



Seat No. \_\_\_\_\_

**HB-003-0496005**

**B. Sc./M. Sc. (Applied Physics) (Sem. VI) (CBCS)**

**Examination**

**April - 2023**

**Experimental Techniques in Physics : Paper XXII**

*(New course)*

**Faculty Code : 003**

**Subject Code : 0496005**

Time :  $2\frac{1}{2}$  / Total Marks : 70

**Instructions :**

- (1) All questions are compulsory.
- (2) Numbers in the right indicate marks.

- 1 (a) Write answers : 4
- (1) Define Interference.
  - (2) What is Etalon ?
  - (3) Explain the relationship between phase difference and path difference.
  - (4) What is multiple beam interferometry ?
- (b) Write answers : (any one) 2
- (1) Explain the concept of division of wave front and vision of amplitude.
  - (2) The initial and final readings of a M.I. screw is 10.7347, and 10.6903 mm as 150 fringers pass. Calculate the wavelength of light used.
- (c) Write answers : (any one) 3
- (1) Discuss Lummer - Gehrcke plate in detail.
  - (2) Explain principle for the formation of Newton's ring and derive the equation for darker and brighter ring.
- (d) Write answers : (any one) 5
- (1) Describe construction and working of Michelson's Interferometer (M.I) with its important application. Why G2 plate is known as compensating plate in Michelson Interferometer ?
  - (2) Deduce an expression for the intensity distribution in fringes for Fabry Perot Interferometer. Discuss the sharpness of fringes.

- 2 (a) Write answers : 4
- (1) State the Malus law.
  - (2) Define Polarization.
  - (3) What do you mean by negative and positive crystal ?  
Give the examples.
  - (4) What is meant by double refraction ?
- (b) Write answers : (any one) 2
- (1) Discuss Rochon prism.
  - (2) Give Huygen's theory of double refraction in uniaxial crystal.
- (c) Write answers : (any one) 3
- (1) Write a note on Nicole prism.
  - (2) Explain the construction, principle and use of quarter wave plate.
- (d) Write answers : (any one) 5
- (1) Write a note detailed on Babinet's compensator and explain how it is better than the retardation plates.
  - (2) Explain theory of production of elliptically and circularly polarized light.
- 3 (a) Write answers : 4
- (1) What is space quantization ?
  - (2) Draw a well labelled diagram for Stark effect for transverse view.
  - (3) Explain in short : Splitting of sodium D lines transverse to the applied magnetic field with necessary figures.
  - (4) What is total angular quantum number  $j$  ?
- (b) Write answers : (any one) 2
- (1) What is Pauli's exclusion principle ?
  - (2) Why Bohr's atom model failed ?
- (c) Write answers : (any one) 3
- (1) Explain Vector Atom Model in detail.
  - (2) Discuss the selection rules in conjunction with the vector atom model.
- (d) Write answers : (any one) 5
- (1) Discuss Zeeman Effect with Lorentz explanation on the basis of classical electron theory.
  - (2) Explain Stark's effect with necessary figures.

- 4 (a) Write answers : 4
- (1) Draw a well labelled diagram of the Raman set up in pre-laser era.
  - (2) Explain the splitting of sodium D lines longitudinal to the applied magnetic field with necessary figures.
  - (3) What is Raman effect ?
  - (4) What is  $\pi$  and  $\sigma$  component of sodium  $D_1$  lines ?
- (b) Write answers : (any one) 2
- (1) Explain : zero-point energy.
  - (2) Discuss spectrum of Harmonic Oscillator.
- (c) Write answers : (any one) 3
- (1) Write the applications of the Raman Effect in physics.
  - (2) Explain the theory of pure rotational spectra of a diatomic molecule treating as a rigid rotator.
- (d) Write answers : (any one) 5
- (1) How the Non-rigid rotator energy level expression explains the observed microwave spectrum ? Draw the diagram and show the spectrum.
  - (2) In what way the IR and Raman spectra are helpful in determining the structure of a molecule ? Explain in detail.
- 5 (a) Write answers : 4
- (1) What is j-j coupling ?
  - (2) What do you mean by resolution of an interferometer ?
  - (3) List the various methods to polarization of light.
  - (4) When Paschen Back effect occurs ?
- (b) Write answers : (any one) 2
- (1) Explain Brewster's law.
  - (2) Write a short note : 1-s coupling.
- (c) Write answers : (any one) 3
- (1) Explain the construction, principle and use of half wave plate.
  - (2) What is magnetic orbital quantum number  $m_l$  ?
- (d) Write answers : (any one) 5
- (1) Write the different tests of analysis of polarized light in detail.
  - (2) Explain the intensity rules for the atomic spectra.