

**H-4/28/22**

Roll No. ....

**IV Semester Examination, 2022**

**M.Sc.**

**PHYSICS**

Paper I

(Atomic and Molecular Physics)

Time : 3 Hours ]

[ Max. Marks : 80

**Note :** All questions are compulsory. Question Paper comprises of 3 sections. Section **A** is objective type/multiple choice questions with no internal choice. Section **B** is short answer type with internal choice. Section **C** is long answer type with internal choice.

**SECTION A**

**1×8=8**

**(Objective Type Questions)**

1. The total energy of the electron in 2<sup>nd</sup> orbit of hydrogen atom is .....
2. Write the quantum condition for the elliptic orbits.
3. What is Larmour precession ?
4. Draw diagram for Anomalous Zeeman Pattern.
5. Define linear top molecule.

P.T.O.

[ 2 ]

6. Pure rotational molecular spectra observed in the ..... resion of the electromagnetic spectrum.
7. For R-branch and P-branch which is correct.  
(a)  $\Delta J = + 1, \Delta J = + 1$   
(b)  $\Delta J = + 1, \Delta J = - 1$   
(c)  $\Delta J = - 1, \Delta J = + 1$   
(d)  $\Delta J = - 1, \Delta J = - 1$
8. Write formation off electronic spectra.

**SECTION B**

**6×4=24**

**(Short Answer Type Questions)**

**Note :** Attempt one question from each unit.

**Unit-I**

1. Write Bohr's postulates and determine the total energy of electron.

Or

Describe vector atom model.

**Unit-II**

2. Explain orbital magnetic dipole moment and define Bohr magneton.

Or

Write a note on nuclear magnetic resonance.

**H-4/28/22**

**Unit-III**

3. Explain symmetric top assymetric top and spherical top molecules with example.

Or

Determine the equation of energies for harmonic oscillator.

**Unit-IV**

4. Explain rotational, vibrational and electronic spectra of molecules.

Or

Write note on Franck Condon principle.

**SECTION C**

12×4=48

**(Long Answer Type Questions)**

**Note :** Attempt *one* question from each unit.

**Unit-I**

1. Prove that the number of terms for  $pd$  configuration is the same for L-S coupling as that for  $j-j$  coupling.

Or

Describe the general features of spectra of alkali-like atoms and explained it.

**Unit-II**

2. What is Paschen-Back effect ? Explain the splitting of sodium lines with the help of it.

Or

Describe normal and anomalous Zeeman's effect. How they are explained by quantum theory ?

**Unit-III**

3. Derive the expression for the energy of a rigid-rotation model of a diatomic molecules and explain the rotational spectrum.

Or

Discuss molecule as Anharmonic oscillator and calculate vibrational frequency and force constant for anharmonic oscillator.

**Unit-IV**

4. Explain P, Q and R branches in vibration-spectra of vibrating rotator.

Or

- (a) Explain Born-oppenheimer approximation.  
(b) Explain formation of electronic spectra.

★ ★ ★ ★ ★ c ★ ★ ★ ★ ★