Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, Dec 2019

Program: B.Tech (ASE, ASE+AVE, Civil, ADE, ECE, EL, FSE, GIE, Mechatronics, BAO, IFM, GG, CCVT) (13 branches)
Course: Chemistry **Semester: I**
Course Code: CHEM 1011 **Time 03 hrs.**
No. of pages: 3 **Max. Marks: 100**

Instructions: 1. Write your enrollment number at the space provided on top of the question paper
2. Do not write anything on question paper except your enrollment number
3. Attempt all parts of a question at one place only
4. Internal choice is given in question No. 7 and 10

SECTION A

S. No.		Marks	CO
Q 1	For the cell reaction : $Ni_{(s)} / Ni^{2+} // Ag^{+} / Ag_{(s)}$ Calculate the equilibrium constant at 25°C. Given, $E^{o}_{Ni2+ / Ni} = -0.25$ V ; $E^{o}_{Ag+ /Ag} = 0.80$ V	**4**	**CO3**
Q 2	What is corrosion? Give any three differences between wet corrosion and dry corrosion.	**4**	**CO3**
Q 3	$A \overset{k_1}{\rightarrow} B \overset{k_2}{\rightarrow} C$ Derive an expression for concentration of A and B after time t.	**4**	**CO2**
Q 4	Write the names and chemical structure of the polymers that are used to make the following: a. Contact lenses b. Cookwares	**4**	**CO5**
Q 5	At 540 K, 0.10 mole of PCl_5 are heated in a 8 litre flask. The pressure of the equilibrium mixture is found to be 1.0 atm. Calculate Kp and Kc for the reaction.	**4**	**CO2**

SECTION B

Q 6 (i)	E^{o} of some elements are given as $I_2 + 2e^- \longrightarrow 2I^-$ $E^{o} = +0.54$ V $MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$ $E^{o} = +1.52$ V $Fe^{3+} + e^- \longrightarrow Fe^{2+}$ $E^{o} = -0.77$ V $Sn^{4+} + 2e^- \longrightarrow Sn^{2+}$ $E^{o} = -0.1$ V I. Select the strongest reductant and oxidant in these. II. Using the above data, predict the spontaneity of the following reactions: (i) $Sn^{4+} + 2Fe^{2+} \longrightarrow Sn^{2+} + 2Fe^{3+}$ (ii) $Sn^{4+} + 2I^- \longrightarrow Sn^{2+} + I_2$ (iii) $Fe^{3+} + 2I^- \longrightarrow Fe^{2+} + I_2$	**4 + 6**	**CO3**
Q 7 (i)	The molar heat of formation of $NH_4NO_{3(s)}$ is -367.54 kj and those of $N_2O_{(g)}$ and $H_2O_{(l)}$ are +81.46 kj and -285.78 kj respectively at 30°C and at 1atm pressure. Calculate ΔH and ΔE for the reaction $NH_4NO_{3(s)} \longrightarrow N_2O_{(g)} + 2H_2O_{(l)}$ OR	**7**	**CO1**

	How will you convert the following? a. benzene to n-propyl benzene b. ethene to ethyne		
(ii)	$SO_2Cl_2 \longrightarrow SO_2 + Cl_2$ is a first order reaction. How long will it take for 20% of the reactant to be left behind, if its half life is 90 minutes. OR Calculate the activation energy of a reaction whose reaction rate at 27^oC gets doubled for 10^oC rise in temperature.	**3**	**CO2**
Q8 (i)	A sample of water was alkaline to both phenolphthalein and methyl orange. 100 ml of this water sample required 30 mL of N/50 H_2SO_4 for phenolphthalein end point and another 20 mL for complete neutralization. Determine the types and extent of alkalinity present.	**5**	**CO4**
(ii)	An exhausted zeolite softner was regenerated by passing 150 litres of NaCl solution, having a strength of 150 gm/L of NaCl . Find the total volume of water that can be softened by this zeolite softener, if the hardness of water is 500 ppm.	**5**	**CO4**
Q9 (i)	The angle of diffraction 2θ for a first order nature was found to be 55^o using X-rays of wavelength $3.12A^o$. Calculate the distance between two diffracted planes.	**5**	**CO5**
(ii)	Define nanomaterials? Discuss the synthesis of nanomaterial by Sol-gel process.	**5**	**CO5**
	SECTION-C		
Q10 (i)	What will happen and why? (6) a. Alumininum articles are exposed to air. b. Copper pipes are used in conjunction with iron pipes in water distribution system. c. Paint is slightly removed at one part of an iron box. OR Write short notes on the following: a. Waterline corrosion b. Bimetallic corrosion	**6**	**CO3**
(ii)	What do you understand by calorific value of a fuel? The following data was obtained in a bomb calorimeter experiment: Weight of the crucible = 3.644 g Weight of crucible + fuel = 4.708 g Water equivalent of the calorimeter = 520 g Water taken in the calorimeter = 2000 g Observed rise in temperature = 2.4°C Cooling correction = 0.068°C Acids correction = 62.6 calories Fuse wire correction = 3.8 calories Cotton thread correction = 1.6 calories Calculate the gross calorific value of the fuel sample. If the fuel contains 8% hydrogen, determine the net calorific value. OR The percentage composition by mass of coal sample is as follows: C=90%, H=3.5%, O=3%, N=1%, S=0.5% and rest is ash.	**6**	**CO1**

	Calculate the volume of oxygen and air required from atmosphere at 27^{o}C and 1 atm pressure for the combustion of 3 Kg of coal.		
(iii)	The equivalent conductivity of CH_3COONa, HCl and NaCl at infinite dilution are 91.6, 425.0 and 128.1 Scm^2 eq^{-1} respectively. Calculate equivalent conductivity of acetic acid at infinite dilution. Also if degree of dissociation of 0.1 N acetic acid is 0.001, find the equivalent conductivity at this concentration of acetic acid. OR Draw the conductance curve for the reaction of: a. strong acid vs. strong base. b. weak acid vs. weak base.	**8**	**CO3**
Q 11(i)	Calculate the amount of lime (88.3% pure) and soda (99.2% pure) required to soften 24,000 litres of water containing the following $Ca(HCO_3)_2$= 1.85 mg/L, $CaSO_4$ = 0.34 mg/L, $Mg(HCO_3)_2$ = 0.42 mg/L, $MgCl_2$ = 0.76 mg/L, $MgSO_4$ = 0.90 mg/L	**7**	**CO4**
(ii)	A conductance cell was filled with 0.01 molar KCl. Its resistance was found to be 150 ohm. The conductivity was observed to be 0.00177 S cm^{-1}. The cell was then washed and filled with 0.05 molar solution of NaCl whose resistance was found to be 325 ohm. Calculate conductivity and molar conductivity of NaCl solution.	**5**	**CO3**
(iii)	Classify polymers on the basis of thermal stability.	**3**	**CO5**
(iv)	Explain ion exchange method for softening of water with suitable equations.	**5**	**CO4**