

Roll No. ....

Total Pages : 03

**GSM/J-21**

**1621**

**PHYSICS**

**Paper VIII**

**Wave and Optics-II**

Time : Three Hours]

[Maximum Marks : 40

**Note :** Attempt *Five* questions in all. Q. No. **1** is compulsory. Attempt *four* more questions selecting *one* question from each Unit. Use of scientific (Non-programmable) calculator is allowed.

1. (a) What is Double Refraction ? Define ordinary and extra ordinary ray. 2
- (b) Define Fourier theorem. 2
- (c) What is translation matrix and system matrix ? 2
- (d) Explain longitudinal and lateral chromatic aberration. 2

**Unit I**

2. (a) Explain Brewster's law and prove that refracted ray and reflected ray are mutually perpendicular to each other. 4
- (b) State and explain the Law of Malus. 4

(3)L-1621

3. (a) Describe the construction and working of a Bi-quartz arrangement in polarimeter. **5**
- (b) Calculate the specific rotation of sugar solution from the following data length of the tube containing solution = 10 cm, volume of solution = 40 c.c., Amount of sugar in solution = 3 gm and Angle of rotation =  $4^{\circ}57'$ . **3**

### Unit II

4. (a) State and prove Fourier integral theorem. **6**
- (b) Define complex form of Fourier series. **2**
5. (a) Apply the Fourier theorem to analyse a square wave into its simple harmonic components. **5**
- (b) Derive Fourier series for an even function in the interval  $(-\pi, \pi)$ . **3**

### Unit III

6. (a) Derive the convolution theorem for Fourier transform. **4**
- (b) Find the Fourier transform of  $f(x) = e^{-x^2/2}$ . **4**
7. (a) Define nodal points. Prove that nodal plane coincide with unit planes when media on either side of optical system have same refractive index. **5**

- (b) If a ray is initially given by  $(2 \times 1)$  matrix, then show that the effect of translation through a distance  $D$  is a homogenous of refractive index  $\mu$  is completely given by  $(2 \times 2)$  matrix  $T = \begin{pmatrix} 1 & 0 \\ D/\mu & 1 \end{pmatrix}$ . **3**

#### Unit IV

8. Explain what is chromatic aberration. How is it connected with dispersive power ? Derive the condition for achromatism for two thin lenses in contact. **8**
9. (a) What is Optical Fiber ? Define and explain the following terms : **5**
- (i) Acceptance angle
  - (ii) Total internal reflection
  - (iii) Numerical aperture
  - (iv) Normalized frequency.
- (b) Calculate the critical angle between two material with indices of  $\mu_1 = 1.45$  and  $\mu_2 = 1.40$ . **3**