G 2783 (Pages : 2) Reg. No.....

Name.....

M.Sc. DEGREE (CSS) EXAMINATION, AUGUST 2014

Second Semester

Faculty of Science

Branch : Chemistry

AN 2C 08/AP 2C 08/CH 2C 08/PH 2C 08/POH 2C 08 – MOLECULAR SPECTROSCOPY

(2012 Admission onwards)

Time : Three Hours Maximum Weight : 30

Section A

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

1. State Born Oppenheimer approximation.
2. What is Stark effect?
3. What are the disadvantages of dispersive IR?
4. What are Stokes and Anti-Stokes lines?
5. Give any *three* applications of lasers.
6. What is Larmour precession?
7. What do you mean by magic angle spinning?
8. What is Kramer's degeneracy?
9. Explain the principle of NQR spectroscopy.
10. What are the factors determining chemical shift?
11. Draw the EPR spectrum of methyl free radical.
12. Deduce theoretically the NMR spectra of $CH_3CHClCH_3$.
13. What are chemical shift reagents? Give one example.

(10 × 1 = 10)

Section B

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

BUNCH 1 (SHORT ESSAY TYPE)

14. What is force constant? How is it determine?
15. Explain the classical theory of Raman spectrum.

Turn over

16. Discuss the theory of NMR spectroscopy.

17. Discuss FT techniques in spectroscopy and explain its advantages.

BUNCH 2 (PROBLEM TYPE)

18. The average value of spacing between the adjacent rotational lines in the spectrum of NaCl is 0.432 cm^{-1}. Show that ion pairs are present in the vapours of NaCl.

19. Determine the rotational energy of CO on the quantum levels J = 1 and 2. If the equilibrium nuclear distance of 10 is 1.131 Å.

20. Determine the force constant for co-vibrator provided $W_e = 2170\ cm^{-1}$

21. The wave numbers of the lines in the P-branch of the rotation-vibration spectra of methane are 3032.30, 3043.15, 3054.00, 3064.85 and 3075.70 cm^{-1}. Determine the moment of inertia and bond distance of methane.

(5 × 2 = 10)

Section C

Answer any **two** *questions.*

Each question carries a weight of 5.

22. (a) Discuss classical and quantum theory of Raman effect.

    (b) Discuss FT NMR spectroscopy.

23. Discuss about different types of lasers.

24. Explain factors influencing Coupling and Karplus relationship.

25. Outline the principle of Mössbauer spectroscopy. Explain the application of this technique in the study of Fe (II) and Fe (III) cyanides.

(2 × 5 = 10)