C 80729 (Pages : 2) Name.....

Reg. No.....

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, MARCH 2020

(CUCSS)

Physics

PHY 4C 12—ATOMIC AND MOLECULAR SPECTROSCOPY

(2012 Admissions)

Time : Three Hours Maximum : 36 Weightage

Section A

Answer **all** *questions from section A.*
Each question carries a weightage of 1.

1. What is L-S coupling scheme ?
2. What is Zeeman effect ?
3. Why NMR spectroscopy is used in biological applications ?
4. What are merits of FTIR spectrum ?
5. With neat diagram give the normal modes of H_2O ? What are its frequencies ?
6. Describe the vibrational coarse structure of electronic absorption from the ground state.
7. What is meant by inverse Raman effect ?
8. What is υ" progression ?
9. Explain Larmour precision ?
10. What are the important applications of ESR Spectroscopy ?
11. What are the merits of LASER as an excitation source for recoding Raman spectra of a samples ?
12. What is the basic principle of Mössbauer spectroscopy ?

(12 × 1 = 12 weightage)

Section B

Answer any **two** *questions from section B.*
Each question carries a weightage of 6.

13. Draw the block diagram of Raman spectrometer and explain its working.
14. Describe with necessary theory account for the splitting of spectral lines in the presence of strong magnetic field.

Turn over

15. Describe with neat diagram the dissociation and predissociation of molecules

16. Derive the Bloch equations by considering nucleus posses magnetic moment and angular momentum.

(2 × 6 = 12 weightage)

Section C

Answer any **four** *questions from section* C.
Each question carries a weightage of 3.

17. The reduced mass of a molecule is 13×10^{-27} kg. and its equilibrium vibration frequency is 1900 cm^{-1}, determine the force constant. $c = 3 \times 10^8$ m/s.

18. Bands in the absorption spectrum of a diatomic molecule ceases its continous bands at 1761 Å. The ground state zero point energy is 793 cm^{-1} and the difference in potential energy minima for the two electronic states corresponds to 49,800 cm^{-1} . Find out the D'_e of the diatomic molecule.

19. Determine the frequency of an unpaired electron when it is subjected to a magnetic field of strength of 0.45 Tesla.$\beta = 9.274 \times 10^{-24}$ JT^1. $h = 6.62 \times 10^{-34}$J.

20. Raman line at 4570 Å is observed from a material when the exciting line is at 4358 Å. Determine the positions of Stokes and anti-stokes lines if the wavelength of the exciting line is changed to 488 nm.

21. Determine the Zeeman components in Å unit, when a spectral line of wavelength 4500 Å, is subjected to a magnetic field of strength 0.3 Tesla. Mass of the electron is 9.1×10^{-31} Kg ; $c = 3 \times 10^8$ m/s.; charge of the electron is 1.6×10^{-19} C.

22. A system of protons at a temperature of 25 °C is placed in magnetic field of strength 3T. Determine the ratio of number of proton spins in the lower to the upper state.

$k = 1.381 \times 10^{-23}JK^{-1}$ $g_N = 5.585$, $\mu_N = 5.052 \times 10^{-27}T$.

(4 × 3 = 12 weightage)