

(6 pages)

S.No. 6998

P 22 PYE 3 B

(For candidates admitted from-2022-2023 onwards)

M.Sc. DEGREE EXAMINATION, NOVEMBER 2023.

Part IV — Physics — Elective

METHODS OF SPECTROSCOPY

Time : Three hours

Maximum : 75 marks

PART A — (20 marks)

Answer ALL questions.

I. (A) Multiple choice questions : (5 × 1 = 5)

1. Which radiation has high energy?

- (a) Radio waves (b) Microwaves
(c) Visible (d) Ultraviolet

2. Which technique is helpful and used for functional group identification?

- (a) FTIR spectroscopy
(b) Electronic spectroscopy
(c) NMR spectroscopy
(d) Rotational spectroscopy

3. The purpose of secondary filter in fluorescence spectroscopy

- (a) Allows only excitation radiation
(b) Allows only emission radiation
(c) Allows both (a) and (b)
(d) Allows transmitted radiation

4. The region of electromagnetic spectrum for nuclear magnetic resonance is _____

- (a) Microwave
(b) UV-rays
(c) Infrared
(d) Radio frequency

5. Which of the following will not show electron spin resonance?

- (a) Free radicals
(b) Paramagnetic material
(c) Transition meta
(d) Diamagnetic materia

(B) Fill in the blanks :

(5 × 1 = 5)

PART B — (5 × 5 = 25)

6. The mass of an atom is entirely due to _____
7. Raman shift depends upon _____.
8. The transitional zone for Raman spectra is _____
9. The region of electromagnetic spectrum for nuclear magnetic resonance is _____.
10. Which electromagnetic radiation is used in ESR _____

II. Descriptive type questions :

(5 × 2 = 10)

11. Explain central field approximation.
12. What is the basic principle of Raman spectroscopy?
13. Define fluorescence.
14. Elaborate spin-lattice relaxation.
15. Write short note on Mossbauer effect.

Answer ALL questions, choosing either (a) or (b).

16. (a) List out some of the applications of spectroscopy.

Or

- (b) Write short note on molecular hybridization.

17. (a) Write short note on Raman and IR spectroscopy.

Or

- (b) Brief about IR imaging and vibrational frequency analysis.

18. (a) How Franck Condon principle account for the intensities of lines in vibrational electronic spectra.

Or

- (b) Differentiate between fluorescence and phosphorescence.

19. (a) Give short note on nuclear quadrupole effect.

Or

- (b) Elucidate the working of high resolution NMR.

20. (a) What is the basic principle and working of ESR spectroscopy?

Or

- (b) Narrate the concept : Doppler velocity shift.

PART C — ($3 \times 10 = 30$)

Answer any THREE questions.

21. Elaborate and deduce the Hartee-Fock equations.
22. Derive an expression for the zero point energy of a diatomic molecule.
23. (a) Explain briefly the informations one can get from vibrational analysis of electronic vibration spectra.
- (b) List and explain the different types of vibration in vibrational spectroscopy.

24. Deduce the Bloch equations with appropriate explanation.

25. Discuss in detail about the recoil less emission and absorption.