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**SUBJECT CODE NO: - Y-2029**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.Sc. T.Y (Sem-VI)**

**Examination March / April - 2023**

**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. Attempt all questions.
2. Use of logarithmic table is allowed.
3. All questions carry equal marks.

Q1 a) Explain Thomson's atom model and give its limitations. 10

b) What is Stark effect? Explain its experimental study with results. 10

**OR**

a) Give the theory of origin of vibration - rotation spectrum of a molecule 10

b) What is LASER? Explain the construction and working of He - Ne laser. 10

Q2 a) What are the drawbacks of Rutherford atom model. 05

b) Give any two applications of Raman effect. 05

c) Calculate the energy of electron in first Bohr's orbit. 05

$$\text{Given: } e = 1.6 \times 10^{-19} \text{ C}$$

$$m = 9.1 \times 10^{-31} \text{ Kg}$$

$$h = 6.6 \times 10^{-34} \text{ JS}$$

$$E_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2$$

d) Find the reduced mass of hydrogen chloride molecule. 05

Given:

$$\text{The mass of } ^{35}\text{Cl} = 5.81 \times 10^{-26} \text{ The mass of } ^1\text{H} = 1.67 \times 10^{-27} \text{ kg}$$

**OR**

a) Write a short note on j-j coupling scheme. 05

b) Write a note on population inversion? 05

c) Calculate the angular momentum of 'd' electron. 05

(Given,  $h = 6.63 \times 10^{-34} \text{ JS}$ )

d) In CO<sub>2</sub> Laser, the energy difference between the two LASER level is 0.1 eV. 05  
Calculate the wavelength and frequency of the radiation.

Given:  $h = 6.63 \times 10^{-34} \text{ JS}$   $c = 3 \times 10^8 \text{ m/s}$

Q3 Choose the correct answer. 10

1. According to Bohrs theory of H-atom, the electron revolving in those circular orbit which have angular momentum is an integral multiple of,

a)  $\hbar$     b)  $\frac{\hbar}{2\pi}$     c)  $\frac{2\pi}{\hbar}$     d)  $\frac{1}{\hbar}$

2. The energy of electron revolving in ground state is,....

a) -13.6 eV    b) 13.6 eV    c) -1.36 eV    d) 136 eV

3. Which of the following correct relation for j,j coupling.

a)  $j=l+s$     b)  $j=l \times s$     c)  $j=l/s$     d)  $j=l-s$

4. The stark effect is..... analogy of the Zeeman effect.

a) magnetic    b) electrical    c) optical    d) magneto-optical

5. According to Rayleigh law of scattering, the intensity of light is inversely proportional to \_\_\_\_\_

a)  $\lambda$     b)  $\lambda^2$     c)  $\lambda^3$     d)  $\lambda^4$

6. Raman lines are \_\_\_\_\_

a) Strongly polarised    b) strongly unpolarised

c) weakly polarised    d) weakly unpolarised

7. Active centres in a ruby laser are \_\_\_\_\_

a)  $\text{Al}^{3+}$  ions    b)  $\text{cr}^{3+}$     c) both  $\text{Al}^{3+}$  and  $\text{cr}^{3+}$  ions    d) ruby rods

8. Better spectrographs can be taken in a very short interval of time by using\_\_\_\_\_
- a) Ordinary camera    b) mobile camera  
c) LASER                d) tracer
9. If the radius of second Bohrs orbit is 2.12 A.U., then the radius of first Bohrs orbit is,\_\_\_\_\_.
- a) 0.53 A.U.    b) 5.3 A.U.    c) 2.12 A.U.    d) 10.6 A.U.
10. If  $L=2$  and  $S=1$  then  $j=?$
- 9) 1                b) 2    c) 3    d) 4