Graphic Era
HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhinyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

End Term (Odd) Semester Examination November 2025

Roll no...........................

Name of the Program and semester: B.Tech I sem
Name of the Course: Engineering Chemistry
Course Code: TCH-101

Time: 3 hour   Maximum Marks: 100

Note:
- *(i)* All the questions are compulsory.
- *(ii)* Answer any two sub questions from a, b and c in each main question.
- *(iii)* Total marks for each question is 20 (twenty).
- *(iv)* Each sub-question carries 10 marks.

Q1.   (2X10=20 Marks)
a. Discuss Hydrogen bonding with its types. Also explain why acetone is more volatile than alcohol? (CO1)
b. Draw the MOT Diagram of NO molecule. Arrange N_2, N^+_2, N^-_2 and N_2^{-2} in order of stability? (CO1)
c. Write the detailed note on (i) Nanomaterials with its applications (ii) Band Theory of Metals? (CO1)

Q2.   (2X10=20 Marks)
a. What are the disadvantages of hard water in terms of boiler troubles. Discuss the scales and sludge formation and removal methods in detail. (CO2)
b. Discuss ion exchange process for water softening with the help of proper chemical reactions. (CO2)
c. Calculate the amount of lime soda required for 10 lakh liter of water sample which on analysis have: $Ca(HCO_3)_2$ = 10.125 ppm; $Mg(HCO_3)_2$ = 18.25 ppm; $MgSO_4$ =6.0 ppm, $CaSO_4$ = 34.0 ppm, $CaCl_2$ = 27.75 ppm, silica = 35.80 ppm. (CO2)

Q3.   (2X10=20 Marks)
a. Differentiate between Thermoplastic and Thermosetting polymer. Explain the reaction of preparation of Bakelite with its uses. (CO3)
b. Write the detailed note on (i)Conducting polymers with its applications (ii)Biodegradable polymers (CO3)
c. Write the preparation, properties and uses of (i) PVC (ii) Nylon 6,6   (CO3)

Q4.   (2X10=20 Marks)
a. What do you meant by Biogas? Explain the working of Biogas plant with the help of neat and clean diagram. (CO4)
b. What is fuel? Discuss the classification and characteristics of a good fuel. (CO4)
c. Define the terms GCV and NCV of a fuel. A sample of coal 1.29 gm fuel was completely combusted in excess of oxygen using bomb calorimeter. The rise in temperature of water in calorimeter was 3.5°C. Calculate the High and Net calorific value, if the water taken in calorimeter is 520 g and water equivalent for calorimeter is 2700g. Given H%= 6.5%, acid correction = 6.26 calorie and latent heat of condensation= 580 cal/gm (CO4)

Q5.   (2X10=20 Marks)
a. Write the detailed note on (i) Electrode and Electrode Potential (ii) Fuel cells (CO5)
b. Define the term corrosion. Explain the mechanism of corrosion with the help of Electrochemical theory. (CO5)
c. Calculate the cell potential of the given cell at 25 degrees centigrade. (R=8.31 J/K/mol; F= 96500 C/mol).
$Cr(s)/Cr^{+3}(0.1\ M)//Fe^{+2}(0.01M)/Fe(s)$
Given $E^o_{Cr+3/Cr}$ =- 0.74 V; $E^o_{Fe+2/Fe}$ = -0.44 V   (CO5)