



**NCC-003-020202** Seat No. \_\_\_\_\_

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

**April / May - 2017**

**Physics : CT - 06**

*(Atomic & Molecular Physics) (Old Course)*

**Faculty Code : 003**

**Subject Code : 020202**

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

[Total Marks : 70

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

- 1** Answer any **seven** of the following : **14**
- (a) Why the hydrogen spectrum is not in X-ray region ?
  - (b) What is Pauli's exclusion principle ?
  - (c) Which term indicates total probability of finding a particle in space ?
  - (d) Whether zeeman shift is observed if monochromatic light is passed through strong magnetic field ?
  - (e) Differentiate homo and hetero-nuclear molecules with suitable examples.
  - (f) What is isotope effect in rotational spectra ?
  - (g) What is the role of "source" in microwave spectrometer ?
  - (h) What is Klystron ? In recent times, which devices replaced Klystron ?
  - (i) What is the role of "Monochromator" in IR spectrophotometer ?
  - (j) What are the P and R branches in a Diatomic Vibrating Rotator ?

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

- (a) Discussing the application of Schrödinger equation for hydrogen atom, derive the equation of motion of free particle of mass "m + n" and the equation of particle of mass "m". 7
- (b) Convert the equation 7

$$\frac{\partial^2 \psi}{\partial x^2} + \frac{\partial^2 \psi}{\partial y^2} + \frac{\partial^2 \psi}{\partial z^2} + \frac{8 \pi^2 m}{h^2} \{E - V\} \psi = 0 \text{ in spherical polar}$$

coordinates and derive the equation for  $r, \theta$  and  $\phi$ .

- (c) Discuss the interpretation of result of the schrödinger equation for atomic energy level. 7
- 3 (a) Give details of different series in alkali spectra. 7
- (b) Explain the Lande g factor for L-S coupling. 7

**OR**

- 3 (a) Discuss non-rigid rotator in detail comparing the energy levels and spectrum of rigid and non-rigid rotator. 7
- (b) How the molecules are classified based on the relative values of principal moments of inertia ? Explain with suitable examples. 7

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

- (a) Explain energy levels and transitions for the rigid prolate and the rigid oblate symmetric rotors. 7
- (b) Explain the first order stark effect of a symmetric top molecule for  $J = 1, K = 1 \rightarrow J = 2, K = 1$  transition. 7
- (c) Write a complete note on each and every part of IR spectrophotometer. 7

- 5** Write short notes on any **two** of the following :
- (a) The Morse curve and the energy levels of a diatomic molecule. **7**
  - (b) Microwave spectrometer **7**
  - (c) Symmetric Stretching, Symmetric Bending and Asymmetric Stretching in CO<sub>2</sub> molecule. **7**
  - (d) Vibrating Diatomic Molecule. **7**
-