

Code No. : B02/401

Second Semester Online Examination, May-June, 2022

M. Sc. PHYSICS

Paper IV

ATOMIC AND MOLECULAR PHYSICS

Time : Three Hours]

[Maximum Marks : 80

Note : Part A and B of each question in each unit consist of 'very short answer type question' which are to be answered in one or two sentences. Part C 'Short answer type' and D 'Long answer type' of each question should be answered within the word limit mentioned.

UNIT-I

1. (A) Define stationary energy states ? 2
 (B) What are selection rules ? 2
 (C) Explain radiation terms.

*(word limit 200-250) 4***OR**

Explain continuous spectra with examples.

- (D) Define quantum number and give physical significance of quantum numbers.

*(word limit 400-450) 12***P.T.O.****OR**

State Pauli's Exclusion principle in detail and find out the maximum number of electrons that can be accommodate in a shell of principal quantum number n ?

UNIT-II

2. (A) What is the Rydberg Schuster Law ? 2
 (B) What is Stark effect ? 2
 (C) What do you mean by paschen Back effect ? Explain it. *(word limit 200-250) 4*

OR

The quantum number of two electrons in two valence electrons atom are :

$$n_1 = 6, l_1 = 3, s_1 = 1/2$$

$$n_2 = 5, l_2 = 1, s_2 = 1/2$$

Find possible values of J by assuming LS coupling.

- (D) What is Anomalous Zeeman effect ? Explain Anomalous Zeeman effect based on quantum theory. Also defines Lande g factor. *(word limit 400-450) 12*

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OR

Describe the salient features of spectra of alkali atoms. Give the theory how does the spin coupled with electrons orbital motion leads to explain the fine structure of alkali spectra and explains D_1 and D_2 lines of Sodium.

UNIT-III

3. (A) Define isotope effect ? 2

(B) Explain term value unit of energy ? 2

(C) Write short note on any **one** from following :

(a) Asymmetric top molecules,

(b) Spherical Top molecules.

(word limit 200-250) 4(D) What is rigid rotator ? Calculate expression for energy and frequency of spectral line for rigid rotator. *(word limit 400-450) 12*

OR

What is symmetric top molecule ? Calculate expression for energy and frequency of spectral line for symmetric top molecule ?

[3]

P.T.O.

UNIT-IV

4. (A) Define vibrational spectroscopy ? 2

(B) Write two applications of IR spectrum ? 2

(C) Write short notes on any **one** from following :

(a) Vibration spectrum of diatomic molecules,

(b) Anharmonic Oscillator.

(word limit 200-250) 4

(D) What is vibrating rotator ? Calculate expression for energy and frequency of spectral line for vibrating rotator.

(word limit 400-450) 12

OR

What type of molecules show vibrational spectra. How P and R branches arise in vibrational spectrum of molecule.

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