SM – 211

IV Semester B.Sc. Examination, June 2008
(Semester Scheme)
PHYSICS – IV
Acoustics, Optics and Lasers

Time : 3 Hours Max. Marks : 60

PART – A

Answer **any five** of the following questions : **(5×6=30)**

1. Obtain an expression for velocity of sound wave in a stretched string and hence write the equation for fundamental frequency of vibration of string. **(5+1)**

2. a) What is acoustic impedance ? Write an expression for it.

   b) Explain with a neat diagram the principle and working of a Carbon-microphone. **(2+4)**

3. a) State Huygen's principle.

   b) Discuss refraction of a Spherical wave front at a plane surface using Huygen's principle. **(2+4)**

4. Discribe the theory of Interference in thin films by refracted light and obtain the conditions for bright and dark fringes. **6**

5. Based an Fresnel's assumptions, discuss how rectilinear propagation of lights is explained. **6**

6. Discuss the Fraunhofer diffraction at a single slit and obtain expressions for directions of secondary maxima and minima. **6**

7. Distinguish between positive and negative uniaxial Crystals. Describe Huygens explanation of double refraction in uniaxial crystal. **(3+3)**

8. Explain, with the help of energy level diagram the terms

   i) Absorption

   ii) Spontaneous emission and

   iii) Stimulated emission. **6**

P.T.O.

PART – B

Answer **any four** of the following questions : **(4×5=20)**

9. A brass rod of length 3m is clamped at the centre. It emits a note of frequency 600 Hz. When it ribrates longitudinally. If the density of brass is 830 kg m^{-3}, calculate the Young's modulus of brass.

10. An air-wedge of angle 0.01 radian is illuminated by monochromatic light of 6000°A falling normally on it. At what distance form the edge of the wedge, will the 10^{th} dark fringe be observed by the reflected light.

11. A zone plate is drawn and then copied on a reduced scale so that the diameter of the central zone is 2mm. If a source of monochromatic hight of wavelength 5000°A, is placed 2m from the zone plate, find the position of the primary image.

12. A plane transmission grating having 6000 lines per cm is used to obtain a spectrum of light by normal incidence from a sodium lamp in the second order. Calculate the angular separation between the two sodium lines whose wavelengths are 5890°A and 5896°A.

13. Plane polarised light passes through a quartz plate with its optic axis parallel to the faces. Calculate the least thickness of the plate for which a phase difference of '$\pi/2$' is introduced between the extraordinary and the ordinary rays.

    Give $n_\epsilon = 1.553$; $n_0 = 1.442$ and $\lambda = 5890$ °A.

14. A He-Ne laser emits light of wavelength 632.8 nm and has an output power of 2.3 mw. How many photons are emitted each minute by the laser when operating ?

    Given h = 6.62×10^{-34} J-S and C = 3×10^8 ms^{-1}

PART – C

Answer **any five** of the following questions : **(5×2=10)**

15. a) Why is an echo not heard, if the distance between the source of sound and obstacle less than 17m ? Explain.

b) When do we have only transmission of sound waves without reflection from a boundary ?

c) Why, is it necessary to have waves of same or nearly same amplitude from coherent sources to produce interference ? Explain.

d) Why is the centre of Newton's rings dark in reflected light ? Explain.

e) How does the intensity of Central maximum vary with the decrease in width of the single slit in Fraunhofer diffraction ? Explain.

f) Why there is dispersion when whole light is incident on a diffraction grating ? Explain.

g) Does resolving power of a grating vary with the colour of light used ? Explain.

h) Will the atoms populated in the metastable state drop to ground state spontaneously ? Explain.