



**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 V**

Course Code	Unit	Topics	Credits	L/Week
USCHT51	I	Molecular Spectroscopy		
	II	Electrochemistry		
	III	Nuclear Chemistry		
	IV	Surface Chemistry & Colloidal State		
USCHT52	I	Molecular Symmetry and Chemical Bonding		
	II	Solid State Chemistry		
	III	Chemistry of Inner Transition Elements		
	IV	Some Selected Topics		
USCHT53	I	Mechanism of Organic Reactions; Pericyclic Reactions & Photochemistry		
	II	Stereochemistry & Heterocyclic Chemistry		
	III	IUPAC & Synthesis of Organic Compounds		
	IV	Spectroscopy-I & Natural Products		
USCHT54	I	Statistical Treatment of Analytical Data-II		
	II	Classical Methods of Analysis (Titrimetry)		
	III	Optical Methods		
	IV	Methods of Separation-I		
USCHP51		Chemistry Practicals I		
USCHP52		Chemistry Practicals II		
USCHP53		Chemistry Practicals III		
USCHP54		Chemistry Practicals IV		

**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 V**

**UNIT I: STATISTICAL TREATMENT OF ANALYTICAL DATA-II (15L)**

**Analytical calculations**

**1.1. Nature of Indeterminate Errors (5L)**

- 1.1.1. The true and acceptable value of a result of analysis
- 1.1.2. Measures of central tendency: mean, median, mode, average
- 1.1.3. Measures of dispersion: Absolute deviation, relative deviation, relative average deviation, standard deviation, ( $s$ , sigma) variance, coefficient of variation

**1.2. Distribution of random errors (2L)**

- 1.2.1. Gaussian distribution curve.
- 1.2.2. Equation and salient features of Gaussian distribution curve

**1.3. Concept of Confidence limits and confidence interval & its computation using (4L)**

- (i) Population standard deviation; (ii) Student's  $t$  test; (iii) Range (Chemical calculations)

**1.4. Criteria for rejection of doubtful result (2L)**

- (i) 2.5  $d$  rule (ii) 4.0  $d$  rule (iii)  $Q$  test

**1.5. Test of Significance (2L)**

- (i) Null hypothesis
- (ii)  $F$ -test (variance ratio test)

**UNIT II: CLASSICAL METHODS OF ANALYSIS (TITRIMETRY) (15L)**

**2.1. Redox Titrations (Numerical & word Problems are expected) (8L)**

- 2.1.1. Introduction
- 2.1.2. Construction of the titration curves and calculation of  $E_{\text{system}}$  in aqueous medium in case of:  
(1) One electron system (2) Multielectron system
- 2.1.3. Theory of redox indicators, Criteria for selection of an indicator. Use of diphenyl amine and ferroin as redox indicators

**2.2. Complexometric Titrations (7L)**

- 2.2.1. Introduction, construction of titration curve
- 2.2.2. Use of EDTA as titrant and its standardization
- 2.2.3. Selectivity of EDTA as a titrant. Factors enhancing selectivity with examples. Advantages and limitations of EDTA as a titrant.
- 2.2.4. Types of EDTA titrations.
- 2.2.5. Metallochromic indicators, theory, examples and applications

### **UNIT III: OPTICAL METHODS (15L)**

#### **3.1. Atomic Spectroscopy: Flame Emission spectroscopy (FES) and Atomic Absorption Spectroscopy (AAS) (7L)**

- 3.1.1. Introduction, Energy level diagrams, Atomic spectra, Absorption and Emission Spectra
- 3.1.2. Flame Photometry– Principle, Instrumentation (Flame atomizers, types of Burners, Wavelength selectors, Detectors)
- 3.1.3. Atomic Absorption Spectroscopy– Principle, Instrumentation (Source, Chopper, Flame and Electrothermal Atomizer)
- 3.1.4. Quantification methods of FES and AAS– Calibration curve method, Standard addition method and internal standard method.
- 3.1.5. Comparison between FES and AAS
- 3.1.6. Applications, Advantages and Limitations

#### **3.2. Molecular Fluorescence and Phosphorescence Spectroscopy (4L)**

- 3.2.1. Introduction and Principle
- 3.2.2. Relationship of Fluorescence intensity with concentration
- 3.2.3. Factors affecting Fluorescence and Phosphorescence
- 3.2.4. Instrumentation and applications
- 3.2.5. Comparison of Fluorimetry and Phosphorimetry
- 3.2.6. Comparison with Absorption methods

#### **3.3. Turbidimetry and Nephelometry (4L)**

- 3.3.1. Introduction and Principle
- 3.3.2. Factors affecting scattering of Radiation: Concentration, particle size, wavelength, refractive index
- 3.3.3. Instrumentation and Applications

### **UNIT IV: METHODS OF SEPARATION–I (15L)**

#### **4.1. Gas Chromatography (8L)**

- 4.1.1. Introduction, Principle, Theory and terms involved
- 4.1.2. Instrumentation: Block diagram and components, types of columns, stationary phases in GSC and GLC, Detectors: TCD, FID, ECD
- 4.1.3. Qualitative, Quantitative analysis and applications
- 4.1.4. Comparison between GSC and GLC

#### **4.2. High Performance Liquid chromatography (HPLC) (7L)**

- 4.2.1. Introduction and Principle, Instrumentation- components with their significance: Solvent Reservoir, Degassing system, Pumps- (reciprocating pumps, screw driven- syringe type pumps, pneumatic pumps, advantages and disadvantages of each pump), Precolumn, Sample injection system, HPLC Columns, Detectors (UV–Visible detector, Refractive index detector)
- 4.2.2. Qualitative and Quantitative Applications of HPLC

## **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