6/12/19 E

This question paper contains 4 printed pages.

Your Roll No. .....

Sl. No. of Ques. Paper	: **8358**	**J**
Unique Paper Code	: **32225310**	
Name of Paper	: **Waves and Optics**	
Name of Course	: **Physics : G.E.**	
Semester	: **III**	
Duration	: **3 hours**	
Maximum Marks	: **75**	

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt five questions in all.

Q. No. 1 is compulsory.

Non-programmable scientific calculator is allowed.

1. Attempt any *five* of the following :
   (a) State any *two* differences between Biprism and Lloyd's mirror fringes.
   (b) What are coherent sources? How are they realized in practice?
   (c) Distinguish between 'Fizeau' and 'Heidinger' fringes. Give examples.
   (d) A parallel beam of light is normally incident on a plane transmission grating having 4250 lines per cm and a second order spectral line is observed at an angle of 30°. Calculate the wavelength of light.

P.T.O.

(e) How are stationary waves formed? Give their characteristics?

(f) Define 'plane of vibration' and 'plane of polarization'.

(g) State the different categories of sound waves with their corresponding frequency range. 3×5=15

2. (a) Explain how interference fringes are formed by a thin wedge shaped film when examined by reflected light. Find the expression for fringe width. 10

(b) Using sodium light (λ = 5893 Å) interference fringes are formed by reflection from a thin air wedge. When viewed perpendicularly 10 fringes are observed in a distance of 1 cm. Calculate the angle of the wedge. 5

3. (a) How will you measure small difference in the wavelengths of two waves with Michelson's Interferometer? 5

(b) A thin film of a material whose refractive index is 1.45 on being introduced in one of the arms of Michelson's Interferometer causes a shift of 6 fringes. If the wavelength of light used is 5890 Å, calculate the thickness of the film. 5

(c) In a Newton's Ring Experiment the diameter of the 10th bright ring changes from 1.40 cm to 1.26 cm when a liquid is introduced between the plate and the lens. Calculate the refractive index of the liquid. 5

4. (a) What is a diffraction grating? Give the complete theory of a plane transmission diffraction grating and explain the formation of spectra by it. 12

(b) In a plane transmission grating the angle of diffraction for second order maxima for wavelength 5×10^{-5} cm is 30°. Calculate the number of lines per cm of grating surface. 3

5. (a) Trace graphically and analytically the motion of a particle that is subjected to two perpendicular simple harmonic motions of equal frequencies, different amplitudes and phase difference of zero. 12

(b) Show that, for light waves of frequency v, travelling in a dispersive medium of refractive index η, the group velocity v_g is given by :

$$\frac{1}{v_g} = \frac{1}{v} - \frac{\lambda}{c}\frac{d\eta}{d\lambda}$$

where v is the phase velocity, c is the velocity of light in vaccum and λ is the wavelength. 3

6. (a) Explain the phenomenon of double refraction. 3

(b) What do you understand by uniaxial and biaxial crystals? 3

(c) Give the construction and working of a Nicol Prism. 9

7. (a) Explain the meaning of half period zones in case of a plane wavefront. Calculate the area of a half period zone and show that it is practically constant. Also show that the amplitude due to complete wavefront is just half of that due to first half period zone alone. 10

(b) For an axial point source for a zone plate, a series of images is obtained. If the sharpest image is obtained at 30 cm and the next sharpest at 6.0 cm on the other side of the source, calculate the distance of the source from the zone plate. 5