UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2021
Programme Name: B. Tech. (APE-Gas, Chemical, ADE, AM-NT, ME, Mechatronics, FSE, Civil)

Course Name	: Chemistry	Semester : I
Course Code	: CHEM 1011	Time : 03 hrs
Nos. of page(s)	: 03	Max Marks: 100

Instructions: Read all the below mentioned instructions carefully and follow them strictly:
1) Mention Roll No. at the top of the question paper.
2) Attempt all the parts of each question at one place only.

SECTION A
1. **Each question will carries 5 marks**
2. **Instruction: Complete the statement/ Select the correct answer**

S. No.	Question	Marks	CO
Q 1	(a) The octane number of a fuel containing 20% of n-heptane and 80% of 2, 2, 4-trimethylpentane will be? (b) Unburned material remaining after 750 ºC during the proximate analysis of coal is known as… (c) Among cyclopropane, cyclobutane, cyclopentane, and cycloheptane which one will be more stable? (d) Write any two specific points of aromatic compounds.	**4*1=4**	**CO1**
Q 2	At 430°C, HI was allowed to decompose into hydrogen and iodine in a reaction vessel according to the following equation: $$2HI\,(g) \rightleftharpoons H_2\,(g) + I_2(g)$$ After reaching to equilibrium, the concentration of $[H_2]$ was 0.047 mole/liter whereas that of [HI] was found to be 0.345 mole/liter. Using the given data find out the value of Kc for above reaction?	**4**	**CO2**
Q 3	Write a brief note on activation energy of a chemical reaction.	**4**	**CO2**
Q 4	Mention any four disadvantages of Hardness of water.	**4**	**CO4**

Q 5	X rays of wavelength 154 pm from a Cu target are diffracted from planes of a metal. Calculate the distance between adjacent Miller planes for a second order reflection. Bragg's angle is 14.2 °.	**4**	**CO5**

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SECTION B

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1. **Each question will carries 10 marks**
2. **Instruction: Write short / brief notes**
3. **Internal choice is given for question number 1.**

Q 1	Describe the proximate analysis in details, giving proper diagram. **OR** Describe the need of ultimate analysis in chemistry in short. During estimation of nitrogen present in organic compound by Kjeldahl's method, 3.5 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 60 ml of N/12 HCl. After absorption, the excess acid requires 15.5 ml of 0.1 N NaOH for neutralization. Determine the percentage of nitrogen in the substance.	**10**	**CO1**
Q 2	Derive the rate constant equation for a third order reaction (3 A→ Product), and find out the equation for its half-life.	**10**	**CO2**
Q 3	(a) Write a brief note on conductometric titration of a strong base against a strong acid, giving neat diagram. (b) Calculate the limiting molar conductivity of C_2H_5COOH, which is a weak electrolyte. The molar conductivities of C_2H_5COONa, HCl and NaCl at infinite dilution are 90.1, 426.16 and 126.45 $S.cm^2/mol$ respectively.	**5+5**	**CO3**
Q 4	(a) Illustrate the bulk polymerization technique for the synthesis of polymer. (b) Describe with examples, thermoplastics polymers.	**5+5**	**CO5**

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SECTION-C

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1. **Each question carries 20 marks**
2. **Instruction: Write long answers**
3. **Internal choice is given for question number 2.**

Q 1	(a) The emf of cell- $\quad$ Ni(s) / Ni^{2+} (a) // Cu^{2+} (0.75M) / Cu(s), is 0.701 V at 25 ^{0}C. **E^0 $_{(Ni^{+2}/Ni)}$ = -0.25 V, E^0 $_{(Cu^{2+}/Cu)}$ = +0.34 V.** (i) Write down the half-cell reaction & complete cell reaction. (ii) Find out the concentration of Ni^{2+} **i.e. the value of "a".**	**7+7+6**	**CO3**

	(b) 0.1N solution of C_2H_5COONa was placed between two electrodes 0.72 cm apart with an area of 2.25 cm^2. The resistance of solution was 52.40 ohm. Calculate the specific and equivalent conductance of the solution. (c) Describe the differential aerial corrosion in brief citing suitable sketch.		
Q 2	(a) 15 ml of a sample of water when titrated with required 10 ml of N/20 HCl using methyl orange indicator gives colour change, but did not give any colour with phenolphthalein. Determine the type and extent of alkalinity is present, in the above sample. **OR** A sample of water on analysis was found to contain following impurities: $\quad\quad\quad$ $Ca(HCO_3)_2$: 10 mg/lt $\quad\quad$ $Mg(HCO_3)_2$:16 mg/lt $\quad\quad\quad$ $CaSO_4$ $\quad$: 18 mg/lt $\quad\quad$ $MgSO_4$ $\quad\quad$: 12 mg/lt Calculate temporary, permanent and total hardness in ppm. Given that atomic weights of Mg = 24; Ca = 40; S = 32; O = 16 and C = 12. (b) Describe in detail the Zeolite based process for softening of water, giving the advantages and disadvantages of its uses. **OR** EDTA method is commonly used for complexometric titration. Describe its reaction with a divalent metal ion alongwith their structure. A 50 mL sample of water was titrated against 0.012 M EDTA and the equivalence point was observed at 29.80 mL. Find out the hardness of water in ppm of $CaCO_3$ equivalent.	**8** **+** **12**	**CO4**