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Total No. of Pages : 02

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**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

I. 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 ($\lambda_{\max}$) 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 E1 and 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.