(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

(2122)

CHEMISTRY

(Same for B.Sc. Microbiology & 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) What is the concept of particle in one-dimensional box ? What is the Schrodinger wave equation for such a case ? How can this equation be solved for ψ and E ? 2

(b) What is Planck's radiation law ? How do Wien's law and Rayleigh Jean's law follow from it ? 2

2. (a) What is the Heisenberg Uncertainty principle ? How is the thought experiment used to illustrate the Heisenberg Uncertainty principle ? What is the limitation of this experiment ? 2

(b) What are the different postulates of quantum mechanics ? Discuss them in detail. 2

UNIT—II

3. (a) Apply quantum mechanical principles to calculate the coefficients of atomic orbitals in sp^2 hybrid orbitals. 2

(b) Write expressions for bonding and antibonding molecular orbital wave functions in terms of the two combining atomic orbital wave functions ψ_A and ψ_B. Discuss graphically the variations of electron probability density for BMO and ψ_A^2 and ψ_B^2 along the internuclear axis. 2

4. (a) What do you understand by gerade and ungerade molecular orbitals ? What is the criteria to check whether a molecular orbital is grade or ungerade ? Explain with suitable examples. 2

(b) Write expression for ψ_{Mo} for H_2^+ ion according to LCAO method. Starting from it, how do you arrive at the expression for $\psi_{+(Mo)}$ and $\psi_{-(Mo)}$? 2

UNIT—III

5. (a) The percentage transmittance of an aqueous solution of disodium fumarate at 250 nm and 298 K is 19.2% for a 5×10^{-4} molar solution in a 1 cm cell. Calculate the absorbance A and the molar absorption coefficient ε. What will be the percentage transmittance of a 1.75×10^{-3} molar solution in a 10 cm cell ? 2

   (b) State and explain Grotthus-Draper law and Stark-Einstein's law of photochemical equivalence. 2

6. (a) Calculate the value of Einstein in kilo joules for orange light $\lambda = 600$ nm. 2

   (b) What do you understand by the terms spin multiplicity, singlet states and triplet states ? Explain phenomenon of fluorescence and phosphorescence using Jablonski diagram. 2

UNIT—IV

7. (a) What is photosensitization ? Explain with two suitable examples. 2

   (b) Explain why photosynthesis of HCl has very high quantum yield while that photosynthesis of HBr is very low. 2

8. (a) For the photochemical reaction $A\rightarrow B$, 1.0×10^{-5} moles of B were formed on absorption of 6.0 joules at 3600 Å. Calculate the quantum efficiency. 2

   (b) What mechanism has been proposed for the photolysis of ammonia ? 2

(Compulsory Question)

9. (a) What is a linear operator ? 1

(b) Explain Beer-Lambert law. 1

(c) Compare the important characteristics of σ and π molecular orbitals. 1

(d) Write expression for Compton shift and explain the results obtained the scattering angles of 0°, 90° and 180°. 1

(e) What is resonance fluorescence ? Give one example. 1

(f) How do photochemical reactions differ from thermal reactions ? 1