

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

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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 (2×1) matrix, then show that the effect of translation through a distance D is a homogenous of refractive index μ is completely given by (2×2) 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**