Shree H.N.Shukla group of colleges

PHYSICS
T.Y.B.Sc. (Sem. VI) (CBCS)
Preliminary Examination
PAPER- 603
SPECTROSCOPY AND APPLIED PHYSICS

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

Instructions : (1) All questions are compulsory.
                          (2) Numbers on right side indicate marks.
                          (3) Symbols have their usual meanings.

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

   (1) Emission spectra are devided in two types namely
        (i) _____ and (ii) _____ .

   (2) Higher the principle quantum number means lesser
        the binding energy of an electron. (true/false)

   (3) In a stark effect, the effect of _____ on spectral
        lines is studied.

   (4) In Paschen-Back effect, weak magnetic field is used
        (true/false).

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

   (1) The series limit wavelength of Balmer series of
        hydrogen spectrum is $3636\ \overset{\circ}{A}$. Calculate the value
        of Rydberg constant.

   (2) Under uniform magnetic field of 4 webers/metre^2
        find Δv for normal Zeeman splitting.

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

   (1) Explain a spin quantum number.

   (2) Draw the experimental arrangement for studying
        Zeeman effect.

(d)   Answer any one in detail :   5

    (1)   Explain magnetic moment of an atom and Lande's g factor.

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

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

    (1)   A vibrational rotation band arises due to transition between two vibrational levels of the same electronic level.   (true/false).

    (2)   In rotational vibrational spectra, near infra-red radiation is absorbed   (true/false).

    (3)   In Raman spectra, lines of same frequency as the incident beam in known as _____.

    (4)   The intensity of stokes and anti-stokes lines can be explained on the basis of classical theory. (true/false).

(b)   Answer any one question :   2

    (1)   Vibration transition occurs with energy change of 1.6×10^{-20} erg/mole, calculate the frequency of radiation [$h = 6.6 \times 10^{-34}$ m^2 kg/s, c $= 3 \times 10^8$ m/s].

    (2)   The exciting line in Raman spectra is $5480 \ \overset{\circ}{A}$ and stokes line is at $5530 \ \overset{\circ}{A}$. Find out the Raman shift.

(c)   Answer any one question :   3

    (1)   Give salient features of rotational vibrational spectra.

    (2)   Give the difference between Raman spectra and fluorescence spectra.

(d)   Answer any one in detail :   5

    (1)   Explain pure rotational spectra.

    (2)   Explain classical theory of Raman effect.

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

(1) What are the three basic radiation processes? (i) _____ (ii) _____ and (iii) _____.

(2) In stimulated emission, σ_{21} is known as _____.

(3) He-Ne Laser is a solid state Laser (true/false).

(4) In ND:YAG Laser, YAG stands for _____.

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

(1) Find the approximate area of laser spot with wavelength $\lambda = 5 \times 10^{-5}$ cm, focal Length 10 cm and radius of lens is 5 cm [area = $\pi(\lambda f/a)^2$]

(2) If laser beam area is 7.85×10^{-3} cm^2 and luminous flux is 0.16 lumens then find out brightness of laser beam.

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

(1) Explain electrical pumping.

(2) Explain principle of Holography.

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

(1) Explain semiconductor laser.

(2) Explain Ruby laser.

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

(1) X-ray can be used to study crystal structures because wavelength of x-ray is of the order of _____.

(2) Deaceeleration of electron produces x-rays. (true/false).

(3) Bragg's law is _____.

(4) In a powder method, polycrystalline powder sample is used (true/false).

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

(1) Calculate the minimum voltage that must be applied to produce x-rays of $2\overset{\circ}{A}$ wavelength.

(2) Find out θ for x-ray diffraction pattern obtained with x-ray having $1\overset{\circ}{A}$ wavelength and interplanar spacing of $2.35\overset{\circ}{A}$ for particular sets of plane.

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

    (1) Give the few important properties of x-rays.

    (2) Explain diffraction of x-rays.

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

    (1) Explain powder diffraction method.

    (2) Explain rotating crystal method.

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

    (1) Optical fibre works on principle of total internal reflection. (true/false).

    (2) _____ decides light gathering ability of the optical fibre.

    (3) Write down Snell's law.

    (4) In order to guide light ray effectively through a fibre, what should be the value of Δ ?

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

    (1) Calculate numerical aperture of an optical fibre with a refractive index of core 1.6 and cladding 1.56.

    (2) Find out the propagation angle of an optical fibre having refractive index of core and cladding 1.6 and 1.56, respectively.

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

    (1) Explain multimode step index fibre.

    (2) Give merits of optical fibre.

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

    (1) Derive expression of an acceptance angle of the optical fibre.

    (2) Explain attenuation in optical fibre.

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