Corrosion: Introduction, Importance and principles, Forms of corrosion (Galvanic, Atmospheric, stress, microbial and soil). Techniques of Corrosion rate measurement (instrumental and non-instrumental). EMF series &Galvanic series and their limitations. Thermodynamics (Pourbaix diagram). Concept of mixed potential theory and its importance in terms of Kinetics (Tafel and Evans diagram), effect of oxidizer and passivity of corrosion. Protection against corrosion (Design improvement, Anodic and cathodic protection, inhibitors, coating). 6 hrs.

Analytical Applications of Electrochemistry -Principles and Applications of Polarography, Cyclic voltammetry, Coulometry, Amperometry and chrono systems. 5hrs.

REFERENCES

1. Chemical Kinetics, K. J. Laidler, Pearson Education, Anand Sons(India) 3rd ed., 2008.
2. Fundamentals of Chemical Kinetics, M.R.Wright, Harwood Publishing, Chichesrer, 1999.
3. Kinetics & Mechanisms of Chemical Transformations, J Rajaram & J C Kuriacose, Macmillan, Delhi,42007.
4. Chemical &Electrochemical Energy Systems, R. Narayan & B. Viswanathan (University Press), 1998.
5. Industrial Electrochemistry, D. Peltcher & F. C. Walsh (Chapman & Hall)1990.
6. Principles and Applications of Electrochemistry–Crow (Chapman hall, New York) 2014
7. An Introduction to metallic corrosion and its prevention-Raj Narayan (Oxford-IBH, New Delhi), 1983.
8. Electrochemistry and Corrosion Science-Nebtor Ferez (Springer Pvt.Ltd.), Delhi, 2010.
9. Instrumental Methds of Chemical Analysis, Kudesia Sawhney, Pragati Prakasha(Meerut).

OC S 404 : SPECTROSCOPY AND ANALYTICAL TECHNIQUES

COURSE OUTCOME:

- Students will learn the basic principles and applications of ESR Spectroscopy, NQR Spectroscopy,
- Students can be familiarising with Mossbauer Spectroscopy, Photoelectron spectroscopy, Atomic absorption Spectroscopy, Emission Spectroscopy, Molecular Luminescence Spectroscopy and Light Scattering methods.
- The students will also trained in the field of Ion Exchange Chromatography, Exclusion Chromatography and Thermal methods
- Overall students can solve the problems related to spectroscopy

UNIT- I: **[12 Hours]**

Electron Spin Resonance Spectroscopy: Basic principles, hyperfine couplings, the 'g' values, factors affecting 'g' values, isotropic and anisotropic hyperfine coupling constants, Zero Field splitting and Kramer's degeneracy. Measurement techniques and Applications to simple inorganic and organic free radicals and to inorganic complexes.

NQR Spectroscopy: Quadrupolar nuclei, electric field gradient, nuclear quadrupole coupling constants, energies of quadrupolar transitions, effect of magnetic field. Applications.

Mössbauer Spectroscopy: The Mössbauer effect, chemical isomer shifts, quadrupole interactions, measurement techniques and spectrum display, application to the study of Fe^{2+} and Fe^{3+} compounds, Sn^{2+} and Sn^{4+} compounds(nature of M-L bond, coordination number and structure), detection of oxidation states and inequivalent Mössbauer atoms.

Photoelectron spectroscopy: Basic principles, valence &core binding energies, shifts in energies due to chemical forces, Photoelectron spectra of simple molecules, Auger transitions, measurement techniques. Applications.

UNIT-II [12 Hours]

Ion Exchange Chromatography: Definitions, requirements for ion-exchange resin, synthesis and types of ion-exchange resins, Principles, basic features of ion-exchange reactions, resin properties, ion-exchange capacity, resin selectivity and factors affecting the selectivity, applications of IEC in preparative, purification and recovery process. Separation of lanthanides.

Exclusion Chromatography: Theory and principle of size exclusion chromatography, experimental techniques for gel-filtration chromatography (GFC) and gel-permeation chromatography (GPC), materials for packing-factors governing column efficiency, methodology and applications.

Thermal methods: Thermogravimetric analysis, Instrumentation, factors affecting the results and applications. Differential thermal analysis, simultaneous DTA-TGA curves. Differential scanning calorimetry, applications.

UNIT – III: **[12 Hours]**

Atomic Absorption Spectrometry: Principle, Theory, working of AAS instruments, analytical applications, interferences.

Emission Spectroscopy: Flame Emission Spectroscopy, plasma emission spectrometry, basic principles of flame photometry, evaluation methods in flame photometry, interferences.

Molecular Luminescence Spectroscopy: Theory of fluorescence and phosphorescence, fluorimetry in quantitative analysis, instruments, fluorescence and structure, fluorescence quenching, phosphorescence method, applications in quantitative analysis.

Light-Scattering methods : Nephelometry and turbidimetry- theory, effects of concentration, particle size and wavelength on scattering, instrumentation and applications. Activation analysis.

REFERENCES:

1.A. Salahuddin Kunju and G. Krishnan: Group Theory and its Applications in Chemistry, PHI Learning, N. Delhi, 2010

2.Gurudeep Raj, Ajay Bhagi and Vinod Jain: Group Theory and Symmetry in Chemistry, 4th edn , Krishna Meetut, 2012.

3. U.C. Agarwala, H.L.Nigam, Sudha Agarwal and S.S. Kalra: Molecular Symmetry in Chemistry via Group Theory, Anne Books, N. Delhi, 2013.

4.G.D. Christian : Analytical Chemistry, (4th Ed.), (John Wiley),1986.

5. R.A.Day and A.L. Underwood : Quantitative Analysis, 5th Ed. (Prentice Hall, India), 1998.

6.H.H.Wlliard, L.L.Merrit and J.J.Dean, Instrumental methods of analysis,(7th Ed.) 1988

7. B.K.Sharma, Instrumental Methods of Chemical Analysis (Goel publishing), 2000.

8.Skoog, Holler and Nieman: Principles of Instrumental Analysis, (Harcourt Afca), 2001