M.Sc. DEGREE EXAMINATION - APRIL 2022
PHYSICS
SECOND SEMESTER

COURSE : **CORE ELECTIVE**
PAPER : **SPECTROSCOPY**
TIME : **3 HOURS** **MAX. MARKS : 100**

SECTION – A

Answer all the questions: **(10 x 3 = 30)**

1. Write the working principle of microwave oven.
2. Explain mutual exclusion principle with an example.
3. Discuss the effect of isotopic substitution in rotational spectra.
4. The exciting line in an experiment is 5460 Å and the stokes line is at 5520 Å. Find the wavelength of the anti-stokes line.
5. What are called hot bands? Give explanation.
6. Give explanation for the state $^1\Sigma^+_g$.
7. Distinguish between SEM and TEM.
8. Define Auger electrons? Explain the principle of Auger Electron Spectroscopy.
9. Outline the significance of Larmor Precession in the study of resonance spectra.
10. What do you know about chemical shift in NMR?

SECTION – B

Answer any five questions: **(5 x 5 = 25)**

11. Distinguish between v' progressions and v'' progression and explain how orbital energies of molecules are estimated by photoelectron spectroscopy.
12. Explain the importance of quadrupole hyperfine interaction in microwave spectra.
13. The fundamental band for DCl^{35} is centered at 2011.00 cm^{-1}. Assume that the internuclear distance is constant at 1.288 Å , then calculate the wavenumbers of the first two lines of each of the P and R – branches of DCl^{35}.
14. Enumerate the instrumentation of IR spectrophotometer with neat diagram.
15. Give short notes on Fortrat Prabolae and dissociation energy.
16. HCl has a B value of 10.593 cm^{-1} and a centrifugal distortion constant D of 5.3 x 10^{-4} cm^{-1}. Estimate the vibrational frequency and force constant of the molecule. The observed vibrational frequency is 2991 cm^{-1}. Explain qualitatively the discrepancy.
17. With a neat schematic diagram, explain how Mossbauer spectrometer is used in understanding the electronic structure of molecules.

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SECTION – C

Answer any three questions. (3x 15 = 45)

18. Obtain an expression for the rotational energy levels of a diatomic molecule, treating them as a rigid rotator. Discuss its spectrum and selection rule.
19. Describe the instrumentation of NMR spectrometer with a neat block diagram and give its resonance condition.
20. What do you mean by EELS? Explain how change in kinetic energy of electrons is measured using EELS.
21. Give an account on the salient features of Franck – Condon Principle for the intensities of line in the vibrational electronic spectra.
22. Discuss in detail the vibrational spectra of a diatomic molecule with reference to harmonic and anharmonic oscillators.

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