M.Sc. DEGREE (C.S.S.) EXAMINATION, MAY 2020

Fourth Semester

Faculty of Science

Branch II—Physics–A—Pure Physics

PH 4C 11—ATOMIC AND MOLECULAR PHYSICS

(Common for All)

(2012 Admission onwards)

Time : Three Hours   Maximum Weight : 30

Part A

Answer any **six** *questions.*
Each question carries a weight of 1.

1. What are Selection Rules ? Explain.

2. Differentiate between LS and jj couplings.

3. State reason for hyperfine structure.

4. What is a Linear Molecule ?

5. State and explain Oppenheimer approximation.

6. Explain the significance of Fortrat parabola.

7. What are CARS ?

8. Explain inverse Raman effect.

9. State the applications of chemical shift.

10. What is ESR ?

$(6 \times 1 = 6)$

Part B

Answer any **four** *questions.*
Each question carries a weight of 2.

11. Obtain the fine structure of sodium atom with diagram.

Turn over

12. Briefly describe the effect of isotopic substitution in the rotational spectra of diatomic molecules.

13. Discuss the relevance of Fourier transform IR spectroscopy.

14. Give an account on Frank-Condon principle.

15. Bring out the structural determination from Raman spectra.

16. Mathematically support the hyperfine structure in ESR.

$(4 \times 2 = 8)$

Part C

Answer **all** *questions.*
Each question carries a weight of 4.

17. (a) Bring out the spectra of hydrogen atom along with various quantum numbers.

Or

(b) Describe Stark effect with theory. How Paschen-Back effect is different from Stark effect ? Discuss.

18. (a) Discuss the theory of the origin of pure rotational spectrum of a diatomic molecule.

Or

(b) Discuss the influence of rotation on the spectra of polyatomic molecules in IR.

19. (a) Describe pure rotational Raman spectra due to linear and symmetric molecules.

Or

(b) Discuss electronic spectra of diatomic molecules with theory.

20. (a) Bring out spin-spin relaxation and spin-lattice relaxation with mathematical support.

Or

(b) Explain Mossbauer Effect. Discuss the experimental set up for Mossbauer spectra along with theory.

$(4 \times 4 = 16)$