Note: Q1 is compulsory question.

Attempt any three questions from Q2 to Q6.

Programmable calculator is allowed.

Q1	**Attempt any Five out of the following:**	**15M**
a.	Differentiate between bonding and anti bonding orbitals.	3M
b.	Define Aromaticity. Find out whether following molecules is aromatic or not. 	3M
c.	Define phase. Calculate no. of phases in following reactions. $FeO_{(g)}+CO_{(g)} \rightleftharpoons Fe_{(s)}+CO2_{(g)}$	3M
d.	Write any three uses of polymers in medicine and surgery.	3M
e.	Write a short note on viscoelasticity.	3M
f.	Explain EDTA method for the estimation of hardness of water.	3M
g.	Define Degree of hardness. Classify the following salts into temporary and permanent hardness causing salts and also calculate their calcium carbonate equivalents. $Ca(HCO_3)_2$ = 48.6 mg/L, $MgSO_4$ = 4.8 mg/L, $CaCl_2$ = 111 mg/L, Fe_2O_3 = 94 mg/L (Ca = 40, H = 1, C = 12, O = 16, Mg = 24, S = 32, Cl = 35.5, Fe = 57)	3M
Q2.	**Attempt the following:**	**15M**
a.	1 g of $CaCO_3$ was dissolved in dilute HCl and diluted to 1 L, 100 ml of this solution required 90 ml of EDTA solution for titration. 100 ml of hard water sample required 30 ml of EDTA solution for titration. 100 ml	5M

of same water sample on boiling, filtering requires 20 ml EDTA solution. Calculate the temporary, permanent and total hardness in ppm.

b. Apply molecular orbital theory to oxygen molecule. 5M

c. What is Glass transition Temperature? Give factors affecting Glass transition temperature. 5M

Q3. Attempt the following: 15M

a. With the help of neat labelled diagram explain Electrodialysis of brackish water. 5M

b. Explain two component system of Lead and Silver with neat labelled diagram. 5M

c. What is fabrication? Explain Injection molding method for the fabrication of polymers. 5M

Q4. Attempt the following: 15M

a. i. Give electronic configurations of 3M

i. Ca (Atomic No. = 20)

ii. Mg (Atomic No. = 12)

iii. Fe (Atomic No. = 26)

a. Ii. Explain reduced phase rule. 2M

b. 50000 L Hard water was softened by Ion exchanger resins. For regeneration of exhausted resins, 300 L of 0.1 N HCl and 0.1 N NaOH solutions were consumed. Calculate hardness of the water sample. 5M

c. Give preparation, properties and uses of 5M

i. Kevlar

ii. PMMA

Q5. Attempt the following: 15M

a. A polymer sample consists of 10 chains with the following molecular weights. Calculate number-average and weight average molecular weights of the sample. 5M

Number of polymer (N_i)	10	5	3

Molecular weight of each polymer (M_i)	5000	4000	3000

b. Explain structure and bonding in benzene. 6M

c. Give applications of phase rule. 4M

Q6. Attempt the following: 15M

a. With the help of MOT explain magnetic nature of carbon monoxide. Calculate bond order of CO molecule. 6M

b. What are conducting polymers? Give applications of conducting polymers. 5M

c. A 25 ml of sample of waste water was refluxed with 20 ml of potassium dichromate solution and after refluxing the excess unreacted dichromate required 12.4 ml of 0.1 M FAS solution. A blank of 10 ml of distilled water on refluxing with 20 ml of dichromate solution required 32 ml of 0.1 M FAS solution. Calculate the COD value of the waste water. 4M

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