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SUBJECT CODE NO: - Y-2167
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. (PATTERN-2013) (T.Y SEM VI)
Examination April / May - 2024
Physics Paper-XIX (Atomic, Molecular Physics & Laser)

[Time: 1:30 Hours]   [Max. Marks: 50]
Please check whether you have got the right question paper.

N. B   1) Solve all questions.
                2) Draw diagram whenever necessary.

Q.1 a) Explain Bohr's postulates for the theory' of hydrogen atom.   **10**
         b) Explain stark effect with its Experimental study and result.   **10**

                                        OR

         a) Give application of Raman Effect for study of Crystal physics, Nuclear   **10**
            physics and chemical effect.
         b) What is Laser pumping? Explain two Level system.   **10**

Q.2 a) Give the drawbacks of Rutherford's atom model?   **5**
         b) What are Stokes and anti-stokes lines in Raman spectrum.   **5**
         c) Calculate the radius and energy of the electron in the nth orbit in hydrogen **5**
            from following data.
   Given: $e = 1.6 \times 10^{-19}$ coulomb
                          $m = 9.1 \times 10^{-31}$ kg
                          $h = 6.6 \times 10^{-34}$ Joule second
                          $Eo = 8.85 \times 10^{-12}$ farad / meters and
                          $C = 3 \times 10^{8}$ ms^{-1}

         d) In an Experiment of Raman effect using mercury radiation of   **5**
            $\lambda = 5461 \times 10^{-10}$m a stokes line of wavelength $\lambda_1 = 5543 \times 10^{-10}$ m was
            observed find Raman shift and wavelength Corresponding to anti-stokes
            Line.

                                        OR

         a) Explain Vector atom model.   **5**
         b) Give the Biological application of laser.   **5**
         c) Calculate the wavelength separation between the two Components lines   **5**
            which are observed in normal Zeeman Effect. the magnetic field used is
            0.4 wb/m^2, specific charge $= 1.76 \times 10^{11}$ Ckg^{-1} and $\lambda = 6000$A^0

d) Find the ratio of population of two States in He-Ne Loser that produces 5
light of wavelength 6328^0 A at 27^0 c
[KT = 8.6×10^{-5} er/kx 300k]
[population ratio, hc = 12400ev]
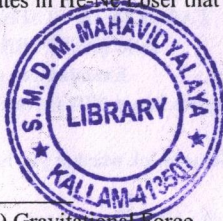
Q.3 Choose the correct answer. 10

1) Electron in the atom are hold due to_____
   a) Nuclear force   b) Gravitational Force
   c) Vander Waal's Force   d) Coulomb force

2) The empirical atomic model was given by
   a) E. Rutherford   b) Niels Bohr
   c) Sommer field   d) None of these

3) On which of the following Level of hydrogen the spin-orbit Interaction
   has no effect
   a) p-Level   b) f-Level
   c) S-Level   d) d-Level

4) Normal Zeeman effect is possible in...
   a) Li   b) He
   c) Na   d) All elements

5) In Raman effect the lines obtained are
   a) Anti-stokes lines   b) Stokes lines
   c) Rayleigh lines   d) All of these

6) In Vibration - rotation spectra for p branch is equal to ------
   a) 0   b) +1   c) -1   d) 2

7) Ruby Laser is a-------
   a) Gaseous Laser   b) Semiconductor Laser
   c) Solid State Laser   d) None of these

8) The population inversion necessary for Laser action used in solid state Laser is....
   a) Electrical discharge
   b) Inelastic atom-atom collision
   c) Direct conversion
   d) Optical pumping

9) Number of spectral Lines in hydrogen atom is
   a) Three
   b) Six
   c) Four
   d) Infinite

10) In Rayleigh's scattering the scattered light has the ---------Frequency
    a) Different
    b) Same
    c) Less
    d) Greater