



NOVEMBER/DECEMBER 2018

MPH31 — SPECTROSCOPY

Time : Three hours

Maximum : 75 marks

SECTION A — (5 × 6 = 30 marks)

Answer ALL questions.

1. (a) Explain the inversion of ammonia microwave spectrum.

Or

- (b) Write applications of microwave spectroscopy to chemical analysis.

2. (a) How do microwave spectra differ from infrared spectra? Give comparison table.

Or

- (b) Discuss the application of IR spectroscopy.

3. (a) Give the classical theory of Raman scattering.

Or

- (b) Outline the coherent anti-Stoke's Raman spectroscopy.

4. (a) Explain the single coil method of NMR experimental method.

Or

- (b) Explain NQR energy level transitions for non-axially symmetric systems having integral and half integral spins.
5. (a) Give a brief account on nuclear interaction and hyperfine structure in ESR.

Or

- (b) Discuss recoilless emission and absorption in Mossbauer spectroscopy.

SECTION B — (3 × 15 = 45 marks)

Answer any THREE questions.

6. (a) With a neat diagram, explain the working of a microwave spectrometer.
- (b) Classify each of the following molecules as a spherical, symmetric or asymmetric top molecule :
- (i)  $\text{CH}_4$
- (ii)  $\text{CH}_3\text{Cl}$ ;
- (iii)  $\text{CH}_2\text{Cl}_2$ ;
- (iv)  $\text{CHCl}_3$ ;

- (v)  $\text{CCl}_4$ ;
- (vi)  $\text{SF}_6$ ;
- (vii)  $\text{H}_2\text{O}$ ;
- (viii)  $\text{C}_2\text{H}_6$ ;
- (ix) Benzene;
- (x)  $\text{NH}_3$ ;
- (xi)  $\text{O}_3$ .



7. (a) Explain vibrational and rotational spectra of diatomic molecules.
- (b) Write a note on rotational vibrators.
8. Discuss the Raman effect in relation to inorganic, organic and physical chemistry.
9. (a) Give the principle of nuclear quadrupole resonance.
- (b) How NQR group frequencies are be studied? Show that the transition frequencies are in the ratio 1:2:3 if the spin of  $\text{Co}^{59}$  nucleus (axially symmetric system) is  $7/2$ .
10. Explain how Mossbauer spectroscopy is used to explain simple biological applications.