JX-003-001503   Seat No. _____

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

October - 2019

Physics : Paper - 503

(Optics & Spectroscopy)

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 a very short answer to the following questions :   **20**

(1) In Michelson Interferometer, when mirrors M_1 and M_2 are exactly perpendicular to each other, circular fringes are obtained. Do you agree ?

(2) In Michelson Interferometer, what is the use of glass plate G_1 ?

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

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

(5) In Nicol prism, the transparent material which is used for cementing the two cut surfaces is known as _____,

(6) In Bi-axial crystals, both the refracted rays are e-rays. 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) How much path difference is introduced by a Babinet compensator when a light passes through it ?

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

(11) In case of LCDs , the crystal molecules are aligned in such a way that their optic axis undergo _____ degree rotation from plate A to B.

(12) The effect of electric field on the atomic spectra is known as _____ effect.

(13) When external magnetic field is very strong, Paschen-Back effect is observed. Is it true or false ?

(14) "TEM" is an abbreviation of _____.

(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 atoms into molecules. Is it true or false ?

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

(20) Give full name of "AFM".

2   Answer the following :

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

(1) Define: amplitude reflection co-efficient and amplitude transmission co-efficient.

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

(3) What is an optic axis ?

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

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

    (3) 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 $\overset{\circ}{A}$ and length of the tube is 20 cm, calculate the refractive index of the gas.

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

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

    (6) Discuss: Half 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: Optical mixing.

    (5) Describe : Babinet's Compensator.

3 Answer the following :

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

    (1) What is Raman effect ?

    (2) What is "Larmor precession" ?

    (3) Give only names of quantum numbers in vector atom model.

    (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) Explain : Hypothesis of spinning electron.

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

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

   (4) Discuss : Paschen-Back effect.

   (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 : Absorption Spectroscopy.

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