- Includes large number of kinetic experiments from which students are made to choose four experiments which illustrate different principles of chemical kinetics.
- They are also expected to learn concepts of thermodynamics by carrying out four experiments from the respective section.
- The paper also includes experiments from spectroscopy and two experiments to be carried out from this section.
- They are trained in Chemical kinetics, chemical thermodynamics and spectroscopic techniques in this course

A. Kinetics and Catalysis (Any FOUR of the following reaction systems to be studied)
(Determination of reaction order and activation parameters, study of salt/solvent/catalytic effects and formulation of reaction scheme and deduction of rate laws).
1. Kinetics of acid catalysed hydrolysis of methyl acetate.
2. Saponification of ethyl acetate by conductivity method.
3. Reaction between potassium persulphate and potassium iodide (including the study of salt effect, dielectric constant effect and catalysis by Ag^{+}/ Fe^{2+} / Cu^{2+} ions).
4. Decomposition of diacetone alcohol by NaOH.
5. Kinetics of (i) Reaction between iodine and acetone and (ii) iodination of aniline.
6. Decomposition of H_2O_2 (including the study of catalytic effect).
7. Reaction between Chromic acid and oxalic acid.
8. Heterogeneous decomposition of ammonia.
9. Surface tension-concentration correlation for solutions (Gibbs equation).
10.Determination of activity of surfaces , free volume of catalysts and surface area of catalysts. **B. Thermodynamics Experiments** (**Any Four experiments to be carried out)**
8. Determination of activities of an electrolyte and non – electrolyte by cryoscopy.
9. Determination of partial molar volumes of (a) Salts – water and (b) alcohol – water (methanol & ethanol) systems by density method.
10. Determination of specific heat of liquids and solutions by calorimetry.
11. Cryoscopic and ebullioscopic analysis of the given mixture of urea and glucose.
12. Study of adsorption of picric acid on charcoal using a calorimeter,

C. Spectrophotometry (Any Two experiments are to be carried out)
1. Determination of pKa values of indicators.
2. Determination of Hammett's acidity function.
3. Spectroscopic investigation of partition coefficient of iodine between H_2O and $CHCl_3$.
4. Study of the effect of ionic strength on the pH of the given acid with the help of indicators using buffer solution by colorimetric method.
5. Determinationmof composition and stability consatant of metal complexes by (Fe^{3+}anDsalislic acid, Ni (II) and 1,10phenanthroline).
6. Simultaneous determination of Manganese and chromium in a solution of dichromate and permanganate mixture

References:
1. Willard, Merrit, Dean &Settle:Instrumental Methods of analysis(Van Nostrand.NY)1981.
2. Sawyer and Roberts : Experimental Electrochemistry for Chemists (Wiley , N.Y)1974.
3. B.P.Levitt : Findlay's Practical Physical Chemistry, (Longman, London), 1973.
4. J. B. Yadav : Advanced Physical Chemistry Experiments (Goel Publishing House), 1988.
5. F. J. Welcher(Ed): Standard methods of Chemical Analysis (Kriegen, N.Y)1975.

4th SEMESTER

AC H 551: COORDINATION CHEMISTRY

COURSE OUTCOME:

- The students will learn spectral properties of complexes, interpretation of spectra,
- Photochemistry of metal complexes, Magnetic behavior of metal complexes,
- Spectral applications of coordination compounds,
- Reactions mechanisms in Transition metal complexes, Electron transfer reactions,

UNIT- I: **[15 Hours]**

Spectral properties of complexes: Term symbols for d^n ions, spectroscopic ground states, selection rules, nature of spectral bands- band shapes, band intensities, band widths, spin-orbit coupling, vibrational structures.

Orgel diagrams, Tanabe-Sugano diagrams, interpretation of spectra of octahedral, distorted octahedral, tetrahedral and square planar complexes, Determination of $_o$ from spectra. Charge transfer bands – origin, types, and characteristics. Photochemistry of metal complexes- photosubstitution and photoredox reactions, ligand photoredox reactions, photoreactions and solar energy conversion.

UNIT- II: **[15 Hours]**

Type of magnetic behaviour, orbital contribution, spin orbit coupling, spin cross-over systems. Measurement of magnetic susceptibility – Gouy and Faraday methods, diamagnetic corrections, ferro- and antiferromagnetic coupling, super paramagnetism. High and low spin equilibria. Magnetic properties of lanthanides and actinides. Infrared spectra of metal complexes, Group frequency concept. Changes in ligand vibrations on coordination- metal ligand vibrations. Spectral applications of coordination compounds - IR spectra of metal carbonyls - ESR spectra-application to copper complexes, Mossbauer spectra- application to iron complexes. NMR spectra - Application to diamagnetic complexes.

UNIT- III: **[15 Hours]**

Reaction Mechanisms in Transition Metal Complexes**:** Energy profile of a reaction, inert and labile complexes, kinetics of octahedral substitution and mechanistic aspects. Acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism and evidences in its favor. Anation reactions, reactions without M-L bond cleavage. Substitution reactions in square planar complexes, trans effect, mechanisms of substitution. Substitution reactions in tetrahedral complexes. Isomerization and racemization reactions of coordination compounds. Electron transfer reactions- inner sphere and outer sphere reactions, complimentary and non-complimentary reactions.

References:

1. D.N.Satyanarayana:Electronic absorption Spectroscopy and Related Techniques, OUP, 2001.
2. F.Basolo and R.G.Pearson: Inorganic Reaction Mechanisms, Wiley Eastern, 1979.
3. W.W.Porterfield: Inorganic chemistry – A Unified Approach, Elsevier, 2005.
4. R.L.Dutta and A Syamal : Elements of Magnetochemistry, Affiliated east-West, 1993.
5. J.E Huheey, R.L.Keiter and A.L.Keiter: Inorganic Chemistry(4^{th}edn),Addison Wesley, 2000.

AC H 552: Synthetic and Natural Products Chemistry

COURSE OUTCOME:

Enable the students:

- To acquire knowledge on the various reagents employed for oxidation and reduction of various kinds of organic molecules.