Roll No. ..... **Total Pages : 03**

GSQ/M-20 **1749**

PHYSICS

Paper XII, PH-602

Atomic and Molecular Spectroscopy

Time : Three Hours] [Maximum Marks : 40

Note : Attempt *Five* questions in all including Q. No. **1** which is compulsory. Select *one* question from each Unit. Non-programmable calculator is allowed.

Compulsory Question

1. (i) Explain the variation of Rydberg constant due to finite mass. **2**

(ii) Derive an expression for spin magnetic moment of an electron. **2**

(iii) What is the difference between *pp* and p^2 configuration in LS coupling ? **2**

(iv) Calculate the separation between successive Zeeman-levels for $^2P_{3/2}$ term in weak magnetic field. **2**

Unit I

2. (a) Deduce the expression for the series spectra of hydrogen—like atom, taking into account the finite mass of the nucleus. **4**

(b) Describe Frank-Hertz experiment and explain the graph obtained between the current and accelerating voltage. **4**

3. Describe Sommerfeld theory of the Hydrogen atom. **8**

Unit II

4. Explain the fine structure of Hydrogen spectrum. **8**

5. Calculate the spin orbit interaction energy for a single non-penetrating valance electron. **8**

Unit III

6. Derive an expression for interaction energy for *jj*-coupling. Obtain the terms arising from the *sp* electron configuration and draw the energy level diagram. **8**

7. Explain helium atom spectrum and give the difference between ortho-helium and para-helium. **8**

Unit IV

8. What is Stark Effect ? Explain weak field Stark Effect in hydrogen atom. Also, give the difference between Zeeman Effect and Stark Effect. **8**

9. Explain the rotational and vibrational energy levels of molecules. **8**