



QP CODE: 26019146



Reg No :

Name :

M.Sc DEGREE (CSS) EXAMINATION, MARCH 2026

Fourth Semester

M Sc PHYSICS (MATERIAL SCIENCE)

Core Courses - PH020401 - ATOMIC AND MOLECULAR SPECTROSCOPY

2019 Admission Onwards

BAABB067

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

Weight 1 each.

1. Explain the concept of electron spin.
2. Differentiate between singlet and triplet states.
3. Microwave source and techniques have to be applied for the observation of ESR. Why?
4. Write the conditions for a molecule to be microwave active.
5. Comment on the breakdown of Born-Oppenheimer approximation.
6. What is Fermi resonance in vibrational spectroscopy.
7. Explain the Stokes' radiation in Raman scattering.
8. Comment on the sample holding techniques used in Raman Spectrometer.
9. Explain why a homo-nuclear molecule exhibit electronic spectra with rotational and vibrational transitions.
10. Explain the significance of Fortrat parabola.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

Weight 2 each.

11. Discuss briefly the theory of Paschen - Back effect.
12. Explain Stark effect.





13. List out the basic requirements of a NMR spectrometer.
14. The rotational spectrum of $^{79}\text{Br}^{19}\text{F}$ shows a series of equidistant line 0.71433 cm^{-1} apart. Calculate the rotational constant and bond length of the molecule.
15. Comment on the rotational spectrum of symmetric top molecules.
16. The first three Rotational Raman lines of a linear triatomic molecule are at 3.56 , 9.52 and 10.55 cm^{-1} from the exciting line. Estimate the rotational constant B and the moment of inertia of the molecule.
17. Describe the inverse Raman effect.
18. Explain photoelectron spectroscopy.

(6×2=12 weightage)

Part C (Essay Type Questions)

Answer any **two** questions.

Weight 5 each.

19. Explain Hund's rule with examples. Obtain the lowest spectral term of Carbon atom.
20. Explain in detail (i) quadrupole interaction (ii) magnetic hyperfine interaction and (iii) isomer shift in Mossbauer spectroscopy.
21. Prove that anharmonic oscillator behaves like a harmonic oscillator but with an oscillating frequency decreasing with increasing vibrational quantum number.
22. Explain the importance of mutual exclusion principle in the structural determination of molecules.

(2×5=10 weightage)

