M. Sc. Chemistry 1st Semester

S.No.	Subject Code	Course Title	L	T	P	C
1	CY-511	Physical Chemistry	3	1	0	4
2	CY-512	Inorganic Chemistry	3	1	0	4
3	CY-513	Organic Chemistry	3	1	0	4
4	CY-514	Analytical Chemistry	3	1	0	4
5	CY-515	Chemistry Practicals	0	0	16	8
Total			12	4	16	24

L=Lecture hours/week P=Practical hours/week T=Tutorial hours/week C=Credits

1. Thermodynamics

Classical Thermodynamics:
Brief resume of concepts of laws of thermodynamics, free energy, chemical potential and entropies. Partial molar properties(viz., energy, volume, entropy, heat content etc.) and their significances & determination.
Concept of fugacity and its determination.Non-ideal systems: Excess functions for non-ideal solutions. Activity & Activity coefficient. Debye-huckel theory for activity coefficient of electrolytic solutions; determination of activity & activity coefficients; ionic strength.
Non-equilibrium Thermodynamics:
Thermodynamic criterion for non-equlibrium states, entropy production and entropy flow, entropy balance equations for different irreversible processes (e.g., heat flow, chemical reaction etc.), non-equilibrium stationary states.
Microscopic reversibility and Onsager's reciprocity relations. Electro-kinetic phenomenon, diffusion and electric conduction.

2. Polarography

Current voltage curve with the dropping mercury electrodes. Experiments set of a polarograph. Scope of polarography, dropping mercury electrodes, its advantage and limitations. Elementary ideas of limiting current, migration current, diffusion current, kinetic current, catalytic current and adsorption current, Ilkovic equation (no derivation), Polarographic maxima, Applications of polarography in various fields. Hrs 8

3. Chemical Kinetics

Parallel, opposing consecutive & chain reactions involved equilibria , induced reaction with examples, induction factor, induction period. Effects of substituents on the rates, linear free energy relationships. Catalysis: Acid-Base catalysis, Enzyme Catalysis.

Theory of reaction rates : a) Collision theory b) Transition state theory c) Comparison of the results of two theories, steric & probability factor and its
physical significance. Hrs 8

Reference Books:

3. Polarographic Techniques by L. Meites, Interscience.
4. Polarography, by Kolthyft & Lingane, Vol. I.
5. Kinetics and Mechanism, Pearson
6. Advanced Chemical Kinetics & Mechanism, Wilkinson.
7. Chemical Kinetics by K.J. Laidler.
8. Chemical Kinetics and Mechanism by A.A. Frost & R.G. Pearson.
9. P.W.Atkins,Physicalchemistry,ELBS.
10. Thermodynamics for chemists, van Nostrand Reinhold co.
11. I.M. Klotz and I.M. Rosenberg, Chemical Thermodynamics, W.A. Benzamin, 1972.

I Stereochemistry and Bonding in Main Group Compounds

VSEPR, Walsh diagrams, d□-p□ bonds, energetics of hybridization.s

II Metal-Ligand Equilibria in Solution

Stepwise and overall formation constants and their interaction, trends in Stepwise constants, factor affecting the stability of metal complexes with
reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by pHmetry
and spectrophotometry.

III Reaction Mechanism of Transition Metal Complexes

Energy profile of a reaction, reactivity of metal complex, inert and labile complexes, kinetic application of valence bond and crystal field theories,
kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect
evidences in favour of conjugate mechanism, anation reactions, reactions
without metal ligand bond cleavage. Substitution reactions in square planar
complexes, the trans effects, mechanism of the substitution reaction. Redox
reactions, outer sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.

Reference Books:

1 Advanced Inorganic Chemistry, F.A. Cotton & Wilkinson, John Wiley.
2 Inorganic Chemistry, J.E. Huhey & Row.
3 Chemistry of the elements, N.N. Greenwood and A. Earnshow, Perfamon

I. Carbohydrates

Classification , structure, uses, isolation, and importance of Carbohydrates
with special reference to Nucleotides, glycosides and glycoproteins. Separation of carbohydrates. Compounds derived from sugars.

II Pericyclic Reactions

Classification of periycyclic reactions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions-conrotatory and disrotatory motions, 4n, 4n+2 and allyl systems,Cycoladditionsantrafacial and suprafacial addition, 4n and 4n+2 systems,2+2 addition of ketenes, 1,3 dipolar Cycoladditions and cheleotropic reaction.
Sigmatropic rearrangements-suprafacial and atrafacial shifts of H,sigmatropic
shifts involving carbon moieties, 3,3-and 5,5- Sigmatropic rearrangements.Claisen,Cope Ene reaction.

III Photochemistry

Interaction of electromagnetic radiation with matter. Types of Photochemical
reactions,quantum yield and actinometry.Excited states and ground states,
singlet & triplet states, forbidden transitions, types of excitation, properties and
nomenclature of excited states, photolytic cleavages, cis-trans Isomerization,
Paterno Buchi reaction, Norrish type reactions, photoreduction of ketones;
Dienone photochemistry & photochemistry of aromatics (addition & isomerization), photosensitizers, Photo-Fries rearrangement, Barton reaction,
Photodegradation of Polymers.

Books Suggested

1. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professionsl.
2. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan.
3. Pericyclic Reactions, S.M. Mukherji, Macmillan, India
4. Chemistry of Natural Products, S. V. Bhat, B. A. Nagasampagi, M. Sivakumar, Narosa Publishing House, New Delhi.
5. Introduction to Medicinal chemistry A. Gringuage, Wiley VCH.

6. Fundamental of Photochemistry, K.R. Rohtagi-Mukherji, Wiley-Eastern
7. Introductroy Photochemistry, A. Cox & T. Camp, McGraw-Hill
8. Photochemistry, R.P. Kundall & A. Gilbert, Thomson Nelson.
9. Molecular Reactions & Photochemistry, C.H. Depuy & O.S. Chapman,
Prentice-Hall.

1 Chromatographic Techniques- Chromatographic methods of separation. Gas Chromatography, HPLC. Adsorption partition, exclusion electrochromatography, Solvent extraction and ion-exchange methods. Hrs
8

2.Electroanalytical Techniques - Electroanalytical technique: voltammetry, cyclic volmammetry, amperometry, coulometry and conductometry. Annodic
sttripping voltammetry; TGA, DTA and online analyzers.
Hrs 8

3.Adsorptions emission spectroscopy- Application of atomic and molecular absorption and emission spectroscopy in quantitative analysis. Light scattering
techniques including nephelometry and Raman spectroscopy
Hrs 6

4.Radio analytical methods.- Fluorescence and Phosphorescence based methods. Hrs 6

Book Suggested

1. Analytical Chemistry, G.D. Christian, J.Wicy.
2. Fundamentals o analytical Chemistry. D.A. Skoog. D.M. West and F.J. Hooler, W.B. Saunders.
3. Analytical Chemistry-Principles. J.H. Kennedy. W.B. Saunders.
4. Analytical Chemistry-Principles and Techniques. LG. Hargis. Prentice Hall.
5. Principles of Instrumental analysis D.A. Skoog and J.L. Loary, W.B. Saunders.
6. Principles of Instrumental Analysis D.A. Skoog W.B. Saunders.
7. Quantitative Analysis, R.A. Day, Jr. and A.L. Underwood, Prentice Hall.
8. Environmental Solution, S.M. Khopkar, Wiley Eastern.
9. Basic Concepts of Analysis Chemistry, S.M. Khopkar, Wiley Eastern.
10. Handbook of Instrumental Techniques for Analytical Chemistry, F. Settle, Prentice Hall.

I. Qualitative Analysis

Separation, purification and identification of binary mixture of Organic compounds using chemical methods. Wherever possible a suitable derivative
is to be prepared.

II. Organic Synthesis involving two steps.

(Synthesis of Organic Compounds)

a. Acetylation of salicylic acid, aniline,
b. Benzoylatinon of aniline and phenol.
c. Preparation of Iodoform from ethanol and acetone.
d. Nitration
Preparation of m-dinitrobenzene
Preparation of p-nitroacetanilide
Halogenation
Preparation of p-bromoacetanilide
Preparation of 2,4,6-tribromophenol.
e. Diazotization/coupling
Preparation of methyl orange and methyl red.
f. Oxidation : Preparation of benzoic acid from toulene.
g. Reduction :
Preparation of aniline from nitrobenzene
Preparation of m-nitroaniline from m-dinitrobenzene.

III. Preparation of selected inorganic compounds:

(i) $K_3[Fe(C_2O_4)_3]$
(ii) $Mn(acac)_3$
(iii) $[Co(Py)_2Cl_2]$
(iv) Hexa thiourea-plumbous nitrate
(v) Prussian Blue
(vi) $[Ni(NH_3)_6]Cl_2$
(vii) $Ni(dmg)_2$
(viii) Hexaurea chromic chloride.
(ix) Hexaammine cobalt (III) acetate
(x) Potassium trioxalato ferrate
(xi) Ferrous Oxalat
(xii) Nickel ammonium sulphate
(xiii) Potassium trioxalatochromate (III)

IV Analysis of alloys & ores by analytical methods.

V Chemical Kinetics

(i) Saponification of Ethylacetate.
(ii) Reaction between acetate & iodine in acidic medium.
(iii) To study the kinetics of between between persulphate and iodide.
(iv) To study primary salt effects in oxidation of iodide ion by

persulphate ion.

VI Conductivity

(i) Determination the basicity of organic acids (oxalic acid/benzoic acid)

(ii) Conductometric titration of (a) Strong acid (b) weak acid and (c) mixture of both with strong base.

(iii) Calculation of dissociation constant of a weak acid and verification of Ostwald's dilution law.

(iv) Solubility of sparingly soluble salt (e.g. $PbSO_4$, $BaSO_4$).

VII Distribution Law

(i) Distribution of acetic acid/benzoic acid between benzene and water.

(ii) Equilibrium constant of the reaction between iodine and potassium iodide.

(iii) Determine partition coefficient of iodine between CCl_4 & water.

(iv) Determine critical solution temperature of phenol water a) NaCl b) naphthalene c) succinic acid.

Analytical Chemistry Practical

1 VIII Polarographic Estimation of Pb, Sn, Ni and Zn in a copper alloy.

2 Determination of Phenylenediamines and quinones(reversible reduction), polarograpy.

3 Estimation of Na, K and Ca by flame photometry.

4 Colourimetric estimations of fluoride and Fe in drinking water.

5 Analysis of Cement.

6 Analysis of Oils and fats.

7 Separation and Estimation of some cations and anions by Ion exchange method.

8 Separation of Amino Acids by Ion –exchange method.

9 Estimation of Sugar in Urine.

10 Analysis of a mixture of CO, CO_2 and SO_2.

Books Suggested

(i) Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham, ELBS.

(ii) Synthesis and Characterization of Inorganic Compounds, W.L. Jolly. Prentice Hall.

(iii) Experiments and Techniques in Organic Chemistry, D.P. Pasto, C.

Johnson and M. Miller, Prentice Hall.
(iv) Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C. Health.
(v) Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.