End Semester Examination July-Dec 2024

Program: B. Tech-CSE (Section III)/B.Tech-M.Tech-DD-CH-CT   **Semester: I**st
Course Name: Engineering Chemistry   **Course Code:** CH14101/CH19101
Maximum Time: 03:00 hrs.   **Full Marks:** 60

Instructions:
1. All questions are compulsory.
2. Assume if any missing data.
3. The CO & PO and Marks related to questions are mentioned on the right-hand side margin.

Questions	CO	PO	Marks
Q.1 (a) Calculate the gross and net calorific value of a coal sample having the following composition: C = 80%, H = 7%, O = 3%, S = 3.5%, N = 2.1% and ash = 4.4 %.	1	1	(5)
(b) What are primary and secondary fuels? Define CV, HCV and NCV.			(5)
(c) Calculate the weight and volume of air required for the combustion of one Kg of carbon.			(5)
Q.2 (a) Derive Nernst equation and give its significance.	2	2	(6)
(b) What is Kohlrausch law?			(3)
(c) The molar conductance of sodium acetate, hydrochloric acid and sodium chloride at infinite dilution are 91.0×10^{-4}, 426.16×10^{-4} and 126.45×10^{-4} $S\ m^2\ mol^{-1}$, respectively at 25 ^{0}C. Calculate the molar conductance at infinite dilution for acetic acid.			(6)
Q.3 (a) Give the designation and formulation of Co(III) amines, and their characteristics based on Werner's theory.	3	3	(5)
(b) Draw molecular energy level diagram for (i) NO and (ii) CO.			(4)
(c) The internuclear distances in some O-O bonds are as follows: O_2^+ (1.12Å) (ii) O_2 (1.21Å) (iii) O_2^- (1.30Å) (iv) O_2^{2-} (1.49Å) Account for the gradation of the internuclear distances in the above series. Which of these species are paramagnetic?			(6)
Q.4 (a) Draw the energy profile diagram of the following elimination reaction: (i) E1 and (ii) E2. Indicate clearly the reactants, transition states, activation energies and products of the above reactions.	4	4	(5)
(b) Describe Saytzeff and Hoffmann rule with suitable examples.			(3)
(c) Predict the products of the following reaction and also mention the name of the reaction.			(7)

(a) $CH_3{-}CHO + CH_3{-}CHO \xrightarrow{NaOH}$

(b) $C_6H_5{-}CHO + C_6H_5{-}CHO \xrightarrow[\text{(ii) } H^+]{\text{(i) Conc. NaOH/}\Delta}$

(c) $H{-}CHO + CH_2HO{-}\overset{CH_2OH}{\underset{CH_2OH}{C}}{-}CHO \xrightarrow[\text{(ii) } H^+]{\text{(i) Conc. NaOH/}\Delta}$

(d) $CH_3{-}\overset{O}{\overset{\|}{C}}{-}CH_3 + CH_3{-}\overset{O}{\overset{\|}{C}}{-}CH_3 \xrightarrow{Ba(OH)_2}$

(e) $C_6H_5{-}CHO + CH_3{-}\overset{CH_3}{\underset{H_3C}{C}}{-}CHO \xrightarrow[\text{(ii) } H^+]{\text{(i) Conc. NaOH/}\Delta}$

(f) $C_6H_6 + R{-}X \xrightarrow{\text{Anhy. } AlX_3/\Delta}$

(g) $C_6H_6 + C_6H_5{-}\overset{O}{\overset{\|}{C}}{-}Cl \xrightarrow[\Delta]{\text{Anhy. } AlX_3/C_6H_6}$