



## 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.

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]

[CO 1]

Q2.

(10 Marks)

- a. Explain the following:

(i) Applications of nanomaterials

(ii) Metallic bonding

OR

- b. Discuss the principle of UV–Visible spectroscopy and explain the various electronic transitions that occur during UV–Visible absorption.

[CO 1]

[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.

OR

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

[CO 1]

[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- $Ca(HCO_3)_2 = 8.1\text{ mg/l}$ ;  $Mg(HCO_3)_2 = 14.6\text{ mg/l}$ ;  $CaSO_4 = 6.8\text{ mg/l}$ ;  $MgCl_2 = 9.5\text{ mg/l}$  and  $NaCl = 3.5\text{ mg/l}$ . Calculate the total hardness present in the water sample.

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]

[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.

OR

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

[CO 2]

[CO 2]