

M.Sc. S.Y. (Physics) (NEP Pattern) Semester-IV  
**04MSCPH1 - Major Paper-I : Optics and Optical Instruments**

P. Pages : 2

Time : Three Hours



**GUG/S/25/16375**

Max. Marks : 80

**Either :**

1. a) Discuss the general theory of image formation in optical systems. Explain how light rays interact with optical elements to produce images, and describe the role of wavefronts in this context. **8**
- b) Compare and contrast Ramsden and Huygens eyepieces. Discuss the necessity of multiple eyepieces in optical instruments and their impact on magnification and field of view. **8**

**OR**

- e) Describe the construction and working principles of microscopes and telescopes. Explain the differences between astronomical telescopes and other types, focusing on their specific design considerations. **8**
- f) Describe the structure and optical properties of a meniscus lens. Explain its applications and advantages in optical systems. **8**

**Either :**

2. a) Explain the working principle of the Michelson interferometer. Discuss how it can be used to measure wavelengths of light, small distances, and refractive indices. Provide examples of its applications in modern physics experiments. **8**
- b) Discuss the formation of localized fringes in optical systems. Derive the expression for the fringe spacing in a two-slit interference setup, considering the wavelength of light, slit separation, and distance to the observation screen. **8**

**OR**

- e) Describe the formation of Newton's rings in a plano-convex lens setup. Derive the expression for the radius of the nth dark ring and discuss how Newton's rings can be used to determine the wavelength of light or the refractive index of a medium. **8**
- f) Explain the construction and working of a Nicol prism and discuss its role in producing polarized light. **8**

**Either :**

3. a) Describe the fundamental principles behind the operation of a camera. Compare and contrast the functionalities of Digital Single-Lens Reflex (DSLR) cameras, and video cameras. **8**
- b) Describe the function of a collimator in optical systems. Explain the construction and working of a compound microscope, including the role of the objective and eyepiece lenses. Derive the expression for its total magnification. **8**

**OR**

- e) Describe the optical design and applications of field glasses. Explain the construction and use of a Jeweller's glass highlighting its importance in detailed inspections. **8**
- f) Describe the construction and working principle of a prism spectroscope. Explain how it is used to analyze light spectra and discuss its applications in scientific research. **8**

**Either :**

- 4.** a) Explain the importance of coherence in holography. How does coherence affect the quality of a hologram? **8**
- b) Discuss the various mechanisms of attenuation in optical fibers. How does attenuation affect signal transmission? **8**

**OR**

- e) Describe the principles, construction, and working of CT scanning. How does it improve medical diagnosis? **8**
- f) Explain the working principle of ultrasound imaging. How are ultrasound waves used to generate medical images? **8**

**5.** Attempt all of the followings.

- a) Define the cardinal points in an optical system. How they influence image formation? **4**
- b) Define optical rotation and discuss the phenomenon in the context of liquid crystals. **4**
- c) Explain the optical principles behind eyeglasses. Discuss how lenses are used to correct common vision defects such as myopia, hyperopia, and astigmatism. **4**
- d) What is non-destructive testing (NDT)? How is holography used in NDT? **4**

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