



HB-003-001503

Seat No. _____

B. Sc. (Sem. V) (CBCS) Examination

May / June – 2017

Physics : Paper - P-503

(Optics & Spectroscopy)

Faculty Code : 003

Subject Code : 001503

Time : $2\frac{1}{2}$ Hours]

[Total Marks : 70

- Instructions :** (1) Figures on right side indicate marks.
(2) Symbols have their usual meanings.

1 Give very short answers to the following questions : **20**

- (1) In Michelson Interferometer, when mirrors M_1 and M_2 are exactly perpendicular to each other, which types of fringes are obtained ?
- (2) In Michelson Interferometer, what is the role of glass plate G_2 ?
- (3) In case of multiple beam interference, if reflectivity $R = 0.5$, then visibility $V = ?$
- (4) Fabry-Perot etalon is an instrument which works on the basis of multiple beam interference.
Is it true or false ?
- (5) For Lummer-Gehreke plate, the angle of incidence at plate A is slightly more than the critical angle of the material of the plate.
Do you agree ?
- (6) In Bi-axial crystals, both the refracted rays are o-rays.
Is it true or false ?
- (7) In Nicol prism, which transparent material is used for cementing the two cut surfaces so that o-rays can be eliminated by total internal reflection ?
- (8) In a positive crystal, the velocity of which ray is maximum along the optic axis ?

- (9) Which type of polarized wave is obtained by superposition of two plane polarized waves which are out of phase by 90° ?
- (10) In Pockel's effect, by which field anisotropy is induced in piezo-electric crystal ?
- (11) How much path difference is introduced by a Babinet compensator when a light passes through it ?
- (12) In case of LCDs, what is "twisted molecular arrangement" ?
- (13) When external magnetic field is very strong, Paschen-Back effect is observed.
Is it true or false ?
- (14) In Zeeman effect, σ - components are polarized at which angle to the π - components ?
- (15) One end of the Raman tube is "horn" shaped and blackened. Why ?
- (16) Lines on low frequency side of exciting lines in Raman spectra are called _____ lines.
- (17) When the emitting substance is heated, bands in the spectra disappears. This is due to conversion of atoms into molecules.
Do you agree ?
- (18) "Electronic band spectra" are obtained in the _____ region.
- (19) In which region "Pure rotation bands" are obtained ?
- (20) "SEM" is an abbreviation of _____.

2 Answer the following :

- (a) Write a short answer to the following : (any three) **6**
 - (1) Define amplitude reflection coefficient and amplitude transmission coefficient.
 - (2) What is Transmission Electron Microscopy ?
 - (3) Draw schematic diagram (experimental figure) of Michelson's Interferometer.

- (4) Write essential components of SEM.
- (5) What are Retarders ? Give their names.
- (6) What is "induced birefringence" ?

(b) Give answers to the following : (any **three**) **9**

- (1) Explain how the difference in the wavelength of two waves can be determined with the help of Michelson's Interferometer.
- (2) In an experiment to determine the refractive index of gas using Michelson's Interferometer, a shift of 200 fringes is observed when all the gas is removed from the tube. If the wavelength of light used is 5890 \AA and length of the tube is 20 cm, calculate the refractive index of the gas.
- (3) Write advantages and disadvantages of AFM.
- (4) Write a note on Kerr's effect.
- (5) Give comparison (any three points) of positive and negative crystal.
- (6) Discuss : Quarter Wave Plate.

(c) Write in detail : (any **two**) **10**

- (1) Discuss the circular fringes obtained in Michelson's Interferometer.
- (2) In case of multiple beam interference, obtain the intensity distribution formula for transmitted beam.
- (3) Describe principle, construction and working of Nicol prism.
- (4) Describe with figure : Babinet's Compensator.
- (5) Discuss the superposition of waves linearly polarized at right angle to each other and obtain general equation of an ellipse.

- 3** Answer the following :
- (a) Write short answers to the following : (any **three**) **6**
- (1) Give the names of quantum numbers in vector atom model.
 - (2) What is "Larmour precession"?
 - (3) What is Raman effect ?
 - (4) Give comparison (two points) between Raman spectra and Fluorescence spectra.
 - (5) Write observation involved in Raman spectra.
 - (6) Explain how the diatomic molecular structure can be analyzed with the help of Raman effect ?
- (b) Give answers to the following : (any **three**) **9**
- (1) Discuss : Space quantization.
 - (2) Write main features of Stark effect.
 - (3) Describe : Paschen-Back effect.
 - (4) Write the "threefold structure" disclosed in the study of molecular spectra.
 - (5) Explain : An orbital quantum number (l).
 - (6) With proper diagram, write experimental set up of Raman effect.
- (c) Write in detail : (any **two**) **10**
- (1) Describe experimental study of Zeeman effect.
 - (2) Discuss the classical interpretation of Normal Zeeman effect.
 - (3) Explain the theory of pure rotational spectra and derive an equation of frequency.
 - (4) Discuss the theory of rotation-vibration spectra.
 - (5) Explain : The classical theory of Raman effect.