21001531

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Reg. No.....

Name.....

M.Sc. DEGREE (C.S.S.) EXAMINATION, NOVEMBER 2021

Fourth Semester

Faculty of Science

Branch II—Physics–A–Pure Physics

PH4C11—ATOMIC AND MOLECULAR PHYSICS

(2012—2018 Admissions—Supplementary/Mercy Chance)

[Common for all]

Time : Three Hours Maximum Weight : 30

Part A

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

1. Explain the reason for the fine structure of sodium atom.
2. Give the features of Lande's g factor.
3. What is meant by line broadening ? Explain.
4. State the factors that influence the intensity of spectral lines.
5. How overtones are developed ?
6. List the advantages of FTIR spectroscopy.
7. What are PARS ?
8. State and explain the Frank- Condon principle.
9. Explain the spin -lattice relaxation process.
10. What are the applications of NMR ?

(6 × 1 = 6)

Turn over

Part B

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

11. Obtain the Stark effect in one electron system.

12. Briefly describe the rotational spectra of polyatomic molecules.

13. Discuss briefly on stimulated Raman Effect.

14. Bring out the rotational fine structure of electronic -vibrational transitions.

15. Obtain the classical theory of NMR.

16. Briefly explain the recoilless emission and absorption.

(4 × 2 = 8)

Part C

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

17. (a) Explain spin-orbit interaction. Derive the expression for spin orbit interaction energy.

Or

(b) Describe normal Zeeman Effect with theory. Discuss Paschen -Back effect with conclusions.

18. (a) Obtain an expression for the rotational level of a diatomic molecule taking it as a rigid rotator. Discuss its spectrum and the relevant selection rules.

Or

(b) Obtain the expression for the vibration rotation spectrum of a diatomic molecule taking it as a HO.

19. (a) Describe vibrational Raman spectra with mathematical support. Bring out non-linear Raman too.

Or

(b) Bring out the progressions and sequences with electronic spectra of diatomic molecules.

20. (a) Discuss Bloch equations for NMR.

Or

(b) Describe magnetic hyperfine and electronic quadrupole interactions with Mossbauer spectroscopy.

(4 × 4 = 16)