

Roll No. 24001015

Total Pages : 04

004205

May 2025

B.Tech. (Second Semester)

Chemistry (CHU-141-V/BSC-102)

Time : 3 Hours]

[Maximum Marks : 75

**Note :** It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other.

### Part A

1. (a) Write the time independent Schrödinger wave equation. 1.5
- (b) Explain orthonormality of the wave function. 1.5
- (c) What are the essential conditions for a molecule to be chiral ? 1.5
- (d) Discuss the criteria of spontaneity of a reaction. 1.5
- (e) Predict the number of NMR signals in  $\text{CH}_3\text{COCH}_3$  and  $\text{CH}_3\text{CH}_2\text{OH}$ . 1.5

- (f) What do you understand by dry corrosion ? 1.5
- (g) What is the role of free energy in determining chemical equilibrium ? 1.5
- (h) What are optical active compounds ? Explain with an example. 1.5
- (i) State the basic difference between London Dispersive forces and dipole-dipole forces. 1.5
- (j) Write the structure and uses of Aspirin drug. 1.5

### Part B

2. (a) Discuss the phenomenon of fluorescence and phosphorescence using Jablonski diagram. 5
- (b) Draw the bonding and anti-bonding orbitals of butadiene. Also discuss the Pauling's and Mulliken scale of electronegativity. 10
3. (a) At what conditions the ideal gas deviates from ideality and explain the correction in ideal gas equation given by van der Waals. 5

- (b) What is Beer-Lambert law ? Discuss the principle of electronic spectroscopy and the different types of electronic transitions in molecules. Also explain the terms auxochromes and chromophores and different shifts in UV-Visible spectroscopy. **10**
4. Derive expression for the total energy for particle in 1-D box with length  $L$  moving with potential  $V(x) = 0, 0 < x < L$ , otherwise  $V(x)$  is infinite. Also draw the molecular orbital diagrams of  $N_2$  and  $O_2$  molecule along with the bond order and magnetic behaviour. **15**
5. (a) Derive the expression for the Nernst equation and mention its applications in electrochemistry. **5**
- (b) Explain the Ellingham diagram and its use in metallurgy. **10**
6. (a) Explain the geometrical and optical isomerism in transition metal complexes. **5**
- (b) Draw the flying wedge, Sawhorse and Newman projection of ethane. Write the enantiomeric and diastereomeric forms of 2, 3 dibromopentane and write its (R, R), (R, S) and (S, S) configuration. **10**

7. Write notes on the following :

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- (a)  $S_N^1$  and  $S_N^2$  reactions.
- (b) Synthesis of paracetamol.
- (c) HSAB principle with examples
- (d) Friedal Craft alkylation.
- (e) Diels-Alder Reaction.

