



Term Evaluation Theory (Odd)-(Late/Lateral Admission) Exam Nov. 2025

Roll no.....

Name of the Course: B. Tech

Semester: I

Name of the Paper: Engineering Chemistry

Paper Code: TCH-101

Time: 1.5 hour

Maximum Marks: 50

Note:

- (i) Answer all the questions by choosing any one of the sub-questions
- (ii) Each question carries 10 marks.

Q1. (10 Marks)

- a. Explain the basic principles of molecular orbital theory and describe how bonding orbitals are different from antibonding orbitals. [CO 1]

OR

- b. How you will arrange F_2 , F_2^- , and F_2^{2-} in the decreasing order of their bond orders by using molecular orbital diagrams? [CO 1]

Q2. (10 Marks)

- a. Explain the following:

(i) Applications of nanomaterials

(ii) Metallic bonding

[CO 1]

OR

- b. Discuss the principle of UV-Visible spectroscopy and explain the various electronic transitions that occur during UV-Visible absorption. [CO 1]

Q3. (10 Marks)

- a. Using the molecular orbital energy level diagrams, prove that the O_2 molecule exhibits paramagnetism whereas the N_2 molecule is diamagnetic. [CO 1]

OR

- b. Describe the types of hydrogen bonding with examples. Why the lower alcohols are more soluble in water than higher alcohols? [CO 1]

Q4. (10 Marks)

- a. Why hardness of water is expressed in $CaCO_3$ equivalent? A sample of water on analysis was found to consist the following impurities- $Ca(HCO_3)_2 = 8.1$ mg/l; $Mg(HCO_3)_2 = 14.6$ mg/l; $CaSO_4 = 6.8$ mg/l; $MgCl_2 = 9.5$ mg/l and $NaCl = 3.5$ mg/l. Calculate the total hardness present in the water sample. [CO 2]

OR

- b. Describe the reverse osmosis process for water purification and desalination. Also explain the role of semipermeable membranes and the advantages of this method. [CO 2]

Q5. (10 Marks)

- a. Discuss the reasons for formation of scales and sludges in boilers and their harmful effects. Explain how they can be prevented. [CO 2]

OR

- b. Explain how water softening occurs through ion exchange process. Write the reactions for ion exchange and regeneration of exhausted resins. [CO 2]