

(i) Printed Pages : 3

Roll No.

(ii) Questions : 9

Sub. Code :

1	7	4	5	3
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Exam. Code :

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B.A./B.Sc. (General) 5th Semester
(2125)

CHEMISTRY (Same for B.Sc. Microbial and Food Technology)

Paper : XIX Physical Chemistry–A

Time Allowed : Three Hours]

[Maximum Marks : 22

Note :— (1) Attempt FIVE questions in all.

(2) Select ONE question each from Units I, II, III, and IV and question no. 9 is compulsory.

(3) Use of a Log table and a simple calculator is allowed.

UNIT—I

1. (a) Derive the Schrodinger wave equation using the second law of Quantum Mechanics.

(b) Explain in detail the "Photoelectric effect". How classical mechanics fails to explain it? 2+2

2. (a) What do you mean by the concept of expectation value? Calculate the expectation value of x , x^2 , and p for a particle in a one-dimensional box.

(b) What is a Hermitian operator? Prove that eigenfunctions of a Hermitian operator having different eigenvalues are orthogonal. 2+2

UNIT—II

3. (a) Explain in detail the linear combination of Atomic Orbitals (LCAO-MO) approximation for H_2^+ .
(b) What do you understand by radial probability? Draw and discuss radial probability distribution curves for 1s, 2s, 3s, 3p, and 4d orbitals. 2+2
4. (a) Apply quantum mechanical principles to calculate the coefficients of atomic orbitals in sp^3 hybrid orbitals.
(b) Explain in detail the Ritz linear combination methods. 2+2

UNIT—III

5. (a) Obtain an expression for Beer's law of transmission of light. What is the physical significance of the extinction coefficient? What are the limitations of Beer's law?
(b) A 0.01 M solution of a compound transmits 20% of the radiation in a container with the path length equal to 1.5 cm. Calculate the molar extinction of the compound. 2+2
6. (a) What are the main points of the difference between thermal reactions and photochemical reactions?
(b) Explain in detail how excited molecules release their energy using a diagram. 2+2

UNIT—IV

7. (a) Explain the kinetics of quenching of fluorescence.
(b) What are photosensitizers, and how do these sensitizers work? What are the conditions that a photosensitizer must fulfill? 2+2

8. (a) What do you understand by the term luminescence? Briefly describe different types of luminescence.
- (b) A certain system absorbs 3×10^{18} quanta of light per second. On irradiation for 20 min, 0.03 moles of reactants were found to have reacted. Calculate the quantum yield for the reaction. 2+2

UNIT—V

(Compulsory Question)

9. (a) Find the expression of $\left(\frac{d}{dx} x\right)^2$.
- (b) Give the expression for the frequency of the spectral lines of the hydrogen atom. Also, give the value of Rydberg's constant.
- (c) What do you understand by the term quantization of energy?
- (d) Under what conditions do quantum mechanics and classical mechanics give the same results?
- (e) What is optical density?
- (f) Explain Einstein. Give its value in SI units. 6×1=6