CLASS: IMSc   SEMESTER : IV
BRANCH: MATH. & COMPUTING   SESSION : SP/2023

SUBJECT: CH213 CHEMISTRY-II

TIME: 3 Hours   FULL MARKS: 50

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.


			CO	BL
Q.1(a)	Explain the continuity of state with the help of P-V isotherm of carbon dioxide.	[5]	1	2
Q.1(b)	Derive Bragg equation. Calculate the Miller indices of crystal plane which cut through the axes at (i) 2a, 3b, c and (ii) 2a, -3b, -3c.	[3+2]	1	2
Q.2(a)	Define and explain the ionic product of water. Discuss buffer action of acetate buffer when small amount of acid and base is added to it.	[2+3]	2	2
Q.2(b)	Deduce an expression for the degree of hydrolysis of a salt of a weak acid and a strong base.	[5]	2	2
Q.3(a)	(i) When PhCH2Br is added to a suspension of KF in benzene no reaction occurs. However, when a catalytic amount of 18-crown-6 ether is added. PhCH2F can be isolated in high yields. If LiF is substituted for KF, there is no reaction even in the presence of the crown ether. Explain the observations. (ii) Draw the π-MO diagram of 1,3-butadiene and indicate the HOMO and LUMO at the ground state.	[3+2]	3	3
Q.3(b)	(i) The addition of chlorine (1mol.) to 1,3-butadiene at 25°C produces 60% 3,4-dichloro-1-butene and 40% 1,4-dichloro-2-butene. At 200°C, the yields are 30% and 70% respectively. Explain the observations with energy profile diagram. (ii) Discus the bromination of 2-butanone in presence of acid and in presence of base. Write down the reaction involved and explain the differential nature of bromination.	[3+2]	3	2
Q.4(a)	How EMF of a cell is determined? Derive Nernst equation.	[2+3]	4	2
Q.4(b)	How equilibrium constant of a cell reaction A + B ⇌ C + D can be determined form the EMF measurement?	[5]	4	3

Q.5(a)   (i) Which mechanism, SN^1 or SN^2, is favorable for reactions with each of the following   [3+2]   5   3
         substrates? Explain

MeO—⟨ ⟩—CH₂Cl   O₂N—⟨ ⟩—CH₂Cl   ClCH₂-OMe
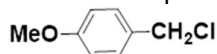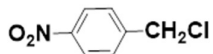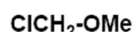
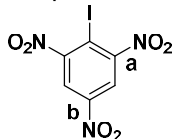   (i)   (ii)   (iii)
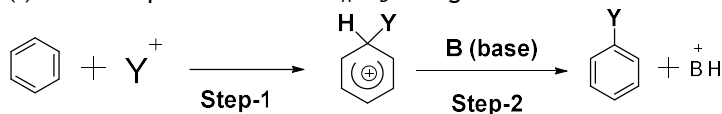
(ii) Explain which C-N bond, 'a' or 'b', has a shorter bond length in the following
compound

Q.5(b)   (i) A two-step reaction with $K_H/K_D \sim 7$ is given below: [3+2]   5   3

Draw and explain the energy profile for the reaction showing the transition state(s)
and the intermediate. Indicate the rate determining step also. Give a real example
which fits with this reaction situation.
(ii) Reaction of CH_3I with NaN_3 increases several folds with change of solvent from
methanol to DMF. -Explain