TDC Odd Semester Exam., November—2019

PHYSICS

(Honours)

(5th Semester)

Course No. : PHSH–501

(Atomic and Molecular Physics)

Full Marks : 35

Pass Marks : 12

Time : 2 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. *(a)* Derive Rutherford's scattering cross-section formula. 5

   (b) What are the limitations of Rutherford's atomic model? 2

2. (a) What are positive rays?   2

   (b) Describe Thomson's parabola method for determination of unknown mass in terms of known mass of positive ions.   5

UNIT—II

3. (a) What is the effect of nuclear motion on atomic spectrum? Deduce the expressions of reduced mass and modified Rydberg constant.   1+2+2=5

   (b) What is Bohr's correspondence principle?   2

4. (a) What is doublet fine structure of X-rays? Give one example.   2+1=3

   (b) Describe the H-like character of X-ray energy states.   4

UNIT—III

5. (a) What is Sommerfeld's atom model? What are the limitations of that model?

                                                    2+2=4

   (b) Using Sommerfeld's atom model, discuss the origin of the fine structure of the spectral lines of the hydrogen atom.   3

(Continued)

6. (a) What are L-S and J-J couplings?   2+2=4

(b) Justify the periodic arrangement of atoms on the basis of conclusions obtained from Pauli's exclusion principle.   3

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UNIT—IV

7. (a) What is Thomson scattering?   2

(b) Derive an expression for scattering cross-section based on Thomson's scattering.   5

8. (a) Give the quantum mechanical explanation of normal Zeeman effect.   5

(b) What is Paschen-Back effect?   2

UNIT—V

9. (a) Discuss in brief Born-Oppenheimer approximation in connection with molecular spectra.   5

(b) Why do molecules show band spectra rather than line spectra?   2

(Turn Over)

10. Discuss harmonic oscillator model for vibrational energy levels of a diatomic molecule. Show that the frequency of the radiated light is equal to the frequency of the oscillator.   5+2=7

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