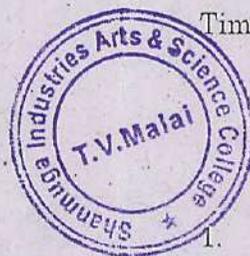


NOVEMBER/DECEMBER 2019

MPH31 — SPECTROSCOPY

Time : Three hours

Maximum : 75 marks



SECTION A — (5 × 6 = 30 marks)

Answer ALL questions.

1. (a) Describe the inversion spectrum of ammonia.
Or
(b) What is a diatomic molecule? Explain the rotational spectra of diatomic molecule.
2. (a) Describe the vibrational spectra of polyatomic molecule.
Or
(b) Obtain an expression for the energy of a Simple Harmonic Oscillator.
3. (a) Discuss the quantum theory of Raman scattering.
Or
(b) The exciting line in an experiment is 5650 \AA and the Stokes line is 5810 \AA . Calculate the wavelength of the anti-Stokes line.

4. (a) A particular NMR spectrometer operates at 30.256 MHz. Calculate the magnetic field required to have resonance for proton ${}^1\text{H}^1$ nucleus and a carbon ${}^{13}\text{C}^{13}$ nucleus. Given magnetic moments of proton and carbon are 2.7927μ and $0.7022 \mu_N$ respectively.

Or

- (b) Explain the quadruple Hamiltonian of NQR.
5. (a) Describe the quantum mechanical theory of ESR.

Or

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



SECTION B — (3 × 15 = 45 marks)

Answer any THREE questions.

6. Discuss:
- (a) the rotational spectrum of a diatomic molecule and
- (b) Stark effect in the symmetric molecules.
7. Write notes on the diatomic vibrating rotator and the normal states of vibration of a polyatomic molecule.

8. Explain the principle, experimental setup and working of coherent anti-Stokes Raman spectroscopy (CARS) with neat sketch. Mention the important applications of CARS.
9. Give the principle of NQR. Describe the construction of NQR spectrometer and explain its working with neat block diagram.
10. With the help of a neat sketch describe a Mossbauer spectrometer. What is isomer shift? Discuss with examples.