

M.Sc. DEGREE (CSS) EXAMINATION, MARCH 2013**First Semester**

Faculty of Science

Branch : Chemistry

AN 1C 03 /AP 1C 03/ CH 1C 03/ PH 1C 03/POH 1C 03—QUANTUM CHEMISTRY AND
GROUP THEORY

(Common to All Branches of Chemistry)

[2012 Admissions]

Time : Three Hours

Maximum Weight : 30

Section A

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

1. Explain the condition of orthogonality of a wave function.
2. Explain the properties of a Hermitian operator.
3. What is Laplacian operator ? Explain with examples.
4. What is meant by spherical harmonics ?
5. Give the postulates of spin by Goudsmith.
6. The electron cloud in spherically symmetrical for s-wave function-Explain why ?
7. Explain the term cyclic group. Give one example.
8. Find the inverse of the matrix

$$\begin{bmatrix} -1 & 1 & 1 \\ 0 & 2 & 4 \\ 5 & 2 & 3 \end{bmatrix}$$

9. What is meant by space group ?
10. Which type of molecules show molecular dissymmetry ?
11. Distinguish between Raman scattering and Rayleigh scattering.
12. What is Frank-Condon Principle ?
13. What are stationary waves ?

(10 × 1 = 10)

Turn over

Section B

*Answer five questions.
Each question carries a weight of 2.*

14. Commutative operators have common eigenfunction. Verify.
15. Show that \hat{L}_y and \hat{L}_x commute.
16. Explain the Stern Gerlach experiment for the spin discovery.
17. Explain with suitable example screw axis and slide planes.
18. Prove that σ_v and σ'_v of NH_3 molecule belong to the same class.
19. Compare the Cartesian and spherical polar co-ordinates.
20. Account for the origin of Raman spectrum.
21. Briefly explain pre dissociation spectrum.

(5 × 2 = 10)

Section C

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

22. State great orthogonality theorem. What are its consequences ?
23. Explain electronic spectra diatomic molecules.
24. Outline the essential postulates of quantum mechanics.
25. What are Hermite polynomials ? How are they used in solving the Schrödinger equation for a harmonic oscillator.

(2 × 5 = 10)