Mamm

Avinashilingam Institute for Home Science and Higher Education for Women

(Deemed to be University under Category 'A' by MHRD, Estd. u/s 3 of UGC Act 1956)
Re-accredited with 'A+' Grade by NAAC. Recognised by UGC Under Section 12B
Coimbatore - 641 043, Tamil Nadu, India

Master's Degree Examination – June 2021
IV Semester

Class : II M.Sc. **Time: 3 Hours**
Major : Physics **Max. Marks: 100**

17MPHC20 Molecular Spectroscopy

PART A **10 x 1 = 10**
Choose the Correct Answer

Course Outcomes:

1. Apply Surface Plasmon effect on Raman Scattering
2. Describe the theory of electronic spectra
3. Analyse ESR spectra
4. Deliberate influence of magnetic field on nuclear interactions.
5. Apply the concepts of nuclear interaction in analyzing the hyperfine splitting

PART A **10 x 1 = 10**
Choose the Correct Answer

1. The lines on the low frequency sides of the Rayleigh line is called CO1K1
   a. Stokes line b. anti-stokes lines c. Rayleigh line d. Raman Line

2. Dipole-dipole interaction between the metal surface and the molecule is CO1K1
   a. Physisorption b. chemisorption
   c. charge transfer interaction d. polarization

3. The vertex of fortrat parabola is known as CO2K1
   a. Band head b. band origin c. P branch d. R branch

4. When an electron spin having magnetic moment μ is placed in a magnetic field B, the interaction energy E? CO2K2
   a. E= -μB cosθ b. E= -μB sinθ c. E= μB cosθ d. none of the above

5. The resonance condition for ESR is CO3K2
   a. 2μgB_0 b. μgB_0 c. 2μB_0 d. - 2μg B_0

6. Electron paramagnetic resonance also referred as CO3K1
   a. SERS b. Nuclear Magnetic Resonance
   c. Electron Spin Resonance d. Nuclear Quadrupole Resonance

7. The excited state life time range of Mossbauer effect source nuclei is CO4K3
   a. 10^{-10}- 10^{-4}sec b. 10^{-10}- 10^{-6}sec c. 10^{-4}- 10^{-6}sec d. 10^{-6}- 10^{-15}sec

8. In Mossbauer effect , maximum absorption occurs when recoil energy is CO4K2
   a. maximum b. minimum c. zero d. same as that gamma ray

9. The standard solvent used in NMR measurement is CO5K1
   a. TMS b. ethanol c. acetaldehyde d. acetone

10. The following is NMR active CO5K1
    a. ${}_2He^4$ b. ${}_8O^{16}$ c. ${}_{16}S^{32}$ d. ${}_1H$

Part B 5 x 6 = 30

Answer ALL questions

Each answer should not exceed 400 words or two pages

11. a. List out the surface selection rules of Surface-enhanced Raman scattering(SERS) CO1K2

(or)

11.b. Explain the basic Principle,Construction and Working of the Surface-Enhanced Raman scatteringmicroprobe with neat diagram CO1K2

12. a. Discuss the Frank Condon principle CO2K3

(or)

12.b. What is Fortrat parabola? Discuss in detail with suitable example. CO2K1

13. a. Discuss the hyperfine process involved in Electron Spin Resonance (ESR). CO3K3

(or)

13.b. With a schematic representation, explain the basic Principle, Construction and Working of the Electron Spin Resonance Spectroscopy. CO3K2

14. a. Explain the basic Principle and Working mechanism of Mossbauer Spectrometer . CO4K2

(or)

14.b. Discuss briefly about quadrupole interaction and splitting of Mossbauer spectrum CO4K3

15. a. Explain the resonance condition of NMR CO5K2

(or)

15.b. Write a brief note on NMR imaging CO5K1

Part C 5 x 12 = 60

Answer ALL questions

Each answer should not exceed 800 words or four pages

16. a. Explain the procedures for the preparation of CO1K2
i) Cold deposited metal film ii)Metal electrodes for SERS study

(or)

16.b. Discuss the applications of Surface-enhanced Raman scatteringanalysis. CO1K3

17. a. Explain briefly the information's one can get from vibration analysis of electronic vibration spectra CO2K2

(or)

17.b. Explain about rotational fine structure of diatomic molecules through electronic- vibration transition diagram CO2K2

18. a. Outline the basic requirement of ESR spectrometer. With a block diagram describe the working of simple balanced ESR spectrometer CO3K3

(or)

18.b. Give the principle of photo electron spectroscopy and describe the functions of photo electron spectrometer with appropriate schematic diagram CO3K3

19. a. Explain the applications of Mossbauer spectrum for the understanding of electronic structure, crystal symmetry, corrosion studies and in biological applications CO4K2

(or)

19.b. Calculate the recoil velocity and energy of the Mossbauer nucleus ^{119}Sn when emitting a gamma ray of frequency 5.76×10^{18}Hz. what is the Doppler shift of the gamma ray frequency to an outside observer? Avogadro number is $6.02\times10^{23}mol^{-1}$. CO4K4

20.a. Describe the working of NMR spectrometer . CO5K3

(or)

20.b. Derive Bloch equations CO5K3