Registration no:

Total Number of Pages: 02

M.Sc.I
FPYE406

4th Semester Regular / Back Examination 2016-17
Physics-IV
BRANCH(S) : M.Sc.I(AC)
Time: 3 Hour
Max Marks: 70
Q Code : Z912

Question No.1 which is compulsory and any five from the rest
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions:** **(2 x 10)**

- **a)** Show that the longitudinal magnification is proportional to lateral magnification.
- **b)** What do you mean by unit planes for an optical system.
- **c)** Deduce the Newton's formula $x_1x_2=f_1f_2$ for an optical system.
- **d)** With a neat diagram show how you can use a biprism to produce two coherent sources.
- **e)** Find out Brewster's angle for a glass slab to be used as a polarizer. The refractive index of the slab is 1.55.
- **f)** What is group velocity?
- **g)** What is de-Broglie hypothesis? A ball of mass 1gm has speed of 100m/s. Calculate the de-Broglie wavelength associated with it.
- **h)** Differentiate between Fresnel and Fraunhofer classes of diffraction.
- **i)** What is photoelectric effect ?
- **j)** What are the conditions for interference?

Q2 **a)** State and explain Fermat's principle of extremum path and analyze a case where the actual path of light may be maximum. Deduce Snell's law of refraction using Fermat's principle. **(7)**

b) Compare Ramsden's eye-piece with Huygens eye-piece. **(3)**

Q3 **a)** What is a Fresnel's Bi-prism? A Biprism is kept 10cm away from a slit illuminated by monochromatic light of wavelength 5896Å. The width of the fringes obtained on a screen 90cm away from the Biprism is 9.0×10^{-4}m. What is the distance between the two coherent sources? **(5)**

b) Draw a neat diagram of Newton's ring experiment. With expression, describe how one can determine wavelength of light by using Newton's ring experiment.. **(5)**

Q4 **a)** What is zone plate? A zone plate has a principal focal length of 1m for a monochromatic light having wavelength 3600Å. Find the principal focal length for light of wavelength 5400Å. **(5)**

b) Compare between zone plate and convex lens. **(5)**

Q5 **a)** Explain Fraunhofer diffraction due to single slit. Obtain the conditions for the maxima and minima. **(7)**

b) What is the limit to the number of maximum possible maxima one can obtain? **(3)**

Q6 **a)** State and verify Malus' law. Find the angle between the axis of an analyzer with the incident rays' electric vector so that the intensity of the polarized light is 25% less than the initial intensity. **(5)**

b) Plane polarized light is incident on a piece of quartz plate cut parallel to its optic axis. Find the minimum thickness for which the ordinary ray and the extraordinary ray combine to form (i) plane polarized light, (ii) circularly polarized light. (Given $\mu_o = 1.582$; $\mu_e = 1.567$; $\lambda = 5000Å$). **(5)**

Q7 **a)** Describe the construct and working of a Nicol prism. Explain with labeled diagram how can it be used as a polarizer as well as an analyzer. **(7)**

b) Differentiate between the ordinary and the extra-ordinary rays? **(3)**

Q8 **a)** Derive time-dependent Schrodinger's wave equation of a particle in one dimensional. **(5)**

b) What is the value of the normalization constant An in the wave function $\Psi = A_n \sin\frac{2n\pi x}{L}$ in the region $0 \le x \le L$? **(5)**