



MCA-003-020202

Seat No. _____

M. Sc. (Physics) (Sem. II) (CBCS) Examination

April / May - 2018

CT - 6 : Atomic & Molecular Physics

(Old Course)

Faculty Code : 003

Subject Code : 020202

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

[Total Marks : 70

- Instructions :** (1) All questions are compulsory.
(2) All questions carry equal marks.
(3) Mathematical symbols have their usual meanings.

1 Answer any Seven : 14

- (a) Write down Schrodinger wave equation for the H - atom showing dependence on the co - ordinate θ only.
- (b) What do you mean by j – j coupling?
- (c) State Pauli's exclusion principle. Why, sometimes, it is termed as "equivalence principle"?
- (d) What is anomalous Zeeman effect? By which elements it can be obtained?
- (e) What do you mean by isotope effect in rotational spectra?
- (f) What are prolate and oblate symmetric top molecules?
- (g) Transition originating from the level having which J value will have the maximum intensity?
- (h) What is meant by IR region of electromagnetic spectrum? Also subdivide it.
- (i) What is klystron? In place of klystrons, which devices are used in recent times?
- (j) What is the usefulness of monochromator in IR spectrometer?

- 2** Write any **Two** :
- (a) Discuss the interpretation of the results obtained from Schrodinger equation for atomic degeneracy of atomic level. **7**
- (b) Discuss the explanation of normal Zeeman Effect on the basis of vector atom model. **7**
- (c) Convert the equation $\frac{\partial^2\Psi}{\partial x^2} + \frac{\partial^2\Psi}{\partial y^2} + \frac{\partial^2\Psi}{\partial z^2} + \frac{8\pi m}{h^2}(E - V) = 0$ in spherical coordinates and derive the equation for r, θ and ϕ **7**

3 Answer the following questions : (ALL ARE COMPULSORY)

- (a) What is Paschen–Back Effect? Show that in a strong magnetic field, a given spectral line will be split up into three components only, with equidistant separation of $eh/4\pi m$. **7**
- (b) Explain Pauli's exclusion principle with the help of exchange degeneracy. **7**

OR

3 Answer the following, questions : (ALL ARE COMPULSORY)

- (a) Discuss non - rigid rotator in detail. Compare the energy levels and spectrum of rigid and non-rigid rotators. **7**
- (b) Explain the interaction of radiation with rotating molecule in detail. **7**

4 Write any **Two** :

- (a) Draw and explain the morse curve and the energy levels of a diatomic molecule. **7**
- (b) Describe the salient features of microwave spectrometer. **7**
- (c) Explain the first order Stark effect of symmetric top molecules for the transition $J = 1, K = 1 \rightarrow J = 2, K = 1$. **7**

5 Write notes on any **Two** :

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- (a) Different series in alkali spectra.
 - (b) Normal modes of vibration in crystal.
 - (c) IR spectrophotometer.
 - (d) Diatomic vibrating rotator.
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