



PAR-1603010602020600 Seat No. _____

**M. Sc. (Physics) (Sem. II) (CBCS) (W.E.F. 2016)
Examination**

August / September - 2020

CT-06 : Atomic and Molecular Physics

Time : $2\frac{1}{2}$ Hours]

[Total Marks : 70

- Instructions :** (1) All questions carry equal marks.
(2) Full marks are indicated at the right side of each question.
(3) Symbols have their usual meanings.

1 Answer any **seven** of the following : **14**

- (a) For the term symbol ${}^2P_{3/2}$ find the value of S, L and J.
- (b) Mention the two different methods by which one can sum orbital and spin momentum of several electrons.
- (c) How will you categorize Zeeman Effect?
- (d) State the interval rule.
- (e) What are the rigid and the non-rigid rotators?
- (f) In case of a diatomic molecule what is the relation among D, B and $\bar{\nu}$?
- (g) What quantum numbers J and K represent?
- (h) What is zero-point energy?
- (i) Explain the subdivision of IR region showing the importance of each subdivision.
- (j) What is the role of "Monochromator" in IR Spectrophotometer?

2 Answer any **two** of the following :

- (a) Discuss the fine structure of H-atom spectrum. **7**
- (b) Explain in detail how electrons occupy orbitals in large atoms. **7**
- (c) Discuss the concept of (i) quantization of direction and **7**
(ii) spinning electron.

PAR-1603010602020600] 1

[Contd....

- 3 (A) Discuss the procedure of summation of (i) orbital contributions and (ii) spin contributions. 7
(B) Discuss the explanation of normal Zeeman Effect on the basis of vector atom model. 7

OR

- 3 (A) Discuss the interaction of radiation with rotating molecule. 7
(B) Explain the isotope effect in rotational spectra. Also state that transition originating from the level having which J value will have the maximum intensity. 7

4 Answer any **two** of the following :

- (a) What are prolate and oblate symmetric top molecules? Explain energy levels and transitions for the rigid prolate and the rigid oblate symmetric rotors. 7
(b) Explain the working of a Microwave Spectrometer in detail. 7
(c) Discuss the Morse curve and the energy levels of a diatomic molecule. 7

5 Write short-notes on any two of the following :

- (a) Vibrating Diatomic Molecule 7
(b) IR Spectrophotometer 7
(c) Normal Vibrations of CO_2 and H_2O molecules 7
(d) Paschen Back Effect in the principal series of Lithium 7
