

(6 pages)

Reg. No. :

Code No. : 7147

Sub. Code : PPHM 42

M.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2019.

Fourth Semester

Physics – Core

SPECTROSCOPY

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

1. In prolate symmetric top molecule the principal moments of inertia is

(a) $I_a = I_b < I_c$

(b) $I_a < I_b = I_c$

(c) $I_a = I_b = I_c$

(d) $I_a \neq I_b \neq I_c$

2. Will the molecule $^{17}\text{O} - ^{16}\text{O}$ show a rotational spectrum?

Yes/No.

3. The spacing between lines in the P and R branches of $^{16}\text{O} - \text{C} - ^{16}\text{O}$

(a) 2 B

(b) 4 B

(c) 6 B

(d) 8 B

4. Which diatomic molecule do not show infrared spectra?

(a) HF

(b) H_2O

(c) N_2

(d) CO_2

5. In O_2 molecule the separation between adjacent rotational Raman lines is

(a) 8 B

(b) 4 B

(c) 6 B

(d) 2 B

6. Molecular vibration will be Raman active only if it causes a change in a component of _____.

7. Which nuclei do not give NMR spectra?

(a) $^1_1\text{H}^2$

(b) $^{12}_6\text{C}^{12}$

(c) $^{13}_6\text{C}^{13}$

(d) $^1_1\text{H}^1$

Page 2

Code No. : 7147



8. The resonance condition for the ESR spectra is
- (a) $h\nu = \frac{1}{2} g M_B$ (b) $h\nu = g M_B B$
- (c) $h\nu = gB$ (d) $h\nu = \frac{g M_B}{B}$
9. SERS spectrum results when the frequency of the emitting radiation matches with _____ frequency of the colloidal particles.
10. Photoelectron spectroscopy technique is excellent for probing atomic and molecular _____ energy levels.

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Out line the effect of isotopic substitution on the rotational spectra of molecules.
- Or
- (b) Distinguish between rigid and non-rigid rotator. How does non-rigidity affect rotational spectra.

Page 3

Code No. : 7147

12. (a) Explain the effect of anharmonicity on the vibrational spectra of diatomic molecules.

Or

- (b) Derive the vibrational frequency of a diatomic molecule.

13. (a) Explain mutual exclusion principle with example.

Or

- (b) Explain the importance of Raman Effect for phase transition studies.

14. (a) Explain chemical shift with examples.

Or

- (b) Explain the factors responsible for the hyperfine structure in ESR spectra.

15. (a) Write a brief note on XEPS.

Or

- (b) Outline briefly the electromagnetic enhancement mechanism in SERS.

Page 4

Code No. : 7147

[P.T.O.]



PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Discuss the rotational spectrum of symmetric top molecules.

Or

- (b) With a neat block diagram explain microwave spectrometer.

17. (a) Explain rotation vibration spectra of polyatomic molecule.

Or

- (b) Explain FT IR spectrometer.

18. (a) Explain classical theory of Raman Scattering.

Or

- (b) Explain the structure determination using Raman spectra.

19. (a) Explain Bloch equations.

Or

- (b) Describe the block diagram, the working of an ESR spectrometer.

20. (a) Explain reflection - absorption Infra-red spectroscopy technique.

Or

- (b) With diagram explain the electron energy loss spectrometer.

