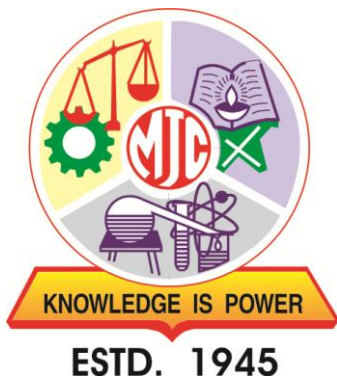


Khandesh College Education Society's
Moolji Jaitha College, Jalgaon
An "Autonomous College" Affiliated to
KBC North Maharashtra University, Jalgaon



SYLLABUS

Chemistry

S.Y.B.Sc.
(Semester III & IV)

Under Choice Based Credit System (CBCS)

[w. e. f. Academic Year: 2020-21]

Course Structure: S.Y.B.Sc (Chemistry)

Duration: The duration of B.Sc. (Chemistry) degree program shall be three years.

Semester	Course Module	Subject code	Title of Paper	Credit	Hours per week
III	DSC	CH-231	Physical chemistry-II	2	2
	DSC	CH-232	Organic chemistry-III	2	2
	DSC	CH-233	Practical course III	2	4
	SEC	CH-230	IT skills for chemist	2	2
IV	DSC	CH-241	Physical chemistry-III	2	2
	DSC	CH-242	Inorganic chemistry-II	2	2
	DSC	CH-243	Practical course IV	2	4
	SEC	CH-240	Basic analytical chemistry	2	2

DSC : Discipline Specific Elective Core Course
SEC : Skill Enhancement Course
CH-YSC : Chemistry (Y-year; S-Semester; C-Course number)

Examination Pattern for S.Y.B.Sc.

Examination	Marks
External Marks	40
Internal Marks	10
Total Marks	50

S.Y.B.Sc. (Chemistry): Semester-III
CH- 231 Physical Chemistry-II

Total Hours: 30

Credits: 2

Course objectives:

- The course is fundamental, still it is helpful to develop experimental skill in the laboratories.
- It is useful to pursue research in chemistry.

Course outcomes:

Students will gain an understanding of:

- the fundamental and advance gaseous state
- importance of van der Waals equation
- core study of Electrolytic Dissociation
- concept of solutions, applicability of Henry's law

Unit I : Gaseous State

10h

Introduction, general characteristics of gases, parameters (volume, pressure temperature and number of moles) of a gas, gas laws (Boyle's law, Charles law, Avogadro's law), Ideal-gas equation, kinetic molecular theory of gases, deviations from ideal behaviour, compressibility factor, effect of pressure and temperature variation on deviations, van der Waals equation, liquefaction of gases-critical phenomenon, van der Waals equation and critical constants, related numericals.

Reference 1: Page Numbers: 5-19, 25-32, 53-56.

Reference 2: Page Numbers: 328-338, 356-361, 364, 366-368.

Reference 3: Page Numbers: 337-339, 364-368.

Unit II : Theory of Electrolytic Dissociation

10h

Introduction, Arrhenius theory of ionization, migration of ions, relative speed of ions: Hittorf's rule, transport number and its determination by Hittorf's and moving boundary method, Kohlrausch's law of independent migration of ions and its application for the calculation of degree of dissociation, conductometric titration: titration of a strong acid against a strong base, titration of a weak acid against a strong base, titration of a strong acid against a weak base, titration of a weak acid against a weak base.

Reference 1: Page Numbers: 333-335, 402, 405-412, 420-421, 433-434.

Reference 2: Page Numbers: 798-816.

Reference 3: Page Numbers: 799-804, 809-815.

Unit III : Solutions

10h

Introduction, concentration of solutions, ways of expressing concentration (per cent by volume, per cent by weight, molarity, molality, mole fraction), solutions of gases in gases, Henry's law, solutions of liquids in liquids, solubility of completely miscible liquids, solubility of partially miscible liquids, phenol-water system, triethylamine-water system, nicotine-water system, vapour pressures of liquid-liquid solutions: first type of mixtures of miscible liquids, second type of mixtures of miscible liquids and third type of mixtures of miscible liquids, solutions of solids in liquids.

Reference 1: Page Numbers: 261-262, 297-298.

Reference 2: Page Numbers: 472-483, 488-489.

Reference 3: Page Numbers: 698-699, 720-723.

References:

1. Maron, S. H. and Prutton C. F., (2012), Principles of Physical Chemistry (4th Edition), Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Bahl, B. S., Bahl, A. and Tuli, G. D., S., (2005), Essentials of Physical Chemistry, Chand and Co Ltd., New Delhi.
3. Puri, B. R., Sharma, L. R. and Pathania, (2007), Principles of Physical Chemistry (42nd Edition), M. S., Vishal Publishing Co., Jalandhar.
4. Atkins, (1998), Physical Chemistry, P. W., ELBS.
5. Barrow, G. M., (2003), Physical Chemistry, International Student Edition.
6. Vishnoi, N. K. And Shukla, R. J., Textbook of Physical Chemistry (Volume I, II and III),
7. Moore, W. J., (1998), Physical Chemistry, Orient Longman.
8. McQuarrie, D. A. And Simon, J. D., (2006), Physical Chemistry- A Molecular Approach, Viva Books Pvt. Ltd., New Delhi
9. Glasstone, S., (1965), An Introduction to Electrochemistry, Van Nostrand, East-West.
10. Robinson, R. A. and Stokes, R. H., (1959), Butterworths, Electrolytic Solutions, London.

Methods of teaching: Lecture method, discussion and problem solving, laboratory method, problem solving method, question answer method, brain storming method, assignment method.

Innovative teaching: ICT enabled teaching, video clips/ movies, online quiz.

S.Y.B.Sc. (Chemistry): Semester-III **CH- 232: Organic Chemistry-III**

Total Hours: 30

Credits: 2

Course Objectives:

- To study stereoisomerism in organic compound and influence of it on molecular properties.
- To learn the writing of reaction mechanisms.
- To study and apply the basic knowledge of reactions.
- To study of synthetic reagents.

Course Outcomes:

- Students get adequate knowledge of different classes of organic molecules, their important reactions and some functional group interconversions.
- Students can write stereochemical structure.
- Students get the knowledge of some organic reactions that helpful to design the desired product and factors to take care of it.

Unit I : Organic Reaction Mechanism

10h

Reagents: Mechanism and application of oxidizing and reducing agent (Osmium tetroxide, Peracids, Lithium aluminium hydride, Sodium

borohydride).

Types of organic reactions with reaction mechanism: Addition (Michael addition, Markovnikov and anti-Markovnikov addition reaction), Elimination (Saytzeff and Hoffmann elimination), substitution (aliphatic electrophilic and nucleophilic, aromatic electrophilic) and rearrangement (Beckmann rearrangement) reactions.

Reference 3: Relevant pages

Reference 5: Relevant pages

Unit II : Stereochemistry

10h

Stereoisomerism, types of stereoisomerism, Flying wedge formula, Fischer Projection, Newman and Sawhorse Projection formula and their interconversions.

Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with Cahn–Ingold–Prelog priority rules.

Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral centres, diastereomers, meso structures, Racemic mixture and methods of resolution. Absolute configuration, R/S designations with Cahn–Ingold–Prelog priority rules.

Conformational isomerism: Factor affecting on stability of Conformation, conformational structure and stability of ethane, butane, cyclohexane, chair and boat forms, axial and equatorial bonds in cyclohexane, factors affecting stability of conformations. Baeyer's angle strain theory.

Reference 1: 101-185.

Reference 4: Page Numbers: 1-61, 82-99, 108-121, 309-337.

Reference 5: Relevant pages.

Unit III : Heterocyclic Compounds

10h

Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom (Furan, Pyrrole, Thiophene and Pyridine).

Synthesis: Paal-Knorr furan synthesis, Knorr pyrrole synthesis, Paal-Knorr Thiophene Synthesis, Hantzsch pyridine synthesis.

Reactions with Mechanism: nitration sulphonation, Friedel-Crafts Acylation of Furan, Pyrrole, Thiophene and Pyridine.

Reference 7: Relevant pages.

Reference 8: Relevant pages.

References:

1. Morrison, R. T. and Boyd, R. N., (2007), Organic Chemistry, sixth edition, Dorling Kindersley (India) Pvt.Ltd. (Pearson Education).
2. Finar, I. L., (2020), Organic Chemistry (Volume 1), sixth edition, Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
3. Ahluwalia V. K. & Parashar R. K., (2010), Organic Reaction Mechanism (Fourth Edition), Narosa.
4. Kalsi P. S., (2019), Stereochemistry Conformation and Mechanism, Tenth Edition, New Age International Publishers.
5. Ernest L. Eliel and Samuel H. Wilen, (2008) Stereochemistry of Organic Compound; Wiley.

6. Sykes, P., (1988), A Guidebook to Mechanism in Organic Chemistry, sixth edition, Orient Longman, New Delhi.
7. Paquette L. A., (1968), Principles of modern heterocyclic chemistry, New York, Benjamin.
8. Jacobi P. A., (2018), Introduction to Heterocyclic Chemistry, John Wiley & Sons.

Methods of teaching: Classroom teaching method, discussion and problem solving, laboratory method, problem solving method, question answer method, brain storming method, assignment method. **Innovative teaching:** ICT enabled teaching, video clips/ movies, online quiz.

S.Y.B.Sc. (Chemistry): Semester-III CH- 233: Practical course III

Total Hours: 60

Credits: 4

(Total Fifteen experiments will be performed in IIIrd semester)

I] Physical Chemistry Practical:

Course Objectives:

- The course is designed to develop the experimental skills.

Course Outcomes:

- the preparation for each experiment by studying lab handouts and links therein
- safety requirements and lab skills to perform physico-chemical experiments
how to keep records of instruments, parameters, and experimental observations
reporting of experimental result
- an appreciation for modern problems and scientific controversies in physical chemistry

Perform any four experiments in semester III of the followings:

1. Conductometric titration of hydrochloric acid with sodium hydroxide
2. Conductometric titration of acetic acid with sodium hydroxide
3. Preparation of 0.05 M potassium hydrogen phthalate solution and standardization of a given NaOH solution.
4. Determination of critical solution temperature of phenol-water system.
5. Draw the graph for the given data using Microsoft excel.(Take printout of graph and attach it to student's Journal)

References:

1. Kitcher, J. A., Findlays Practical Chemistry, Revised.
2. Vogel, A. I., Textbook of Quantitative Inorganic Analysis.
3. Das, R. C. and Behera, Experimental Physical Chemistry.
4. Yadav, J. B., Advanced Practical Physical Chemistry, Goel Publishing.

5. Daniels, F. and Williams, J., Experimental Physical Chemistry.
6. Shoemaker, R. and Gerland, Advanced Physical Chemistry Experiments.
7. Willard, Merritt Dean and Settle, Instrumental Methods of Analysis.

II] Organic Chemistry Practical:

Course Objectives:

- To develop practical hand.
- To know the methods related to organic qualitative analysis.
- To know the chemical structure drawing by using computer software.

Course Outcome:

- Students get the knowledge of organic qualitative analysis.
 - The experiments are helpful to enhance practical hand.
 - The students are able to draw the chemical structure by using software.
1. Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols and carbonyl compounds) (Minimum eight compounds).
 2. Any three of following:
 - i) To draw the chemical formulae and structure with the help of Chem Draw. (Draw at least five structure with their names and attach print out of it to students' journal.)
 - ii) Synthesis of aspirin from salicylic acid.
 - iii) Preparation of methyl orange.
 - iv) Preparation of dibenzalpropanone from benzaldehyde by using NaOH.
 - v) Identification of Alcohols and Phenols by using test either Lucas test, Ferric chloride test, chromic acid test.

References:

1. Svehla, G., (2012), Vogel's Qualitative Inorganic Analysis, Pearson Education.
2. Mendham, J., (2019), Vogel's Quantitative Chemical Analysis, Pearson.
3. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., (1996), *Textbook of Practical Organic Chemistry*, , 5th edition, Prentice-Hall.
4. Mann, F.G. & Saunders, B.C., Practical Organic Chemistry, Orient-Longman, (1960).
5. Li, Z., Wan, H., Shi, Y., & Ouyang, P. (2004). Personal experience with four kinds of chemical structure drawing software: review on ChemDraw, ChemWindow, ISIS/Draw, and ChemSketch. *Journal of Chemical Information and Computer Sciences*, 44(5), 1886-1890.
6. Cousins, K. R. (2011). Computer review of chemdraw ultra 12.0.

Methods of teaching: Laboratory method, discussion and problem solving, problem solving method, question answer method, Heuristic method.

Innovative teaching: ICT enabled teaching, video clips/ movies.

S.Y.B.Sc. (Chemistry): Semester-III

CH- 230: IT Skill for Chemist

Total Hours: 30

Credits: 2

Course Objectives:

- Students would be able to draw chemical structure, formulae and will be familiar with educational software like Chem Draw, excel etc.
- To enhance the skill of numeric data handling obtained from experiments, derivations etc.
- To acquire the knowledge of statistical analysis.

Course Outcomes:

- Students should be familiar with some educational software like Chem Draw to draw chemical structures.
- Students get the skill of numerical data handling to plot the various graphs.
- Students get the skill of statistical analysis of obtained experimental analysis.

Unit I : Introductory Writing Activities

08h

Introduction to word processor and structure drawing (Chem Sketch/ Chem Draw) software. Incorporating chemical structures, chemical equations, expressions from chemistry into word processing documents.

Reference 4: Relevant pages.

Reference 5: Relevant pages.

Unit II : Handling Numeric Data

12h

Spreadsheet software (Excel), creating a spreadsheet, entering and formatting information, basic functions and formulae, creating charts, tables and graphs. Incorporating tables and graphs into word processing documents. Simple calculations, plotting graphs using a spreadsheet (Planck's distribution law, radial distribution curves for hydrogenic orbitals, gas kinetic theory, data from phase equilibria studies. Graphical solution.

Reference 2: Relevant pages.

Unit III : Numeric Modelling

10h

Simulation of pH metric titration curves. Excel functions LINEST and Least Squares. Numerical curve fitting, linear regression (rate constants from concentration time data, molar extinction coefficients from absorbance data), numerical differentiation (e.g. handling data from potentiometric and pH metric titrations, pKa of weak acid), integration (e.g. entropy/enthalpy change from heat capacity data).

Reference 1: Relevant pages.

Reference 2: Relevant pages.

Reference 3: Relevant pages.

References:

- 1 De Levie, R. (2001). How to Use Excel® in Analytical Chemistry and in General Scientific Data Analysis. Cambridge University Press.
- 2 Noggle J. H., (1985), Physical chemistry on a Microcomputer. Little Brown & Co.
- 3 Venit S. M., (1996), Programming in BASIC: Problem solving with structure and style. Jaico Publishing House: Delhi.

- 4 Li Z., Wan H., Shi Y. and Ouyang P. (2004), Personal experience with four kinds of chemical structure drawing software: review on ChemDraw, ChemWindow, ISIS/Draw, and ChemSketch. Journal of Chemical Information and Computer Sciences, 44(5), 1886-1890.
- 5 Cousins K. R., (2011). Computer review of chemdraw ultra 12.0.

Methods of teaching: Classroom teaching method, discussion and problem solving, laboratory method, problem solving method, question answer method, brain storming method, assignment method. **Innovative teaching:** ICT enabled teaching, video clips/ movies, online quiz.

S.Y. B.Sc. (Chemistry): Semester-IV CH- 241 Physical Chemistry-III

Total Hours: 30

Credits: 2

Course Objectives:

- The course is fundamental, still it is helpful to develop experimental skill in the laboratories.
- It is useful to pursue research in chemistry.

Course Outcomes:

Students will gain an understanding of:

- importance of colligative properties
- core study of electrochemistry
- application of Nernst equation
- the fundamental and advance concepts of thermodynamics

Unit I : Theory of Dilute Solutions

10h

Introduction, vapour pressure of a liquid, Raoult's law of vapour pressure colligative properties, lowering of vapour pressure, relative lowering of vapour pressure, relation between relative lowering of vapour pressure and molar mass of solute, elevation of boiling point, relation between elevation of boiling point and molar mass of solute, Landberger's method for the determination of elevation of boiling point, depression of freezing point, relation between depression of freezing point and molar mass of solute, osmotic pressure, van's Hoff equation for osmotic pressure of a solution, determination of molar mass of a solute from osmotic pressure measurements, related numericals.

Reference 1: Page Numbers: 312-343.

Reference 2: Page Numbers: 500-530.

Reference 3: Page Numbers: 726-748.

Unit II : Electromotive Force

10h

Introduction, measurement of electromotive force of an unknown cell, Weston standard cell, reversible cells, relation between electromotive force and free energy, single electrode potential, standard electromotive force of a cell, determination of electromotive of a half-cell, Nernst equation, reference electrode, primary reference electrode: Standard Hydrogen Electrode (SHE), secondary reference electrode: standard silver-silver electrode, Calomel

electrode, glass electrode, quinhydrone electrode, determination of pH of a solution using the quinhydrone electrode and glass electrode, potentiometric titrations (acid-base titrations, oxidation-reduction titrations and precipitation titrations), related numericals.

Reference 1: Page Numbers: 471-547.

Reference 2: Page Numbers: 907-934

Reference 3: Page Numbers: 880-917.

Unit III : Chemical Thermodynamics

10h

Introduction, enthalpy of a system, molar heat capacities, relation between C_p and C_v , Joule-Thomson effect, concept of entropy, standard entropy, concept of residual entropy, Clapeyron equation, Clausius- Clapeyron equation, integrated form of Clausius- Clapeyron equation, applications of Clausius-Clapeyron equation, fugacity and activity, partial molar properties, chemical potential and its significance, Gibb's-Duhem equation.

Reference 1: Page Numbers: 111-115, 120-123, 163-164, 201-203, 210-213.

Reference 2: Page Numbers: 236-237, 238-243, 281-283, 307-313, 316-321.

Reference 3: Page Numbers: 464-466, 477-478, 505, 513, 522-523, 525-530.

References:

1. Maron, S. H. and Prutton, C. F., (2012), Principles of Physical Chemistry (4th Edition), Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Bahl, B. S., Bahl, A. and Tuli, G. D., (2005), Essentials of Physical Chemistry, S. Chand and Co Ltd., New Delhi.
3. Puri, B. R., Sharma, L. R. and Pathania, M. S., (2007), Principles of Physical Chemistry (42nd Edition), Vishal Publishing Co., Jalandhar.
4. Atkins, P. W., (1998), Physical Chemistry, ELBS.
5. Barrow, G. M., (2003), Physical Chemistry, International Student Edition.
6. Vishnoi, N. K. And Shukla, R. J. Textbook of Physical Chemistry (Volume I , II and III),
7. Moore, W. J., (1988), Physical Chemistry, Orient Longman.
8. McQuarrie, D. A. And Simon, J. D., (2006), Physical Chemistry- A Molecular Approach, Viva Books Ovt. Ltd., New Delhi.
9. Glasstone, S., (1965), An Introduction to Electrochemistry, Van Nostrand, East-West.
10. Robinson, R. A. and Stokes, R. H., (1959), Electrolytic Solutions, Butterworths, London.
11. Glasstone, S., (1965), Thermodynamics for Chemist, D. Van Nostrand.

Methods of teaching: Classroom teaching method, discussion and problem solving, laboratory method, problem solving method, question answer method, brain storming method, assignment method. **Innovative teaching:** ICT enabled teaching, video clips/ movies, online quiz.

S.Y.B.Sc. (Chemistry): Semester-IV CH- 242 Inorganic Chemistry-II

Total Hours: 30

Credits: 2

Course Objectives:

- To know and be aware of formation of double salts and Coordination Compounds
- To be aware of trends in various properties of d-block elements.
- Make familiar with different concepts of Acid-Base properties.
- To make aware about Acid-Base properties in different solvents ie. aqueous and non-aqueous solvents

Course Outcome:

Student will be able to

- learns about the importance of Coordination compound.
- understand coordinate bonding between metal and ligands.
- get the knowledge of biological importance of many chelate compounds.
- apply knowledge of catalytic activities of d-block elements and their variable oxidation state.
- differentiate between Acids-Bases with respective to solvents.

Unit I : Basic Concept of Coordination Chemistry

12h

A) Introduction, Double salt's and coordination compounds, coordination complexes and complex ions, coordination number, Unidentate, bidentate and poly-dentate ligands, chelating ligands and chelates, charge on complex or complex ion, physical methods use in the study of complexes, Nomenclature of coordination compound.

B) Werners Theory – Assumptions, Isomerism, EAN rule, stability of complexes ion and Factors affecting stability of complex ion, stereochemistry of coordination compound with coordination Number 4 and 6, Isomerism in coordination compounds.

Reference- 7: Page numbers. 729-735, 738-741.

Reference-1: Relevant Pages.

Unit II : d-block Elements and Their Properties

8h

Elements of first, second and third transition series, General characteristics of d-block elements-

a) Metallic character b) Molar volume and densities c) Atomic radii d) Ionic Radii e) Melting and boiling points f) Ionization Energies g) Reactivity h) Oxidation states i) Standard electrode potential j) Reducing Properties k) Colour l) Magnetic properties m) Catalytic Properties n) Tendency to form complexes

Reference-1: pages numbers: 653-671

Reference-2: pages numbers: 615 -624

Reference-3: pages numbers 1128-1143

Unit III : Acids, Bases and Solvent Chemistry

10h

A) Introduction, Terms- Solvent, Solute, Solution, Solvation & Hydration, Dielectric Constant, Non-aqueous solvents, classification, chemistry of

- liquid ammonia, N₂O₄ and BrF₃.
- B) Donor and acceptor properties of solvent, Levelling & Differentiating Solvents, Co-Solvating Agents.
- C) Molten salts & their classification, Uses, solvents for electrochemical reactions, purity of solvents.
- D) Definition and approaches- i) solvent system concept – Merits/Advantages, Limitations ii) Lux-flood concept & its application iii) Lewis concept- Limitations, Merits etc. iv) Generalized Acid-base concepts, Advantages, Limitations.
- E) Hard and soft acids and bases: definitions, Pearson HSAB concept, theories of Hardness and softness, application and limitation of HSAB concepts.

Reference-4: pages numbers 220, 221, 223-229, 234-236.

Reference-5: pages numbers. 238-249, 255-258, 263, 266, 269, 270.

Reference-6: pages numbers 374-386.

References:

1. Lee J. D., (2014), Concise Inorganic Chemistry, 5th Edition.
2. Sharma, Puri, Kalia, (2017), Principles of Inorganic Chemistry, 30th edition Milestone Delhi.
3. Gurdeep Raj, (2016), Advanced Inorganic Chemistry, Volume - I, 23rd edition, Goel Publishing House, Meerut.
4. Cotton, F.A., Wilkinson G., Paul Guss, (2007), Basic Inorganic chemistry, 3rd edition by John Wiley and Sons.
5. Manku, G.S., Theoretical principals of Inorganic chemistry, Tata Mc.GrawHill edition.
6. Gurudeep Raj, (2015), Advanced Inorganic chemistry, Vol. I, 23rd Edition, Goel publishing House, Meerut.
7. Puri, B.R., Sharma L.R., Kalia K.C., (2017), Principals of Inorganic Chemistry, Milestone publishers and distributors.
8. Bruce, M., Mahan, Rollie J. Meyers, (2010), University Chemistry, 4th Edition, Pearson.

Methods of teaching: Classroom teaching method, discussion and problem solving, laboratory method, problem solving method, question answer method, brain storming method, assignment method. **Innovative teaching:** ICT enabled teaching, video clips/ movies, online quiz.

S.Y.B.Sc. (Chemistry): Semester-IV CH- 243: Practical course IV

Total Hours: 60

Credits: 4

(Total Fifteen experiments will be performed in IVth semester)

I] Physical Chemistry

Course Objectives:

- The course is designed to develop the experimental skills.

Course Outcomes:

- the preparation for each experiment by studying lab handouts and links therein
- safety requirements and lab skills to perform physico-chemical experiments
how to keep records of instruments, parameters, and experimental observations
reporting of experimental result
- an appreciation for modern problems and scientific controversies in physical chemistry

Perform any four experiments in semester IVth of the followings:

1. To determine the molecular weight of a given non-volatile solute by Landsberger's method.
2. To determine the molecular weight of a given non-volatile solute by depression in freezing point method.
3. To determine the Ecal (oxi.) using quinhydrone electrode.
4. To determine the pH of the given solutions using quinhydrone electrode.
5. Draw the graph for the given data using Microsoft excel and find out the value of slope of the graph. (Take printout of graph and attach it to student's Journal)

References:

1. Kitcher, J. A., Findlays Practical Chemistry, Revised.
2. Vogel, A. I., Textbook of Quantitative Inorganic Analysis.
3. Das, R. C. and Behera, Experimental Physical Chemistry.
4. Yadav, J. B., Advanced Practical Physical Chemistry, Goel Publishing.
5. Daniels, F. and Williams, J., Experimental Physical Chemistry.
6. Shoemaker and Gerland, Advanced Physical Chemistry Experiments.
7. Willard, Merrit Dean and Settle, Instrumental Methods of Analysis.

II] Inorganic Chemistry Practical:**Course Objectives:**

Student to...

- know about formation of coordination compounds and metal complexes.
- know certain methods of quantitative estimation of components.
- find out purity of prepared compound.
- know skill of inorganic preparation.

Course Outcomes:

Student will be able to

- get practical skill and may use this skill for next academic session with proper improvement.
- achieve knowledge of certain methods of quantitative estimation.
- learn preparation metal complexes.
- aware of use of certain metal complexes, acid-bases, catalytic activities of metals.

Perform any eleven experiments in semester IVth of the followings:

- 1) Prepare Tetramine Cu (II) sulphate.
- 2) Prepare and determine purity of Ammonium Ferric Sulphate $[(\text{NH}_4)_2\text{SO}_4 \cdot \text{Fe}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}]$.

- 3) Estimation of Ba as BaSO₄ (by Ignition using filter paper) by gravimetrically.
- 4) Estimation of acetic acid in commercial vinegar using NaOH.
- 5) Estimation of aspirin in the drug sample.
- 6) Determination of volume strength of H₂O₂
- 7) Estimation of Mg⁺² by complexometric titration with EDTA
- 8) Estimation of copper iodometrically
- 9) Determination of Hardness of water.
- 10) Determination of available chlorine in Bleaching Powder.
- 11) To estimate manganese volumetrically by Volhard's method.
- 12) Prepare and determine purity of Sodium Trioxalato Ferrate Trihydrate [Na₃[Fe(C₂O₄)₃]3H₂O].
- 13) Estimation of Ca⁺² by complexometric titration with EDTA
- 14) To estimate chloride volumetrically by Volhard's method.
- 15) Prepare Ferrous ammonium sulphate (Mohr's salt).

References:

1. Mendham, J., (2009) Vogel's Quantitative Chemical Analysis ,6th Ed., Pearson.
2. Svehla G., (2002), Vogel's Qualitative Inorganic Analysis, Pearson Education.
3. Christian, G. D. (2006), Analytical chemistry,(5th Edition).
4. Mendham, J.,Denny R. C., Barnes, Thomas,(2009), Quantitative chemical analysis.
5. Skoog, D. A., West D. M., Holler F. J.,(1992), Analytical chemistry.
6. Bassett, Denney, Jeffreys, (1989), Vogel's text book of quantitative inorganic analysis.
7. Khopkar, S. M., (2008), Basic concepts of analytical chemistry.
8. Kamboj, P. C., Systematic Practical Chemistry, Vishal Publication
9. Mukhopadhyay, R., Chatterjee, Advanced Practical Chemistry, Books and Allied (P) Ltd.
10. Ghoshal, Mahapatra, Nad, An Advanced Chemistry In Practical Chemistry, New Central Book Agency (P) Ltd.
11. Nemade, A.M., Zope, V.S., Rajput A.P., Gujrathi R.B., A Textbook of Practical Chemistry, Prashant Publications.

Methods of teaching: Laboratory method, discussion and problem solving, problem solving method, question answer method, Heuristic method. **Innovative teaching:** ICT enabled teaching, video clips/ movies.

S.Y.B.Sc. (Chemistry): Semester-IV CH- 240 Basic Analytical Chemistry

Total Hours: 30

Credits: 2

Course Objectives:

- To get the knowledge of basic concept of analytical Chemistry.
- To study the analysis of soil sample.
- To study the analysis of water sample.
- To learn the methods involving food processing, food preservations and adulteration.
- To understand, how analysis can be done with the help of instrument.

Course Outcomes:

Students are able to learn

- basic concept of analytical Chemistry.
- method involving analysis of soil.
- knowledge of water analysis.
- methods involving food processing, food preservations and adulteration.

Unit I : Introduction to Analytical Chemistry 10h

Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

Reference 3, 4, 5 (Relevant pages)

Unit II : Chromatography 08h

Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.

a. Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}).

b. To compare paint/dyes/organic samples by TLC method.

Reference: 1, 2, 3, 11 (Relevant pages)

Unit III : Analysis of Water Sample and Food Products 12h

A] Analysis of water sample

Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.

a. Determination of pH, acidity and alkalinity of a water sample.

b. Determination of dissolved oxygen (DO) of a water sample.

B] Analysis of Food Products

Nutritional value of foods, idea about food processing, food preservations and adulteration.

a. Identification of adulterants in some common food items like salt, coffee powder, chilli powder, turmeric powder and pulses, etc.

b. Analysis of preservatives and colouring matter.

Reference: 4, 7, 8 (Relevant pages)

Reference: 6, 9, 10 (Relevant pages)

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Methods of teaching: Classroom teaching method, discussion and problem solving, laboratory method, problem solving method, question answer method, brain storming method, assignment method. **Innovative teaching:** ICT enabled teaching, video clips/ movies, online quiz.