(i) Printed Pages : 4   Roll No. ....

(ii) Questions   : 9   Sub. Code : | 0 | 4 | 5 | 3 |

                                Exam. Code : | 0 | 0 | 0 | 5 |

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

(2123)

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, selecting **ONE** question from each Unit I, II, III and IV and Question No. **9** is compulsory.

(2) Use of log tables and simple calculator is allowed.

UNIT–I

1. (a) Apply Schrodinger wave equation to a particle in one-dimensional box and obtain the expression for the Eigen function and Eigen value of the energy.   2

   (b) Derive Planck's radiation law. Comment on the statement that Wien's law and Rayleigh-Jeans law follow Planck's radiation law.   2

2. (a) What is Compton Effect ? What is 'Compton shift' ? Write expression for Compton shift and explain the results obtained for scattering angles of $0°$, $90°$ and $180°$.   2

(b) Starting from the complete form of Schrodinger wave equation, how can you modify it to the form $\hat{H}\psi = E\psi$? Write the result in a generalized form. 2

UNIT–II

3. (a) What is hybridization ? What is meant by sp^2 and hybridization ? Apply quantum mechanics to obtain the wave functions of the three sp^2 hybrid orbitals. 2

(b) What are the criteria or the conditions for the formation of molecular orbitals from atomic orbitals ? Compare the important characteristics of σ and π molecular orbitals. 2

4. (a) Discuss the application of Valence Bond Theory to study the bond dissociation energy and equilibrium bond distance of H_2 molecule. Explain at least one improvements that is made in the wave function to get better agreement of calculated value with the experimental value. 2

(b) What do you understand by Linear Combination of Atomic Orbitals (LCAO) ? How can it be applied to H_2^+ ion to calculate its energy ? Comment on the values of the energy obtained. 2

UNIT–III

5. (a) Calculate the transmittance, absorbance and absorption coefficient of a solution which absorbs 90% of a certain wavelength of light beam passed through a 1 cm cell containing 0.25 M solution. 2

(b) Name and state the basic laws of photochemistry. Give the numerical value of one Einstein in different units in terms of wavelength in cm and Å.   2

6. (a) How do photochemical reactions differ from thermal reactions ?   2

(b) Explain Lambert's and Beer's laws. What do you understand by 'absorption coefficient' and 'molar extinction coefficient' ?   2

UNIT–IV

7. (a) What are photochemical reactions ? What mechanism has been proposed for the photochemical decomposition of HI ?   2

(b) What is meant by primary and secondary processes in photochemistry ? The quantum efficiency for the hydrogen chlorine reaction is very high, why ?   2

8. (a) Distinguish between fluorescence and phosphorescence. Draw energy level diagrams to explain these processes and discuss them briefly.   2

(b) The quantum efficiency of the photochemical reaction $H_2(g) + Cl_2(g) \xrightarrow{h\nu} 2HCl(g)$ is 1×10^6 with a wavelength of 480 nm. What amount of HCl (g) would be produced under these conditions when one joule of radiant energy is absorbed ?   2