Total No. of Printed Pages:2

SUBJECT CODE NO:- 2029
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. T.Y. (Sem-VI)
Examination March/April-2022 (To Be Held In June/July-2022)
Physics Paper-XIX
(Atomic, Molecular Physics & Laser)

[Time: 1:53 Hours] **[Max. Marks:50]**

Please check whether you have got the right question paper.

N.B. i) Solve all questions.
ii) Draw the diagram whenever necessary.

Q.1 a) Discuss the merits and limitations of Bohr's theory. 10
b) What is Zeeman shift? Obtain an expression for Zeeman shift. 10

OR

a) Discuss the applications of Raman effect for the study of nature of liquid, crystal physics, nuclear physics and chemical effect. 10
b) Describe the construction and working of CO_2 laser. 10

Q.2 a) i) What are drawbacks of Rutherford's atom model? 05
ii) Calculate the wavenumber, wavelength and frequency of H_α line of Hydrogen. 05
($R = 1.097 \times 10^7 m^{-1}$)

b) i) What are stokes and anti-stokes lines in Raman Spectrum. 05
ii) The exciting line in an experiment with Raman effect is 5460 Å. If the stoke line has $\lambda = 5520$ Å. Calculate the wavelength of anti-stoke line. 05

OR

a) i) Explain an experimental study of stark effect. 05
ii) Calculate the wavelength separation between two component lines which are observed in normal Zeeman effect. The magnetic field used in 0.5 Wb/m^3. [Specify charge = 1.76×10^{11} ckg^{-1} and $\lambda = 6000$ Å] 05
b) i) Discuss the properties of laser beam. 05
ii) Find the ratio of population inversion of two states in He-Ne laser that produces a light of wavelength 6328Å at 27°C. 05

Q.3 Choose the correct answer 10

1. Nuclear Model of atom was proposed by –
(a) Rutherford (b) Niels Bohr
(c) J.J. Thomson (d) Sommerfield

2. If the mass of electron is reduced to half, the Rydberg constant becomes-
(a) double (b) half
(c) one fourth (d) unchange

3. In normal Zeeman effect a level of given l splits into –
   (a) l levels (b) 2 l levels
   (c) $(2\ l + 1)$ levels (d) $(2\ l - 1)$ levels

4. ……..coupling scheme holds for light atoms.
   a) L-S b) J – J c) both a & b d) none of these

5. In Raman effect, stoke's lines are observed when
   (a) $\Delta\vartheta$ is positive (b) $\Delta\vartheta$ is negative
   (c) $\Delta\vartheta$ is zero (d) none of these

6. The selection rule for Raman scattering is –
   (a) $\Delta J = \pm 1$ (b) $\Delta J = \pm 2$
   (c) $\Delta J = \pm 3$ (d) $\Delta J = \pm 4$

7. The active centres in Ruby lasers are –
   (a) aluminum ions (b) Chromium ions
   (c) both a & b (d) None of these

8. A laser beam is a –
   (a) Coherent (b) highly directional
   (c) monochromatic (d) all of these

9. In Rayleigh's scattering, the scattered light has ____ Frequency.
   (a) Same (b) different
   (c) less (d) grater

10. The value of spin quantum number of an electron in hydrogen atom is
    a) -1/2 b) +1/2 c) 1 d) 0