B. Sc. (Part I)

Physics Paper III
(Optics and Laser)

P. Pages : 4

Time : Three Hours

Max. Marks : 40

Note : 1. All questions are compulsory and carry equal marks.
2. Draw neat diagram wherever necessary.

Either :

1. a) State and explain Fermat's principle. **2**

b) Define power of a lens and state its unit. **2**

c) What is monochromatic aberration. **1**

d) What is spherical aberration ? How it can be reduced. **3**

OR

2. p) What is lens ? **1**

q) What is chromatic aberration ? **1**

r) Derive the lens formula for thin lens, assuming the equation of refraction through lens. **3**

s) Calculate the power of two thin lenses of focal length f_1 and f_2 separated by a distance 'd'. **3**

Either :

3. a) Define interference of light. **1**

b) Obtain an expression for the path difference between the reflected beams for the interference in thin films due to reflected light. **3**

c) Draw a neat ray diagram of Michelson's interferometer. **2**

d) Explain how wavelength of monochromatic source light can be determined with the help of Michelson's interferometer. **2**

OR

4. p) What are Newton's rings ? How they are formed ? **3**

q) Derive an expression for the diameter of bright Newton's rings by reflected light. **3**

r) Newton's rings are observed in reflected light of wavelength 5.9×10^{-5} cm. The diameter of the 10th dark ring is 0.5 cm. Find the radius of curvature of lens. **2**

Either :

5. a) Explain the term diffraction of light. **1**

b) Distinguish between Fresnel and Fraunhofer type diffraction. **2**

c) What are Fresnel half period zones. **2**

d) What is zone plate. How it is constructed ? **3**

OR

6. p) What is the resolving power of an optical instrument. **1**

q) Explain Rayleigh's criterion of resolution. **2**

r) Derive an expression for resolving power of a telescope. **3**

s) Find the aperature of the objective of a telescope which may be used to resolve two objects separated by 4.88×10^{-6} radians, Given wavelength of light 5000 A°. **2**

Either :

7. a) Explain plane transmission grating. How it is constructed. **2**

b) What is grating element. **1**

c) State and explain Brewster's law. **3**

d) Explain how Nicol prism can be used as a polariser. **2**

OR

8. p) What is double refraction, Explain. **2**

q) Give the principle and construction of Nicol prism. **3**

r) What is quarter wave plate. **1**

s) Calculate the thickness of quarter wave plate. **2**

Given : $\lambda = 5890\,A^{\circ}$; $\mu_e = 1.553$; $\mu_o = 1.544$

Either :

9. a) Distinguish laser from ordinary light. **2**

b) Explain the main parts of laser system. **3**

c) Explain the three level laser system. **3**

OR

10. p) What is population inversion ? **2**

q) Describe the construction and working of helium - neon laser. **4**

r) State any four applications of laser.. **2**

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