E 2925 (Pages : 2) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, APRIL 2022

Fifth Semester

Core Course—QUANTUM MECHANICS AND SPECTROSCOPY

(Common for B.Sc. Chemistry Model I, Model II, B.Sc. Petrochemicals and B.Sc. Chemistry Environment and Water Management)

[2013–2016 Admissions]

Time : Three Hours Maximum Marks : 60

Part A

Answer **all** *questions.*

Each question carries 1 *mark.*

1. State de-Broglie relationship.
2. What is Compton effect?
3. Why H_2 molecule is microwave inactive?
4. State Grotthuss–Drapers law.
5. What are operators?
6. What is meant by normalised wave functions?
7. What are hot bonds?
8. How many peaks will be there in the NMR spectra of acetaldehyde?

(8 × 1 = 8)

Part B

Answer any **six** *questions.*

Each question carries 2 *marks.*

9. What are wave functions? Explain its significance.
10. Explain the significance of the Heisenberg's uncertainty principle.
11. Explain the term zero point energy.
12. What are Stokes and antistokes lines?
13. Write note on Frank-Condon principle.
14. Sketch the NMR spectra of acetophenone.
15. Write note on Beer–Lambert's law.

Turn over

16. What is meant by Quantum Yield?
17. Write note on black body radiations.
18. What is chemiluminescence?

(6 × 2 = 12)

Part C

Answer any **four** *questions.*
Each question carries 4 *marks.*

19. Differentiate between electromagnetic waves and matter waves.
20. Discuss the vibrational energy levels of a harmonic accelerator. Write expressions for energy and force constant.
21. Briefly discuss shielding and de-shielding with suitable examples.
22. Discuss the principle of mass spectroscopy.
23. Derive energy equation for a particle in a one dimensional box.
24. Show that for a rigid diatomic rotar, the moment of inertia is given by $I = \mu r^2$.

(4 × 4 = 16)

Part D

Answer any **two** *questions.*
Each question carries 12 *marks.*

25. (a) Briefly discuss the postulates of quantum mechanics.
    (b) Write brief note on quantum numbers explain its significance.
26. (a) Compare Valence bond and Molecular orbital theory.
    (b) Write a short note on Quantum theory of Raman effect.
27. (a) Briefly discuss the electronic spectrum of polyatomic molecules. Explain the different types of transitions.
    (b) Discuss the principle of NMR spectroscopy.
28. (a) Discuss the Jablonski diagram of depecting various photophysical process.
    (b) Discuss photosensitized reaction using suitable example.

(2 × 12 = 24)