Roll No. | | | | | | | | | | | | **Total No. of Pages : 02**

Total No. of Questions : 09

B.Tech. (AIDS/AIML/IOT/CSD/ETE/Blockchain/CE/CSE/DS /EE/ECE/FT/IT/ME/Robotics & Artificial Intelligence/Internet of Things and Cyber Security including Block Chain Technology) (Sem.–1,2)

CHEMISTRY-I

Subject Code : BTCH101/23

M.Code : 93800

Date of Examination : 18-12-2024

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION - B & C have FOUR questions each.**
3. **Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.**
4. **Select atleast TWO questions from SECTION - B & C.**

SECTION-A

l. Write short notes on :

a) What does ψ^2 represent in the context of the Schrodinger wave equation?

b) Explain how n-type and p-type doping modify the band structure of a semiconductor and affect its conductivity?

c) Define chromophores and auxochromes. How do they influence the absorption spectrum of a molecule?

d) Write the expression for the energy levels of a diatomic molecule in rotational spectroscopy.

e) What are Ionic interactions, and how do they differ from dipolar interactions?

f) How does the zeolite process work in softening of hard water?

g) What is the hardness of water? Differentiate between temporary and permanent hardness.

h) What is ionization energy, and how does it vary across periods and groups in the periodic table?

i) What is optical activity and how it can be used to distinguish between enantiomers?

j) How does a free radical addition reaction occur?

SECTION-B

2. a) How can you explain the splitting of d-orbitals in an octahedral crystal field?

   b) Give the solution to the Schrodinger equation for a particle in a one-dimensional box.

3. a) Provide the molecular orbital energy level diagram for nitrogen (N_2). Based on this diagram, determine the bond order, discuss the molecule's stability, and explain whether it is paramagnetic or diamagnetic.

   b) What is fluorescence, and how is it used in medical applications?

4. a) What are the selection rules for vibrational and rotational transitions in diatomic molecules?

   b) List two factors that can affect the wavelength (λ_{max}) and intensity of absorption bands in electronic spectroscopy. Also explain the reason.

5. a) What is the van der Waals equation of state, and how does it describe the behavior of real gases?

   b) Describe Boyle's Law and Charles's Law. Also derive the ideal gas equation.

SECTION-C

6. a) What is electrochemical corrosion, and how does it differ from dry corrosion?

   b) What is the relationship between free energy and the electromotive force (emf) of a cell?

7. a) Explain the concept of Hard and Soft Acids and Bases (HSAB) and give examples of each.

   b) Explain electron affinity and its trend across periods and groups of the periodic table giving suitable reasoning.

8. a) Perform a conformational analysis of Ethane and illustrate the potential energy diagram for its various conformations.

   b) What is chirality and explain why certain molecules are chiral?

9. a) What are the different between E1and E2 elimination reaction?

   b) What is Markovnikov’s rule, and how does it apply to addition reactions?

NOTE : Disclosure of Identity by writing Mobile No. or Marking of passing request on any paper of Answer Sheet will lead to UMC against the Student.