



Devrukh Shikshan Prasarak Mandal's
Nya. Tatyasaheb Athalye Arts, Ved. S.R. Sapre Commerce and
Vid. Dadasaheb Pitre Science College
(Autonomous)

Late Kakasaheb Pandit Educational Campus,
Devrukh, Dist: Ratnagiri- 415 804, Maharashtra

NAAC Accredited 'A' Grade (Third Cycle), Mumbai University Best College Award 2009-10

Syllabus

Programme: T. Y. B. Sc.

Course- Analytical Chemistry

w.e.f. Academic Year 2021-22

Choice Based Credit System
T. Y. B. Sc.
Chemistry Syllabus
To be implemented from the Academic year 2021-22

Course Content

Semester VI

Course Code	Unit	Topics	Credits	L/Week
USCHT61	I	Chemical Thermodynamics & Chemical Kinetics		
	II	Polymers & Renewable Sources		
	III	Quantum Chemistry & Applied Electrochemistry		
	IV	NMR & ESR Spectroscopy		
USCHT62	I	Coordination Chemistry		
	II	Properties of Coordination Compounds		
	III	Organometallic Chemistry		
	IV	Some Selected Topics		
USCHT63	I	Stereochemistry & Biomolecules		
	II	Molecular Rearrangements & Carbohydrates		
	III	Spectroscopy-II		
	IV	Polymers; Catalysts & Reagents		
USCHT64	I	Electro Analytical Techniques		
	II	Methods of Separation-II & Introduction to Quality		
	III	Food and Cosmetics Analysis		
	IV	Thermal Methods and Analytical Method Validation		
USCHP61		Chemistry Practicals I		
USCHP62		Chemistry Practicals II		
USCHP63		Chemistry Practicals III		
USCHP64		Chemistry Practicals IV		

T.Y.B.Sc. Syllabus Chemistry Paper-IV
Analytical Chemistry

Semester VI

UNIT I: ELECTRO ANALYTICAL TECHNIQUES (15L)

1.1. Polarography (10L)

- 1.1.1. Introduction to voltametric methods of analysis
- 1.1.2. Principles of polarographic analysis, Dropping Mercury Electrode, Instrument and working of polarographic apparatus,
- 1.1.3. Ilkovic equation and quantitative analysis, Polarogram and chemical analysis,
- 1.1.4. Factors affecting polarographic wave, Quantitative Applications, Numerical Problems

1.2. Amperometric Titrations (5L)

- 1.2.1. Principle, Rotating Platinum Electrode (Construction, advantages and limitations)
- 1.2.2. Titration curves with example
- 1.2.3. Advantages and limitations

UNIT II: METHODS OF SEPARATION-II & INTRODUCTION TO QUALITY (15L)

2.1 High Performance Thin Layer Chromatography (HPTLC) (5L)

- 2.1.1 Introduction and Principle, Stationary phase, Sample application and mobile phase
- 2.1.2 Detectors
 - a) Scanning densitometer- components, Types of densitometers: Single beam and Double beam,
 - b) Fluorometric Detector
- 2.1.3 Advantages, disadvantages and applications
- 2.1.4 Comparison of TLC and HPTLC

2.2 Ion Exchange Chromatography (6L)

- 2.2.1 Introduction, Principle.
- 2.2.2 Types of Ion Exchangers, Ideal properties of resin
- 2.2.3 Ion Exchange equilibria and mechanism, selectivity coefficient and separation factor
Factors affecting separation of ions
- 2.2.4 Ion exchange capacity and its determination for cation and anion exchangers.
- 2.2.5 Applications of Ion Exchange Chromatography with reference to: Preparation of demineralized water, Separation of amino acids.

2.3 Quality in Analytical Chemistry (4L)

- 2.3.1 Concepts of Quality, Quality Control and Quality Assurance
- 2.3.2 Chemical Standards and Certified Reference Materials; Importance in chemical analysis
- 2.3.3 Quality of material: Various grades of laboratory reagents.

Topic for Self-Study:

Solvent Extraction: Introduction, Nernst Distribution law,
Factors affecting extraction: Chelation, Ion pair formation and Solvation
Craig's counter current extraction: Principle, apparatus and applications

UNIT III: FOOD AND COSMETICS ANALYSIS (15L)

3.1. Introduction to food chemistry (10L)

3.1.1. Food processing and preservation:

Introduction, need, chemical methods, action of chemicals (Sulphur dioxide, boric acid, sodium benzoate, acetic acid, sodium chloride and sugar) and pH control, Physical methods (Pasteurization and Irradiation)

3.1.2. Determination of boric acid by titrimetry and sodium benzoate by HPLC.

3.1.3. Study and analysis of food products and detection of adulterants:

- 1) Milk: Composition & nutrients, types of milk (fat free, organic and lactose milk), Analysis of milk for lactose by Lane Eynon's Method
- 2) Honey: Composition, Analysis of reducing sugars in honey by Coles Ferricyanide method
- 3) Tea: Composition, types (green tea and mixed tea), Analysis of Tannin by Lowenthal's method
- 4) Coffee: Constituents and composition, Role of Chicory, Analysis of caffeine by Bailey Andrew method

3.2. Cosmetics (5L)

Introduction and sensory properties

Study of cosmetic products:

- 1) Face powder: Composition, Estimation of calcium and magnesium by complexometry
- 2) Lipstick: Constituents, Ash analysis for water soluble salts: borates, carbonates and zinc oxide
- 3) Deodorants and Antiperspirants: Constituents, properties, Estimation of zinc by gravimetrically.

UNIT IV: THERMAL METHODS AND ANALYTICAL METHOD VALIDATION

4.1. Thermal Methods (12L)

4.1.1 Introduction to various thermal methods (TGA, DTA and Thermometric titration)

4.1.2. Thermogravimetric Analysis (TGA)

Instrumentation-block diagram, thermobalance (Basic components: balance, furnace, temperature measurement and control, recorder)

Thermogram (TG curve) for $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ and $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

Factors affecting thermogram-Instrumental factors and Sample characteristics

Applications:

Determination of drying and ignition temperature range

Determination of percent composition of binary mixtures

(Estimation of Calcium and Magnesium oxalate)

4.1.3. Differential Thermal Analysis (DTA):

Principle, Instrumentation, and Reference material used

Differential thermogram (DTA curve) $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ and

$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

Applications, Comparison between TGA and DTA.

Reference Books:

Analytical Chemistry

1. D. Harvey, Modern Analytical Chemistry, The McGraw-Hill Pub. 1st Edition (2000)
2. H.S. Ray, R Sridhar and K.P. Abraham, Extraction of Nonferrous Metals, Affiliated East-West Press Pvt. Ltd. New Delhi (1985) reprint 2007.
3. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, Fifth edition, ELBS Publication (1996)
4. D.A. Skoog D.M. West and F.J. Holler, Fundamentals of Analytical Chemistry, 7th Edition (printed in India in 2001) ISBN Publication.
5. Analytical Chemistry, J.G. Dick, 1973 Tata McGraw Hill Publishing Co. Ltd. New Delhi.
6. Quantitative analysis, Dey & Underwood, Prentice Hall of India, Pvt. Ltd. New Delhi
7. Fundamentals of Analytical Chemistry, Skoog 8th edition, Saunders college publishing