PB-003-1016033 Seat No. _____

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

March / April - 2020

Physics : 603

(New Course)

Faculty Code : 003

Subject Code : 1016033

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

Instructions : (1) Give answers of the questions is given answer sheet.
(2) All questions are compulsory.
(3) Symbols have their usual meaning.
(4) Figures on the right hand side indicate full marks.

1 (a) Answer following objective questions : (1 mark of each) **4**

(1) In normal Zeeman effect, which component is missing, when observed in parallel direction?

(2) Paschen back effect follows l-s coupling. (True/False)

(3) Who put forward the hypothesis of electron spin in 1925?

(4) What is the change in the frequency in normal Zeeman effect?

(b) Answer any one question : **2**

(1) The radiation given off by the excited Hg atoms returning to their normal state gives a spectral line at 2537 $\mathring{A}$. Calculate the corresponding photon energy in eV. $h = 6.62 \times 10^{-34}\ m^2 kg/s$ $c = 3 \times 10^8\ m/s$

(2) Under uniform magnetic field of 5 weber/m^2 find Δv for normal splitting. $e = 1.6021 \times 10^{-19}\ c$; mass of electron $= 9.109 \times 10^{-31} kg$.

(c) Answer any one question : **3**

(1) What is total magnetic Quantum no. ?

(2) Calculate wavelength of the radiation emitted from a hydrogen atom when the electron jumps from 3rd level to ground level? Rydberg const. 1.09×10^7 m^{-1}.

(d) Answer any one in detail : **5**

(1) What is Normal Zeeman effect? Explain classical interpretation of it.

(2) Explain vector atom model and Anomalous Zeeman effect.

2 (a) Answer following objective questions : (1 mark of each) **4**

(1) Which are the most complex molecular spectra?

(2) $\Delta v = v_i - v_s$ gives the equation of Raman shift. (True / False)

(3) Which type of molecular spectra falls in far infrared or microwave region?

(4) Intensity of Raman lines is roughly _____ of incident radiation.

(b) Answer any one question : **2**

(1) In the microwave spectrum of identical rigid diatomic molecules, the separation between the spectral lines is recorded to be 0.7143 cm^{-1}. Calculate the moment of inertia of the molecule in kg. m^2.

(2) With exciting line $2536\,\mathring{A}$, a Raman line for a same is observed at $2612\,\mathring{A}$. What is the Raman shift?

(c) Answer any one question : **3**

(1) Application of Raman spectra.

(2) The moment of inertia of the CO molecule is 1.46×10^{-46} Kgm^2. Calculate the energy in eV. $(m_r = 1)$.

(d) Answer any one in detail : **5**

(1) Explain quantum theory of Raman effect.

(2) Explain the theory of rotational-vibration spectra.

3 (a) Answer following objective questions : (1 mark of each) **4**

(1) LASER is the short form of _____.

(2) A monochromatic light generally consists of single wave length. (True/false)

(3) Coherent properties of Laser mean _____.

(4) Nd - YAG Laser has _____ level pumping scheme.

(b) Answer any one question : **2**

(1) The wavelength of emission is 5000 A° and the coefficient of spontaneous emission is 10^6/s. Determine the coefficient for the stimulated emission. $(\mu = 1)$

(2) A semiconductor diode laser has a peak emission wavelength of 1.55 μm. find its band gap in eV.

(c) Answer any one question : **3**

(1) What is population inversion.

(2) The coefficient of spontaneous emission is 10^6 per s and the coefficient of stimulated emission is $1.3 \times 10^{19} j^{-1} m^3 s^{-2}$. Calculate the wavelength of emission. $(\mu = 1)$

(d) Answer any one in detail : **5**

(1) Explain Helium-Neon Laser with diagram in detail.

(2) Discuss Holography in detail.

4 (a) Answer following objective questions : (1 mark of each) **4**

(1) In Coolidge tube the intensity and quality of X-ray can be controlled independently. (True/false)

(2) The expression of Duane-Hunt law is _____.

(3) In _____ method the beam of continuous X-ray radiation falls upon a single crystal.

(4) _____ indicates Bragg's law.

(b) Answer any one question : **2**

(1) Find the wavelength of second order X-ray by NaCl crystal at an angle of 4.5. The grating element of NaCl crystal is $2.81 \overset{\circ}{A}$.

(2) Calculate the smallest wavelength of X-ray produced from an X-ray tube operating at 50kV.

(c) Answer any one question : **3**

(1) 10 $k\,eV$ electrons are indecent on a thin metallic film of atomic space 5.5×10^{-10} m. Calculate the angle of deviation for first order maxima.

(2) Mention any five properties of X-rays.

(d) Answer any one in detail : **5**

(1) With neat diagram, explain Bragg's spectrometer.

(2) Discuss Laue method for X-ray, diffraction..

5 (a) Answer following objective questions : (1 mark of each) **4**

(1) When light ray passes from a denser medium to a rarer medium, it is bent away from the normal in the rarer medium. (True/false)

(2) Equation of numerical aperture NA = _____

(3) What is a critical angle?

(4) Define multimode fibre.

(b) Answer any one question : **2**

(1) Find the propagation angle in optical fibre with refractive index 1.43 and refractive index of clad material is 1.4

(2) Calculate the fractional index change for a given optical fibre, if the refractive indices of the core and cladding are 1.5 and 1.4 respectively.

(c) Answer any one question: **3**

(1) Explain : loss in fibre optics.

(2) Calculate the numerical aperture and acceptance angle of an optical fibre with a cladding index of 1.50 and core index 1.55.

(d) Answer any one in detail :

(1) Explain fibre optics communication system in detail.

(2) What is an acceptance angle? Derive an equation of acceptance angle.