



**LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**

**M.Sc. DEGREE EXAMINATION – CHEMISTRY**

THIRD SEMESTER – APRIL 2018

**CH 3810- MOLECULAR SPECTROSCOPY**

Date: 21-04-2018  
Time: 01:00-04:00

Dept. No.

Max. : 100 Marks

**Part-A**

*Answer ALL questions.*

**(10 × 2= 20)**

1. How is signal to noise ratio improved?
2. What are prolate and oblate symmetric top molecules?
3. Define zero point energy
4. What is Stark effect?
5. Why are anti-Stokes lines less intense than Stokes lines?
6. What is Born-Oppenheimer approximation?
7. Why are EPR spectra recorded in the first derivative mode?
8. Calculate the 'g' value for a free electron.
9. What is isomer shift?
10. Mention the significance of asymmetry parameter.

**Part-B**

*Answer any EIGHT questions.*

**(8 × 5= 40)**

11. Discuss the effect of isotopic substitution on the rotational spectra of molecules.
12. Explain the rotational spectra of symmetric top molecules using suitable examples.
13. What are the factors affecting the width of the spectral lines? Explain.
14. Apply the selection rules for parallel and perpendicular vibrations of a symmetric top molecule and explain the formation of P, Q and R branches.
15. Explain the rotational spectra of a linear molecule using Raman spectra.
16. What are lasers? Explain any two types of lasers.
17. What is diamagnetic anisotropy? Give an example.
18. Discuss the spin spin splitting involved in the proton NMR of pure n-propanol.
19. Explain the EPR spectra of triplet state with an example.
20. Describe the factors that influence geminal and vicinal coupling.
21. Discuss the application of quadrupole splitting in predicting the oxidation state of metal ions.
22. Highlight the importance of molecular ion and isotopic peaks.

**Part-C**

*Answer any FOUR questions.*

**(4 × 10= 40)**

23. Explain the rotational transitions in non-rigid rotors of a diatomic molecule.
24. Discuss the various types of transitions possible in electronic spectroscopy.
- 25a. Write a short note on the energy levels of a diatomic molecule using Morse curve.
- b. What is the change in the rotational constant B when hydrogen is replaced by deuterium in hydrogen molecule? (5+5)
26. Discuss the principle of COSY and HETEROCOSY with suitable examples.
- 27a. Distinguish between isotropic and anisotropic hyperfine coupling with relevant examples.
- b. Explain the quadrupole transitions in spherical and axially symmetric fields. (5+5)
28. Explain with suitable example i) Zero field splitting ii) the theory of Mossbauer spectroscopy.

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