Name:

Enrolment No:

UPES

End Semester Examination, May 2024

Course: Chemistry **Semester: II**

Program: B.Tech. APE + Civil + FSE + ASE + ME + AE **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. 9 and 10.**
3) **ATTEMPT ALL THE PARTS OF A QUESTION AT ONE PLACE ONLY.**

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Describe four main characteristics of a good fuel?	**4**	**CO1**
Q 2	Derive the integrated rate expression for a chemical reaction with rate law equation, Rate = $k[A]^3$	**4**	**CO2**
Q 3	Explain the determination of order of a reaction by graphical method.	**4**	**CO2**
Q 4	Discuss any four factors which affects the rate of a chemical reaction.	**4**	**CO2**
Q 5	Describe the four different types of nanomaterials based on dimension?	**4**	**CO5**

SECTION B
(4Qx10M= 40 Marks)

Q 6	For the given cell: $Cr(s) \mid Cr^{+3}(aq, 0.01M) \parallel Ag^{+}(aq, 0.1M) \mid Ag(s)$; Write down the cell reaction and calculate the EMF of the cell, if $E^{\circ}_{Cr+3/Cr}$ = -0.744V and $E^{\circ}_{Ag+/Ag}$ = +0.80V	**10**	**CO3**
Q 7	a. Explain the various types of hardness present in the water. b. A water sample contains 200 mg of $CaSO_4$ per litre. Calculate the hardness in terms of $CaCO_3$ equivalent. Given Atomic weight of Ca=40, S=32, O=16.	**10**	**CO4**
Q 8	a. Write down the formula of number average molecular weight, weight average molecular weight and PDI. b. Discuss the polymerization technique in which polymer is formed in pure state.	**5** **5**	**CO5**

Q 9	Discuss the working and construction of a bomb calorimeter with the help of a suitable diagram. **OR** (i) During estimation of nitrogen present in organic compound by Kjeldahl's method, 0.257 g of an organic substance was heated with conc. sulphuric acid and then distilled with excess of strong alkali. The ammonia gas evolved was absorbed in 25 ml of N/5 HCl, which required 23.2 ml of N/10 NaOH for neutralization. Determine the % of nitrogen in the substance. (ii) 0.1986 g of an organic substance gave on combustion 0.3850 g of CO_2 and 0.1802 g of H_2O. Calculate the % of carbon and hydrogen in it.	**10**	**CO1**
SECTION-C (2Qx20M=40 Marks)			
Q 10	(i) 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 filtrate required 6ml of 0.02 M EDTA for titration. Calculate total hardness, permanent hardness and temporary hardness of water sample. **OR** A water sample is not alkaline to phenolphthalein. However, 100ml of water sample reached the end point of titration using methyl-orange as indicator with 36.5ml of 0.02N HCl. What are the types and amount of alkalinity present in water. (ii) Discuss the cation and anion exchange resin method for the softening of water. **OR** What do you understand by the term alkalinity of water. Which ions are responsible for it. Define the relation between P and M in the calculation of alkalinity of water if CO_3^{2-} and HCO_3^- are present in water.	**10** **10**	**CO4**
Q 11	(i) Explain the factors which effect the rate of corrosion. (ii) Why is pitting corrosion much more dangerous to provoke catastrophic failure than oxidation corrosion. (iii) Elaborate the sacrificial anode techniques for the prevention of corrosion. (iv) The equivalent conductance of NH_4Cl, NaOH and NaCl at infinite dilution are 149.7, 247.8 and 126.45 Sm^2eq^{-1}, respectively. Calculate equivalent conductance for NH_4OH at infinite dilution.	**7+3+5+5**	**CO3**