D 42564 (Pages : 2) Name.....

Reg. No.....

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, JUNE 2018

(CUCSS)

Physics

PHY 4C 12—ATOMIC AND MOLECULAR SPECTROSCOPY

(2012 Admissions)

Time : Three Hours **Maximum : 36 Weightage**

Section A

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

1. What are the possible values of n, l and m_s if a hydrogen atom has $m_1 = -2$?
2. Explain the role of spin orbit interaction in fine structure splitting.
3. Is the state $5^2D_{3/2}$ correct or erroneous ?
4. What is centrifugal distortion ?
5. Outline the effect of isotopic substation on the rotational spectra of molecules.
6. What are hot bands ? Why are they called so ?
7. Why anti-stocks lines are less intense than stocks line ?
8. Explain mutual exclusion principle with example.
9. What is predissociation ?
10. What is Larmour precession ?
11. Explain spin-lattice relaxation.
12. Explain the term chemical shift.

(12 × 1 = 12 weightage)

Section B

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

13. Describe normal Zeeman effect and explain normal Zeeman effect using quantum theory.
14. Explain Born-Oppenhemier approximation. Discuss on the normal modes and vibrations of H_2O and CO_2 molecules.
15. Discuss Raman spectra of diatomic molecules. Point out the similarity and differences in infrared and Raman spectra.
16. Discuss the various relaxation processes for nuclei and derive Blosh equations.

(2 × 6 =12 weightage)

Turn over

Section C

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

17. Obtain the terms for the sp electronic configuration in LS coupling scheme.

18. The IR spectrum of H^1Br^{79} consists of a series of lines spaced 17 cm^{-1} apart, find the inter nuclear distance of H^1Br^{79}.

19. Value of ω_e and $\omega_e x_e$ are 1580.36 and 12.073 cm^{-1} respectively for the ground state of O_2 calculate the zero point energy (1 ev = 8068 cm^{-1}).

20. The fundamental and first overtone of CO occur at 2143.3 cm^{-1} and 4260 cm^{-1} calculate the dissociation energy.

21. A free electron gives resonance at the frequency of 9.5 GHz when the magnetic field strength is 0.34 T, at what frequency the resonance occurs if the magnetic field is 1.3 T ?

22. A mossbeaur nucleus ^{57}Fe makes the transition from the excited state of energy 14.4 KeV to the ground state. Evaluate its recoil velocity.

(4 × 3 = 12 weightage)