HCN-003-001503 Seat No. _____

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

October - 2017

Physics : P - 503

(Optics & Spectroscopy) (New Course)

Faculty Code : 003
Subject Code : 001503

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

Instructions :

(1) All questions are compulsory.

(2) Figures on right hand side indicate marks.

(3) Symbols have their usual meanings.

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

(1) In Michelson Interferometer, what is the role of glass plate G_2 ?

(2) In Michelson Interferometer, when mirrors M_1 and M_2 are not exactly perpendicular to each other, which type of fringes are obtained ?

(3) In case of multiple beam interference, if reflectivity R = 1, then visibility V = ?

(4) Lummer-Gehreke plate is an instrument which works on the basis of multiple beam interference.
- Is it true or false ?

(5) Optic axis is the direction in an uniaxial crystal along which the e-ray and o-ray travel with the same speed.
- Do you agree ?

(6) In Bi-axial crystals, the velocity of which ray is minimum along the optic axis ?
- Is it true or false ?

(7) In a negative crystal, the velocity of which ray is minimum along the optic axis ?

(8) Which type of resultant polarized wave is obtained by superposition of two plane polarized waves which are in same phase ?

(9) 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.

(10) In Kerr effect, by means of which field anisotropy is induced ?

(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) "TEM" is an abbreviation of _____.

(14) When external magnetic field is very strong, Paschen-Back effect is observed ?

- Is it true or false ?

(15) In Zeeman effect, σ-components are polarized at which angle to the π-components ?

(16) "Electronic band spectra" are obtained in the _____ region.

(17) In which region "Pure rotation bands" are obtained ?

(18) When the emitting substance is heated, bands in the spectra disappears and becomes lines. This is due to conversion of molecules into atoms.

- Is it true ?

(19) One end of the Raman tube is "horn" shaped and blackened. Why ?

(20) Lines on high frequency (short wavelength) side of exciting lines in Raman spectra are called _____ lines.

2 Answer the following :

(a) Write short answers to the following : (any three) **6**

(1) What is the principle of Scanning Electron Microscopy ?

(2) Write essential components of SEM.

(3) Define amplitude reflection coefficient and amplitude transmission coefficient.

(4) Draw schematic diagram (experimental figure) of Nicol prism.

(5) What is "induced birefringence' ?

(6) What are Retarders ? Give their names.

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

(1) In an experiment to determine the refractive index of a 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 A^o and length of the tube is 20 cm, calculate the refractive index of the gas.

(2) Explain : Determination of difference in the wavelength of two waves with the help of Michelson's Interferometer.

(3) Write a note on Lummer and Gehreke plate.

(4) Give comparison (any three points) of positive and negative crystal.

(5) Write a note on Pockel's effect.

(6) Discuss : Quarter Wave Plate.

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

(1) Describe principle, construction and working of Michelson Interferometer.

(2) Discuss in detail : circular fringes obtained in Michelson's Interferometer.

(3) In case of multiple beam interference, obtain the intensity distribution formula for transmitted beam.

(4) Discuss the superposition of waves linearly polarized at right angle to each other and obtain general equation of an ellipse.

(5) Describe : Babinet's Compensator.

3 Answer the following :

(a) Write short answers to the following : (any three) **6**

(1) Define "Larmour procession".

(2) Give the names of quantum numbers in vector atom model.

(3) What is Raman effect ?

(4) Write comparison between Raman spectra and Fluorescence spectra.

(5) Write any four applications of Raman spectroscopy.

(6) Write observations involved in Raman spectra.

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

(1) Write the "three fold structure" disclosed in the study of molecular spectra.

(2) Describe : Paschen-Back effect.

(3) Discuss : Hypothesis of spinning electron.

(4) Explain : An orbital quantum number (l).

(5) Write main features of Stark effect.

(6) Discuss briefly : experimental set up of Raman effect.

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

(1) Describe the theory of rotation-vibration spectra.

(2) Explain the theory of pure rotational spectra and derive an equation of frequency.

(3) Describe experimental study of Zeeman effect.

(4) Explain : The classical theory of Raman effect.

(5) Discuss the classical interpretation of Normal Zeeman effect.
