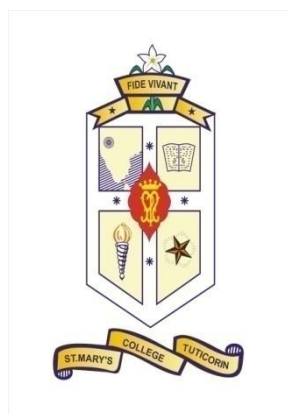


# **St. Mary's College (Autonomous), Thoothukudi**

**Re-accredited with 'A+' Grade by NAAC**



## **Curriculum**

### **Department of Chemistry**

(From June 2024 onwards)

### **Semester I & II**

**Preamble:**

Chemistry is a branch of Physical Science that deals with the composition, structure, behavior and properties of matter. Chemistry is at the center of our knowledge of the physical world around us. Each of us feels the impact of Chemistry in everyday of our lives.

**Vision:**

To produce knowledgeable Chemists and educate future scientists to enhance services to the community.

**Mission:**

To equip the students with the conceptual and experimental tools for the holistic development of professional graduates in academia, industry and government to meet the global environmental issues through chemical education.

## PROGRAMME OUTCOMES (PO) OF B.SC DEGREE PROGRAMME

PO No.	After completion of the Undergraduate programme the students of St. Mary's College will be able to
PO 1	acquire an in-depth domain knowledge and a comprehensive knowledge of various disciplines to become skilled professionals
PO 2	enrich their communicative skills, and enhance their creative, numerical, analytical and problem solving skills
PO 3	gain potential skills to excel in digital literacy, team management, scientific reasoning, research and self-directed life-long learning to emerge as entrepreneurs
PO 4	be aware of the environment with a social responsibility for the well-being of humanity and the planet at large
PO 5	be an empowered, economically independent woman with a global perspective to emerge holistically in the egalitarian society

## PROGRAMME SPECIFIC OUTCOMES

PO No.	After completion of the Undergraduate programme the students of St. Mary's College will be able to	PO Addressed
PSO1	Students acquire in-depth knowledge of the fundamental concepts in organic, inorganic and physical chemistry.	PO 1
PSO2	Students will be able develop creativity in academics and research and apply digital tools to collect, analyse and interpret data and present scientific findings.	PO2 & PO3
PSO3	Gain competence to pursue higher education and career opportunities in chemistry and allied fields.	PO 3
PSO4	Exhibit leadership qualities to work individually and within a team in organizing curricular, co-curricular and extracurricular activities.	PO 4
PSO5	Apply the concepts of chemistry to solve problems in the educational, industrial, entrepreneurial pursuits and contribute towards the holistic development of self and community.	PO 5

**ST. MARY'S COLLEGE (AUTONOMOUS), THOOTHUKUDI**

**Department of Chemistry  
Course Structure 2024-2027  
Semester I**

Part	Components	Course Code	Course Title	Hours/Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil /	24ULTA11	இக்கால இலக்கியம் செய்யுள், இலக்கணம், இலக்கிய வரலாறு, சிறுகதை Fundamental French Course	6	3	40	60	100
	French	24ULFA11						
II	General English	24UGEN11	Poetry, Prose, Extensive Reading and Communicative English I	6	3	40	60	100
III	Core I	24UCHC11	General Chemistry I	5	5	40	60	100
	Core Practical I	24UCHCR1	Volumetric Analysis I	3	3	40	60	100
	Generic Elective I	24UBOE11/	Basics of Botany I /	4/6	3/4	40	60	100
		24UMAE11	Mathematics I					
Generic Elective Practical I	24UBOER1	Basics of Botany Practical I	2	1	40	60	100	
IV	Skill Enhancement Course I	24UCHSE1	Food Chemistry	2	2	20	30	50
	Ability Enhancement Course I	24UAVE11	Value Education	2	2	20	30	50
<b>Total</b>				<b>30</b>	<b>22</b>			

### Semester II

Part	Components	Course Code	Course Title	Hours/Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil /	24ULTA21	சமய இலக்கியங்கள் செய்யுள், இலக்கணம்,	6	3	40	60	100
	French	24ULFA21	இலக்கிய வரலாறு Proficient French Course					
II	General English	24UGEN21	Poetry, Prose, Extensive Reading and Communicative English II	6	3	40	60	100
III	Core II	24UCHC21	General Chemistry II	5	5	40	60	100
	Core Practical II	24UCHCR2	Volumetric Analysis II	3	3	40	60	100
	Generic Elective II	24UBOE21	Basics of Botany II /	4/6	3/4	40	60	100
		24UMAE21	Mathematics II					
Generic Elective Practical II	24UBOER2	Basics of Botany Practical II	2	1	40	60	100	
IV	Skill Enhancement Course II	24UCHSE2	Dairy Chemistry	2	2	20	30	50
	Ability Enhancement Course II	24UAEV21	Environmental Studies	2	2	20	30	50
<b>Total</b>				<b>30</b>	<b>22</b>			

### Semester III

Part	Components	Course Code	Course Title	Hours/Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil /	24ULTA31	காப்பிய இலக்கியங்கள் செய்யுள், இலக்கணம்,	6	3	40	60	100
	French	24ULFA31	இலக்கிய வரலாறு, புதினம் French Literature and Grammar I					
II	General English	24UGEN31	Poetry, Prose, Extensive Reading and Communicative English III	6	3	40	60	100
III	Core III	24UCHC31	Physical Chemistry I	4	4	40	60	100
	Core Practical III	24UCHCR3	Inorganic qualitative analysis of simple salt	2	2	40	60	100
	Generic Elective III	24UPHE32	Physics I	4	3	40	60	100
	Generic	24UPHER3	Physics Practical I	2	1	40	60	100

	Elective Practical III							
	NME I	24UCHN31	Industrial Chemistry	2	2	20	30	50
IV	Skill Enhancement Course III	24UCHSE3	Chemical Safety	2	2	20	30	50
	Ability Enhancement Course III	24UAYM31	Yoga and Meditation	2	2	20	30	50
	Self-Study/ MOOC / Internship (Compulsory)	24UCHSS1	Chemistry for Competitive Examination		+2	--	50	50
<b>Total</b>				<b>30</b>	<b>22+2</b>			

### Semester IV

Part	Components	Course Code	Course Title	Hours/Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil /	24ULTA41	சங்க இலக்கியங்கள் செய்யுள், இலக்கணம், இலக்கிய வரலாறு, நாடகம்	6	3	40	60	100
	French	24ULFA41	French Literature and Grammar II					
II	General English	24UGEN41	Poetry, Prose, Extensive Reading and Communicative English IV	6	3	40	60	100
III	Core IV	24UCHC41	Organic Chemistry I	4	4	40	60	100
	Core Practical IV	24UCHCR4	Inorganic qualitative analysis of a mixture	2	2	40	60	100
	Generic Elective IV	24UPHE42	Physics II	4	3	40	60	100
	Generic Elective Practical IV	24UPHER4	Physics Practical II	2	1	40	60	100
	NME II	24UCHN31	Everyday Chemistry	2	2	20	30	50
IV	Skill Enhancement Course IV	24UCHSE4	Pharmaceutical Chemistry	2	2	20	30	50
	Ability Enhancement Course IV (Entrepreneurial Based)	24UACH41	Entrepreneurial Skills in Chemistry	2	2	20	30	50
V	NCC / NSS / Sports				1			
	CDP Extension Activity				+1			
<b>Total</b>				<b>30</b>	<b>23+1</b>			

### Semester V

Part	Components	Course Code	Course Title	Hours/Week	Credits	Max. Marks		
						CIA	ESE	Total
III	Core V	24UCHC51	Organic Chemistry II	6	5	40	60	100
	Core VI	24UCHC52	Inorganic Chemistry I	5	5	40	60	100
	Core VII	24UCHC53	Physical Chemistry II	5	5	40	60	100
	Core Practical V	24UCHCR5	Physical Chemistry Practicals	5	5	40	60	100
	Core Practical VI	24UCHCR6	Organic Analysis and Preparation of organic compounds	3	-	40	60	100
	Discipline Specific Elective I	24UCHE51/ 24UCHE52	Polymer Chemistry/ Nano Chemistry	4	3	40	60	100
IV	Skill Enhancement Course V	24UCHSE5	Industrial Chemistry	2	2	20	30	50
	Self-Study / Online Course / Internship (Optional)	24UCHSS2	Applied Chemistry		+2		50	50
<b>Total</b>				<b>30</b>	<b>25+2</b>			

### Semester VI

Part	Components	Course Code	Course Title	Hours/Week	Credits	Max. Marks		
						CIA	ESE	Total
III	Core VIII	24UCHC61	Organic Chemistry III	5	5	40	60	100
	Core IX	24UCHC62	Inorganic Chemistry II	5	5	40	60	100
	Core X	24UCHC63	Physical Chemistry III	4	4	40	60	100
	Core Practical VI	24UCHCR6	Organic Analysis and Preparation of organic compounds	3	2	40	60	100
	Core Practical VII	24UCHCR7	Gravimetric Analysis and Inorganic Preparations	5	3	40	60	100
	Core XI	24UCHP61	Project and viva voce	4	4	40	60	100
	Discipline Specific Elective II	24UCHE61 / 24UCHE62	Instrumental methods of Analysis / Advanced Topics in Chemistry	4	3	40	60	100
<b>Total</b>				<b>30</b>	<b>26</b>			

SEMESTER- I			
Part III	Core I	General Chemistry - I	
Course Code: 24UCHC11	Hrs/Week: 5	Hrs/Sem: 75	Credits: 5

### Objectives

- To apply methods of balancing redox reactions
- To communicate the concepts and results of their laboratory experiments clearly and concisely to both chemists and non-chemists through effective writing and oral communication skills
- To inculcate the students the basic principles and concepts in Chemistry.
- To understand the basic chemical principles in Inorganic, Organic and Physical Chemistry.

### Course Outcomes

CO No.	Upon completion of this course, students will be able to	Cognitive Level
CO 1	Describe the periodic properties of the different groups of compounds, nomenclature of different class of organic compounds, quantum numbers natural and artificial radioactivity, nuclear forces and nuclear stability, the interfering radicals, common ion effect and solubility product.	K1
CO 2	Associate the factors affecting ionization energy, polarization of a bond with electronegativity, the concept of quantum mechanics, theory of radioactivity, theory of indicators	K2
CO 3	Apply the rules for filling up of orbitals, hybridization concept, g and u character in atomic orbitals, understand the basis of fundamental particles, the nuclear reactions in various fields, the principles of gravimetric analysis	K3
CO 4	Analyse redox titration, homolytic and heterolytic fission, $\psi$ and $\psi^2$ -charge cloud concept, magic number and mass defect, Simple and interfering acid radicals	K4
CO 5	Evaluate the methods of balancing redox reactions, steric effect of substituents, anomalous electronic configuration, tracer technique, accuracy & precision	K5



## **UNIT I: Periodic Properties and Concept of Electron Transfer**

Modern periodic law- long form of periodic table – merits and demerits– classification of elements based on their electronic configuration- Major trends in periodic table – Slater’s rule- calculation of effective nuclear charge - periodic properties – trends in ionic and covalent radii- ionization energy- electron affinity and electro negativity –factors affecting ionization energy- electron affinity and electro negativity- scales of electro negativity – Alfred-Rochow’s scale – Pauling scale – Mulliken approach – applications of electro negativity.

Concept of electron transfer -Oxidation and reduction – Oxidation number concept of oxidation and reduction- Rules for assigning oxidation number –Electronic concept in inorganic reactions – Redox reactions – oxidant- Important Oxidants and their reduction half reaction – Fe(III) and  $\text{KMnO}_4$ –Reductant -important reductants and their oxidation half reaction Fe(II) and oxalic acid. Methods of balancing redox reactions ion electron method- oxidation number method.

## **UNIT II: Basic Concepts of Organic Chemistry**

Classification and nomenclature of organic compounds – Open chain and closed chain compounds- systems of naming organic compounds- rules of IUPAC system of nomenclature branched alkanes- cyclo alkanes – alkenes- alkynes and substituents-compounds having functional groups- poly functional groups.

Structural formula – Shapes of organic molecules.  $sp^3$ -  $sp^2$  and  $sp$  hybridization in organic compounds with suitable examples.

Polar effects – Inductive (+I and –I)- Electromeric effect-Resonance/Mesomeric effect (+R and – R - +M and –M) – examples- Hyper conjugation (Baker Nathan effect) and steric effect.

Bond fission – homolytic and heterolytic fission. Reaction intermediates – carbocation- carbanion- free radicals and carbenes – their generation- shapes and stability. Types of reaction-substitution-elimination –addition – polymerisation-definition and examples.

## **UNIT III: Basic Quantum Chemistry**

Dual character of an electron-de Broglie equation- Heisenberg’s uncertainty principle- Introduction to quantum mechanics-fundamental postulates-Schrodinger wave equation- – eigen value – eigen function – significance of  $\psi$  and  $\psi^2$ -charge cloud concept and orbitals- Shapes of s- p and d atomic orbitals-nodal planes-g and u character in atomic orbitals-Radial and angular parts of the wave functions and their variations for 1s- 2s- 2p- 3s- 3p and 3d orbitals (Only graphical representation)-radial and angular nodes and their significance.

Quantum numbers-origin-principal – orbital – angular momentum and spin quantum number- Significance of quantum numbers-Rules for filling electrons in various orbitals- Pauli's exclusion principle-Hund's rule-Aufbau principle- sequence of filling up of orbitals- schematic representation of electronic configuration- anomalous electronic configurations.

#### **UNIT IV: Nuclear Chemistry**

Isotopes- isobars and isotones – unit of radioactivity--half-life period – radioactive equilibrium – Soddy Fajan's displacement law – Theory of radioactivity – radioactive series – artificial transmutation of elements – natural and induced radioactivity – Constitution of nuclei – stability of nuclei and (n/p) ratio – magic number- mass defect- mass energy relationship- binding energy and calculation of binding energy from mass defect-nuclear fusion and fission reactions – Plutonium and Hydrogen bombs – applications of Radioactivity in medicine-industry-agriculture–tracer technique- carbon dating-rock dating.

#### **UNIT V: Analytical Methods**

Analytical Chemistry - Chemical Analysis - Types of Chemical Analysis – Qualitative and Quantitative Analysis- Volumetric Analysis – Principle – Standard Solutions - Normality and Molarity – Principles of Titrations – Theory of Indicators - Types of Titrations – Acidimetry- Alkalimetry- Permanganometry- Dichrometry- Iodometry- Argentometry- Complexometry.

Principles of gravimetric analysis – precipitation methods – conditions of precipitation – coprecipitation and post precipitation

Qualitative Inorganic Analysis – Dry Test- Flame Test- Wet Test - Testing of Simple and Interfering Acid Radicals- Test for sulphide- sulphate- nitrate (brown ring test)- bromide and iodide (silver nitrate test)- chloride and chromate (chromyl chloride test)- oxalate and fluoride (calcium chloride test)- borate (ethyl borate test)- phosphate ( ammonium molybdate test) – Elimination of Interfering Acid Radicals – Chromate-Oxalate- fluoride – phosphate – Principle for identification of Basic Radicals - Common ion effect and solubility product - Testing of the Basic Radicals belonging to different Groups - Test for lead- copper- cadmium- antimony- bismuth- cobalt- nickel- manganese- zinc- barium- strontium- calcium- magnesium and ammonium

#### **Recommended Text**

1. Puri B. R, Sharma L. R., Kalia K. C. Principles of Inorganic Chemistry. Delhi: Milestone publishers and distributors, 2010.

2. Tewari K. S, Vishnoi N. K, Mehrotra S.N. A Text Book of Organic Chemistry. Vikas Publishing 2<sup>nd</sup> Revised Editions 1998.
3. Arun Bahl, B. S. Bahl, G. D. Tuli. Essentials of Physical Chemistry New Delhi: S. Chand and Company Ltd. Revised edition 2008.

### Reference Books

1. Puri, Sharma B.R, Madan L.R S. Pathania. Principles of Physical Chemistry. Vishal Publishing Co, 2008.
2. Arun Bahl and Bahl B.S. Advanced Organic chemistry. S. Chand and Company Ltd., Reprint 2005.
3. Tewari N. Advance Organic Reaction mechanism Books and allied (P) Ltd. Kolkata: Second revised edition 2005.
4. Jain M. K and Sharma S. C. Modern Organic Chemistry. Vishal Publishing Company, 2008.

### Level of correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
<b>CO-1</b>	3	3	3	2	2	3	2	2	2	2
<b>CO-2</b>	3	2	2	2	2	3	2	3	2	2
<b>CO-3</b>	3	3	2	2	2	3	2	2	1	3
<b>CO-4</b>	3	3	2	3	2	3	3	3	1	3
<b>CO-5</b>	3	2	3	3	3	3	3	3	2	3
<b>Ave.</b>	3	2.6	2.4	2.4	2.2	3	2.4	2.6	1.8	2.6

<b>Mapping</b>	<b>&lt;40%</b>	<b>≥ 40% and &lt; 70%</b>	<b>≥ 70%</b>
<b>Relation</b>	<b>Low Level</b>	<b>Medium Level</b>	<b>High Level</b>
<b>Scale</b>	<b>1</b>	<b>2</b>	<b>3</b>

<b>SEMESTER I</b>			
<b>Core Practical</b>		<b>Volumetric Analysis I</b>	
<b>Course Code: 24UCHCR1</b>	<b>Hrs/Week: 3</b>	<b>Hrs/Sem: 45</b>	<b>Credits: 3</b>

### Objectives

- To know an idea about Quantitative estimation
- To learn the preparation of inorganic compounds

### Course Outcomes

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>Cognitive Level</b>
CO-1	Explain the basic principles involved in acidimetry and alkalimetry titrations	K1
CO-2	Compare the methodologies of different permanganometric titrations	K2
CO-3	Calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution.	K3
CO-4	Identify the end point of various iodometric and dichrometric titrations	K4
CO-5	Estimate the concentration of given solution	K5

## QUANTITATIVE ANALYSIS (VOLUMETRIC METHODS)

A double titration involving the preparation of a primary standard- standardization of the link solution- making up of the given solution and its estimation. Concepts of acids- bases- oxidants — Theory of Indicators. (Use of digital balance is permitted).

### TITRIMETRIC QUANTITATIVE ANALYSIS:

	Substance to be estimated	Primary Standard
<b>I Acidimetry and alkalimetry.</b>	1. NaOH/ Na <sub>2</sub> CO <sub>3</sub>	Na <sub>2</sub> CO <sub>3</sub>
	2. HCl/H <sub>2</sub> SO <sub>4</sub> /oxalic acid	Oxalic acid
<b>II Permanganometry</b>	3. Oxalic acid	Oxalic acid
	4. Mohr's salt	Mohr's Salt
	5. Fe <sup>2+</sup>	Mohr's Salt
<b>III Dichrometry - External indicator method</b>		
	6. Fe <sup>2+</sup>	Mohr's Salt
<b>IV Iodometry</b>	7. CuSO <sub>4</sub> /K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>	K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>
	8. KMnO <sub>4</sub>	CuSO <sub>4</sub>

### V Course work (Not for external examination)

1. Estimation of acetic acid in vinegar samples
2. Estimation of oxalate content in vegetables and fruits such as tomato- guava- grapes- etc.
3. Estimation of Sodium Carbonate and Sodium Bicarbonate in a mixture.

### REFERENCE BOOKS

1. Arthur D. Vogel. Vogel's Textbook of Quantitative Chemical Analysis. Longman's Green & Co Ltd, London, sixth Edition 2004.
2. Raghupati Mukhopadhyay, Pratul Chatterjee. Advanced Practical Chemistry. Books and Allied (P) Ltd., Third Edition 2007.

**Level of correlation between PO's, PSO's and CO's**

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
<b>CO-1</b>	3	2	3	2	2	3	3	3	2	3
<b>CO-2</b>	3	3	3	3	2	3	3	3	2	3
<b>CO-3</b>	3	3	3	3	3	3	3	3	3	3
<b>CO-4</b>	3	3	3	3	3	3	3	3	3	3
<b>CO-5</b>	3	3	3	3	3	3	3	3	3	3
<b>Ave.</b>	3	2.8	3	2.8	2.6	3	3	3	2.6	3

<b>Mapping</b>	<b>&lt;40%</b>	<b>≥ 40% and &lt; 70%</b>	<b>≥ 70%</b>
<b>Relation</b>	<b>Low Level</b>	<b>Medium Level</b>	<b>High Level</b>
<b>Scale</b>	<b>1</b>	<b>2</b>	<b>3</b>

SEMESTER- I			
ELECTIVE		CHEMISTRY FOR PHYSICAL SCIENCES I	
Course Code: 24UCHE11	Hrs/Week: 4	Hrs/Sem: 60	Credits: 3

### Objectives

- To know about Atomic structure and chemical bonding
- To identify Sources and importance of organic compounds
- To acquire knowledge of colloids and thermodynamics
- To basics and applications of kinetics and catalysis

### Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Ability to explain the quantum Numbers, Sources of organic compounds, coagulation of colloids, types of systems, Order and molecularity.	K1
CO-2	Explain the shapes of Atomic Orbitals, purification of organic compounds, gold number, laws of thermodynamics and rate expression for I and II (2A Products) order reactions.	K2
CO-3	Understand the principles involving atom, elemental analysis, emulsion and it's types, Carnot's cycle and Half-life period	K3
CO-4	Assess the chemistry of bonding, calculation of molecular weight, surfactants, free energy change and catalysis.	K4
CO-5	Identify the bond order and magnetic properties, calculation of molecular formula, determination of molecular weights, conditions for spontaneity and the concept of energy of activation	K5

### **Unit I: Atomic Structure and Chemical Bonding**

Atomic Structure: Wave nature of Matter- Schrodinger equation (Derivation not required)- Quantum Numbers- Shapes of Atomic Orbitals and its Significance. Pauli's Exclusion principle-Hund's Rule- Aufbau Principle.

Chemical Bonding: Molecular Orbital Theory-bonding- antibonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen- Helium- Nitrogen- Oxygen- Bond order and magnetic properties.

### **Unit II: Introduction to Organic Compounds**

Definition and importance-Sources of organic compounds-purification of organic compounds Crystallisation- Fractional crystallisation- Sublimation- Solvent extraction-Soxhlet Extraction- Elemental analysis-qualitative analysis of Carbon- Hydrogen- Nitrogen- Sulphur and halogen- estimation of Carbon- Hydrogen- Nitrogen- Calculation of empirical formula - Determination of molecular weight by Chloroplatinic salt method -Calculation of molecular formula

### **Unit III: Analytical Chemistry**

Introduction to Qualitative and Quantitative Analysis- Principle of volumetric analysis- Molarity- Molality- Normality-standard solution- primary standard- secondary standard-theory of acid-base titrations – acid base indicators-redox titrations – permanganometry - Error analysis – types of errors– Minimising Errors – accuracy and precision – Methods of expressing precision- mean- median- mean deviation- standard deviation and confidence limit.

### **Unit IV: Thermodynamics**

Types of systems- reversible and irreversible processes- isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics- Carnot's cycle and efficiency of heat engine - Entropy and its significance - Free energy change and its importance (no derivation) - Conditions for spontaneity in terms of entropy and Gibbs free energy -Relationship between Gibbs free energy and entropy.

### **UNIT V: Kinetics and Catalysis**

Order and molecularity- Integrated rate expression for I and II (2A Products) order reactions. Pseudo first order reaction- methods of determining order of a reaction – Half-life period – Catalysis - homogeneous and heterogeneous- catalyst used in Contact and Haber's processes- Concept of energy of activation and Arrhenius equation.



### Recommended Text

1. V. Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009.
2. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
3. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry; S. Chand and Company, New Delhi, twenty third edition, 2012.
4. P. L. Soni, H. M. Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

### Reference Books

1. P. L. Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
2. B. K. Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
3. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.

### Level of correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	3	2	2	3	3	3	2	3
CO-2	3	3	3	2	2	3	3	3	2	3
CO-3	3	3	3	2	2	3	3	3	2	3
CO-4	3	3	3	2	2	2	2	3	2	3
CO-5	3	3	3	2	2	3	3	3	2	3
Ave.	3	3	3	2	2	3	3	3	2	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

<b>SEMESTER- I</b>			
<b>ELECTIVE</b>		<b>Chemistry For Biological Sciences I</b>	
<b>Course Code : 24UCHE12</b>	<b>Hrs/Week: 4</b>	<b>Hrs/Sem: 60</b>	<b>Credits: 3</b>

### Objectives

- To know about Atomic structure and chemical bonding
- To identify Sources and importance of organic compounds
- To acquire knowledge of colloids and biomolecules
- To basics and applications of Chromatography and

### Course Outcomes

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>Cognitive Level</b>
CO-1	ability to explain Wave nature of Matter, sources of organic compounds- coagulation of colloids, Chromatography and configuration	K1
CO-2	explain the Quantum Numbers, purification of organic compounds, protective colloids, Adsorption Chromatography and interconversion	K2
CO-3	understand Shapes of Atomic Orbitals, Fractional Crystallisation, gold number, Experimental method and epimerization	K3
CO-4	assess the Molecular Orbital Theory, Elemental analysis, determination of molecular weights, good Adsorbents and mutarotation	K4
CO-5	identify the Bond order, Molecular orbital diagrams, applications of Colloids, applications of Chromatography and isolation	K5

## **Unit I: Atomic Structure and Chemical Bonding**

Atomic Structure: Wave nature of Matter- Schrodinger equation (Derivation not required)- Quantum Numbers- Shapes of Atomic Orbitals and its Significance. Pauli's Exclusion principle- Hund's Rule- Aufbau Principle.

Chemical Bonding: Molecular Orbital Theory-bonding- antibonding- and non-bonding orbitals. Molecular orbital diagrams for Hydrogen- Helium- Nitrogen- Bond order and magnetic properties.

## **Unit II: Introduction to Organic Compounds**

Definition and importance-Sources of organic compounds-purification of organic compounds Crystallisation- Fractional crystallisation- Sublimation -Solvent extraction- Soxhlet extraction Elemental analysis-qualitative analysis of Carbon- Hydrogen- nitrogen- Sulphur and halogen- estimation of Carbon- Hydrogen- Nitrogen - Calculation of empirical formula - Determination of molecular weight by Chloroplatinic salt method -Calculation of molecular formula

## **Unit III: Analytical Chemistry**

Introduction to Qualitative and Quantitative Analysis – Principle of volumetric analysis- Molarity - Molality-Normality-standard solution- primary standard - secondary standard-theory of acid-base titrations – acid base indicators-redox titrations – permanganometry - Error analysis – types of errors – Minimising Errors – accuracy and precision – Methods of expressing precision- mean- median- mean deviation- standard deviation and confidence limit.

## **Unit IV: Chromatography**

Chromatography- Classification- Adsorption Chromatography-Principle– Adsorbents- Characteristics of good Adsorbents- Principle- Experimental method and applications of Column Chromatography- Thin layer Chromatography-Paper Chromatography- Ion Exchange Chromatography

## **Unit V: Biomolecules**

Carbohydrates- Classification- configuration of D-Glucose- D-Fructose- D- Mannose and D- Galactose (Structure only)- interconversion of glucose and fructose- interconversion of arabinose and glucose-epimerization- mutarotation-general study of starch and cellulose.

Amino acids- classification-essential amino acids- isolation from proteins- peptide linkage- polypeptide.

Proteins- classifications- colour reactions- structure.

### Recommended Text

1. V. Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009.
2. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
3. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry; S. Chand and Company, New Delhi, twenty third edition, 2012.
4. P. L. Soni, H. M. Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

### Reference Books

1. P. L. Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
2. B. K. Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
3. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.

### Level of correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	3	2	2	3	3	3	2	3
CO-2	3	3	3	2	2	3	3	3	2	3
CO-3	3	3	3	2	2	3	3	3	2	3
CO-4	3	3	3	2	2	2	2	3	2	3
CO-5	3	3	3	2	2	3	3	3	2	3
Ave.	3	3	3	2	2	3	3	3	2	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

<b>SEMESTER- I</b>			
<b>Generic Elective</b>		<b>Chemistry Practical I</b>	
<b>Code: 24UCHER1</b>	<b>Hrs./Week: 2</b>	<b>Hrs/Sem: 30</b>	<b>Credits: 1</b>

### Objectives

- To provide knowledge on the basics of preparation of solutions.
- To provide knowledge on the principles and practical experience of volumetric analysis
- **Course Outcomes**

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>Cognitive Level</b>
CO-1	Learn the concept of various titrations.	K1
CO-2	Understand the acidimetry and alkalimetry, permanganometry and complexometric titrations.	K2
CO-3	Calculate the concentrations of unknown solutions.	K3
CO-4	Develop the skill to estimate the amount of a substance present in a given solution.	K4
CO-5	Analyse their skill in the analysis of water.	K5

## **VOLUMETRIC ANALYSIS**

1. Estimation of sodium hydroxide using standard sodium carbonate.
2. Estimation of hydrochloric acid using standard oxalic acid.
3. Estimation of ferrous sulphate using standard Mohr's salt.
4. Estimation of oxalic acid using standard ferrous sulphate.
5. Estimation of potassium permanganate using standard sodium hydroxide.
6. Estimation of Zinc using EDTA.
7. Estimation of Total Hardness of water by EDTA method.

## **Reference Books**

1. V. Venkateswaran, R. Veerasamy, A. R. Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.

<b>SEMESTER- I</b>			
<b>SEC</b>		<b>Food Chemistry</b>	
<b>Code : 24UCHSE1</b>	<b>Hrs/Week: 2</b>	<b>Hrs/Sem: 30</b>	<b>Credits:2</b>

### Objectives

- To know about types of food
- To identify food adulteration and poisons
- To have awareness of food additives and preservation

### Course Outcomes

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>Cognitive Level</b>
CO-1	Learn about Food adulteration - contamination of Wheat, Rice, Milk and Butter.	K1
CO-2	Get an awareness about food poisons like natural poisons (alkaloids - nephrotoxin) pesticides, DDT, BHC, malathion	K2
CO-3	Get an exposure on food additives, artificial sweeteners, Saccharin, Cyclamate and Aspartate in the food industries.	K3
CO-4	Acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages examples.	K4
CO-5	Study about fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats – MUFA and PUFA	K5

## **UNIT I: Food Adulteration**

Sources of food- types- advantages and disadvantages. Food adulteration - contamination of wheat- rice- milk- butter etc. with clay stones- water and toxic chemicals -Common adulterants- Ghee adulterants and their detection. Detection of adulterated foods by simple analytical techniques

## **Unit II: Food Poison**

Food poisons - natural poisons (alkaloids - nephrotoxin) – pesticides- (DDT- BHC- Malathion) -Chemical poisons - First aid for poison consumed victims.

## **UNIT III: Food Additives**

Food additives -artificial sweeteners – Saccharin - Cyclamate and Aspartate Food flavours – esters- aldehydes and heterocyclic compounds – Food colours – Emulsifying agents – preservatives -leavening agents. Baking powder –yeast – tastemakers – MSG - vinegar.

## **UNIT IV: Beverages**

Beverages- soft drinks- soda- fruit juices-alcoholic beverages - examples. Carbonation-addiction to alcohol– diseases of liver and social problems.

## **UNIT V: Edible Oils**

Fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventing heart diseases- determination of iodine value- RM value- saponification values and their significance.

## **Recommended Text**

1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co. Publishers, second edition, 2006.
3. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
4. Food Chemistry, Dr. L. Rakesh Sharma, Evincepub publishing, 2022.
5. Food processing and preservation, G. Subbulakshmi, Shobha A Udipi, Padmini S Ghugre, New age international publishers, second edition, 2021.

## **Reference Books**

1. H.-D. Belitz, Werner Grosch, Food Chemistry Springer Science & Business Media, 4<sup>th</sup> Edition, 2009.



2. M.Swaminathan, Food Science and Experimental Foods, Ganesh and Company, 1979.
3. Hasenhuettl, Gerard. L.; Hartel, Richard. W. Food Emulsifiers and their applications Springer New York 2nd ed. 2008.
4. Food Chemistry, H.-D. Belitz, W. Grosch, P. Schieberle, Springer, fourth revised and extended edition, 2009.
5. Principles of food chemistry, John M. deMan, John W. Finley, W. Jefferey Hurst, Chang Yong Lee, Springer, Fourth edition, 2018.

**Level of correlation between PO's, PSO's and CO's**

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
<b>CO-1</b>	3	1	1	3	2	3	3	3	3	3
<b>CO-2</b>	3	2	2	3	2	3	3	3	3	3
<b>CO-3</b>	3	2	2	3	2	3	3	3	3	3
<b>CO-4</b>	3	2	2	3	2	3	3	3	3	3
<b>CO-5</b>	3	1	1	3	2	3	3	3	3	3
<b>Ave.</b>	3	1.6	1.6	3	2	3.0	3.0	3.0	3.0	3.0

<b>Mapping</b>	<b>&lt;40%</b>	<b>≥ 40% and &lt; 70%</b>	<b>≥ 70%</b>
<b>Relation</b>	<b>Low Level</b>	<b>Medium Level</b>	<b>High Level</b>
<b>Scale</b>	<b>1</b>	<b>2</b>	<b>3</b>

Semester II			
Part III		Core II General Chemistry-II	
Code: 24UCHC21	Hrs/Week: 5	Hrs/Sem: 75	Credits: 5

### Objectives

- To recall the basic methods of purification of ores.
- To understand the characteristic features of s and p block compounds
- To know the importance of compounds containing nitrogen
- To have an idea about the properties of alkenes, alkynes and aromatic substitution.
- To acquire knowledge in colligative properties.

### Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Explain the different steps of metallurgy, Mechanism of addition reaction, reactions of nitrile and isonitrile and the concept of vapour pressure	K1
CO-2	Describe calcination and roasting, characteristic features of alkali and alkaline earth metals, theories of osmosis, descending and ascending of amine	K2
CO-3	Investigate the methods of refining, mechanism of various substitution reactions, aromatic and non-aromatic compounds, determine molecular weight of compounds and effects of substituents on the basicity of amines.	K3
CO-4	Apply the principle of colligative properties in day to day life Like kidney dialysis, reverse osmosis, apply purification methods in inorganic compound synthesis, identify differentiate different nitrogen containing compounds	K4
CO-5	Evaluate abnormal molecular weights of compounds, refining methods, Vant hoff's theory for solutions, mechanism of organic reactions, separate primary, secondary and tertiary amines,	K5

## **UNIT I: General Principles of Extraction of Metals**

Minerals and ores - different steps of metallurgy – crushing and grinding of the ore – concentration of the ore – hand picking - gravity separation (Hydraulic Washing) - electromagnetic separation – electrostatic separation – froth flotation process – leaching- calcination– roasting –difference between calcination and roasting – reduction to free metals – reduction by displacement- thermal decomposition-carbon (smelting) - heating in air- Gold Schmidt’s aluminothermic process – Kroll’s process - Refining of impure metals – thermal refining – distillation- liquation – vapour phase refining – Van Arkel process - Mond’s process- electrolytic process- zone refining process. Types of furnaces – Fuel fired – blast-reverberatory- vertical retort and muffle –Electric furnace – Arc furnaces – types - resistance furnace.

## **UNIT II: s and p Block Elements**

General characteristics of IA and IIA group elements – diagonal relationship of lithium with magnesium – anomalous behaviour of lithium and beryllium – Sodium carbonate and sodium bicarbonate – preparation – properties and uses – principle of fire extinguisher. Boron – classification and nomenclature of boron hydrides – preparation- structure and uses of diborane – relative strength of boron trihalides. Oxo compounds of boron – ortho boric acid – preparation- properties and uses - Borax bead test. Carbides – Classification with examples – Preparation – Properties- uses and structure of Calcium Carbide- Boron Carbide- Aluminium Carbide and Silicon Carbide - Halogens - Peculiarities of fluorine –etching on glass.

## **Unit III: Nitro compounds and Amino compounds**

Preparation and reaction of nitrile and isonitrile – distinction between nitroalkane and alkyl nitrites–Preparation of o- p- m dinitrobenzene- trinitrobenzene.

Aliphatic amine – separation of mixture of amine – (Hoffmann- Heisenberg method)- Comparison of 1<sup>o</sup>- 2<sup>o</sup> & 3<sup>o</sup> amines- Mustard oil reaction- Mannich reaction – ascending and descending of amines.

Aromatic amines – effect of substituents on the basicity of aromatic amines- preparation and properties of phenylenediamine

Diazonium compounds- Preparation of diazonium chloride and its synthetic applications.

## **UNIT IV: Hydrocarbons and Halogen Compounds**

Alkenes – Mechanism of addition reaction to alkenes – Markanikow’s rule- Peroxide effect epoxidation – ozonolysis. Dienes Classification –Conjugated dienes –(1,2 &1,4-addition )-

Diel's Alder reaction. Alkynes – terminal & non-terminal alkynes – acidic nature of acetylenic hydrogen atom. Aromatic hydrocarbon- Concept & Condition – Huckel's Rule- Aromatic-antiaromatic & non- aromatic compounds – Mechanism of aromatic electrophilic & Nucleophilic substitution reactions- Orientation ( Electronic concept) – direct influence of substitution o- m & p directing – Benzyne mechanism.

Aliphatic halogen compounds –Mechanism of  $S_N1$ -  $S_N2$ - E1- E2 reaction – Halogen derivatives- Preparation and properties of Vinyl chloride – Allyl chloride – Preparation & uses of Chloroprene- Aromatic halogen compounds – Nuclear & Side chain halogen compounds distinction.

### **UNIT V: Colligative Properties**

Definition- lowering of Vapour Pressure-- Raoult's Law - measurement of vapour pressure lowering-- Ostwald and Walker's Dynamic method – Elevation of boiling point and its determination- Landsberger –walker method. Depression of freezing point and its determination –Rast's Camphor method –Abnormal molecular masses of electrolytes – Osmosis-Definition -Some Interesting Experiments Demonstrating Osmosis-Silica Garden-Semipermeable Membranes -Preparation of Cupric Ferrocyanide Membrane - Osmotic Pressure -Kidney Dialysis-Determination of Osmotic Pressure-Berkeley And Hartley's Method –Modern Osmometer –Isotonic Solutions -Theories of Osmosis -Membrane Solution Theory -Vapour Pressure Theory- Reverse Osmosis-Desalination of Sea

Water by Hollow-Fibre Reverse Osmosis-Nanotube Membranes- Calculation of Osmotic Pressure-Determination of Molecular Weight – Relation Between Vapour Pressure And Osmotic Pressure Osmotic Pressure of Electrolytes.

### **Recommended Text**

1. Puri B.R, Sharma L.R, Kalia K. C. Principles of Inorganic Chemistry. Delhi: Milestone Publishers and distributors, 2010.
2. Tewari K. S, Vishnoi N.K, Mehrotra S. N. A Text Book of Organic Chemistry. 2nd Revised Editions, 1998.
3. Kalsi P.S .Stereochemistry Conformation and Mechanism.New Age International, 2005.
4. Arun Bahl, Bahl B.S, Tuli G. D. Essentials of Physical Chemistry. New Delhi: S. Chand and Company Ltd. Revised edition 2008.

### Reference Books

1. Puri B.R, Sharma L.R, Madan Pathania S. Principles of Physical Chemistry. Vishal Publishing Co. 2008.
2. Arun Bahl and Bahl B.S. Advanced Organic chemistry.S.Chand and Company Ltd. Reprint, 2005.
3. Tewari N. Advance Organic Reaction mechanism. Kolkata: Books and allied (P) Ltd. Second revised edition 2005.
4. Jain M. K and Sharma S. C. Modern Organic Chemistry. Vishal Publishing Company, 2008.
5. R.D Mathan, Sathyaprakash, (2003), Modern Inorganic Chemistry, S. Chand and company, New Delhi.
6. P.L. Soni, H. M. Chawla, Text book of Organic Chemistry, Sulthan chand & Sons , New Delhi, 29<sup>th</sup> edition, 2007.

### Level of correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	2	2	2	3	2	2	1	2
CO-2	3	3	2	2	2	3	2	3	1	2
CO-3	3	3	2	2	2	3	2	3	1	3
CO-4	3	3	2	3	2	3	3	3	1	3
CO-5	3	2	3	3	3	3	3	3	1	3
Ave.	2.8	2.8	2.2	2.4	2.2	3	2.4	2.8	1	2.6

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

<b>SEMESTER II</b>			
<b>Core Practical</b>		<b>Volumetric Analysis II</b>	
<b>Course Code: 24UCHCR2</b>	<b>Hrs/Week: 3</b>	<b>Hrs/Sem: 45</b>	<b>Credits: 3</b>

### Objectives

- To know an idea about Quantitative estimation
- To learn the preparation of inorganic compounds

### Course Outcomes

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>Cognitive Level</b>
CO-1	Explain the basic principles involved in complexometric titrations	K1
CO-2	Compare the methodologies of different complexometric titrations	K2
CO-3	Calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution using complexometry	K3
CO-4	Identify the end point of various complexometric titrations	K4
CO-5	Estimate the concentration of given solution	K5

## QUANTITATIVE ANALYSIS (VOLUMETRIC METHODS)

A double titration involving the preparation of a primary standard- standardization of the link solution- making up of the given solution and its estimation. Concept of complex formation- Theory of Indicators. (Use of digital balance is permitted).

## TITRIMETRIC QUANTITATIVE ANALYSIS:

Substance to be estimated Primary Standard

### Complexometry

- |              |                      |
|--------------|----------------------|
| 1. $Zn^{2+}$ | $ZnSO_4 \cdot 7H_2O$ |
| 2. $Mg^{2+}$ | $MgSO_4$             |
| 3. $Ca^{2+}$ | $CaSO_4$             |
| 4. $Pb^{2+}$ | $Pb(NO_3)_2$         |
| 5. $Mn^{2+}$ | $MnSO_4 \cdot H_2O$  |
| 6. $Ni^{2+}$ | $ZnSO_4 \cdot 7H_2O$ |
| 7. $Cu^{2+}$ | $CuSO_4$             |

Course work (Not for external examination)

1. Estimation of Total Hardness of water

Level of correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	3	2	2	3	3	3	2	3
CO-2	3	3	3	3	2	3	3	3	2	3
CO-3	3	3	3	3	3	3	3	3	3	3
CO-4	3	3	3	3	3	3	3	3	3	3
CO-5	3	3	3	3	3	3	3	3	3	3
Ave.	3	2.8	3	2.8	2.6	3	3	3	2.6	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

<b>SEMESTER- II</b>			
<b>ELECTIVE - CHEMISTRY FOR PHYSICAL SCIENCES II</b>			
<b>Code: 24UCHE21</b>	<b>Hrs/Week: 4</b>	<b>Hrs/Sem: 60</b>	<b>Credits: 3</b>

### Objectives

- To study concepts of co-ordination chemistry
- To know the preparation and uses of organic compounds
- To know about industrial chemistry.
- To learn the importance of electrochemistry
- To study various photochemical phenomenon

### Course Outcomes

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>Cognitive Level</b>
CO-1	State the IUPAC nomenclature, preparation and uses of sodium Carbonate, fuels, electrochemical series and the laws of photochemistry.	K1
CO-2	Outline the werner's theory, preparation and uses of Sodium bicarbonate, water hardness, ionic product of water and quantum yield.	K2
CO-3	Understand the EAN rule, preparation and uses of basic lead carbonate, softening of hard water, conductometric titrations and hydrogen chloride reaction.	K3
CO-4	Demonstrate the Pauling's theory, preparation and uses of gypsum, demineralization process, electroplating and luminescence process,	K4
CO-5	Explain chelation, Preparation and uses of lithophone, sterilisation of water, fuel cells and photosensitisers.	K5



### **Unit I: Coordination Chemistry**

Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature - Werner's theory - EAN rule - Pauling's theory – Valence bond theory -Postulates - Applications to  $[\text{Ni}(\text{CO})_4]$  -  $[\text{Ni}(\text{CN})_4]^{2-}$  -  $[\text{Co}(\text{CN})_6]^{3-}$  Chelation -Applications in qualitative and quantitative analysis.

### **Unit II: Preparation and Use of some important Organic Compounds**

Preparation and uses of Sodium Carbonate- Sodium Bicarbonate- Potassium Cyanide- basic Beryllium Acetate- preparation and uses of basic Lead Carbonate or White lead-basic Lead Sulphate- Green Vitriol- Blue Vitriol- Gypsum- Plaster of Paris- Milk of Lime- Quick Lime- Epsom -Lithophone.

### **Unit III: Industrial Chemistry**

Fuels- Classification- gaseous fuel like water gas- producer gas- liquefied petroleum gas- Gobar gas- Compressed Natural gas.

Hardness of Water- Temporary and Permanent Hardness- disadvantage of hard water-softening of hard water- Zeolite process. Demineralization process- Reverse Osmosis - Sterilisation of water for domestic use by Chlorine- Ozone and UV Light.

### **Unit IV: Electrochemistry**

Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water –Ph-  $\text{pK}_a$ -  $\text{pK}_b$ . Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome plating – Types of cells -fuel cells.

### **UNIT V: Photochemistry**

Beer Lambert's law- Grothus - Draper's law and Stark-Einstein's law of photochemical equivalence- Quantum yield – Kinetics of Hydrogen-chloride reaction. Phosphorescence-fluorescence- chemiluminescence- Bioluminescence – Thermoluminescence - photosensitization and photosynthesis (definition with examples).

### **Recommended Text**

1. V. Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009.
2. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
3. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry; S. Chand and Company, New Delhi, twenty third edition, 2012.

4. P. L. Soni, H. M. Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

#### Reference Books

1. P. L. Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
2. R. Puri, L. R. Sharma, M. S. Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.
3. B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

#### Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
<b>CO-1</b>	3	3	3	2	2	3	3	3	2	3
<b>CO-2</b>	3	3	3	2	2	3	3	3	2	3
<b>CO-3</b>	3	3	3	2	2	3	3	3	2	3
<b>CO-4</b>	3	3	3	2	2	2	2	3	2	3
<b>CO-5</b>	3	3	3	2	2	3	3	3	2	3
<b>Ave.</b>	3	3	3	2	2	3	3	3	2	3

<b>Mapping</b>	<b>&lt;40%</b>	<b>≥ 40% and &lt; 70%</b>	<b>≥ 70%</b>
<b>Relation</b>	<b>Low Level</b>	<b>Medium Level</b>	<b>High Level</b>
<b>Scale</b>	<b>1</b>	<b>2</b>	<b>3</b>

SEMESTER- II			
ELECTIVE - Chemistry For Biological Sciences II			
Code: 24UCHE22	Hrs/Week: 4	Hrs/Sem: 60	Credits: 3

### Objectives

- To know about co-ordination Chemistry
- To preparation and uses of organic compounds
- To acquire knowledge of industrial Chemistry and agricultural chemistry
- To know the basic of pharmaceutical Chemistry

### Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	state the IUPAC nomenclature, preparation and uses of sodium Carbonate, fuels	K1
CO-2	outline Werner's theory - preparation and uses of Sodium bicarbonate, water hardness	K2
CO-3	understand the EAN rule, preparation and uses of basic lead carbonate, softening of hard water	K3
CO-4	demonstrate the Pauling's theory, preparation and uses of gypsum, demineralization process	K4
CO-5	Explain chelation, Preparation and uses of lithophone, sterilisation of water,	K5

## **Unit I: Coordination Chemistry**

Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature - Werner's theory - EAN rule - Pauling's theory – Valence bond theory- Postulates - Applications to  $[\text{Ni}(\text{CO})_4]$ -  $[\text{Ni}(\text{CN})_4]^{2-}$ - $[\text{Co}(\text{CN})_6]^{3-}$  Chelation -Applications in qualitative and quantitative analysis.

## **Unit II: Preparation and Use of some important Organic Compounds**

Preparation and uses of Sodium Carbonate- Sodium Bicarbonate- Potassium Cyanide- basic Beryllium Acetate- preparation and uses of basic Lead Carbonate or White lead- basic Lead Sulphate- Green Vitriol- Blue Vitriol- Gypsum- Plaster of Paris- Milk of Lime- Quick Lime- Epsom- Lithophone.

## **Unit III: Industrial Chemistry**

Fuels- Classification- gaseous fuel like water gas- producer gas- liquefied petroleum gas- Gobar gas- Compressed Natural gas.

Hardness of Water- Temporary and Permanent Hardness- disadvantage of hard water- softening of hard water- Zeolite process. Demineralization process- Reverse Osmosis - Sterilisation of water for domestic use by Chlorine- Ozone and UV Light.

## **Unit IV: Agricultural Chemistry**

Fertilizers- micro and macro nutrients in plant growth- characteristics and importance of manures- preparation and uses of urea- ammonium sulphate- CAN- DAP- super phosphate- triple super phosphate and mixed fertilizers-biofertilizers

Pesticides- insecticides-fungicides-rodenticides-bactericides and herbicides- preparation and uses of Lead arsenate- Bordeaux mixture- Zineb- Epsom and Aluminium Phosphide.

## **Unit V: Pharmaceutical Chemistry**

Drugs- Definition- Preparation and Uses of some common drugs with examples- mouthwashes (hydrogen Peroxide)-antacids (aluminium hydroxide and magnesium trisilicates)- analgesics (aspirin)- antipyretics (paracetamol)- sedatives (Diazepam) and Hypnotics (barbituric acid)- Antiseptic and Anaesthetic - Difference between Antiseptic and Anaesthetic- Anaesthetics (chloroform)- Antiseptics (alum- boric acid- zinc oxide- potassium permanganate- Dettol)

## **Recommended Text**

1. V. Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009.
2. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.

3. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry; S. Chand and Company, New Delhi, twenty third edition, 2012.
4. P. L. Soni, H. M. Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

#### Reference Books

1. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry; S. Chand and Company, New Delhi, twenty third edition, 2012.
2. P. L. Soni, H. M. Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
3. P. L. Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
4. B. R. Puri, L. R. Sharma, M. S. Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.
5. B. K. Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

#### Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	3	2	2	3	3	3	2	3
CO-2	3	3	3	2	2	3	3	3	2	3
CO-3	3	3	3	2	2	3	3	3	2	3
CO-4	3	3	3	2	2	2	2	3	2	3
CO-5	3	3	3	2	2	3	3	3	2	3
Ave.	3	3	3	2	2	3	3	3	2	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

<b>SEMESTER- II</b>			
<b>Part III Chemistry Practical II</b>			
<b>Course Code: 23UCHER2</b>	<b>Hrs/Week: 2</b>	<b>Hrs/Sem: 30</b>	<b>Credits: 2</b>

### Objectives

- To know an idea about identification of organic functional groups
- To learn the different types of organic compounds with respect to their properties
- To determine the elements in organic compounds.

### Course outcomes

<b>CO. No.</b>	<b>Upon completion of this course, students will be able to</b>	<b>Cognitive Level</b>
CO-1	Gain an understanding of the physical state, odour, colour and solubility of the given organic compound.	K1,
CO-2	Identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.	K2
CO-3	Compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, aldehyde, glucose and explain the reactions behind it.	K3
CO-4	Analyze the aliphatic and aromatic compound.	K4
CO-5	Assess the elements such as nitrogen, sulphur and halogens.	K5

## SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS

The analysis must be carried out as follows:

- (a) Functional group tests [dihydric phenol- acids (mono & di) aromatic primary amine- amides (mono & di)- aldehyde- ester and glucose].
- (b) Detection of elements (N and S).
  - (a) To distinguish between aliphatic and aromatic compounds.
  - (b) To distinguish – Saturated and unsaturated compounds.

### Reference Books

1. V. Venkateswaran, R. Veerasamy, A. R. Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.

### Level of Correlation between PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	3	3	3	3	3	3	3	3
CO-3	3	3	3	3	3	3	3	3	3	3
CO-4	3	3	3	3	3	3	3	3	3	3
Ave.	3	3	3	3	3	3	3	3	3	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

<b>SEMESTER- II</b>			
<b>SEC- II Dairy Chemistry</b>			
<b>Code: 24UCHSE2</b>	<b>Hrs/Week: 2</b>	<b>Hrs/Sem: 30</b>	<b>Credits: 2</b>

### Objectives

- To know about the chemistry of milk and milk products
- To analyse about the processing of milk
- To learn about the preservation and formation of milk products.

### Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Understand about general composition and microbiology of milk, chemistry of creaming process and types of milk and milk products.	K1
CO-2	Acquire knowledge about milk constituents, pasteurization of Milk, major milk products, special milk, fermented and other milk products.	K2
CO-3	Learn about physical properties and factors affecting the composition of milk, chemical changes in milk processing, common adulterants and their detection, composition and nutritive value of special milk and composition of various milk products.	K3
CO-4	Explain about estimation of fat and total solids in milk, physiochemical changes in milk processing, antioxidants, synergists in milk products, definition and composition of various milk, definition and condition for cultured fermented and butter milk	K4
CO-5	Have an idea about composition and constituents of milk, processing of milk, adulterants and their detection, flow diagram for manufacture of various special milk, types of drying and drying process in milk powder.	K5



## **UNIT I: Composition of Milk**

Milk-definition-general composition of milk- constituents of milk – lipids- proteins- carbohydrates- vitamins and minerals - physical properties of milk – colour- odour- acidity- specific gravity- viscosity and conductivity -Factors affecting the composition of milk – adulterants- preservatives with neutralizer- examples and their detection- estimation of fat-acidity and total solids in milk- Milk Enzymes and their specific function.

## **Unit II: Processing of Milk**

Microbiology of milk - destruction of micro - organisms in milk- physico – chemical changes taking place in milk due to processing – boiling- pasteurization – types of pasteurization – Bottle- Batch and HTST (High Temperature Short Time) – Vacuum pasteurization – Ultra High Temperature Pasteurization.

## **UNIT III: Major Milk Products**

Cream - definition - composition - chemistry of creaming process - gravitational and centrifugal methods of separation of cream - estimation of fat in cream. Butter - definition -composition - theory of churning – desi butter - salted butter- estimation of acidity and moisture content in butter. Ghee - major constituents - common adulterants added to ghee and their detection - rancidity - definition - prevention - antioxidants and synergists - natural and synthetic.

## **UNIT IV: Special Milk**

Standardised milk - definition - merits - reconstituted milk - definition - flow diagram of manufacture - Homogenised milk - flavoured milk - vitaminised milk - toned milk -Incitation milk - Vegetable toned milk - humanized milk -condensed milk – definition- composition and nutritive value.

## **UNIT V: Milk Lipids / Enzymes**

Milk Lipids- Classification-Phospholipids- Lecithin –Occurrence- Composition and Functions – Estimation of Milk Fat – Iodine number- Reichert -Meissl Number- Saponification Number – Milk sugar- Lactose- Physical and Chemical Properties- Significant aspects of lactose in milk and milk products- Estimation of Lactose - Fehling’s solution and Chloramine –T method

### Recommended Text

1. K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, first edition, 2006.
2. K. S. Rangappa and K.T. Acharya, Indian Dairy Products, Asia Publishing House New Delhi, 1974.
3. Text book of dairy chemistry, M.P. Mathur, D. Datta Roy, P. Dinakar, Indian Council of Agricultural Research, 1<sup>st</sup> edition, 2008.
4. A Text book of dairy chemistry, Saurav Singh, Daya Publishing house, 1<sup>st</sup> edition, 2013.
5. Text book of dairy chemistry, P. L. Choudhary, Bio-Green book publishers, 2021.

### Reference Books

1. Robert Jenness and S. Patom, Principles of Dairy Chemistry, S.Wiley, New York, 2005.
2. F. P. Wond, Fundamentals of Dairy Chemistry, Springer, Singapore, 2006.
3. Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi, 1980.
4. P. F. Foxand, P. L. H. Mcsweeney, Dairy Chemistry and Biochemistry, Springer, Second edition, 2016.
5. Dairy chemistry and biochemistry, P. F. Fox, T. Uniacke-Lowe, P.L.H. McSweeney, J.A. OMahony, Springer, Second edition, 2015.

### Level of Correlation between PO's, PSO's and CO's

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	1	1	3	2	3	2	3	3	3
CO-2	3	2	2	3	2	3	2	3	2	3
CO-3	3	2	2	3	2	3	2	3	2	3
CO-4	3	2	2	3	2	2	2	3	2	3
CO-5	3	1	1	3	2	3	2	3	3	3
Ave.	3	1.6	1.6	3	2	3	2	3	2.4	3

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3