UPES
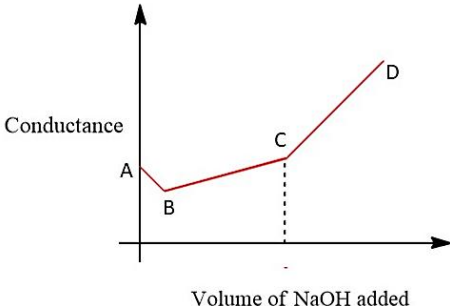**End Semester Examination, May 2025**

Course: Chemistry   Semester: II
Program: B.Tech. ASE + ME + AE + EE + ECE   Time   : 03 hrs.
Course Code: CHEM1013   Max. Marks: 100

Instructions: Read all the instructions below carefully and follow them strictly.
1) Mention Roll No. at the top of the question paper.
2) Internal choice is given in Q. no. 8 and 10.
3) ATTEMPT ALL THE PARTS OF A QUESTION AT ONE PLACE ONLY.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain catalytic cracking of hydrocarbons with examples.	4	CO1
Q 2	At 500^0C, the reaction between N_2 and H_2 to form ammonia has K_c = 12.0 x 10^{-2}. What is the value of K_p for the reaction? (Given gas constant = 0.0821 L atm $K^{-1}mol^{-1}$)	4	CO2
Q 3	Derive the rate expression for a unimolecular reaction at low pressure according to Lindemann theory.	4	CO2
Q 4	For a certain first order reaction, $t_{0.5}$ is 200 s. Calculate the time required for 75% completion of a reaction.	4	CO2
Q 5	Explain synthesis of nanomaterials using microemulsion method.	4	CO5

SECTION B
(4Qx10M= 40 Marks)

Q 6	The molar conductance of CH_3COONa, HCl and NaCl at infinite dilution are $91x10^{-4}$, $426.16x10^{-4}$ and $126.45x10^{-4}$ Sm^2mol^{-1}, respectively at 25°C. Calculate the molar conductance at infinite dilution for CH_3COOH. If molar conductance of 0.01M aqueous solution of CH_3COOH is $16.32x10^{-4}$ Sm^2mol^{-1}, calculate the degree of dissociation of CH_3COOH.	10	CO3
Q 7	A 100ml sample of water required 13.5ml of 0.02 M EDTA solution for titration using EBT as indicator. Another 100ml of water from the same source was boiled and precipitates were removed by filtration. The	10	CO4

	filtrate required 6ml of 0.02 M EDTA for titration. Calculate total hardness, permanent hardness and temporary hardness of water sample.		
Q 8	a) Provide a brief overview of the bulk polymerization method, including its key advantages and disadvantages. **OR** Write the molecular structure of the polymer and its monomer unit, used for the manufacture of tyres and contact lenses. b) Define thermoplastics and thermosets. **OR** Calculate the number average molecular mass of a polymer having 30 molecules with molecular mass 4000 each, 30 molecules with molecular mass 6000 each and 40 molecules with molecular mass 8000 each.	**5** **5**	**CO5**
Q 9	a) 0.2346 g of an organic substance gave on combustion 0.2754 g of CO_2 and 0.4488 g of water. Calculate the % of carbon and hydrogen in it. b) Define octane number and mention four methods used to increase it.	**5** **5**	**CO1**
SECTION-C **(2Qx20M=40 Marks)**			
Q 10	a) Explain the following graph **OR** The standard reduction potentials of Cu^{+2}/Cu and Ag^+/Ag electrodes are +0.337 and +0.799V, respectively. Construct a galvanic cell using these electrodes so that its standard EMF is positive. For what concentration of Ag^+ will the EMF of the cell at 25°C be zero if the concentration of Cu^{+2} is 0.01M? b) Discuss the effect of the environment on the rate of corrosion and the methods to prevent it. **OR** Explain the various types of film (metal oxide layer) formed during the oxidation corrosion.	**10** **10**	**CO3**

Q 11			
	a) A sample of water contains following impurities: $MgSO_4 = 60$ mg/l, $CaSO_4 = 68$ mg/l, $Mg(HCO_3)_2 = 146$ mg/l, $CaCl_2 = 111$ mg/l. Calculate the quantity of lime (70% pure) and soda (95% pure) needed for softening 4000 l of water. (Given atomic wt. H=1, C=12, O=16, Cl=35.5, Mg=24, S=32, Ca=40).	10	CO4
	b) With the help of suitable reactions, explain the process of purification of water by ion-exchange method. Write advantages and disadvantages of the method.	10	