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DB-003-001503 Seat No. _____

B. Sc. (Sem. VI) Examination

March – 2022

Physics : Paper - 503

(Optics & Spectroscopy)

(Old Course)

Faculty Code : 003

Subject Code : 001503

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

Instructions : (1) Symbols have their usual meanings.
(2) Figures to the right indicate marks.
(3) Non-programmable scientific calculator is allowed.
(4) Attempt all questions.

1 Answer the following in short : **20**

(1) For negative crystal

(A) $\mu_0 > \mu_e$ (B) $\mu_0 < \mu_e$

(C) $\mu_0 = \mu_e$ (D) None of the above

(2) What is the visibility of fringes in the case of Michelson interferometer?

(A) $\frac{\text{Imax} - \text{Imin}}{\text{Imax} + \text{Imin}}$ (B) $\frac{\text{Imax} - \text{Imin}}{\text{Imax}}$

(C) $\frac{\text{Imax} + \text{Imin}}{\text{Imax} - \text{Imin}}$ (D) $\frac{\text{Imax} - \text{Imin}}{\text{Imin}}$

(3) The thickness of thin transparent sheet is obtained with MI is

(A) $\text{m}/2(\text{m}-1)$ (B) $\text{m}\lambda/2(\mu - D)$

(C) $m\lambda/(\mu - 1)$ (D) $2m\lambda/(\mu - 1)$

(4) A phase difference arising between e-rays and o-rays is given by

(A) $\frac{2\pi(\mu_0 - \mu_e)d}{\lambda}$ (B) $2\pi(\mu_e - \mu_0)d/\lambda$

(C) $\frac{2\pi(\mu_0 + \mu_e)d}{\lambda}$ (D) None

(5) Which one is true when determined by M.I.

(A) $\frac{m\lambda}{2\lambda}+l$ (B) $\frac{m\lambda}{2l}-1$

(C) $\frac{m\lambda}{2l}$ (D) $2\frac{m\lambda}{l}+l$

(6) S.E.M. is _____ (full name it)

(7) Lummer-Gehrcke plate is used for

(A) Observing the 3D image of an object

(B) Observing the molecules

(C) Observing the fine structure of spectral lines

(D) None

(8) A compensator is an optical device whose function is to compensate ?

(A) A path difference (B) A phase difference

(C) Both of above (D) None of above

(9) An artificial double refraction is induced by

(A) Mechanical strain (B) Electric field

(C) Magnetic field (D) All of above

(10) _____ is responsible for Cotton-Mouton effect.

(A) Magneto-optic effect (B) Electro-optic effect

(C) Mechanical strain (D) None

(11) Raman spectra are consisting of _____ line.

(A) Stokes (B) anti-Stokes

(C) both (D) None

(12) Orbital quantum number is denoted by

(A) μl (B) Pl

(C) ml (D) l

(13) According to Lorentz classical theory the change in frequency of light, when placed in magnetic field is given by

(A) $eH/2\pi m_3$ (B) $eH^2/2\pi m_3$

(C) $eH/4\pi m_3$ (D) $eH^2/4\pi m_3$

(14) _____ gives the equation of Raman shift

(A) $\Delta V = V_i - V_s$ (B) $\Delta V = V_i + V_s$

(C) $\Delta V = V_s - V_i$ (D) None

(15) _____ is responsible for Stark effect.

(A) Strong magnetic field (B) Weak magnetic field

(C) Electric field (D) All of above

(16) Who put forward the hypothesis of electron spin ?

(A) Einstein and Maxwell

(B) Newton and Kelvin

(C) Ulenbeak and Goudsmit

(D) None

(17) In anomalous Zeeman Effect the componet separation is governed by the factor,

(A) $\Delta P_j g$ (B) ΔJ_g

(C) $\Delta \mu_j g$ (D) Δmj_g

(18) _____ is the most complex of molecular spectra.

(A) Pure vibrational spectra

(B) Pure rotational spectra

(C) Rotation-vibration spectra

(D) Electronic-band spectra

(19) Which one is true for the total energy of molecule in a given quantum state is made up of

(A) Vibrational, Rotational and Optical

(B) Vibrational, Rotational and Gravitational

(C) Vibrational, Rotational and Electronic

(D) Electronic, Rotational and Optical

(20) The approximate intensity of Ratnan spectra is given by

(A) 1.01% of incident radiation

(B) .01% of incident radiation

(C) .001% of incident radiation

(D) 10.1% of incident radiation

2 (A) Attempt any **three** in brief : **6**

(1) What is Babinet Compensator ?

(2) Define optical axis.

(3) What do you mean by anisotropic crystal?

(4) What is Interferometer ?

(5) What is Kerr Effect ?

(6) Explain double refraction.

(B) Attempt any **three** : **9**

(1) Describe multiple beam interference.
(2) What is Cotton-Mouton effect ?
(3) What is half wave plate ?
(4) Write applications of SEM and TEM.
(5) What is Fabry-Perot interferometer ?
(6) Explain how to determine the thickness of a thin plate of transparent material with M.I ?

(C) Attempt any **two** : **10**

(1) Derive intensity distribution formula for multiple beam interference.
(2) Give Huygen's explanation of Double refraction.
(3) What is orbital quantum number ?
(4) Write a note on LCD.
(5) Explain Nichol prism with necessary diagram.

3 (A) Attempt any **three** in brief : **6**

(1) What is Raman effect ?
(2) What is fine structure ?
(3) Draw the experimental set up for Raman effect.
(4) What is orbital quantum number ?
(5) What is Zeeman Effect ?
(6) Explain 'spinning electron'.

(B) Attempt any **three** : **9**

(1) Application of Raman spectre.
(2) What is rotational-vibrational spectre ?
(3) Give comparison between Raman spectra and fluorescence spectra.
(4) Explain Anomalous Zeeman effect.
(5) What is Stark effect ?
(6) What do you mean by space quantization ?

(C) Attempt any **two** : **10**

(1) Explain pure rotational spectra.
(2) Explain electronic band spectra.
(3) Explain vector atom model and Normal Zeeman effect.
(4) Explain Paschen-Back Effect.
(5) Explain quantum theory of Raman Effect.