Name: Enrolment No:	

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

Course: Chemistry I **Semester: II**
Program: B. Tech. AE, APE-Up, EE, ECE, RSEE **Time : 03 hrs.**
Course Code: CHEM 1011 **Max. Marks: 100**

Instructions:
1. **All questions are compulsory.**
2. **Write all parts of a question at one place.**

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Discuss the various types of correction made in bomb calorimeter.	**4**	**CO1**
Q 2	When one mole of liquid benzene is completely burnt in O_2 at constant pressure to form liquid water and CO_2 gas, ΔH is -781 Kcal at 25°C. Calculate the heat of this reaction at constant volume at the same temperature. (R = 2 Cal/K/mol).	**4**	**CO2**
Q 3	Compare gaseous fuel with liquid fuel in terms of Calorific Value, storage, risk of fire hazards and smoke.	**4**	**CO1**
Q 4	0.257 g of an organic substance was Kjeldahlized by heating with conc. sulphuric acid and then distilled with excess of strong alkali. The ammonia gas evolved was absorbed in 50 ml of N/10 HCl, which required 23.2 ml of N/10 NaOH for neutralization. Determine the % of nitrogen in the substance.	**4**	**CO1**
Q 5	Briefly discuss microemulsion method used for the synthesis of nanoparticles.	**4**	**CO5**

SECTION B
(4Qx10M= 40 Marks)

Q 6	How can corrosion be controlled by (i) Modification of environment (ii) Relative areas of anode and cathode (iii) Sacrificial protection (iv) Protective coatings	**10**	**CO4**

	Explain each with suitable examples.		
Q 7	(i) In a polymer sample, 20 % of the molecules have a molecular mass 20000; 40 % have 30000 and the rest have 40000. Calculate PDI. (ii) X-rays of wavelength 36 nm is diffracted at an angle of 40°. Calculate the inter-planar spacing assuming third order diffraction.	**5** **5**	**CO5**
Q 8	For thermal decomposition of N_2O, the proposed mechanism is: $N_2O \xrightarrow{K_1} N_2 + O$ $O + O + M \xrightarrow{K_2} O_2 + M$ $O + N_2O \xrightarrow{K_3} N_2 + O_2$ $O + N_2O \xrightarrow{K_4} 2NO$ Derive the rate law in terms of N_2O.	**10**	**CO2**
Q 9	A sample of water contains following impurities: $Mg(HCO_3)_2$ = 73 mg/lt, $CaCl_2$ = 222 mg/lt, $MgSO_4$ = 120 mg/lt, $CaSO_4$ = 164 mg/lt. Calculate the quantity of lime (74% pure) and soda (90% pure) needed for softening 5000 litre of water. **OR** With the help of suitable diagram and reactions, discuss zeolite process used for the softening of hard water. List out its advantages and disadvantages.	**10**	**CO3**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	(i) The standard reduction potential of Cu^{2+}/Cu and Ag^+/Ag electrodes are +0.337 V and +0.799 V respectively. Construct a galvanic cell using these electrodes so that its E°_{cell} is positive. For what $[Ag^+]$ will the EMF of cell be zero if $[Cu^{2+}]$ is 0.01M. **OR** a. For Barium hydroxide, calculate $\wedge_0$ (molar conductivity) at 25^0C from the following. $\wedge_0$ NaOH =248.61 Sm^2mol^{-1} ; $\wedge_0$NaCl = 126.45 Sm^2mol^{-1} ; $\wedge_0BaCl_2$ = 279.96 Sm^2mol^{-1} b. Differentiate between specific conductance and molar	**10** **10**	**CO4**

	conductance. How they are interrelated? (ii) In a particular cell, 0.01M solution of KCl gave a resistance of 15Ω while 0.01M solution of HCl gave a resistance of 51.4Ω at the same temperature. If the specific conductance of 0.01M KCl is $0.1409 Sm^{-1}$, calculate cell constant, specific conductance and equivalent conductance of HCl solution. **OR** a. What is salt bridge? What is its function in a galvanic cell? Justify your answer. b. What is electrochemical series? Discuss briefly five applications of electrochemical series with suitable examples.		
Q 11	(i) A sample of water on analysis was found to contain the following impurities: **Impurity** | $MgCO_3$ | $Ca(HCO_3)_2$ | $CaCl_2$ | $MgCl_2$ **Quantity (mg/L)** | 7 | 5 | 9 | 6 **Mol. Wt.** | 84 | 162 | 111 | 95 Calculate the temporary, permanent and total hardness of water in ppm. (ii) 500 mL of water sample, on titration with N/50 HCl gave a titre value of 29 mL to phenolphthalein end point and another 500 mL of the sample on titration with same acid gave a titre value of 58 mL to methyl orange end point. Calculate the alkalinity present in the sample and comment on the type of alkalinity present.	**10** **10**	**CO3**