UPES
UNIVERSITY OF TOMORROW

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2022

Course: Chemistry   Semester: I
Program: B.Tech. FSE   Duration: 03 hrs.
Course Code: CHEM 1001   Max. Marks: 100
Instructions: Read the instructions given below carefully:
     1.   All questions are compulsory.
     2.   Internal choice is given in question 9 of Section B and question 11 of section C.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	What is half-life period of a chemical reaction? How it can be used to determine order of a reaction?	4	CO2
Q 2	For the reaction, $2NOCl \rightleftharpoons 2NO + Cl_2$ 10 moles of NOCl were initially placed in a 5 lit flask. After equilibrium, the flask contained 3.30 moles of NOCl. Calculate the equilibrium constant Kc at $25^{o}C$ for this reaction.	4	CO2
Q 3	Explain the various types of tacticity found in polymers.	4	CO5
Q 4	List out the various water softening techniques applicable for a hard water sample.	4	CO4
Q 5	Which part of iron nail will corrode when its half portion will be inside the wood and half portion will remain outside the wood? Justify your answer.	4	CO3

SECTION B
(4Qx10M= 40 Marks)

Q 6	(i) List out the advantages of polymers over traditionally used materials like metals and ceramics. (ii) X-rays of wavelength 4×10^{-10} m is diffracted at an angle of 5°. Find out the inter-planar spacing assuming first order diffraction.	5+5	CO5
Q 7	For a two-step consecutive reaction given by $R \rightarrow N \rightarrow P$, the rate constants are K_1 and K_2. Calculate the concentration of R and N after time 't'.	10	CO2
Q 8	(i) What is electrolytic conductance? Write the three different types of its measurement.	5+5	CO3

	(ii) The molar ionic conductance of strong electrolytes NaOH, NaCl and $BaCl_2$ at infinite dilution are 248.1×10^{-4}, 126.5×10^{-4} and 280×10^{-4} $Sm^2 mol^{-1}$, respectively. Calculate molar conductance of $Ba(OH)_2$ at infinite dilution.		
Q 9	A conductivity cell is filled with 0.05M KCl. Its specific conductance and observed resistance is $6.67 \times 10^{-3} \Omega^{-1} cm^{-1}$ and 243Ω, respectively. When the cell is filled with 0.01M NaOH, observed resistance is 681Ω. Calculate specific and molar conductance of 0.01M NaOH. **OR** Briefly discuss the various methods of prevention of metal from corrosion.	**10**	**CO3**

<p align="center">SECTION-C
(2Qx20M=40 Marks)</p>

Q 10	(i) A sample of water on analysis was found to contain the following impurities: <table><tr><th>Impurity</th><th>Ca(HCO₃)₂</th><th>Mg(HCO₃)₂</th><th>CaSO₄</th><th>MgSO₄</th></tr><tr><td>Quantity (mg/L)</td><td>4</td><td>6</td><td>8</td><td>10</td></tr></table> Calculate the total hardness, permanent hardness, and carbonate hardness of water sample. (Given the atomic masses as Ca=40, Mg=24, H=1, C=12, O=16, S=32)	**10**	**CO4**
	(ii) 200 mL of water sample, on titration with N/50 HCl using phenolphthalein as an indicator, gave the end point when 10 mL of acid were run down. Another lot of 200 mL of the sample also required 10 ml of the acid to obtain methyl-orange end point. What type of alkalinity is present in the sample and what is its magnitude?	**10**	
Q 11	(i) The determination of calorific value of a coal sample gave the following results: Weight of sample = 0.9g Water equivalent of calorimeter = 440g Weight of water = 2560g Increase in temperature = 2.42°C Cooling correction = 0.052°C Fuse wire correction = 10.0cal. Calculate the gross and net calorific value if the coal contains 6% hydrogen. Assume latent heat of steam as 600cal/g. **OR** Calculate the standard heat of formation of propane if its heat of combustion is -2220.2 kj/mol. The heat of formation of carbon dioxide and water are -393.5 and -285.8 kj/mol respectively at 25°C.	**20**	**CO1**

(ii) Briefly discuss the fractional distillation of petroleum giving the boiling point ranges of the distilled products.

OR

0.2346 g of an organic compound containing carbon, hydrogen and oxygen only was analyzed by the combustion method. The increase in weight of the $CaCl_2$ tube and the potash bulbs at the end of the operation was found to be 0.2754 g and 0.4488 g respectively. Calculate the % of carbon, hydrogen and oxygen in it.