# VANITA VISHRAM WOMEN'S UNIVERSITY

## SCHOOL OF SCIENCE & TECHNOLOGY

## DEPARTMENT OF CHEMISTRY

# BACHELOR OF SCIENCE (B.Sc.)

## Syllabus of

# SEMESTERS 5

## Core Courses (CC), Discipline Specific Elective (DSE)

## w.e.f. the Academic Year 2024-2025

## BACHELOR OF SCIENCE (B.Sc.)

**Semester-V**
**CORE COURSE (CH11430)**

## INORGANIC CHEMISTRY-V

**Credits: 2 (Theory)**
**Contact hours per week: 2 (Theory)**

### Course Objectives

- Detailed study of metal complex formation and splitting of metal complex , metal complex geometry.
- Understand the factors influencing the stability and reactivity of coordination complexes, including ligand field strength, steric effects, and electronic properties.
- Introduce students to the fundamental principles of inorganic reaction mechanisms, including reaction kinetics, thermodynamics, and the role of transition states and intermediates..

### Course Outcomes

After completing the course, the students will be able to:

- Demonstrate a thorough understanding of the fundamental principles of coordination chemistry, including coordination number, ligand types, and metal-ligand bonding.
- Identify and predict the coordination geometry of metal complexes using theories such as crystal field theory and molecular orbital theory.
- Develop a deep understanding of the fundamental principles governing inorganic reaction mechanisms, including electron transfer, nucleophilic substitution, and oxidative addition/reductive elimination.
- Analyze and predi///ct the pathways and mechanisms of various inorganic reactions, including associative, dissociative, and interchange mechanisms.

| Sr. No. | Unit | Minimum No. of Contact Hours | Weightage in % |
|---|---|---|---|
| 1. | **Coordination Chemistry** | 15 | 50% |
| 2. | **Inorganic Reaction Mechanism and Kinetics** | 15 | 50% |
| | **Total** | **30** | **100** |

| B.Sc. Chemistry Semester-V | |
|---|---|
| **INORGANIC CHEMISTRY-V** | **2 Hours /week** |
| **Topic** | **Hours** |
| **Unit – I** | |
| **Coordination Chemistry**<br>Werner's theory, Isomerism, Nomenclature, Valence bond theory (inner and outer orbital complexes), Back bonding, Crystal field theory, Measurement of 10Dq (Δo), CFSE in weak and strong fields. Pairing energies, factors affecting the magnitude of 10Dq (Δo, Δt), Octahedral vs. Tetrahedral coordination. Tetragonal distortions from octahedral geometry. Jahn Teller theorem. Square planar geometry. | 15 |
| **Unit – II** | |
| **Inorganic Reaction Mechanism and Kinetics**<br>Introduction to inorganic reaction mechanism, Substitution reaction in square planar complexes, trans effect, Theories of trans effect, Mechanism of nucleophilic substitution in square planar complexes, Thermodynamic and kinetic stability, kinetic of octahedral substitution, Ligand field theory effect and reaction rates, Mechanism of substitution in octahedral complexes. | 15 |

**Reference Books:**


1. Inorganic Chemistry second edition by Catherine E. Housecroft and Alan G. Sharpe, Pearson, 2005.
2. Cotton, F.A. & Wilkinson, G. Advanced Inorganic Chemistry, Wiley, VCH, 1999.
3. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.
4. Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry Fourth Ed., Pearson, 2010
5. Atkins, P. W and Shriver D. N. Atkins' Inorganic Chemistry 5th Ed. Oxford University Press (2010).

**BACHELOR OF SCIENCE (B.Sc.)**

**Semester-V**
**CORE COURSE (CH11440)**

## ORGANIC CHEMISTRY-V

**Credits: 2 (Theory)**
**Contact hours per week: 2 (Theory)**

### Course Objectives

- To understand the deep concepts of organic reactions like rearrangements and catalysis.
- Enhancing the knowledge of polymers and their mechanism.
- Make students more aware of the chemicals found in pharmaceutical and dyes field.
- Develop an appreciation for the importance of the role of chemistry in industries.
- Improve their ability to think critically and logically.

### Course Outcomes

After completing the course, the students will be able to:

- Understand the detailed concepts of rearrangements, catalysis and green approach.
- Understand the application of organic fields in the real world.

| Sr. No. | Unit | Minimum No. of Contact Hours | Weightage in % |
|---|---|---|---|
| **1.** | **Molecular Rearrangement** | 15 | 50 % |
| **2.** | **Catalysis and Synthetic Polymers** | 15 | 50 % |
| | **Total** | **30** | **100** |

| B.Sc. Chemistry Semester-V | |
|---|---|
| **ORGANIC CHEMISTRY-V** | **2 Hours /week** |
| **Topic** | **Hours** |
| **Unit – I** | |
| **Molecular Rearrangement**<br>a) Introduction, structure and synthesis of Intermediates: Carbocation, Carbanion, Free Radical, Carbene, Nitrene.<br>b) Reactions and rearrangement: Damjanov, Shapiro, Arndt-Estert, Wolff Rearrangement, Beckmann, Bamford–Stevens, Curtius, Sandmeyer. | 15 |
| **Unit – II** | |
| **a) Catalysis:** Basic of Catalysis, Catalysis and Enzyme-Catalyzed Reactions, Nucleophilic Catalysis, Acid Catalysis, Base Catalysis, Metal-Ion Catalysis, Intramolecular Catalysis.<br>**b) Synthetic Polymers:** General Classes of Synthetic Polymers, Chain-Growth Polymers, Branching of the Polymer Chain, Cationic Polymerization, Anionic Polymerization, Ziegler–Natta Catalysts, Polymerization of Dienes, Manufacture of Rubbers and Copolymers. | 15 |

1. **Reference Books:**

   1. Solomons, T.W G., Fryhle, B. Craig. Organic Chemistry, John Wiley & Sons, Inc (2009).
   2. McMurry, J.E. Fundamentals of Organic Chemistry, Seventh edition Cengage Learning, 2013.
   3. P Sykes, A Guide Book to Mechanism in Organic Chemistry, 6th Edition (1997), Orient
   4. Longman, New Delhi.
   5. 4 Morrison R. T. and Boyd R. N. Organic Chemistry, Sixth Edition Prentice Hall India, 2003.
   6. Organic Chemistry, Paula Bruice, Eighth edition, Pearson, 2020.

**BACHELOR OF SCIENCE (B.Sc.)**

**Semester-V**
**CORE COURSE (CH11450)**

## PHYSICAL CHEMISTRY - V

**Credits: 2 (Theory)**
**Contact hours per week: 2 (Theory)**

### Course Objectives

- To understand electrochemical cells, electrodes and their applications.
- To understand types, properties, detection and measurement of radioactive reactions in brief.

### Course Outcomes

After completing the course, the students will be able to understand:

Theory and significance of :

1. Electrochemical cells, electrodes and their significance.
2. Radioactive reactions in brief.

| Sr. No. | Unit | Minimum No. of Contact Hours | Weightage in % |
|---|---|---|---|
| 1. | **Electrochemistry** | 15 | 50% |
| 2. | **Nuclear Chemistry-I** | 15 | 50% |
| | **Total** | **30** | **100** |

| B.Sc. Chemistry Semester-V | |
|---|---|
| **PHYSICAL CHEMISTRY - V** | **2 Hours /week** |
| **Topic** | **Hours** |
| **Unit – I** | |
| **Electrochemistry**<br>Half reactions, Electrochemical cells, Cell potential or emf, Calculation and Measurement of emf of a cell. Relation between emf and free energy, Determination of emf of a half-cell, Nernst equation, Calculation of half-cell potential, Calculation of cell potential and equilibrium constant for the cell reaction. , Reference electrodes, calomel electrode, the dipping calomel electrode, the glass electrode. | 15 |
| **Unit – II** | |
| **Nuclear Chemistry-I**<br>Radioactivity, Types of Radiations, Properties of Radiations, Detection and measurement of Radioactivity, Ionisation Chamber, Geiger-Muller Counter, Scintillation Counter, Film Badges, Types of Radioactive Decay, α-Decay, β-Decay, Rate of Radioactive Decay, radioactivity Half-Life, Activity of a radioactive substance, Calculation and numerical based on of Half-life, Calculation of sample left after time T, Average life, Radioactive Dating. | 15 |

**Reference Books:**


1. Atkins P. and De Paula, J. Physical Chemistry Tenth Ed., OUP, 2014.
2. Castellan, G. W. Physical Chemistry 4th Ed., Narosa, 2004.
3. Engel, T. and Reid, P. Physical Chemistry 3rd Ed., Prentice Hall, 2012.
4. Essentials of physical chemistry by A. S. Bhal and G. D. Tuli, Pub : S. Chand
5. Levine, I. N. Physical Chemistry 6th Ed., Tata McGraw-Hill, 2011.
6. Nuclear chemistry by Arnikar

**BACHELOR OF SCIENCE (B.Sc.)**

**Semester-V**
**CORE COURSE (CH11460)**

## ANALYTICAL CHEMISTRY - I

**Credits: 2 (Theory)**
**Contact hours per week: 2 (Theory)**

### Course Objectives

- To understand the fundamentals of Analytical Chemistry and importance of treatment of Analytical Data .
- To understand the solubility and factors affecting precipitation and principle of thermogravimetry.

### Course Outcomes

After completing the course, the students will be able to understand:

Theory and significance of :

- Analytical Chemistry and handling of Analytical Data.
- Gravimetry and Thermogravimetric Applications.

| Sr. No. | Unit | Minimum No. of Contact Hours | Weightage in % |
|---|---|---|---|
| 1. | (A) INTRODUCTION TO ANALYTICAL CHEMISTRY: (B)TREATMENT OF ANALYTICAL DATA | 15 | 50% |
| 2. | GRAVIMETRIC ANALYSIS | 15 | 50% |
| | **Total** | **30** | **100** |

| B.Sc. Chemistry Semester-V | |
|---|---|
| **ANALYTICAL CHEMISTRY - I** | **2 Hours /week** |
| **Topic** | **Hours** |
| **Unit – I** | |
| **(A) INTRODUCTION TO ANALYTICAL CHEMISTRY:**<br>Chemical and Instrumental Analysis (advantages and disadvantages) Overview of methods used in Quantitative analysis (classification of classical and instrumental analysis), Factors affecting the choice of analytical methods (in brief), Step in quantitative analysis (Flow diagram),<br>**(B) TREATMENT OF ANALYTICAL DATA:**<br>Significant figures Error Definition, Types of errors: Determinants errors, indeterminate errors, constant and proportional errors. Define and explain the following terms Accuracy and Precision, mean, median, deviation, average deviation, standard deviation, variance, coefficient of variation, relative mean deviation, range, absolute errors, relative errors. Minimization of determinants errors, Rejection of result from a set of results, 2.5 d rule and Q-test. (Problems based on the above topics). | 15 |
| **Unit – II** | |
| **GRAVIMETRIC ANALYSIS :**<br>Factors affecting solubility of precipitates. (1) Common ion (2) Diverse ions (3) pH (4) Hydrolysis (5) Complex formation (With Numerical problems) The precipitation process,. Nucleation growth. Von Weimarn's theory of relative supersaturation. Digestion of precipitates Factor affecting quality of precipitate: Co - precipitation and post precipitation Precipitation from homogeneous solution with illustration of Barium and Aluminum. General introduction of TGA. | 15 |

## Reference Books:


1. Quantitative Analysis by R. A. Day & A. L. Underwood, 6 th ed. Pub. Prentice Hall of India ltd.
2. Vogel's Text Book Inorganic Quantitative Analysis, 6 th ed.
3. Analytical Chemistry (Principles & Technique) by Lary G. Hargis.
4. Fundamental of Analytical Chemistry by Skoog D. A. & West D. M.
5. Holler F.J.Instrumental Methods of Analysis by B. K. Sharma
6. Instrumental analysis by R.D.Braun Mc Graw Hill.
7. Analytical Chemistry by Gary Christian Instrumental methods of chemical analysis
8. Dr.H.Kaur. Pragati prakashan Meerut.
9. College Analytical Chemistry by Mangaonkar, Teckchandani, Sathe, Ghalsasi, Jain (Himalaya Publication House)

**BACHELOR OF SCIENCE (B.Sc.)**

**Semester-V**
**CORE COURSE (CH11470)**

## INDUSTRIAL CHEMISTRY-I

**Credits: 2 (Theory)**
**Contact hours per week: 2 (Theory)**

### Course Objectives

- To understand the important aspects of Unit Processes and Operations.
- To understand the industrial process of some chemicals which will be helpful in future for research.

### Course Outcomes

After completing the course, the students will be able to understand:

Theory and significance of :

- Importance of Unit Processes for manufacturing industrially important chemicals in Industry.
- Concept of manufacturing processes of Glass, Alloy and other compounds.

| Sr. No. | Unit | Minimum No. of Contact Hours | Weightage in % |
|---|---|---|---|
| **1.** | **Unit Processes** | 15 | 50% |
| **2.** | **[A] Glasses<br>[B] Non Ferrous alloys<br>[C] Industrial manufacturing process with flow diagram & their uses.** | 15 | 50% |
| | **Total** | **30** | **100** |

| B.Sc. Chemistry Semester-V | |
|---|---|
| **INDUSTRIAL CHEMISTRY-I** | **2 Hours /week** |
| **Topic** | **Hours** |
| **Unit – I** | |
| **Unit Processes**<br>(i) Nitration: Nitrating agents, Mechanism of aromatic nitration, Industrial chemicals derived from Benzene, Naphthalene, Anthracene using Nitration. (ii) Sulfonation and Sulfation: Sulfonating and Sulfating agents, Mechanism of aromatic Sulfonation, Industrial chemicals derived from Benzene, Naphthalene using Sulphonation. (iii) Amination: Aminating agents, Amination by reduction, Amination by Ammonolysis, Industrial chemicals derived from Benzene using Amination. | 15 |
| **Unit – II** | |
| **a) Glasses:** Classification, properties and uses of glasses.<br>**b) Non Ferrous alloys :** Monel metal, Duralumin, Phosphorus bronze, Brass, German silver.<br>**c) Industrial manufacturing process with flow diagram & their uses:**<br>(1) Preparation of methanol from synthesis gas.<br>(2) Preparation of Isopropanol From Propylene.<br>(3) Preparation of Acetone From Isopropanol. | 15 |

**Reference Books:**


1. Organic Chemistry: A Mechanism Approach; Penny Chaloner, CRC Press, Tailor and Francis; Florida.
2. Fine Chemicals: The Industry and Its Business, P. Pollak, 2nd Edition, Wiley.
3. Chemical Process Industries by R. N. Shreve.
4. Riegel's Hand-Book of Industrial Chemistry, Ed. by James A. Kent. 5. Industrial Chemicals by Faith, Keyes, Clark.


**BACHELOR OF SCIENCE (B.Sc.)**

**Semester-V**
**CORE COURSE (CH11480)**

## NATURAL PRODUCTS-I

**Credits: 2 (Theory)**
**Contact hours per week: 2 (Theory)**

### Course Objectives

- To understand the basics of alkaloids.
- To understand the role of vitamins and hormones.
- To understand the basics of terpenes.

### Course Outcomes

After completing the course, the students will be able to understand:

Theory and significance of :

- Concept of natural products and its importance.
- Definition of vitamin and hormones, Need for vitamin in body and types of vitamins.
- Fundamentals of alkaloids and terpenes.

| Sr. No. | Unit | Minimum No. of Contact Hours | Weightage in % |
|---|---|---|---|
| 1. | **Vitamins and Hormones** | 15 | 50% |
| 2. | **Alkaloids and Terpenes** | 15 | 50% |
| | **Total** | **30** | **100** |

| B.Sc. Chemistry Semester-V | |
|---|---|
| **NATURAL PRODUCTS-I** | **2 Hours /week** |
| **Topic** | **Hours** |
| **Unit – I** | |
| **Vitamins and Hormones**<br>**Vitamins:** Definition, Need for vitamin in body, types of vitamins, water soluble and fat soluble Vitamins, Structural determinations of Vitamin $B_{12}$ (Cyanocobalamin), Vitamin C (L-Ascorbic acid).<br>**Hormones:** Definition, Classification, Structural determinations of Thyroxine, Adrenalin and their synthesis. | 15 |
| **Unit – II** | |
| **Alkaloids and Terpenes**<br>**Alkaloids:** Natural occurrence, General structural features, isolation and their physiological action Hoffmann's exhaustive methylation, Emde's modification, Structure elucidation and synthesis of Hygrine and Nicotine. Medicinal importance of Nicotine, Morphine and Reserpine.<br>**Terpenes:** Occurrence, classification, isoprene rule; Elucidation of structure and synthesis of Citral, Neral and α-terpineol. | 15 |

Reference Books:


1. Biochemistry, Satya Prakash Datta, Concise medical textbooks, 2 edition, Bailliere, Tindall & Cassell, 1972.
2. Organic Chemistry - Paula Yurkanis Bruice, 8 edition,
3. Chemistry of organic Natural Product Vol. I & II by O. P. Agarwal.
4. Chemistry of organic Natural Product Vol. I & II by G. Chatwal.
5. Organic Chemistry by I. L. Finar.

**BACHELOR OF SCIENCE (B.Sc.)**
**Semester-V**
**CORE COURSE (CH11490)**
**CHEMISTRY PRACTICAL- V**

**Credits: 6 (Practical)**
**Contact hours per week: 12 (Practical)**

**Course Objectives**

- To perform quantitative analysis.
- To perform gravimetric analysis.
- Identification of organic compounds.
- Observation of different chemical tests.
- Preparation and use of reagents in various organic transformation reactions.
- Understand the method of chemical separation of mixtures.
- Derivatives of compounds.
- To understand and investigate the order of given chemical reactions through kinetic study.
- To study buffer capacity and ionization phenomenon through pH metry.
- To study precipitation titration through conductometric titrations.

**Course Outcomes**

After completing the course, the students will develop an ability to conduct experiments and interpret results, while observing responsible and ethical scientific conduct;

- The learner shall be able to perform simple volumetric, gravimetric and inorganic qualitative analysis.
- The learner shall be able to perform chemical separation of binary mixtures and their qualitative analysis with derivatives.
- Perform practical application of Chemical kinetics, Conductometric and EMF for the study of given chemical reactions.

**Inorganic Chemistry Practicals**
**Gravimetric Analysis(Any Three):.**

1. $Fe^{+2}$ as $Fe_2O_3$ from Fe-$NH_4$-$SO_4$+ $CuSO_4$.
2. $Ba^{+2}$ as $BaSO_4$ from $BaCl_2$ + $FeCl_3$.
3. $Al^{+3}$ as $Al_2O_3$ from $Al_2(SO_4)_3$ + $CuSO_4$.
4. $Ca^{+2}$ as CaC2O4.H2O.
5. $Cu^{+2}$ as CuSCN.

**Estimation of Alloy (Any one):**

1. Brass - Zinc as $Zn_2P_2O_7$ gravimetrically & Copper by iodometrically (volumetric).
2. German silver - Nickel as $Ni(DMG)_2$ gravimetrically & Copper by iodometrically (volumetric).

**Organic Chemistry Practicals**

Qualitative analysis of binary organic mixture (S+S) (S+L) (L+L) type: **(Minimum Six)**. Chemical separation of binary mixtures and their qualitative analysis with derivatives in following manner:

a. Type detection
b. Method of seperation
c. Identification of each compound including functional group tests, Confirmatory tests, M.P./B.P.
d. Derivative of any one component.

**Physical Chemistry Practicals (Any Five)**

1. To investigate rate of reaction between $K_2S_2O_8$ and KI, $a = b$, $a \neq b$
2. Polarimetry: Determination of angle of rotation of given substance using three different dilutions and determination of concentration of unknown solution. Sugar, Glucose, Tartaric acid.
3. pH metry: To measure pH of different buffer solutions and to study their buffer capacity.
4. pH metry: To determine the degree of ionization and ionization constant of Acetic acid by different dilution.
5. Conductometry: To determine the amount of $BaCl_2$ in the given solution using $K_2CrO_4$ solution.
6. Potentiometry: To determine the normality of a given HCl solution using 0.5N NaOH.

**Reference Books:**


1. Vogel's qualitative inorganic analysis, A. I. Vogel, 6th Ed, Pearson.
2. Quantitative analysis by R.A. Day and A.L. Underwood.
3. Vogel's qualitative organic analysis.
4. Elementary Practical Organic Chemistry Part-II Qualitative Organic Analysis by A. I. Vogel.
5. Comprehensive Practical Organic Chemistry Qualitative Analysis by Ahluwalia & Aggarwal.
6. Advanced practical physical chemistry by J B Yadav 16th edition, Goyal publication.

**BACHELOR OF SCIENCE (B.Sc.)**
**Semester-V**
**DSE I (CH14210)**

# Dyes and Pigments

**Credits: 2 (Theory)**
**Contact hours per week: 2 (Theory)**

## Course Objectives

- To learn the chemistry of Synthetic Dyes and Intermediates.
- To understand the concept of dyes and pigments.
- To aware students about colour chemistry.
- To aware students about application of dyes and pigments in everyday life.

## Course Outcomes

After completing the course, the students will be able to understand:

- Basic concepts of Dyes and Pigments.
- Importance of Dyes and Pigments in everyday life.
- This course deepens students' understanding of dyes and pigments, crucial for their industrial roles. It equips them with foundational knowledge to tackle industry challenges, fostering practical skills vital for their careers.

| Sr. No. | Unit | Minimum No. of Contact Hours | Weightage in % |
|---|---|---|---|
| 1. | **Basic Concept of Dyes** | 15 | 50 % |
| 2. | **Non Textile Uses of Dyes and Pigments** | 15 | 50 % |
| | **Total** | **30** | **100** |

| B.Sc. Chemistry Semester-V | |
|---|---|
| **Dyes and Pigments** | **2 Hours /week** |
| **Topic** | **Hours** |
| **Unit – I** | |
| **Basic Concept of Dyes**<br><br>**[A] Dyes**: Relation between colour and chemical constitution with reference to Witt's theory, Introduction of Dyes, Natural Dyes, Nomenclature of Dye Intermediates, Colour Index. Absorption of visible light, colour of wavelength absorbed, complementary colour. Relation between color and chemical constitution with reference to Witt's theory, Fastness Properties, Exhaustion and fixation properties of Dyes.<br><br>**[B] Classification of Dyes:** based on structure, based on mode of application to fibres.<br><br>**[C] Synthesis of Dyes:** (1) 3-phenyl, 7-methoxy coumarin (2) Blankophore-B (3) Eosin (4) Alizarine. | 15 |
| **Unit – II** | |
| **Non Textile Uses of Dyes and Pigments**<br>**[A] Non textile Uses of Dyes:** Introduction, Dyes in medicine, leather, paper, colour photography and electro photography, food, cosmetics, displays and laser dyes.<br><br>**[B] Pigments:** Definition, Difference between dyes & pigments.<br><br>Synthesis of Pigments: Yellow G, Benzidine Orange, Pigments Orange VI. | 15 |

**Reference Books:**


1. The chemistry of synthetic Dyes, Vol. I to VII by Venkataraman, Academic Press, New York. Chemistry of Synthetic Dyes & Pigments by Lubs.
2. Dyes and their intermediates by E. N. Abrahart. . Handbook of synthetic dyes and pigments, Vol. I & II by K. M. Shah.

**BACHELOR OF SCIENCE (B.Sc.)**

**Semester-V**

**DSE II (CH14220)**

## Separation Techniques

**Credits: 2 (Theory)**
**Contact hours per week: 2 (Theory)**

### Course Objectives

- Provide an introduction to separation and purification in chemistry.
- Discuss classification of chromatography.
- To understand the common uses of paper chromatography and TLC.

### Course Outcomes

Enable to understand;
- The application of separation techniques.
- The application of chromatographic techniques.

| Sr. No. | Unit | Minimum No. of Contact Hours | Weightage in % |
|---|---|---|---|
| 1. | Separation and Purification Techniques | 15 | 50% |
| 2. | Introduction to Chromatography | 15 | 50% |
| | Total | 30 | 100 |

| B.Sc. Chemistry Semester-V | |
|---|---|
| **Separation Techniques** | **2 Hours /week** |
| **Topic** | **Hours** |
| **Unit – I** | |
| **Separation and Purification Techniques**<br>Crystallization, Sublimation, Filtration, Decantation, Re-crystallization, Evaporation, Centrifugation, Distillation, Distillation Techniques (Simple Distillation, Steam Distillation, Distillation Under Reduced Pressure, Fractional Distillation), Applications | 15 |
| **Unit – II** | |
| **Introduction to Chromatography**<br>Introduction, Classification of Chromatographic Methods, Paper chromatography: Principle, various modes of development, detection of spots, retardation factors, factors that affect the reproducibility of Rf values, selection of solvent. Thin layer chromatography: stationary phase, adsorbents, liquid phase supports, plate preparation, mobile phase, sample application, development, saturation of chamber, detection of spot, Rf values (effect of adsorbent, solvent, solute, development process). | 15 |

**Reference Books:**


1. Fundamentals of Analytical Chemistry, Skoog, West, Hollar and Crouch, 8th Ed.
2. Modern Analytical Chemistry by David Harvey, 3 rd Ed.
3. Vogel's qualitative inorganic analysis, A. I. Vogel, 6th Ed, Pearson.
4. Quantitative analysis by R.A. Day and A.L. Underwood.
5. Vogel's qualitative organic analysis.
6. F.W. Fifield and D. Kealy : Analytical Chemistry.
7. Daniel C Harris: Exploring chemical analysis.
8. Daniel C Harris: Quantitative chemical analysis.
9. R.V. Dilts Analytical Chemistry- Methods of Separation.
10. O. Mikes, R.A. Chalmers: Laboratory Handbook of Chromatographic Methods.

**BACHELOR OF SCIENCE (B.Sc.)**
**Semester-V**
**DSE Lab (CH14230)**
**DSE CHEMISTRY LAB**

**Credits: 2 (Practical)**
**Contact hours per week: 4 (Practical)**

**Course Objectives**

- To perform paper chromatography of amino acids.
- To perform paper chromatography of sugar samples.
- To perform paper chromatography for Separation and identification of Metal Ions.
- To prepare organic dyes.

**Course Outcomes**

After completing the course, the students will develop an ability to conduct experiments and interpret results, while observing responsible and ethical scientific conduct;

- The learner shall be able to perform paper chromatography for different samples.
- The learner shall be able to perform preparation of dye sample

**Chemistry Practicals (Any Five)**

1. Determination of Rf value of amino acids using paper chromatography.
2. Separation and identification of sugar samples present in a given mixture by paper chromatography.
3. Separation and identification of Metal Ions by Paper Chromatography (group 1 metals).
4. Preparation of Azo dyes.
5. Preparation of Eosin.
6. Crystallization of organic compounds.

**Reference Book:**


1. Principles of Instrumental Analysis: D.A. Skoog, Holler and Crouch (Cengage learning, 7 th edition)
2. Instrumental Analysis: G. D. Caristian and J. E. O'Reilly (Allyn & Bacon Inc., New York, 2 nd edition.
3. Chromatography Concept and Contrast, James M. Miller.
4. The chemistry of synthetic Dyes, Vol. I to VII by Venkataraman, Academic Press, New York. Chemistry of Synthetic Dyes & Pigments by Lubs.
5. Dyes and their intermediates by E. N. Abrahart. . Handbook of synthetic dyes and pigments, Vol. I & II by K. M. Shah.