

4. Kapoor, K.L. (2015), **A Textbook of Physical Chemistry**, Vol.1, 6th Edition, McGraw Hill Education.
5. Kapoor, K.L. (2015), **A Textbook of Physical Chemistry**, Vol.5, 3rd Edition, McGraw Hill Education.

Practicals:

1. Khosla, B.D.; Garg, V.C.; Gulati, A. (2015), **Senior Practical Physical Chemistry**, R. Chand & Co.

GE 9: Chemistry: Conductance and Electrochemistry

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

| Course title & Code | Credits | Credit distribution of the course | | | Eligibility criteria | Pre-requisite of the course |
|--|----------|-----------------------------------|----------|--------------------|----------------------|-------------------------------------|
| | | Lecture | Tutorial | Practical/Practice | | |
| Conductance and Electrochemistry (GE-9) | 4 | 2 | | 2 | | Basic knowledge of Chemistry |

Learning Objectives

The Learning Objectives of this course are as follows:

- To make students learn about conductance, its measurement and applications.
- To make students learn the principles of electrochemical cells: Electrolytic and Galvanic cell, measurement of, measurement of emf and its applications.

Learning outcomes

By the end of the course, the students will be able to:

- Explain the factors that affect conductance, migration of ions and application of conductance measurement.
- Understand different types of galvanic cells, their Nernst equations, measurement of emf, calculations of thermodynamic properties and other parameters from the emf measurements.
- Understand applications of Emf measurements in relation to determination of activity coefficients, pH of a solution and Potentiometric titrations.

SYLLABUS OF GE-9

Theory:

Unit 1: Conductance

(10 Hours)

Quantitative aspects of Faraday's laws of electrolysis. Arrhenius theory of electrolytic dissociation. Conductivity: equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes, Kohlrausch Law of independent migration of ions. Wein Effect and Debye–Falkanhegan Effect.

Transference number and its experimental determination using Hittorf and moving boundary methods, Ionic mobility, applications of conductance measurements: determination of degree of ionization of weak electrolytes, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid-base).

Unit 2: Electrochemistry **(20 Hours)**

Reversible and irreversible cells with Examples, concept of EMF of a cell, measurement of EMF of a cell, Nernst equation and its importance, types of electrodes, standard electrode potential (reduction Potential) and its application to Gas–ion half-cell. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: G, H and S from EMF data. Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference, liquid junction potential; determination of activity coefficients and salt bridge, pH determination using hydrogen electrode. Potentiometric titrations-qualitative treatment (acid-base and oxidation-reduction only).

Practicals: **(60 Hours)**

(Laboratory periods: 60)

1. Conductance

- (i) Determination of cell constant.
- (ii) Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
- (iii) Perform the following conductometric titrations:
 - a) Strong acid vs strong base
 - b) Weak acid vs strong base.

2. Potentiometry

Perform the potentiometric titrations of (i) Strong acid vs strong base, (ii) Weak acid vs strong base and (iii) Mohr's salt vs KMnO_4 .

References:

Theory:

1. Castellan, G.W. (2004), **Physical Chemistry**, Narosa.
2. Kapoor, K.L. (2015), **A Textbook of Physical Chemistry**, Vol 1, 6th Edition, McGraw Hill Education.
3. Kapoor, K.L. (2013), **A Textbook of Physical Chemistry**, Vol 3, 3rd Edition, McGraw Hill Education.

Practicals:

1. Khosla, B.D.; Garg, V.C.; Gulati, A. (2015), **Senior Practical Physical Chemistry**, R. Chand & Co.