Sub Code: AHT002 **ROLL NO……..……..**

I SEMESTER EXAMINATION, 2023 – 24

Ist yr B.Tech.

Engineering Chemistry

Duration: 3:00 hrs **Max Marks: 100**

Note: - Attempt all questions. All Questions carry equal marks. In case of any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.

Q 1.	Answer any four parts of the following. a) Draw the molecular orbital diagram of CO and O_2 molecule. Calculate its bond order and predict its magnetic behavior? b) Explain the tacticity in polymer. c) Differentiate between sludge and scale formation in boiler. d) Explain sacrificial coating method for the prevention of corrosion. e) Discuss the principle of the Bomb Calorimeter. How is it used to determine the GCV & LCV of the Fuel? f) Define functionality of the monomer for the formation of polymer. Also explain why methanol do not polymerize.	5x4=20
Q 2.	Answer any four parts of the following. a) Write a short note on reverse osmosis. How it is different from osmosis. b) Discuss the postulate of valance bond theory and its limitation. Also give structure and hybridization of XeF_4. c). Give the preparation and properties of Nylon 6,6, PTFE, PET and Buna-N. d) Discuss cathodic protection methods for the prevention of corrosion. e) 10000 litres of hard water was softened by passing it through zeolite softener. The exhausted zeolite softener bed was regenerated by passing it through 58 litres of NaCl solution containing 100 g/l of brine solution. Calculate the hardness of water in term of $CaCO_3$ equivalent. f) Comment on the IR activity and microwave activity of following compound along with reason COS, NH_3, CO_2, CH_4	5x4=20
Q 3.	Answer any two parts of the following. a) Explain $[Co(NH_3)_6]^{3+}$ is an inner orbital complex while $[Ni(NH_3)_6]^{2+}$.is an outer orbital complex. Also comment on the magnetic properties of both complexes. b) Differentiate between:- (i) Homopolymer and co-polymer (ii) Thermoplastic and Thermosetting polymers c) Define alkalinity of water. 100 ml of a sample of water required 30.0 ml of 0.01 M EDTA for titration using Eriochrome Black-T indicator. In another experiment, 100 ml of the same sample after boiling required 10 ml of 0.01 M EDTA using Eriochrome Black-T indicator. Calculate (i) the total hardness, (ii) permanent hardness, (iii) carbonate hardness, in terms of mg/lit of $CaCO_3$.	10x2= 20
Q 4.	Answer any two parts of the following. a). Define Hess law. The heats of combustion of C (s, graphite), H_2 (g) and CH_4 (g) at 298 K and 1 atm are respectively −393.50 kJ/mol, −285.83 kJ/mol and −890.36 kJ/mol. What is the enthalpy of formation for CH_4?	10x2= 20

	b) Discuss the various vibrational modes in IR spectroscopy of polyatomic molecules. Draw all possible vibrational mode for CS_2 molecule c) Derive Nerst equation. The EMF of a cell measured by means of a hydrogen electrode against a saturated calomel electrode at 298 K is 0.4188 V if the pressure of the H_2 was maintained at 1 atm. Calculate the pH of the unknown solution given potential of reference electrode is 0.2415 V	
Q 5.	Answer any two parts of the following. a) What are ion exchange resins? With the help of neat sketch, discuss ion exchange process for water softening. Compare its merit over zeolite process. b) Write a short note on any two from the following i. Nucleophilic addition reaction ii. Nucleophilic substitution reaction iii. Diels-Alder reaction c) Why is TMS used as an internal standard in NMR spectroscopy? Two isomeric compounds A and B have molecular formula $C_{10}H_{14}$. The ^1H NMR spectra of these isomers gave the following data: Isomer A: δ 1.30 (9H,s); δ 7.28 (5H, s) Isomer B: δ 0.88 (6H, d); δ 1,86 (1H, m); δ 2.45 (2H, d); δ 7.12 (5H,s). Giving reasons assign the structures for the two isomers.	10x2= 20

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