a) Name of Course : B.Sc (Prog) Life Sciences /Physical Sciences

b) Semester : III

c) Name of the Paper : Solutions, Phase Equilibrium, Conductance,

Electrochemistry& Functional Group Organic Chemistry-II

d) Unique Paper Code : 42174304
e) Duration : 3:00 Hours
f) Maximum Marks : 75

Instructions for Candidates

1. Write your Roll number, user ID, UPC of paper on the top of first answer paper.

2. Attempt all parts of a question together.

3. Attempt any **four** questions out of **six** questions. Two Question from each section.

4. Use of non-programmable scientific calculator is allowed.

5. Use internet only for downloading of Question paper and uploading the answer-sheet.

SECTION –A

1(a) The resistance of 0.01N NaCl solution at 25^0C is 100 ohms. Cell constant of conductivity cell is unity. Calculate the equivalent conductivity.   3

(b) What is meant by transport number of an ion? Explain.   3

(c) What is triple point of water? What is the effect of changing pressure and temperature at the triple point?   3

(d) Distinguish between Henry's law from Raoult's law.   3

(e) What is reference electrode? Describe SHE.   3

(f) Explain the Nernst distribution law. How law get modified when there is association or dissociation of solute take place in any one of the solvents.   3.75

2(a) Draw the phase diagram of sulphur and explain its salient features.   5

(b) For the cell Cd│CdSO$_4$ (a=1) Hg$_2$SO$_4$ │Hg at 318 K, calculate ΔG, ΔS and ΔH. The cell emf is given by $E(V)= 0.6708-1.02\times10^{-4}(t-25) – 2.4 \times 10^{-6}(t-25)^2$, where **t** is temperature in ^0C.   5

(c) How the transference number is determined using Hittorf Method. 4

(d) Construct the vapour pressure- composition and boiling point-composition plots for binary liquid pairs showing (i) ideal behaviour and (ii) non- ideal behaviour .Why liquids showing non-ideal behaviour cannot be separated completely into the pure components by fractional distillation? 4.75

3(a) Construct the phase diagram from the following data of a two component system A and B miscible in the liquid state only.

Mass% B	0	10	25	35	45	55	65	80	92	100
Freezing Point(^{0}C)	119	112	99	90	78	83	95	108	113	115

Calculate the composition at the eutectic point and also determine the eutectic temperature. Label the diagram and also draw cooling curves for melts with compositions 40% and 80% B (by mass). Indicate the phases separating during cooling of the melts.
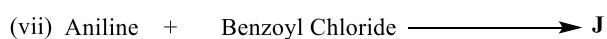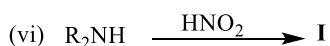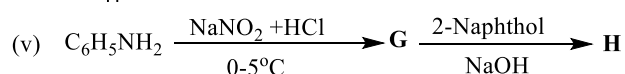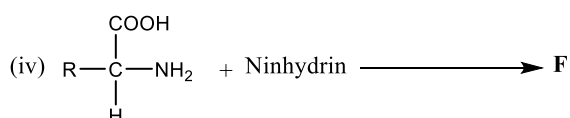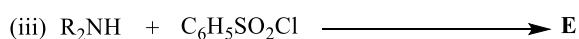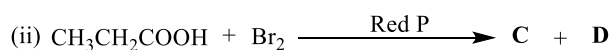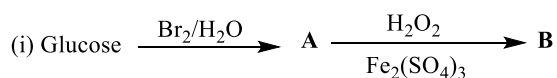5

(b) What are concentration cells? Derive an expression for the emf of an electrolyte concentration cell with transference. 5

(c) Explain the terms mutual solubility temperature(MST) , Critical Solution temperature(CST). Give examples and draw all three type of CST systems. 4

(d) The resistance of a 0.02 mol dm^{-3} solution of acetic acid in a cell (cell constant= 0.2063cm^{-1}) was found to be 888 ohm. What is the degree of ionization of the acid at this concentration? 4.75

Section B

Q 1. (a) Complete the following reactions:

(i) Glucose $\xrightarrow{Br_2/H_2O}$ A $\xrightarrow[Fe_2(SO_4)_3]{H_2O_2}$ B

(ii) CH_3CH_2COOH + Br_2 $\xrightarrow{Red\ P}$ C + D

(iii) R_2NH + $C_6H_5SO_2Cl$ $\longrightarrow$ E

(iv) R—C(COOH)(NH_2)(H) + Ninhydrin $\longrightarrow$ F

(v) $C_6H_5NH_2$ $\xrightarrow[0-5^oC]{NaNO_2\ +HCl}$ G $\xrightarrow[NaOH]{2\text{-Naphthol}}$ H

(vi) R_2NH $\xrightarrow{HNO_2}$ I

(vii) Aniline + Benzoyl Chloride $\longrightarrow$ J

(b) Compound (A) ($C_4H_8O_4$) gives positive test with Tollen's reagent. Treatment of (A) with bromine water produces an optically active compound (B). Oxidation of (A) with nitric acid gives an optically inactive compound (C). Compound (A) can be prepared from L-glyceraldehyde by Kiliani-Fischer synthesis. Deduce the structure of the compound A, B, C and write the reactions involved.

(c) (i) Draw the structure formula for tetrapeptide Ala-Tyr-Ser-Gly and also write the name of the tetrapeptide.   (10, 6, 2.75)

Q2. (a) An organic compound (A) with molecular formula $C_2H_4O_2$ turns blue litmus red and gives a positive $NaHCO_3$. On treatment with PCl_5, (A) gives compound (B). Compound (B) when treated with NH_3 forms compound (C). On reaction with $Br_2/NaOH$, (C) gives compound (D) with molecular formula CH_5N.

(i) Give the reactions, identify A, B, C and D.

(ii) Name the reaction involved in the conversion of C to D. Also give the mechanism of this reaction.

(b) How will you differentiate the following (one chemical test with reaction)

(i) Ethylamine and Aniline

(ii) Acetic acid and Acetone

(iii) Glucose and Acetophenone

(c) Outline the Solid Phase synthesis of Ala-Val.

(d) Arrange the following compounds in increasing order of Basicity

(i) Primary, Secondary and Tertiary amine in gaseous phase

(ii) Aniline and *p*-Nitroaniline   (6, 3.75, 4, 5)

Q3. (a) Carry out the following conversions

(i) Phenylacetic acid to benzylamine

(ii) Aniline to p-Bromoaniline

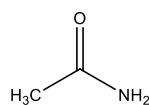(iii) Methanol to Methylacetate
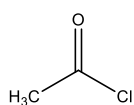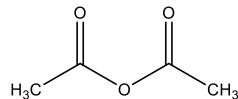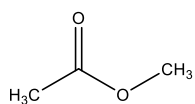
(iv) Propanoic Acid to Lactic Acid

(v) Ethyl Chloride to Alanine

(b) An unknown pentapeptide on amino acid analysis shows that it contains the following residues Gly, 2×Ala, Met and Phe. Treatment with original peptide with carboxypeptidase gives alanine as first free amino acid residue. Sequential treatment of pentapeptide with phenylisothiocyanate followed by mild hydrolysis gives the following derivatives in the order.
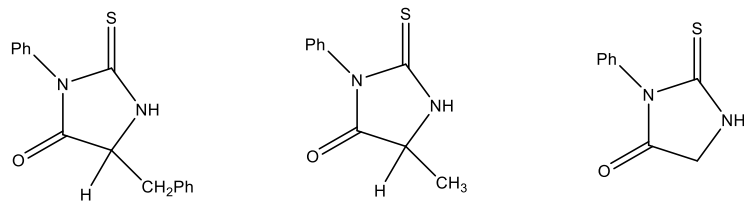
Deduce the structure of pentapeptide and write the reactions involved.

(c) Give and explain the relative reactivity order of the following derivatives of carboxylic acids towards nucleophilic substitution reaction

(10, 5, 3.75)