$4 \times 10 = 40$

SECTION 'C'
Long Answer questions (Word limit 400-450 words.)

Q. 1. Describe the general features of spectra of alkali- like atoms and explain it.

OR

Explain spectral theory for the atom having two optical electrons with outer configuration 4p4d in L-S and J-J coupling.

Q. 2. Explain normal and anomalous Zeeman's effect and prove it quantum mechanically.

OR

Describe the Paschen-back effect. How it is explain by the quantum theory.

Q. 3. Describe diatomic molecule as Anharmonic oscillator and find force constant for it.

OR

Describe diatomic molecule as a rigid- rotator and explain rotational energy level and its spectra.

Q. 4. Write note on the following –

(i) Born-Oppenheimer approximation

(ii) Vibrational structure of electronic Bond-system in Emission.

OR

Discuss the fine structure of infrared bonds of diatomic molecules and explain P-Q and R branches in the vibration rotation spectra.

ROLL NO....................

PHY. 402/22

IV SEMESTER EXAMINATION, 2022

M.Sc. (PHYSICS)

PAPER-II

ATOMIC AND MOLECULAR PHYSICS

TIME: 3 HOURS   **MAX.- 80**
                                        MIN.- 16

Note: The question paper consists of three sections A, B & C. All questions are compulsory.
Section A- Attempt all MCQ questions
Section B- Attempt one question from each unit.
Section C- Attempt one question from each unit.

SECTION 'A' $2 \times 8 = 16$
Multiple Choice Questions

1. Total energy of electron in 3rd allowed orbit of hydrogen atom is -

(a) -13.6 ev   (b) -3.39 ev

(c) -1.51 ev   (d) – 0.45 ev

2. In sodium atom the transition $3^2P_{1/2} \rightarrow 3^2S_{1/2}$ have the wavelength.

(a) 5890   (b) 5896   (c) 6890   (d) 6896

3. A singlet spectral line viewed at right angles to the magnetic field direction in split into-

    (a) Six components   (b) Four components

    (c) Three components   (d) One components

4. The stark effect in due to -

    (a) Electric field   (b) Magnetic field

    (c) Both the field   (d) No field

5. The basic requirement for the emission or absorption of radiation by a transition between rotational energy state is -

    (a) Homonuclear and permanent dipole moment

    (b) Heteronuclear & Permanent dipole moment

    (c) Only Home nuclear

    (d) None of the above

6. In non-rigid rotator the separation between lines is-

    (a) increase with increasing J

    (b) decrease with decreasing J

    (c) no change with J

    (d) decrease slightly with increasing J

7. For R branch ΔJ should be -

    (a) $\Delta J = 0$ (b) $\Delta J = 1$

    (c) $\Delta J = -1$ (d) All the above

8. The electronic band system lies in the

    (a) visible or ultraviolet region   (b) Infrared region

    (c) Radio wave region   (d) All the region

SECTION 'B' $4 \times 6 = 24$

Short Answer Type Questions

Q.1. Explain vectors atom model.

OR

Derive an impression for energy of the electron in the orbit using Bohr's model.

Q.2. Derive an expression for the Larmor processional frequency. Write its importance.

OR

Describe Nuclear Magnetic Resonance.

Q.3. Write down the expression for the energy of non rigid rotator model of a diatomic molecule and predict the pure rotational spectrum of the molecule.

OR

Derive and expression for the vibrational energy of a distomic molecule a Harmonic Oscillator.

Q.4. Explain electronic spectra of distomic molecules.

OR

Write note on frank – Condon principle.