffraction angle.

(a) Obtain the conditions for principal maxima and minima of

- i. interference term
- ii. diffraction term

(b) A transmission grating having 5000 slits per centimeter is illuminated at normal incident by a light of wavelength 632 nm. If fifth order bright fringe is missing, calculate the slit width and the slit separation.