MANIPAL
ACADEMY of HIGHER EDUCATION
(Institution of Eminence Deemed to be University)

Reg. No.										

DEPARTMENT OF SCIENCES
I SEMESTER M.Sc. (CHEMISTRY)
END SEMESTER REGULAR EXAMINATIONS, NOVEMBER & DECEMBER 2023
PHYSICAL CHEMISTRY [CHM 5103]
(CHOICE BASED CREDIT SYSTEM - 2021)

Time: 3 Hours Date: 04/12/2023 MAX. MARKS: 50

Note (i) Answer ALL questions
(ii) Draw diagrams, and write equations wherever necessary

Q. No.		Marks	CO	BL
1A	Why is model needed to study the electrified interface, and how did Stern explain this concept using the Helmholt-Perrin and Gouy-Chapman model.	4	2	6
1B	(i) Using the Debye-Huckel limiting law, calculate the value of $\gamma_{\pm}$ in 5.0×10^{-3}M solutions of $Ca(NO_3)_2$ (ii) Draw a diagram illustrating the conditions under which ion-pair formation is possible and when it is not possible, based on the Bjerrum hypothesis.	3	2	3
1C	Explain asymmetric effect and electrophoretic effect found in strong electrolytes and also write the significant of Debye-Huckel Onsager equation.	3	2	2
2A	Describe partially miscible liquid systems involving three components with one pair and two pairs of partially miscible liquids.	4	4	6
2B	Derive Gibbs-Helmholtz equation and give the applications of it.	3	3	4
2C	(i) The E.M.F. of the cell $Zn/ZnCl_2$:AgCl(s)/Hg involving the cell reaction $Zn(s) + 2AgCl(s) \rightleftharpoons Zn^{2+} + 2Cl^- + 2Ag$ (s) is 1.005 at 298 K. Calculate the heat content change at the given temperature ($\frac{\partial E}{\partial T} = -4.0 \times 10^{-4}$ and $F = 96500$ coulombs) (ii) Find the change in melting point per atmosphere change of pressure from the following data Melting point of Sulphur = 398°K $V_\alpha - V_\beta = 0.0250$ $\Delta H_f = 9.3$ cal/gm $dP = 1.013 \times 10^6$	3	3	3
3A	Using the assumptions of absolute reaction rate theory show that exponential factor (pA) does not depend upon activation energy (E_a)	4	1	3
3B	Explain the electrocapillary action using mercury manometer and how it can be helpful in determining interfacial tension?	3	2	4
3C	State third law of thermodynamics. Derive the equation for absolute entropies.	3	3	3

4A	Write an explanatory note on isothermal explosion during gas phase combustion of hydrogen. Derive rate expression.	4	1	2
4B	Explain the influence of solvent dielectric constant on the rate of the reaction	3	1	4
4C	Using Rice and Herzfeld mechanism, show that thermal decomposition of ethane to ethylene is a first order reaction.	3	1	3
5A	Explain the Michaelis Menten concept of mechanism for explaining the influence of substrate on the rate of reaction.	4	1	4
5B	Apply van't Hoff intermediate for general catalytic mechanism and arrive to a rate expression for reaction catalyzed by surfaces.	3	1	3
5C	Derive rate expression for bimolecular surface reaction using Langmuir-Hinshelwood mechanism.	3	1	3

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