M.Sc. DEGREE (CSS) EXAMINATION, AUGUST 2013

Second Semester

Faculty of Science

Branch : Chemistry

AN 2C 08/AP 2C 08/CH 2C 08/PH 2C 08/PO 2C 08—MOLECULAR SPECTROSCOPY

(2012 admissions)

[Common to all branches of Chemistry]

Time : Three Hours   Maximum Weight : 30

Section A

Answer any **ten** *questions.*
Each question carries a weight of 1.

1. What is Doppler broadening ?

2. What is spherical top molecules ? Give *one* example.

3. Explain Fermi resonance.

4. Explain mutual exclusion principle.

5. What is Frank-Condon principle ?

6. Explain Karplus relationship.

7. What is NOE effect ?

8. Write McConnell equation and explain the terms.

9. What is NQR spectroscopy ?

10. Give the principle of Mossbauer spectroscopy.

11. What are the factors influencing 'g' values.

12. What is FID in FTNMR ?

13. Explain the applications of Stark effect.

$(10 \times 1 = 10)$

Section B

Answer any **five** *questions by attempting not more than 3 questions from each bunch.*
Each question carries a weight of 2.

Bunch 1 (Short Essay Type)

14. What is 'g' factor ? How is g values determined ?

15. Explain two dimensional NMR.

Turn over

16. What are selection rules ? Explain it in IR and EPR spectroscopy.

17. Write on X-ray photoelectron spectroscopy.

Bunch 2 (Problem Type)

18. Determine the principal moment of inertia of methane if its band length is 1.09 A°

19. The average value of spacing between the adjacent lines in the rotational spectrum of diatomic molecule CX is 3.8432 Jcm^{-1}. The equilibrium distance is 1.131 A°. Find the diatomic mass of X.

20. Calculate the wave numbers of the lines in the rotational spectrum of CO for the $0 \rightarrow 1, 1 \rightarrow 2, 2 \rightarrow 3$ transitions if the equilibrium bond distance of CO is 1.131 A°.

21. Calculate the number of absorption maxima in the purely rotational spectrum of CO : $W_e = 2170$ cm^{-1}, $X_e = 6.11 \times 10^{-3}$, $B_0 = 1.931$ cm^{-2}.

$(5 \times 2 = 10)$

Section C

Answer any two questions.
Each question carries a weight of 5.

22. (a) Discuss about vibrational spectra of poly atomic molecules.

    (b) Explain the disadvantages of dispersive IR.

23. (a) Discuss Resonance Raman scattering and resonance fluorescence.

    (b) Discuss about the applications of Lasers.

24. (a) Discuss relaxation methods in NMR spectroscopy.

    (b) Discuss FTNMR.

25. Explain the application of Mossbauer spectroscopic techniques in the study of Fe(11) and Fe (111) cyanides.

$(2 \times 5 = 10)$