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(FOR THE CANDIDATES ADMITTED DURING THE ACADEMIC YEAR 2025 ONLY)

SUB CODE 25PCY206

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS : APRIL 2026

M.Sc CHEMISTRY **MAXIMUM MARKS: 75**

SEMESTER : II **TIME : 3 HOURS**

PHYSICAL CHEMISTRY-II-QUANTUM CHEMISTRY AND NANO CHEMISTRY

SECTION – A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS. (K1)

1. What is the probability density of a wavefunction φ(x,t) at time t in element of volume dv?

a) $\varphi^*(x,t)\varphi(x,t)dv$ b) $\varphi(x,t)dv$ c) $\varphi^*(x,t)dv$ d) $\varphi(x,t)$

2. What is the distance between two consecutive crests or troughs of a wave called?

a) Amplitude b) Frequency c) Wavelength d) Phase

3. Schrödinger's equation can be solved analytically for which systems?

a) Complex many-particle systems b) Simple one-dimensional systems

c) Any quantum system regardless of complexity d) Systems involving only classical mechanics

4. Which of the following is a potential environmental application of nanotechnology?

a) Carbon emissions b) Oil spill cleanup c) Deforestation d) Plastic production

5. Which technique is commonly used for the fabrication of nanoparticles?

a) Sedimentation b) Filtration c) Distillation d) Lithography

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES (K2)

6. Give the possible measured values of observable A called?

7. What is the Pauli exclusion principle?

8. The phenomenon describing the finite probability of the particle penetrating the barrier is called _____.

9. What is the term used to describe the self-assembly of nanoparticles into ordered structures?

10. The field that integrates nanotechnology with biology called_____.

SECTION – B (5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.(K3)

11. a) Sketch the black body radiation with neat explanation.

(OR)

b) Compile a note on Eigen functions and Eigen values.

12. a) Explain the approximate methods used in quantum mechanics and the necessity for these methods.

(OR)

b) Show the Shapes of the atomic orbitals for d orbitals.

13. a) Infer Slater determinant.

(OR)

b) Construct the HMO treatment of butadiene systems.

14. a) Elaborate about nano cluster and nano rod.

(OR)

b) List out the applications of nanomaterials.

15. a) Build the instrumentation of Fourier Transform Infrared spectroscopy .

(OR)

b) Compile a note on Photoluminescence study.

SECTION – C (5 X 8 = 40 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.(K4)

16. a) Criticize the application of Schrodinger equation to the particle in a 1D box

(OR)

b) Outline on rigid rotator of diatomic molecules.

17. a) Describe the perturbation method applicable to H atom in ground state.

(OR)

b) Derive the Variation methods applicable to H atom in ground state.

18. a) Construct the antisymmetric wavefunctions.

(OR)

b) Build the HMO treatment of benzene system.

19. a) Construct the Bottom-up approaches on nano material synthesis.

(OR)

b) Make a note on Laser ablation.

20. a) Explain the instrumentation of Scanning electron microscope.

(OR)

b) Discuss the instrumentation of atomic force microscopy.

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