

Course Code	Course Title	C	H	I	E	T
17P4CMC12	PHYSICAL CHEMISTRY-IV	4	4	25	75	100

**UNIT I ELECTROCHEMISTRY – I** 12 Hrs

Theory of strong electrolytes, Interionic attraction theory- Debye-Huckel model of ionic atmosphere- Debye-Huckel Onsager equation-derivation, verification and modifications- Wien effect – Debye Falkenhagen effect - Debye Huckel limiting law-extension- Huckel Bronsted equation- Determination of activity coefficients using Bronsted equation. - concept of activity and activity coefficient, Activities in electrolytic solutions - ionic strength -- mean molal ionic activity coefficient of strong electrolytes - calculations.

**UNIT II ELECTROCHEMISTRY- II** 12 Hrs

Electrical double layer - Theories of electrical double layers – Helmholtz model – Chapman model – Stern model - electrode processes - Kinetics of electrode processes - Butler-Volmer equation- Tafel equation - Over voltage- theories of over voltage - application of over voltage- - Corrosion- principles of electrochemical corrosion- Dry and wet corrosion and its mechanism. Types of corrosion- Galvanic, aeration, stress, pitting corrosion. Polarography- theory and applications- Batteries- Nickel-Cadmium, lead-acid battery - Electrochemical energy conversions. Storage and Fuel cells: Primary and Secondary Fuel cells. H<sub>2</sub>-O<sub>2</sub> fuel cells and its advantages.

**UNIT III NON-EQUILIBRIUM THERMODYNAMICS** 12 Hrs

Introduction - Phenomenological laws and Onsager's reciprocal relations-entropy product- ion specific examples of entropy production - Prigogine's principle of minimum entropy production - entropy production in coupled phenomena-an elementary introduction to bioenergetics

**UNIT IV SURFACE CHEMISTRY** 12 Hrs

Adsorption – physisorption and chemisorption. Adsorption isotherms: BET and Gibbs adsorption isotherms. Different types of adsorption. Adsorption with dissociation – competitive adsorption – non-ideal adsorption. Thermodynamics of adsorption. Surface area determination. Kinetics and mechanism of unimolecular and bimolecular reactions – Langmuir-Hinshelwood and Langmuir-Rideal mechanisms.

**UNIT V RADIATION CHEMISTRY AND CATALYSIS** 12 Hrs

Radiation chemistry: Source of high energy – interaction of high energy radiation with matter – radiolysis of water – G-value – reactions of hydrated electrons OH and H radicals – experimental techniques : Dosimetry.

Homogeneous catalysis - acid-base catalysis – protopic and protolytic mechanism - Bronsted relationships - secondary' salt effect acidity functions - Hammett's acidity function - enzyme catalysis - Michaeli's - Menten kinetics.

**Text Book(s):**

1. Bockris, J.O.M and Reddy, AK.N., “Modern Electrochemistry 1 – Ionics”, Second Edition, Springer, New Delhi, 2006.
2. Samuel Glasstone, “Electrochemistry”, First Edition (Latest revised), East-West Press, New Delhi, 2010
3. Adamson, A.W. and Gast, A.P., “Physical Chemistry of Surfaces”, Sixth Edition, Wiley India Pvt., Ltd., New Delhi, 2012.
4. Laidler, K.J., “Chemical Kinetics” Sixth Edition, Pearson Education, New Delhi, 2011.
5. Atkins, P. and de Paula, J., “Physical Chemistry”, Ninth Edition, Oxford University Press, New Delhi, 2011.
6. Mortimer, R.G. “Physical Chemistry”, Third Edition, Academic Press – An imprint of Elsevier, London, 2009.

**Reference Books:**

1. Viswanathan, B, Venkatraman, R, Rengarajan, K. Sundaram, S and Ragavan, P.S., “Electrochemistry”, First Edition, S. Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai, 2007.
2. Ball, D.W., “Physical Chemistry”, First Indian Edition, Cengage Rearing India Pvt., Ltd., New Delhi, 2009.
3. Puri, B.R., Sharma, L.R. and Pathania, M.S., “Principles of Physical Chemistry”, Forty eighth Edition, Vishal Publishing Co., Jalandhar, 2015.
4. Engel, T. and Reid, P., “Physical Chemistry”, Second South Asian Edition, Pearson Publication, New Delhi, 2011.
5. Berry, R.S., Rice, S.A and Ross, J., “Physical Chemistry”, Second Edition, Oxford University Press, New York, 2007.