

D 101292

(Pages : 2)

Name.....

Reg. No.....

FOURTH SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY)
EXAMINATION, APRIL 2024

(CBCSS)

Physics

PHY 4C 12—ATOMIC AND MOLECULAR SPECTROSCOPY

(2019 Admission onwards)

Maximum : 30 Weightage

Time : Three Hours

Section A

8 short questions, each answerable within 7.5 minutes.

Answer all questions.

Each question carries weightage 1.

1. Define Stark effect.
2. Figure the normal modes of water molecule.
3. Draw the schematic diagram of IR spectrometer.
4. What are the selection rules for the parallel vibrations?
5. What is the principle of ESR?
6. Define nuclear magneton.
7. What is the principle of FTIR?
8. What is chemical shift?

(8 × 1 = 8 weightage)

Section B

4 Essay questions, each answerable within 30 minutes.

Answer any two questions.

Each question carries weightage 5.

9. Explain rotational fine structure of electronic vibration spectra. Explain P, Q and R branches. Explanation, figure.
10. Explain vector atom model. With necessary figure briefly explain :
 - (a) L-S coupling.
 - (b) J-J coupling?

Turn over

11. Explain diatomic vibrating rotator.
12. Explain with figure Vibrational Raman spectra.

(2 × 5 = 10 weight)

Section C

7 problem questions, each answerable within 15 minutes.

Answer any **four** questions.

Each question carries weightage 3.

13. Rotational and centrifugal distortion constants of HCl molecule are 10.593 cm^{-1} and $5.3 \times 10^{-4} \text{ cm}^{-1}$ respectively. Estimate the vibrational frequency and force constant of the molecule.
14. Explain dissociation.
15. Explain with figure vibrational coarse structure.
16. The band origin of a transition in C_2 is observed at $19,378 \text{ cm}^{-1}$ while rotational structure indicates that the rotational constants in excited and ground states are respectively $B' = 1.7527 \text{ cm}^{-1}$ and $B'' = 1.6326 \text{ cm}^{-1}$. Estimate the position of the band head.
17. Derive the classical theory of Raman scattering.
18. Draw and explain Fortrat parabola.
19. Explain nuclear magnetic resonance condition.

(4 × 3 = 12 weight)