


**B.Sc., Chemistry Syllabus  
(TANSCHE)**

**2023 – 2024**

**PG & Research Department of Chemistry  
Bishop Heber College (Autonomous)  
Tiruchirappalli -620 017**

## **Contents**

- i. Introduction
  - ii. PO and PSO Description
  - iii. UG – Template
  - iv. Methods of Evaluation & Methods of Assessment
  - v. Semester Index.
  - vi. Subjects – Core, Elective, Nonmajor, Skill Enhanced, Ability Enhanced, Extension Activity, Environment, Professional Competency
    - 1) Course Lesson Box
    - 2) Course Objectives
    - 3) Units
    - 4) Learning Outcome
    - 5) Reference and Text Books
    - 6) Web Sources
    - 7) PO & PSO Mapping tables
- 

## 1. INTRODUCTION

### **B.Sc. Chemistry: Programme Outcome, Programme Specific Outcome and Course Outcome**

Chemistry is the study of composition and transformation of matter. A science that is central to energy production, health care, new material development for electronics and other applied fields and environmental protection. Bachelor's degree in Chemistry is the culmination of in-depth knowledge of Inorganic, Organic and Physical chemistry and specialized courses such as Pharmaceutical Chemistry, spectroscopy, Nanoscience, Forensic Science, Cosmetics & Personal Grooming, Food chemistry, Dairy Chemistry and so on. Thus, this programme helps learners in building a solid foundation for higher studies in Chemistry. The hands on experience the students gain in Practicals enable them to apply theory to solve problems in everyday life, think critically and innovatively. An aptitude for research is instilled through project work and industrial internship.

Students completing this programme will be able to present the concepts of Chemistry clearly and precisely. They can find solutions to pressing problems that mankind is facing today. They can interpret data and present their findings to both scientific community and laymen and have ability to work as a team and evolve to become an entrepreneur

Completion of this programme will also enable the learners to join teaching profession, conducting research in Industry and Government run research labs. A B.Sc chemistry student has the option to diversify to other branches such as Biochemistry, Biotechnology, Forensic Science etc... They have employability opportunities in public and private sector jobs in energy, pharmaceutical, Food, cosmetic industries etc...

**LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME**

<b>Programme:</b>	<b>B.Sc. Chemistry</b>
<b>Programme Code:</b>	
<b>Duration:</b>	<b>3 Years (UG)</b>
<b>Programme Outcomes:</b>	<p><b>1: Disciplinary knowledge:</b> Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study</p> <p><b>2: Communication Skills:</b> Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.</p> <p><b>3: Critical thinking:</b> Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.</p> <p><b>4: Problem solving: Capacity</b> to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.</p> <p><b>5: Analytical reasoning:</b> Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.</p> <p><b>6: Research-related skills:</b> A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation</p> <p><b>7: Cooperation/Team work:</b> Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team</p> <p><b>PO8: Scientific reasoning:</b> Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.</p> <p><b>PO9: Reflective thinking:</b> Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.</p> <p><b>PO10 Information/digital literacy:</b> Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.</p> <p><b>PO 11 Self-directed learning:</b> Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.</p> <p><b>PO 12 Multicultural competence:</b> Possess knowledge of the values and beliefs of</p>

	<p>multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.</p> <p><b>PO 13: Moral and ethical awareness/reasoning:</b> Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.</p> <p><b>PO 14: Leadership readiness/qualities:</b> Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.</p> <p><b>PO 15: Lifelong learning:</b> Ability to acquire knowledge and skills, including „learning how to learn“, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.</p>
<p><b>Programme Specific Outcomes:</b></p>	<p>On successful completion of Bachelor of Physics with Computer Applications programme, the student should be able to:</p> <p><b>PSO1: Disciplinary Knowledge:</b> Understand the fundamental principles, concepts, and theories related to physics and computer science. Also, exhibit proficiency in performing experiments in the laboratory.</p> <p><b>PSO2: Critical Thinking:</b> Analyse complex problems, evaluate information, synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions and communicate effectively</p> <p><b>PSO3: Problem Solving:</b> Employ theoretical concepts and critical reasoning ability with physical, mathematical and technical skills to solve problems, acquire data, analyze their physical significance and explore new design possibilities.</p> <p><b>PSO4: Analytical &amp; Scientific Reasoning:</b> Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models.</p> <p><b>PSO5: Research related skills:</b> Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects.</p> <p><b>PSO6: Self-directed &amp; Lifelong Learning:</b> Set learning goals, manage their own learning, reflect on their learning, adapt to new contexts, seek out new knowledge, collaborate with others and to continuously improve their skills and knowledge, through ongoing learning and professional development, and contribute to the growth and development of their field.</p>

<b>PO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>
<b>PO1</b>	✓					
<b>PO2</b>		✓				
<b>PO3</b>			✓			
<b>PO4</b>				✓		
<b>PO5</b>					✓	
<b>PO6</b>						✓

## **2. Highlights of the Revamped Curriculum:**

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising statistical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced statistical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Statistics based problem solving skills are included as mandatory components in the 'Training for Competitive Examinations' course at the final semester, a first of its kind.
- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Statistical Quality Control course is included to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest DBMS and Computer software for Analytics.

**Value additions in the Revamped Curriculum:**

<b>Semester</b>	<b>Newly introduced Components</b>	<b>Outcome / Benefits</b>
<b>I</b>	<b>Foundation Course</b> To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract Statistics and simulating mathematical concepts to real world.	<ul style="list-style-type: none"> <li>• Instil confidence among students</li> <li>• Create interest for the subject</li> </ul>
<b>I, II, III, IV</b>	<b>Skill Enhancement papers</b> (Discipline centric / Generic / Entrepreneurial)	<ul style="list-style-type: none"> <li>• Industry ready graduates</li> <li>• Skilled human resource</li> <li>• Students are equipped with essential skills to make them employable</li> </ul>
		<ul style="list-style-type: none"> <li>• Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects</li> </ul>
		<ul style="list-style-type: none"> <li>• Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc.</li> </ul>
		<ul style="list-style-type: none"> <li>• Entrepreneurial skill training will provide an opportunity for independent livelihood</li> <li>• Generates self – employment</li> <li>• Create small scale entrepreneurs</li> <li>• Training to girls leads to women empowerment</li> </ul>
		<ul style="list-style-type: none"> <li>• Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools</li> </ul>
<b>III, IV, V &amp; VI</b>	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	<ul style="list-style-type: none"> <li>• Strengthening the domain knowledge</li> <li>• Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature</li> <li>• Students are exposed to Latest topics on Computer Science / IT, that require strong statistical background</li> </ul>



		<ul style="list-style-type: none"> <li>Emerging topics in higher education / industry / communication network / health sector etc. are introduced with hands-on-training, facilitates designing of statistical models in the respective sectors</li> </ul>
<b>IV</b>	DBMS and Programming skill, Biostatistics, Statistical Quality Control, Official Statistics, Operations Research	<ul style="list-style-type: none"> <li>Exposure to industry moulds students into solution providers</li> <li>Generates Industry ready graduates</li> <li>Employment opportunities enhanced</li> </ul>
<b>II year Vacation activity</b>	Internship / Industrial Training	<ul style="list-style-type: none"> <li>Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.</li> </ul>
<b>V Semester</b>	Project with Viva – voce	<ul style="list-style-type: none"> <li>Self-learning is enhanced</li> <li>Application of the concept to real situation is conceived resulting in tangible outcome</li> </ul>
<b>VI Semester</b>	Introduction of Professional Competency component	<ul style="list-style-type: none"> <li>Curriculum design accommodates all category of learners; ‘Statistics for Advanced Explain’ component will comprise of advanced topics in Statistics and allied fields, for those in the peer group / aspiring researchers;</li> <li>‘Training for Competitive Examinations’ –caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, ISS, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.</li> </ul>
<b>Extra Credits: For Advanced Learners / Honors degree</b>		<ul style="list-style-type: none"> <li>To cater to the needs of peer learners / research aspirants</li> </ul>

<b>Skills acquired from the Courses</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
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**Consolidated Semester wise and Component wise Credit distribution**

<b>Parts</b>	<b>Sem I</b>	<b>Sem II</b>	<b>Sem III</b>	<b>Sem IV</b>	<b>Sem V</b>	<b>Sem VI</b>	<b>Total Credits</b>
<b>Part I</b>	3	3	3	3	-	-	12
<b>Part II</b>	3	3	3	3	-	-	12
<b>Part III</b>	11	11	11	11	22	18	84
<b>Part IV</b>	6	6	5	8	4	2	31
<b>Part V</b>	-	-	-	-	-	1	1
<b>Total</b>	23	23	22	25	26	21	<b>140</b>

**\*Part I, II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree**

<b>Methods of Evaluation</b>		
<b>Internal Evaluation</b>	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
<b>External Evaluation</b>	End Semester Examination	75 Marks
	Total	100 Marks
<b>Methods of Assessment</b>		
<b>Recall (K1)</b>	Simple definitions, MCQ, Recall steps, Concept definitions	
<b>Understand/ Comprehend (K2)</b>	MCQ, True/False, Short essays, Concept explanations, Short summary or overview	
<b>Application (K3)</b>	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain	
<b>Analyze (K4)</b>	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge	
<b>Evaluate (K5)</b>	Longer essay/ Evaluation essay, Critique or justify with pros and cons	
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations	

**Syllabus – B. Sc., Chemistry (2023-2026)**  
**SEMESTER-WISE DISTRIBUTION OF HOURS AND CREDITS**

Se m.	Part	Course	Course Code	Course Title	Hrs. /We ek	Cred it	Marks		
							CIA	ESA	Total
I	I	Language I	U23TM1L1	பொதுத்தமிழ் I	6	3	25	75	100
	II	English I	U23EG1L1	Prose and Short Stories	6	3	25	75	100
	III	CC1-Core Theory - 1	U23CH101	General Chemistry-1	5	5	25	75	100
		CC2-Core Practical – I	U23CH1P1	Quantitative Inorganic estimation (Titrimetry) and Inorganic Preparation	3	3	40	60	100
		Allied -I Maths/Allied Zoology	U23CHMY1	Algebra and Calculus	6	5	25	75	100
			U23CHZY1	Biology of Invertebrates and Chordates	3	3	25	75	100*
	Allied Practical – 1	U23CHZP1	Allied Zoology Practical -I	3	2	40	60	100	
	IV	Foundation Course-FC	U23CH1N1	Basics of Chemistry	2	2	CIA 100		
		SEC-1 NMEC – I	U23CH1E1	Food Chemistry	2	2	25	75	100
			U23CH1EA	Role of Chemistry in Daily life					
					<b>30</b>	<b>23</b>			
II	I	Language	U23TM2L2	பொதுத்தமிழ் II	6	3	25	75	100
	II	English	U23EG2L2	Poetry and Shakespere	6	3	25	75	100
	III	CC3-Core Theory - II	U23CH202	General Chemistry-II	5	5	25	75	100
		CC4-Core Practical – II	U23CH2P2	Qualitative Organic Analysis and Preparation of Organic Compounds	3	3	40	60	100
		Allied – 2 Maths/Allied Zoology	U23CHMY2	Differential Equations and Laplace Transforms	6	5	25	75	100
			U23CHZY2	Human Physiology and Economic Zoology	3	3	25	75	100*
	Allied Practical – 2	U23CHZP2	Allied Zoology Practical - II	3	2	40	60	100	
	IV	SEC – 2 (NMEC – II)	U23CH2E2	Dairy Chemistry	2	2	25	75	100
		SEC – 3 (SBEC-I)	U23CH2S3	Cosmetics and Personal Care Products	2	2	25	75	100
						<b>30</b>	<b>23</b>		
III	I	Language	U23TM3L3	பொதுத்தமிழ் III	6	3	25	75	100
	II	English	U23EG3L3	One Act Plays and Abridged Novel	6	3	25	75	100
	III	CC5-Core Theory - III	U23CH303	General Chemistry-III	5	5	25	75	100
		CC6-Core Practical – III	U23CH3P3	Qualitative Inorganic Analysis	3	3	40	60	100
		Allied Theory -3	U23PH3Y3	<b>Allied Physics-I</b>	3	3	25	75	100
		Allied Practical – 3	U23PHYP3	Allied Physics Practical-I	3	2	40	60	100
	IV	SEC – 4	U23CH3S4	Entrepreneurial Skill in Chemistry	1	1	CIA 100		
		SEC – 5 (SBEC -II)	U23CH3S5	Pesticide Chemistry	2	2	25	75	100
		EVS	U23EST41	Environmental Studies	1*	-	-	-	-
						<b>30</b>	<b>22</b>		
IV	I	Language	U23TM4L4	பொதுத்தமிழ் IV	6	3	25	75	100
	II	English	U23EG4L4	Language through Literature.	6	3	25	75	100
	III	CC7-Core Theory - IV	U23CH404	General Chemistry-IV	5	5	25	75	100
		CC8-Core Practical – IV	U23CH4P4	Physical Chemistry Practical-I	3	3	40	60	100
		Allied - 4	U23PH4Y4	<b>Allied Physics-II</b>	3	3	25	75	100
	Allied Practical -3	U23PHYP4	Allied Physics Practical -II	2	2	40	60	100	
	IV	SEC – 6	U23CH4S6	Life Skills	2	2	CIA 100		
		SEC – 7 C2C	U23CH4S7	Water Quality Assessment and Management.	2	2	CIA 100		
		EVS	U23EST41	Environmental Studies	1	2	25	75	100
					<b>30</b>	<b>25</b>			

V	III	CC9-Core Theory - V	U23CH505	Organic Chemistry-I	5	4	25	75	100	
		CC10-Core Theory - VI	U23CH506	Inorganic Chemistry-I	5	4	25	75	100	
		CC11-Core Theory - VII	U23CH507	Physical Chemistry-I	6	4	25	75	100	
		CC12-Core Project with Viva-Voce	U23CH5PJ	In-house Group Project	4	4	40	60	100	
		Elective - 1	U23CH5:A	Biochemistry	4	3	25	75	100	
		Elective - 2	U23CH5:B	Industrial Chemistry	4	3	25	75	100	
	IV	VLO	U23VLO51/ U23VLO52	Abundant Life. / Human Values	2	2	CIA 100			
		Summer Internship/ Industrial Training	U23CH511	Summer Internship/ Industrial Training	-	2	CIA 100			
				<b>30</b>	<b>26</b>					
VI	III	CC13-Core Theory - VIII	U23CH608	Organic Chemistry-II	6	4	25	75	100	
		CC14-Core Theory - IX	U23CH609	Inorganic Chemistry-II	6	4	25	75	100	
		CC16-Core Practical - V	U23CH6P5	Physical Chemistry Practical-II	3	2	40	60	100	
		CC17-Core Practical -VI	U23CH6P6	<b>Applications of Computer in Chemistry</b>	3	2	40	60	100	
		Elective - 3	U23CH6:A	<b>Pharmaceutical Chemistry</b>	5	3	25	75	100	
		Elective - 4	U23CH6:B	Physical Chemistry-II	5	3	25	75	100	
	U23CH6:C		Polymer Chemistry							
	IV	SEC-8- Professional Competency Skill	U23CH6G1	Seminar Presentation	2	2	CIA 100			
	V	Extension Activities	U23ETA61	Extension Activities	-	1	-	-		
					<b>30</b>	<b>21</b>				

**Total Courses: 49    Total Hours : 180    Total Credits: 140**

<b>Title of the Course</b>	<b>GENERAL CHEMISTRY-I</b>						
<b>Paper No.</b>	<b>Core I</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	5	<b>Course Code</b>	U23CH101
		<b>Semester</b>	<b>I</b>				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	4	1	-		5		
<b>Prerequisites</b>	Higher secondary chemistry						
<b>Objectives of the course</b>	<p>The course aims at giving an overall view of the</p> <ul style="list-style-type: none"> <li>• various atomic models and atomic structure</li> <li>• wave particle duality of matter</li> <li>• periodic table, periodicity in properties and its application in explaining the chemical behaviour</li> <li>• nature of chemical bonding, and</li> <li>• fundamental concepts of organic chemistry</li> </ul>						
<b>Course Outline</b>	<b>UNIT I</b>						
	<b>Atomic structure and Periodic trends</b>						
	<p>History of atom (J.J.Thomson, Rutherford); Moseley's Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck's quantum theory - Bohr's model of atom; The Franck-Hertz Experiment; Interpretation of H-spectrum; Photoelectric effect, Compton effect; Dual nature of Matter- De- Broglie wavelength-Davisson and Germer experiment Heisenberg's Uncertainty Principle; Electronic Configuration of Atoms and ions- Hund's rule, Pauli's exclusion principle and Aufbau principle;</p> <p>Numerical problems involving the core concepts.</p>						
<b>Unit II</b>							
<b>Introduction to Quantum mechanics</b>							
<p>Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wavefunctions, Formulation of Schrodinger wave equation - Probability and electron density-visualizing the orbitals -Probability density and significance of <math>\Psi</math> and <math>\Psi^2</math>.</p>							
<b>Modern Periodic Table</b>							
<p><b>Cause of periodicity</b>; Features of the periodic table; classification of elements - Periodic trends for atomic size- Atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electronegativity-electronegativity scales, applications of electronegativity.</p> <p>Problems involving the core concepts</p>							

### **UNIT-III: Structure and bonding - I**

#### **Ionic bond**

Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle – lattice energies, Madelung constant; relative effect of lattice energy and solvation energy; Ion polarisation – polarising power and polarizability; Fajans' rules - effects of polarisation on properties of compounds; problems involving the core concepts.

#### **Covalent bond**

Shapes of orbitals, overlap of orbitals –  $\sigma$  and  $\Pi$  bonds; directed valency - hybridization; VSEPR theory - shapes of molecules of the type  $AB_2$ ,  $AB_3$ ,  $AB_4$ ,  $AB_5$ ,  $AB_6$  and  $AB_7$

Partial ionic character of covalent bond-dipole moment, application to molecules of the type  $A_2$ ,  $AB$ ,  $AB_2$ ,  $AB_3$ ,  $AB_4$ ; percentage ionic character- numerical problems based on calculation of percentage ionic character.

### **UNIT-IV: Structure and bonding - II**

VB theory – application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species –  $CO_2$ ,  $NO_2$ ,  $CO_3^{2-}$ ,  $NO_3^-$ ; limitations of VBT; MO theory - bonding, antibonding and nonbonding orbitals, bond order; MO diagrams of  $H_2$ ,  $C_2$ ,  $O_2$ ,  $O_2^+$ ,  $O_2^-$ ,  $O_2^{2-}$ ,  $N_2$ ,  $NO$ ,  $HF$ ,  $CO$ ; magnetic characteristics, comparison of VB and MO theories.

Coordinate bond: Definition, Formation of  $BF_3$ ,  $NH_3$ ,  $NH_4^+$ ,  $H_3O^+$  properties

Metallic bond-electron sea model, VB model; Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor – types, applications of semiconductors

Weak Chemical Forces - Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces; Hydrogen bonding – Types, special properties of water, ice, stability of DNA; Effects of chemical force, melting and boilingpoints.

### **UNIT-V:**

#### **Basic concepts in Organic Chemistry and Electronic effects**

Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction intermediates – carbanions, carbocations, carbenes, arynes and nitrynes.

Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductomeric and electromeric effects.

Resonance – resonance energy, conditions for resonance - acidity of phenols, basicity of aromatic amines, stability of carbonium ions, carbanions and free

	<p>radicals, reactivity of vinyl chloride, dipole moment of vinyl chloride and nitrobenzene, bond lengths; steric inhibition to resonance.</p> <p>Hyperconjugation - stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitromethane</p> <p>Types of organic reactions- addition, substitution, elimination and rearrangements</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)</p>
Skills acquired from this course	<p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. Madan, R. D. and Sathya Prakash, <i>Modern Inorganic Chemistry</i>, 2<sup>nd</sup>ed.; S. Chand and Company: New Delhi, 2003.</li> <li>2. Rao, C.N. R. <i>University General Chemistry</i>, Macmillan Publication: New Delhi, 2000.</li> <li>3. Puri, B. R. and Sharma, L. R. <i>Principles of Physical Chemistry</i>, 38<sup>th</sup>ed.; Vishal Publishing Company: Jalandhar, 2002.</li> <li>4. Bruce, P. Y. and Prasad K. J. R. <i>Essential Organic Chemistry</i>, Pearson Education: New Delhi, 2008.</li> <li>5. Dash UN, Dharmarha OP, Soni P.L. <i>Textbook of Physical Chemistry</i>, Sultan Chand &amp; Sons: New Delhi, 2016</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Maron, S. H. and Prutton C. P. <i>Principles of Physical Chemistry</i>, 4<sup>th</sup>ed.; The Macmillan Company: New York, 1972.</li> <li>2. Lee, J. D. <i>Concise Inorganic Chemistry</i>, 4th ed.; ELBS William Heinemann: London, 1991.</li> <li>3. Gurudeep Raj, <i>Advanced Inorganic Chemistry</i>, 26<sup>th</sup>ed.; Goel Publishing House: Meerut, 2001.</li> <li>4. Atkins, P.W. &amp; Paula, J. <i>Physical Chemistry</i>, 10th ed.; Oxford University Press: New York, 2014.</li> <li>5. Huheey, J. E. <i>Inorganic Chemistry: Principles of Structure and Reactivity</i>, 4<sup>th</sup> ed.; Addison, Wesley Publishing Company: India, 1993.</li> </ol>
<b>Website and e-learning source</b>	<ol style="list-style-type: none"> <li>1) <a href="https://onlinecourses.nptel.ac.in">https://onlinecourses.nptel.ac.in</a></li> <li>2) <a href="http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm">http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm</a></li> <li>3) <a href="http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html">http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html</a></li> <li>4) <a href="https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding">https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding</a></li> <li>5) <a href="https://www.chemtube3d.com/">https://www.chemtube3d.com/</a></li> </ol>

**Course Learning Outcomes (for Mapping with POs and PSOs)****On completion of the course the students should be able to**

- CO1:** explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.
- CO2:** classify the elements in the periodic table, types of bonds, reaction intermediates electronic effects in organic compounds, types of reagents.
- CO3:** apply the theories of atomic structure, bonding, to calculate energy of a spectral transition,  $\Delta x$ ,  $\Delta p$  electronegativity, percentage ionic character and bond order.
- CO4:** evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects
- CO5:** construct MO diagrams, predict trends in periodic properties, assess the properties of elements, and explain hybridization in molecules, nature of H – bonding and organic reaction mechanisms.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

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



<b>Title of the Course</b>	<b>Quantitative Inorganic Estimation (Titrimetry) and Inorganic Preparations</b>						
<b>Paper No.</b>	<b>Core Practical I</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	U23CH1P1
		<b>Semester</b>	I				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	-	-	3		3		
<b>Prerequisites</b>	Higher secondary chemistry						
<b>Objectives of the course</b>	<p>This course aims at providing knowledge on</p> <ul style="list-style-type: none"> <li>• laboratory safety</li> <li>• handling glasswares</li> <li>• Quantitative estimation</li> <li>• preparation of inorganic compounds</li> </ul>						
<b>Course Outline</b>	<b>Unit I</b>						
	<p><b>Chemical Laboratory Safety in Academic Institutions</b></p> <p>Introduction - importance of safety education for students, common laboratory hazards, assessment and minimization of the risk of the hazards, prepare for emergencies from uncontrolled hazards; concept of MSDS; importance and care of PPE; proper use and operation of chemical hoods and ventilation system; fire extinguishers-types and uses of fire extinguishers, demonstration of operation; chemical waste and safe disposal.</p> <p><b>Common Apparatus Used in Quantitative Estimation (Volumetric)</b></p> <p>Description and use of burette, pipette, standard flask, measuring cylinder, conical flask, beaker, funnel, dropper, clamp, stand, wash bottle, watch glass, wire gauge and tripod stand.</p> <p><b>Principle of Quantitative Estimation (Volumetric)</b></p> <p>Equivalent weight of an acid, base, salt, reducing agent, oxidizing agent; concept of mole, molality, molarity, normality; primary and secondary standards, preparation of standard solutions; theories of acid-base, redox, complexometric, iodimetric and iodometric titrations; indicators – types, theory of acid-base, redox, metal ion and adsorption indicators, choice of indicators.</p>						
<b>Unit II</b>							
<p><b>Quantitative Estimation(Volumetric)</b></p> <p>Preparation of standard solution, dilution from stock solution</p> <p><b>Permanganometry</b></p> <p>Estimation of sodium oxalate using standard ferrous ammonium sulphate</p>							

	<p><b>Dichrometry</b>  Estimation of ferric alum using standard dichromate (external indicator)  Estimation of ferric alum using standard dichromate (internal indicator)</p> <p><b>Iodometry</b>  Estimation of copper in copper sulphate using standard dichromate</p> <p><b>Argentimetry</b>  Estimation of chloride in barium chloride using standard sodium chloride/  Estimation of chloride in sodium chloride (Volhard's method)</p>
	<p><b>Unit III</b>  <b>Complexometry</b>  Estimation of hardness of water using EDTA</p> <p><b>Estimations</b>  Estimation of iron in iron tablets  Estimation of ascorbic acid.</p> <p><b>Preparation of Inorganic compounds-</b>  Potash alum  Tetraammine copper (II) sulphate  Hexamminecobalt (III) chloride  Mohr's Salt</p>
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. <i>Basic Principles of Practical Chemistry</i>, 2<sup>nd</sup> ed.; Sultan Chand &amp; Sons: New Delhi, 1997.</li> <li>2. Nad, A. K.; Mahapatra, B.; Ghoshal, A.; <i>An advanced course in Practical Chemistry</i>, 3<sup>rd</sup> ed.; New Central Book Agency: Kolkata, 2007.</li> </ol>
Reference Books	1. Mendham, J.; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.; <i>Vogel's Textbook of Quantitative Chemical Analysis</i> , 6 <sup>th</sup> ed.; Pearson Education Ltd: New Delhi, 2000.
Website and e-learning source	<p><b>Web References:</b></p> <ol style="list-style-type: none"> <li>1) <a href="http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis">http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis</a></li> <li>2) <a href="https://chemdictionary.org/titration-indicator/">https://chemdictionary.org/titration-indicator/</a></li> </ol>
<p><b>Course Learning Outcomes (for Mapping with POs and PSOs)</b></p> <p><b>On successful completion of the course the students should be able to</b></p> <p><b>CO1:</b> explain the basic principles involved in titrimetric analysis and inorganic preparations.</p> <p><b>CO2:</b> compare the methodologies of different titrimetric analysis.</p> <p><b>CO3:</b> 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.</p> <p><b>CO4:</b> assess the yield of different inorganic preparations and identify the end point of various titrations.</p>	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M

**CO-PO Mapping (Course Articulation Matrix)**

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

<b>Title of the Course</b>	Basics of Chemistry						
<b>Paper No.</b>	FC						
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>2</b>	<b>Course Code</b>	U23CH1N1
		<b>Semester</b>	<b>I</b>				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	2		-		2		
<b>Pre requisites</b>	Higher secondary chemistry						
<b>Objectives of the course</b>	<p>To provide an introduction to basic concepts in inorganic, organic, physical and analytical chemistry to under graduate students.</p> <ul style="list-style-type: none"> <li>•</li> </ul>						
<b>CourseOutline</b>	<p><b>UNIT- 1</b>  <b>Good Laboratory Practices</b>-Safety in chemistry lab, handling hazardous chemicals like bromine, sodium metal, concentrated acids, bases etc., Introduction to laboratory glass wares, pipette, burette, standard flask, separating funnel, funnel, Cleaning of Glass apparatus.Primary and secondary standard substances,Preparation of standard solution, quantitative dilution methods, Application of qualitative analysis.Significant figures- Precision, Accuracy, Error and its types.</p>						
	<p><b>UNIT- 2</b>  Mole concept, Equivalent weight and molecular weight calculations, Molar volume, oxidation, reduction, oxidation number and valency, variable valency, calculation of oxidation state of ions in inorganic compounds. Concentration terms-normality, molarity, molality, mole fraction and parts per million, parts per billion.</p>						
	<p><b>UNIT-3</b>  Modern Periodic table,Grouping of elements into different blocks, Quantum numbers, Atomic orbitals, shapes of s, p and d orbitals, Pauli's exclusion principle, Hund's rule of maximum multiplicity, Aufbau's principle, electronic configuration of elements.Atomic number, Atomic Mass, Molecular mass and Formula Mass, Writing chemical formulae of inorganic compounds,Types of chemical bonds with suitable examples.</p>						

	<p><b>UNIT- 4</b>  Importance of organic chemistry, general classification of organic compounds, Homologous series, functional groups, IUPAC nomenclature of organic compounds (Alkanes, alkenes, alkynes, alcohols, aldehydes, ketones, ethers, acids, esters, amines). Modern concept of bonding in organic molecules, <math>sp^3</math>, <math>sp^2</math> and <math>sp</math> hybridization in carbon (methane, ethane, ethene, benzene and ethyne as examples).</p>
	<p><b>UNIT- 5</b>  Bond fission-homolytic fission and heterolytic fission, formation of reaction intermediates (carbocations, carbanions and free radicals), stability of reaction intermediates. Nucleophiles, electrophiles and free radicals. Types of organic reactions with one example for each-Substitution reaction, Electrophilic substitution, Nucleophilic substitution, Addition reactions, Elimination reaction, Rearrangement reaction.</p>
Recommended Text Book	<p>1. A text book of Organic Chemistry, Arun Bahl, B.S. Bhal  2. Vogel's textbook of Quantitative Chemical Analysis, Pearson</p>
Reference Books	<p>1. Principles of physical chemistry, B. R. Puri, L.R. Sharma, Madan S. Pathania  2. Principles of Inorganic Chemistry, B.R. Puri, L.R. Sharma, K.C. Kalia</p>

<b>Title of the Course</b>	<b>FOOD CHEMISTRY</b>						
<b>Paper No.</b>	<b>SEC –I</b>						
<b>Category</b>	<b>NME</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>2</b>	<b>Course Code</b>	<b>U23CH1E1</b>
		<b>Semester</b>	<b>I</b>				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	2	-	-		2		
<b>Prerequisites</b>	Higher secondary Chemistry						
<b>Objectives of the course</b>	<p>This course aims at giving an overall view of the</p> <ul style="list-style-type: none"> <li>● Types of food</li> <li>● Food adulteration and poisons</li> <li>● Food additives and preservation</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT I</b></p> <p><b>Food Adulteration</b> 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.</p>						
	<p><b>Unit-II</b></p> <p><b>Food Poison</b> Food poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion) -Chemical poisons - First aid for poison consumed victims.</p>						
	<p><b>UNIT-III</b></p> <p><b>Food Additives</b> 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.</p>						
	<p><b>UNIT-IV</b></p> <p><b>Beverages</b> Beverages-softdrinks-soda-fruitjuices-alcoholicbeverages-examples. Carbonation-addictionto alcohol– diseases ofliver andsocial problems.</p>						
	<p><b>UNIT-V</b></p> <p><b>Edible Oils</b> 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 heartdiseases-determination of iodine value,RM value,saponification values and their significance.</p>						

<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.</li> <li>2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand &amp; Co. Publishers, second edition, 2006.</li> <li>3. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.</li> <li>4. Food Chemistry, Dr. L. Rakesh Sharma, Evincepub publishing, 2022.</li> <li>5. Food processing and preservation, G. Subbulakshmi, Shobha A Udipi, Padmini S Ghugre, New age international publishers, second edition, 2021.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. H.-D. Belitz, Werner Grosch, Food Chemistry Springer Science &amp; Business Media, 4<sup>th</sup> Edition, 2009.</li> <li>2. M. Swaminathan, Food Science and Experimental Foods, Ganesh and Company, 1979.</li> <li>3. Hasenhuettl, Gerard. L.; Hartel, Richard. W. Food Emulsifiers and their applications Springer New York 2nd ed. 2008.</li> <li>4. Food Chemistry, H.-D. Belitz, W. Grosch, P. Schieberle, Springer, fourth revised and extended edition, 2009.</li> <li>5. Principles of food chemistry, John M. deMan, John W. Finley, W. Jefferey Hurst, Chang Yong Lee, Springer, Fourth edition, 2018.</li> </ol>
<b>Website and</b>	
<b>e-learning source</b>	
<p><b>Course Learning Outcomes (for Mapping with POs and PSOs)</b></p> <p><b>On completion of the course the students should be able to</b></p> <p><b>CO 1:</b> learn about Food adulteration - contamination of Wheat, Rice, Milk, Butter.</p> <p><b>CO 2:</b> get an awareness about food poisons like natural poisons (alkaloids - nephrotoxin) pesticides, DDT, BHC, Malathion</p> <p><b>CO 3:</b> get an exposure on food additives, artificial sweeteners, Saccharin, Cyclamate and Aspartate in the food industries.</p> <p><b>CO 4:</b> acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages examples.</p> <p><b>CO 5:</b> study about fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats –MUFA and PUFA</p>	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

**CO-PO Mapping (Course Articulation Matrix)**

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

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



<b>Title of the Course</b>	<b>ROLE OF CHEMISTRY IN DAILY LIFE</b>						
<b>Paper No.</b>	<b>SEC-I</b>						
<b>Category</b>	<b>NME</b>	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	U23CH1EA
		<b>Semester</b>	I				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	2	-	-		2		
<b>Prerequisites</b>	Higher secondary chemistry						
<b>Objectives of the course</b>	<p>This course aims at providing an overall view of the</p> <ul style="list-style-type: none"> <li>• importance of Chemistry in everyday life</li> <li>• chemistry of building materials and food</li> <li>• chemistry of Drugs and pharmaceuticals</li> </ul>						
<b>Course Outline</b>	<b>UNIT-I</b>						
	General survey of chemicals used in everyday life. Air - components and their importance; photosynthetic reaction, air pollution, green - house effect and the impact on our life style. Water - Sources of water, qualities of potable water, soft and hard water, methods of removal of hardness-water pollution						
	<b>Unit-II</b>						
	Building materials - cement, ceramics, glass and refractories - definition, composition and application only. Plastics - polythene, PVC, bakelite, polyesters, melamine-formaldehyde resins -preparation and uses only.						
	<b>UNIT-III</b>						
Food and Nutrition - Carbohydrates, Proteins, Fats - definition and their importance as food constituents – balanced diet – Calories minerals and vitamins (sources and their physiological importance). Cosmetics – tooth paste, face powder, soaps and detergents, shampoos, nail polish, perfumes - general formulation and preparations - possible hazards of cosmetic use.							
<b>UNIT-IV</b>							
Chemicals in food production – fertilizers - need, natural sources; urea,NPK fertilizers and super phosphate. Fuel – classification - solid, liquid and gaseous; nuclear fuel examples and uses.							
<b>UNIT-V</b>							
Pharmaceutical drugs - analgesics and antipyretics - paracetamol and aspirin. Colour chemicals - pigments and dyes - examples and applications. Explosives - classification and examples.							

<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.</li> <li>2. A textbook of pharmaceutical chemistry by Jayashree Ghosh, S Chand publishing, 2012.</li> <li>3. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.</li> <li>4. B. K. Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014. Introduction to forensic chemistry, Kelly M. Elkins, CRC Press Taylor &amp; Francis Group, 2019.</li> <li>5. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand &amp; Co. Publishers, second edition, 2006.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Randolph. Norris Shreve, Chemical Process Industries, McGraw-Hill, Texas, fourth edition, 1977.</li> <li>2. W.A. Poucher, Joseph A. Brink, Jr. Perfumes, Cosmetics and Soaps, Springer, 2000.</li> <li>3. A.K. De, Environmental Chemistry, New Age International Public Co., 1990.</li> </ol>
<b>Website and e-learning source</b>	
<p><b>Course Learning Outcomes (for Mapping with POs and PSOs)</b></p> <p><b>On completion of the course the students should be able to</b></p> <p><b>CO1:</b> learn about the chemicals used in everyday life as well as air pollution and water pollution.</p> <p><b>CO2:</b> get knowledge on building materials cement, ceramics, glass and plastics, polythene, PVC bakelite, polyesters,</p> <p><b>CO3:</b> acquire information about Food and Nutrition. Carbohydrates, Proteins, Fats Also have an awareness about Cosmetics Tooth pastes, face powder, soaps and detergents.</p> <p><b>CO4:</b> discuss about the fertilizers like urea, NPK fertilizers and super phosphate. Fuel classification solid, liquid and gaseous; nuclear fuel - examples and uses</p> <p><b>CO5:</b> have an idea about the pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin and also about pigments and dyes and its applications.</p>	

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>
<b>CO1</b>	S	S	S	S	S	S	S	M	S	M
<b>CO2</b>	M	S	S	S	M	S	S	M	M	M
<b>CO3</b>	S	S	S	M	S	S	S	M	S	M
<b>CO4</b>	S	S	S	S	S	S	S	M	M	M
<b>CO5</b>	S	M	S	S	S	S	S	M	M	S

**CO-PO Mapping (Course Articulation Matrix)**

<b>CO /PO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to Pos</b>	3.0	3.0	3.0	3.0	3.0

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

Title of the Course	GENERAL CHEMISTRY-II						
Paper No.	Core II						
Category	Core	Year	I	Credits	5	Course Code	U23CH202
		Semester	II				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		
Prerequisites	General Chemistry I						
Objectives of the course	<p>This course aims at providing an overall view of the</p> <ul style="list-style-type: none"> <li>• chemistry of acids, bases and ionic equilibrium</li> <li>• properties of s and p-block elements</li> <li>• chemistry of hydrocarbons</li> <li>• applications of acids and bases</li> <li>• compounds of main block elements and hydrocarbons</li> </ul>						
Course Outline	<p><b>UNIT-I</b></p> <p><b>Acids, bases and Ionic equilibria</b>            Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant; dissociation of poly basic acids, ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degree of dissociation; acid base indicators, theory of acid base indicators – action of phenolphthalein and methyl orange, titration curves - use of acid base indicators; Buffer solutions – types, mechanism of buffer action in acid and basic buffer, Henderson-Hasselbalch equation;            Salt hydrolysis - salts of weak acids and strong bases, weak bases and strong acids, weak acids and weak bases - hydrolysis constant, degree of hydrolysis and relation between hydrolysis constant and degree of hydrolysis;            Solubility product - determination and applications; numerical problems involving the core concepts.</p> <p><b>Unit-II</b></p> <p><b>Chemistry of s - Block Elements</b>            Hydrogen: Position of hydrogen in the periodic table. Alkali metals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Preparation, properties and uses of NaOH, Na<sub>2</sub>CO<sub>3</sub>, KBr, KClO<sub>3</sub> alkaline earth metals. Anomalous behaviour of Be.</p>						

**Chemistry of p- Block Elements (Group 13 & 14)**

preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al. comparison of carbon with silicon. Carbon-di-sulphide – Preparation, properties, structure and uses. Percarbonates, per monocarbonates and per dicarbonates.

**UNIT-III****Chemistry of p- Block Elements (Group 15-18)**

General characteristics of elements of Group 15; chemistry of  $\text{H}_2\text{N-NH}_2$ ,  $\text{NH}_2\text{OH}$ ,  $\text{HN}_3$  and  $\text{HNO}_3$ . Chemistry of  $\text{PH}_3$ ,  $\text{PCl}_3$ ,  $\text{PCl}_5$ ,  $\text{POCl}_3$ ,  $\text{P}_2\text{O}_5$  and oxy acids of phosphorous ( $\text{H}_3\text{PO}_3$  and  $\text{H}_3\text{PO}_4$ ).

General properties of elements of group 16 - Structure and allotropy of elements - chemistry of ozone - Classification and properties of oxides - oxides of sulphur and selenium – Oxy acids of sulphur (Caro's and Marshall's acids).

Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids ( $\text{HF}$ ,  $\text{HCl}$ ,  $\text{HBr}$  and  $\text{HI}$ ), oxides and oxy acids ( $\text{HClO}_4$ ). Inter-halogen compounds ( $\text{ICl}$ ,  $\text{ClF}_3$ ,  $\text{BrF}_5$  and  $\text{IF}_7$ ), pseudo halogens [ $(\text{CN})_2$  and  $(\text{SCN})_2$ ] and basic nature of Iodine.

Noble gases: Position in the periodic table. Preparation, properties and structure of  $\text{XeF}_2$ ,  $\text{XeF}_4$ ,  $\text{XeF}_6$  and  $\text{XeOF}_4$ ; uses of noble gases - clathrate compounds.

**UNIT-IV****Hydrocarbon Chemistry-I**

**Petroproducts:** Fractional distillation of petroleum; cracking, isomerisation, alkylation, reforming and uses

**Alkenes**-Nomenclature, general methods of preparation – Mechanism of  $\beta$ -elimination reactions –  $\text{E}_1$  and  $\text{E}_2$  mechanism - factors influencing – stereochemistry – orientation – Hofmann and Saytzeff rules. Reactions of alkenes – addition reactions – mechanisms – Markownikoff's rule, Kharasch effect, oxidation reactions – hydroxylation, oxidative degradation, epoxidation, ozonolysis; polymerization.

**Alkadienes**

Nomenclature - classification – isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2 and 1, 4 additions; free radical addition to conjugated dienes– Diels–Alder reactions – polymerisation – polybutadiene, polyisoprene (natural rubber), vulcanisation, polychloroprene.

**Alkynes**

Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerisation and isomerisation.

	<p><b>Cycloalkanes:</b> Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations. Conformational analysis of cyclohexane, mono and di substituted cyclohexanes. Geometrical isomerism in cyclohexanes.</p>
	<p><b>UNIT-V</b> <b>Hydrocarbon Chemistry - II</b> <b>Benzene:</b> Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's (4n+2) rule and its applications. Electrophilic substitution reactions - General mechanism of aromatic electrophilic substitution - nitration, sulphonation, halogenation, Friedel-Craft's alkylation and acylation. Mono substituted and disubstituted benzene - Effect of substituent - orientation and reactivity. <b>Polynuclear Aromatic hydrocarbons:</b> Naphthalene - nomenclature, Haworth synthesis; physical properties, reactions - electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel - Crafts acylation &amp; alkylation, preferential substitution at <math>\beta</math> - position - reduction, oxidation - uses. Anthracene - synthesis by Elbs reaction, Diels - Alder reaction and Haworth synthesis; physical properties; reactions - Diels-Alder reaction, preferential substitution at C-9 and C-10; uses.</p>
Extended Professional Component (is a part of internal	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
component only, Not to be included in the external examination question paper)	
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2<sup>nd</sup>ed, S.Chand and Company, New Delhi.</li> <li>2. Sathya Prakash, Tuli G D, Basu S K and Madan R D, (2003), Advanced Inorganic Chemistry, 17<sup>th</sup> ed., S.Chand and Company, New Delhi.</li> <li>3. Bahl B S, Arul Bhal, (2003), Advanced Organic Chemistry, 3<sup>rd</sup> ed., S.Chand and Company, New Delhi.</li> <li>4. Tewari K S, Mehrotra S N and Vishnoi N K, (1998), Text book of Organic Chemistry, 2<sup>nd</sup> ed., Vikas Publishing House, New Delhi.</li> <li>5. Puri B R, Sharma L R, (2002), Principles of Physical Chemistry, 38<sup>th</sup> ed., Vishal Publishing Company, Jalandhar.</li> </ol>

<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Maron S H and Prutton C P, (1972), Principles of Physical Chemistry, 4<sup>th</sup> ed., The Macmillan Company, Newyork.</li> <li>2. Barrow G M, (1992), Physical Chemistry, 5<sup>th</sup> ed., Tata McGraw Hill, New Delhi.</li> <li>3. Lee J D, (1991), Concise Inorganic Chemistry, 4<sup>th</sup>ed., ELBS William Heinemann, London.</li> <li>4. Huheey J E, (1993), Inorganic Chemistry: Principles of Structure and Reactivity, 4<sup>th</sup> ed., Addison Wesley Publishing Company, India.</li> <li>5. Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol – I, 26<sup>th</sup> ed., Goel Publishing House, Meerut.</li> <li>6. Agarwal O P, (1995), Reactions and Reagents in Organic Chemistry, 8<sup>th</sup>ed., Goel Publishing House, Meerut.</li> </ol>
<b>Website and e-learning source</b>	<p> <a href="https://onlinecourses.nptel.ac.in/http://cactus.dixie.edu/sblack/chem1010/lecture_notes/4B.html">https://onlinecourses.nptel.ac.in/http://cactus.dixie.edu/sblack/chem1010/lecture notes/4B.html</a>  <a href="http://www.auburn.edu/~deruija/pdareson.pdf">http://www.auburn.edu/~deruija/pdareson.pdf</a><a href="https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding">https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding</a> </p> <p> <b>MOOC components</b>  <a href="http://nptel.ac.in/courses/104101090/">http://nptel.ac.in/courses/104101090/</a>  Lecture 1: Classification of elements and periodic properties  <a href="http://nptel.ac.in/courses/104101090/">http://nptel.ac.in/courses/104101090/</a> </p>

**Course Learning Outcomes (for Mapping with POs and PSOs)**

**On completion of the course the students should be able to**

- CO1:** explain the concept of acids, bases and ionic equilibria; periodic properties of s and p block elements, preparation and properties of aliphatic and aromatic hydrocarbons
- CO2:** discuss the periodic properties of sand p- block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids
- CO3:** classify hydrocarbons, types of reactions, acids and bases, examine the properties s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons
- CO4:** explain theories of acids, bases and indicators, buffer action and important compounds of s-block elements
- CO5:** assess the application of hard and soft acids indicators, buffers, compounds of s and p-block elements and hydrocarbons

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

**CO-PO Mapping (Course Articulation Matrix)**

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

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



<b>Title of the Course</b>	<b>QUALITATIVE ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS</b>						
<b>Paper No.</b>	<b>Core Practical II</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	U23CH2P2
		<b>Semester</b>	II				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	-	-	3		3		
<b>Prerequisites</b>	General Chemistry II						
<b>Objectives of the course</b>	<p>This course aims at providing knowledge on</p> <ul style="list-style-type: none"> <li>laboratory safety</li> <li>handling glass wares</li> <li>analysis of organic compounds</li> <li>preparation of organic compounds</li> </ul>						
<b>Course Outline</b>	<b>UNIT I</b>						
	<p>Safety rules, symbols and first-aid in chemistry laboratory  Basic ideas about Bunsen burner, its operation and parts of the flame.  Chemistry laboratory glassware –basis information and uses</p>						
<b>Course Outline</b>	<b>Unit II</b>						
	<p><b>Qualitative Organic Analysis</b>  Preliminary examination, detection of special elements - nitrogen, sulphur and halogens  Aromatic and aliphatic nature, Test for saturation and unsaturation, identification of functional groups using solubility tests  Confirmation of functional groups</p> <ul style="list-style-type: none"> <li>monocarboxylic acid, dicarboxylic acid</li> <li>monohydric phenol, polyhydric phenol</li> <li>aldehyde, ketone, ester</li> <li>carbohydrate (reducing and non-reducing sugars)</li> <li>primary, secondary, tertiary amine</li> <li>monoamide, diamide, thioamide</li> <li>anilide, nitro compound</li> <li>Preparation of derivatives for functional groups</li> </ul>						

	<p><b>UNIT III</b></p> <p><b>Preparation of Organic Compounds</b></p> <ol style="list-style-type: none"> <li>i. Nitration - picric acid from Phenol</li> <li>ii. Halogenation - p-bromo acetanilide from acetanilide</li> <li>iii. Oxidation - benzoic acid from Benzaldehyde</li> <li>iv. Microwave assisted reactions in water:       <ol style="list-style-type: none"> <li>v. Methyl benzoate to Benzoic acid</li> <li>vi. Salicylic acid from Methyl Salicylate</li> <li>vii. Rearrangement - Benzil to Benzilic Acid</li> <li>viii. Hydrolysis of benzamide to Benzoic Acid</li> </ol> </li> </ol>
	<p><b>Separation and Purification Techniques (Not for Examination)</b></p> <ol style="list-style-type: none"> <li>1. Purification of organic compounds by crystallization (from water / alcohol) and distillation</li> <li>2. Determination of melting and boiling points of organic compounds.</li> <li>3. <b>Steam distillation</b> - Extraction of essential oil from citrus fruits/eucalyptus leaves.</li> <li>4. <b>Chromatography (any one) (Group experiment)</b> <ol style="list-style-type: none"> <li>(i) Separation of amino acids by Paper Chromatography</li> <li>(ii) Thin Layer Chromatography - mixture of sugars / plant pigments / permanganate dichromate.</li> <li>(iii) Column Chromatography - extraction of carotene, chlorophyll and xanthophyll from leaves / separation of anthracene - anthracene picrate.</li> </ol> </li> <li>5. <b>Electrophoresis</b> – Separation of amino acids and proteins. <b>(Demonstration)</b></li> <li>6. Isolation of casein from milk/Determination of saponification value of oil or fat/Estimation of acetic acid from commercial vinegar. (Any one Group experiment) (4,5&amp; 6–not for ESE)</li> </ol>
<p><b>Reference Books</b></p>	<ol style="list-style-type: none"> <li>1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. <i>Basic Principles of Practical Chemistry</i>, 2<sup>nd</sup> ed.; Sultan Chand: New Delhi, 2012.</li> <li>2. Manna, A.K. <i>Practical Organic Chemistry</i>, Books and Allied: India, 2018.</li> <li>3. Gurtu, J. N; Kapoor, R. <i>Advanced Experimental Chemistry (Organic)</i>, Sultan Chand: New Delhi, 1987.</li> <li>4. Furniss, B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R. <i>Vogel's Textbook of Practical Organic Chemistry</i>, 5<sup>th</sup> ed.; Pearson: India, 1989.</li> </ol>

<b>Website and e-learning source</b>	<a href="https://www.vlab.co.in/broad-area-chemical-sciences">https://www.vlab.co.in/broad-area-chemical-sciences</a>
<b>Course Learning Outcomes (for Mapping with POs and PSOs)</b>	
<b>On completion of the course the students should be able to</b>	
<b>CO1:</b> observe the physical state, odour, colour and solubility of the given organic compound.	
<b>CO2:</b> identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.	
<b>CO3:</b> compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non-reducing sugars and explain the reactions behind it.	
<b>CO4:</b> exhibit a solid derivative with respect to the identified functional group.	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
<b>CO1</b>	S	S	S	S	S	S	S	M	S	M
<b>CO2</b>	M	S	S	S	M	S	S	M	M	M
<b>CO3</b>	S	S	S	M	S	S	S	M	S	M
<b>CO4</b>	S	S	S	S	S	S	S	M	M	M

#### CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>Weightage</b>	12	12	12	12	12
<b>Weighted percentage of Course Contribution to Pos</b>	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

Title of the Course	DAIRY CHEMISTRY						
Paper No.	SEC- II						
Category	NME	Year	I	Credits	2	Course Code	U23CH2E2
		Semester	II				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	-	-		2		
Prerequisites	Higher secondary chemistry						
Objectives of the course	<p>This course aims at providing an overall view of the</p> <ul style="list-style-type: none"> <li>• chemistry of milk and milk products</li> <li>• processing of milk</li> <li>• preservation and formation of milk products.</li> </ul>						
Course Outline	<b>UNIT I</b> <b>Composition of Milk</b> 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.						
	<b>Unit II</b> <b>Processing of Milk</b> 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.						
	<b>UNIT III</b> <b>Major Milk Products</b> 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.						
	<b>UNIT IV:</b> <b>Special Milk</b> 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.
	<p><b>UNIT V</b></p> <p><b>Fermented and other Milk Products</b></p> <p>Fermented milk products – fermentation of milk - definition, conditions, cultured milk - definition of culture - example, conditions - cultured cream, butter milk - Bulgarian milk - acidophilous milk – Yoheer Indigeneous products- khoa and chhena definition - Ice cream -definition-percentage composition-types-ingredients-manufacture of ice-cream, stabilizers - emulsifiersandtheirrole-milkpowder-definition-needformakingmilkpowder-dryingprocess-types of drying.</p>
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, first edition, 2006.</li> <li>2. K. S. Rangappa and K.T. Acharya, Indian Dairy Products, Asia Publishing House New Delhi, 1974.</li> <li>3. Text book of dairy chemistry, M.P. Mathur, D. Datta Roy, P. Dinakar, Indian Council of Agricultural Research, 1 st edition, 2008.</li> <li>4. A Text book of dairy chemistry, Saurav Singh, Daya Publishing house, 1 st edition, 2013.</li> <li>5. Text book of dairy chemistry, P. L. Choudhary, Bio-Green book publishers, 2021.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Robert Jenness and S. Patom, Principles of Dairy Chemistry, S.Wiley, New York, 2005.</li> <li>2. F.P.Wond, Fundamentals of Dairy Chemistry, Springer, Singapore, 2006.</li> <li>3. Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi, 1980.</li> <li>4. P.F.Fox and P.L.H. Mcsweeney, Dairy Chemistry and Biochemistry, Springer, Second edition, 2016.</li> <li>5. Dairy chemistry and biochemistry, P. F. Fox, T. Uniacke-Lowe, P.L.H. McSweeney, J.A. OMahony, Springer, Second edition, 2015.</li> </ol>
<b>Website and e-learning source</b>	

**Course Learning Outcomes (for Mapping with POs and PSOs)****On completion of the course the students should be able to****CO 1:** understand about general composition of milk – constituents and its physical properties.**CO 2:** acquire knowledge about pasteurization of Milk and various types of pasteurization - Bottle, Batch and HTST Ultra High Temperature Pasteurization.**CO 3:** learn about Cream and Butter their composition and how to estimate fat in cream and Ghee**CO 4:** explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk.**CO 5:** have an idea about how to make milk powder and its drying process - types of drying process

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
<b>CO1</b>	S	S	S	S	S	S	S	M	S	M
<b>CO2</b>	M	S	S	S	M	S	S	M	M	M
<b>CO3</b>	S	S	S	M	S	S	S	M	S	M
<b>CO4</b>	S	S	S	S	S	S	S	M	M	M
<b>CO5</b>	S	M	S	S	S	S	S	M	M	S

**CO-PO Mapping (Course Articulation Matrix)**

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to Pos</b>	3.0	3.0	3.0	3.0	3.0

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

<b>Title of the Course</b>	<b>COSMETICS AND PERSONAL GROOMING</b>						
<b>Paper No.</b>	<b>SEC-III (Discipline Specific)</b>						
<b>Category</b>	<b>SEC</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>2</b>	<b>Course Code</b>	<b>U23CH2S3</b>
		<b>Semester</b>	<b>I/ II</b>				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	2	-	-		2		
<b>Prerequisites</b>	Higher secondary Chemistry						
<b>Objectives of the course</b>	<p>This course aims at familiarizing the students with</p> <ul style="list-style-type: none"> <li>• formulations of various types of cosmetics and their significance</li> <li>• hair, skin and dental care</li> <li>• makeup preparations and personal grooming</li> </ul>						
<b>Course Outline</b>	<p><b>Unit I</b> <b>Skin care</b> Nutrition of the skin, skin care and cleansing of the skin; face powder – ingredients; creams and lotions – cleansing, moisturizing all purpose, shaving and sunscreen (formulation only); Gels – formulation and advantages; astringent and skin tonics – key ingredients, skin lightness, depilatories.</p>						
	<p><b>Unit II</b> <b>Hair care</b> Shampoos – types – powder, cream, liquid, gel – ingredients; conditioner – types – ingredients <b>Dental care</b> Tooth pastes – ingredients – mouth wash</p>						
	<p><b>Unit III</b> <b>Make up</b> Base – foundation – types – ingredients; lipstick, eyeliner, mascara, eye shadow, concealers, rouge</p>						
	<p><b>Unit IV</b> <b>Perfumes</b> Classification - Natural – plant origin – parts of the plant used, chief constituents; animal origin – amber gries from whale, civetone from civet cat, musk from musk deer; synthetic – classification emphasizing characteristics – esters – alcohols – aldehydes – ketones</p>						

	<p><b>Unit V</b> <b>Beauty treatments</b></p> <p>Facials - types – advantages – disadvantages; face masks – types; bleach - types – advantages– disadvantages; shaping the brows; eyelash tinting; perming – types; hair colouring and dyeing ; permanent waving – hair straightening; wax – types – waxing; pedicure, manicure - advantages – disadvantages</p>
<b>Recommended Text</b>	1. Thankamma Jacob, (1997) Foods, drugs and cosmetics – A consumer guide, Macmillan publication, London.
<b>Reference Books</b>	1. Wilkinson J B E and Moore R J, (1997) Harry’s cosmeticology, 7 <sup>th</sup> ed., Chemical Publishers, London. 2. George Howard, (1987) Principles and practice of perfumes and cosmetics, Stanley Therones, Chettenham
<b>Website and e-learning source</b>	1. <a href="http://www.khake.com/page75.html">http://www.khake.com/page75.html</a> 2. Net.foxsm/list/284
<p><b>Course Learning Outcomes (for Mapping with POs and PSOs)</b></p> <p><b>On completion of the course the students should be able to</b></p> <ul style="list-style-type: none"> <li>• <b>CO1:</b> know about the composition of various cosmetic products</li> <li>• <b>CO2</b> understand chemical aspects and applications of hair care and dental care and skin care products.</li> <li>• <b>CO3</b> understand chemical aspects and applications of perfumes and skin care products.</li> <li>• <b>CO4</b> to understand the methods of beauty treatments their advantages and disadvantage</li> <li>• <b>CO5</b> understand the hazards of cosmetic products.</li> </ul>	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
<b>CO1</b>	S	S	S	S	S	S	S	M	S	M
<b>CO2</b>	M	S	S	S	M	S	S	M	M	M
<b>CO3</b>	S	S	S	M	S	S	S	M	S	M
<b>CO4</b>	S	S	S	S	S	S	S	M	M	M
<b>CO5</b>	S	M	S	S	S	S	S	M	M	S

**CO-PO Mapping (Course Articulation Matrix)**

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to Pos</b>	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO’s and CO’s



<b>Title of the Course</b>	<b>GENERAL CHEMISTRY -III</b>						
<b>Paper No.</b>	<b>Core III</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	II	<b>Credits</b>	5	<b>Course Code</b>	U23CH303
		<b>Semester</b>	III				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	4	1	-		5		
<b>Prerequisites</b>	General Chemistry – I and II						
<b>Objectives of the course</b>	<p>This course aims to provide a comprehensive knowledge on</p> <ul style="list-style-type: none"> <li>the physical properties of gases, liquids, solids and X-ray diffraction of solids.</li> <li>fundamentals of nuclear chemistry and nuclear waste management.</li> <li>applications of nuclear energy</li> <li>basic chemistry of halo-organic compounds, phenol and other aromatic alcohols.</li> <li>preparation and properties of phenols and alcohols.</li> </ul>						
<b>Course Outline</b>	<b>UNIT I</b>						
	<p><b>Gaseous state</b></p> <p>Kinetic molecular model of a gas: postulates and derivation from the kinetic gas equation; The Maxwell –Boltzmann distribution of speed of molecules- average, root mean square and most probable velocity and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Collision frequency; collision diameter; mean free path and viscosity of gases.</p> <p>Real gases: Deviations from ideal gas behaviour, (Andrew’s and Amagat’s plots); compressibility factor, Z, and its variation with pressure for different gases. equations of states for real gases-van der Waal’s equation; Virial equation; Boyle temperature; Numerical problems based on equations of states for real gases, isotherms of real gases – critical phenomena – isotherms of CO<sub>2</sub> - continuity of state–Van der waal’s equation and the critical state; law of corresponding states-liquefaction of gases; numerical problems involving the core concepts.</p>						
<b>Unit-II</b>							
<b>Liquid and Solid State</b>							
<p>Properties of Liquids- Surface tension, viscosity and their applications. Crystalline and amorphous – differences - geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism.</p> <p>Crystals –size and shape; laws of crystallography; symmetry elements – plane,</p>							

centre and axis; Miller indices, unit cells and space lattices; classification of crystal systems; Bravais lattices; X – ray diffraction – Bragg’s equation

Packing in atomic solids – simple cubic, body centered cubic, face centered and hexagonal close packing; Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO<sub>2</sub>; comparison of structure and properties of diamond and graphite; numerical problems involving core concepts  
Defects in solids - stoichiometric and nonstoichiometric defects.

**Liquid crystals** – classification and applications.

### UNIT-III

#### Nuclear Chemistry

Natural radioactivity -  $\alpha$ ,  $\beta$  and  $\gamma$  rays; half-life period; Fajan–Soddy group displacement law; Geiger–Nattal rule; isotopes, isobars, isotones, mirror nuclei, iso diaphers; nuclear isomerism; radioactive decay series; magic numbers; units – Curie, Rutherford, Roentgen; nuclear stability - neutron- proton ratio; binding energy; packing fraction; mass defect. Simple calculations involving mass defect and B.E., decay constant and  $t_{1/2}$  and radioactive series.

Isotopes – uses – tracers – determination of age of rocks by radiocarbon dating. (Problems to be worked out)

Nuclear energy; nuclear fission and fusion – major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures.

### UNIT-IV

#### Halogen derivatives

##### Aliphatic halogen derivatives

Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions – S<sub>N</sub>1, S<sub>N</sub>2 and S<sub>N</sub>i mechanisms with stereochemical aspects and effect of solvent.

**Di, Tri & Tetra Halogen derivatives:** Nomenclature, classification, preparation, properties and applications.

##### Aromatic halogen compounds

Nomenclature, preparation, properties and uses

Mechanism of nucleophilic aromatic substitution – benzyne intermediate.

##### Aryl alkyl halides

Nomenclature, benzyl chloride – preparation – preparation properties and uses

**Alcohols:** Nomenclature, classification, preparation, properties, use; conversions – ascent and descent of series; test for hydroxyl groups. Oxidation of diols by periodic acid and lead tetraacetate.

	<p><b>UNIT-V</b></p> <p><b>Phenols</b> Nomenclature; classification, Preparation from diazonium salts, cumene, Dow's process, Raching process; properties – acidic character and effect of substitution on acidity. Reactions – Fries, claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimen, Kolbe, Schmidt, Gatermann synthesis, Libermann, nitro reaction, phthalein reaction.</p> <p>Resorcinol, quinol, picric acid – preparation, properties and uses.</p> <p><b>Aromatic alcohols</b> Nomenclature, benzyl alcohol – methods of preparation – hydrolysis, reduction of benzaldehyde, Cannizzaro reaction, Grignard synthesis, physical properties, reactions – reaction with sodium, phosphorus pentachloride, thionyl chloride, acetic anhydride, hydrogen iodide, oxidation – substitution on the benzene nucleus, uses. Thiols: Nomenclature, structure, preparation and properties.</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. B.R. Puri, L.R. Sharma, M.S. Pathania; <i>Principles of Physical Chemistry</i>, 46<sup>th</sup> edition, Vishal Publishing, 2020.</li> <li>2. B.R. Puri, L.R. Sharma and K.C. Kalia, <i>Principles of Inorganic Chemistry</i>, Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009.</li> <li>3. 4. P.L. Soni and Mohan Katyal, <i>Textbook of Inorganic Chemistry</i>, Sultan Chand &amp; amp; Sons, twentieth edition, 2006.</li> <li>4. M. K. Jain, S. C. Sharma, <i>Modern Organic Chemistry</i>, Vishal Publishing, fourth reprint, 2003.</li> <li>5. S.M. Mukherji, and S.P. Singh, <i>Reaction Mechanism in Organic Chemistry</i>, Macmillan India Ltd., third edition, 1994.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. T. W. Graham Solomons, <i>Organic Chemistry</i>, John Wiley &amp; amp; Sons, fifth edition, 1992.</li> <li>2. A. Carey Francis, <i>Organic Chemistry</i>, Tata McGraw-Hill Education Pvt., Ltd.,New Delhi, seventh edition, 2009.</li> <li>3. I. L. Finar, <i>Organic Chemistry</i>, Wesley Longman Ltd, England, sixth edition, 1996.</li> </ol>

	4. P. L. Soni, and H. M. Chawla - <i>Text Book of Organic Chemistry</i> , New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007. 5. J.D. Lee, <i>Concise Inorganic Chemistry</i> , Blackwell Science, fifth edition, 2005.
<b>Website and e-learning source</b>	<b>MOOC components</b> <a href="https://nptel.ac.in/courses/104104101">https://nptel.ac.in/courses/104104101</a> Solid state chemistry <a href="https://nptel.ac.in/courses/103106071">https://nptel.ac.in/courses/103106071</a> Nuclear industries and safety <a href="https://nptel.ac.in/courses/104106119s">https://nptel.ac.in/courses/104106119s</a> Introduction to organic chemistry
<b>Course Learning Outcomes (for Mapping with POs and PSOs)</b>	
<b>On completion of the course the students should be able to</b>	
<b>CO1:</b> explain the kinetic properties of gases by using mathematical concepts.	
<b>CO2:</b> describe the physical properties of liquid and solids; identify various types of crystals with respect to its packing and apply the XRD method for crystal structure determinations.	
<b>CO3:</b> investigate the radioactivity, nuclear energy and its production, also the nuclear waste management.	
<b>CO4:</b> write the nomenclature, physical & chemical properties and basic mechanisms of halo organic compounds and alcohols.	
<b>CO5:</b> investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including thiol.	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
<b>CO1</b>	S	S	S	S	S	S	S	M	S	M
<b>CO2</b>	M	S	S	S	M	S	S	M	M	M
<b>CO3</b>	S	S	S	M	S	S	S	M	S	M
<b>CO4</b>	S	S	S	S	S	S	S	M	M	M
<b>CO5</b>	S	M	S	S	S	S	S	M	M	S

#### CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to Pos</b>	3.0	3.0	3.0	3.0	3.0

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

<b>Title of the Course</b>	<b>QUALITATIVE INORGANIC ANALYSIS</b>						
<b>Paper No.</b>	<b>Core Practical III</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	II	<b>Credits</b>	3	<b>Course Code</b>	U23CH3P3
		<b>Semester</b>	III				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
		-	3		3		
<b>Prerequisites</b>	General chemistry						
<b>Objectives of the course</b>	To develop the skill on systematic analysis of simple inorganic salts and mixture of salts.						
<b>Course Outline</b>	<p><b>Semi - Micro Qualitative Analysis</b></p> <ol style="list-style-type: none"> <li>1. Analysis of simple acid radicals: Carbonate, sulphide, sulphate, thiosulphite, chloride, bromide, iodide, nitrate</li> <li>2. Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate, arsenate, arsenite.</li> <li>3. Elimination of interfering acid radicals and Identifying the group of basic radicals</li> <li>4. Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, tin, antimony, iron, aluminium, arsenic, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium</li> <li>5. Analysis of a mixture - I to VIII containing two cations and two anions (of which one is interfering type)</li> </ol>						
<b>Skills acquired from this course</b>	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.						
<b>Recommended Text</b>	<p><b>Reference Books:</b>  V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand &amp; Sons, New Delhi, second edition, 1997.</p>						
<b>Website and e-learning source</b>	<a href="https://www.vlab.co.in/broad-area-chemical-sciences">https://www.vlab.co.in/broad-area-chemical-sciences</a>						
<b>Course Learning Outcomes (for Mapping with POs and PSOs)</b>							

On successful completion of the course the students should be able to

**CO 1:** acquire knowledge on the systematic analysis of Mixture of salts.

**CO 2:** identify the cations and anions in the unknown substance.

**CO 3:** identify the cations and anions in the soil and water and to test the quality of water.

**CO4:** assess the role of common ion effect and solubility product

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M

#### CO-PO Mapping (Course Articulation Matrix)

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

<b>Title of the Course</b>	<b>ENTREPRENEURIAL SKILLS IN CHEMISTRY</b>						
<b>Paper No.</b>	<b>SEC IV</b>						
<b>Category</b>	<b>Skill Enhancement Course</b>	<b>Year Semester</b>	<b>II III</b>	<b>Credits</b>	<b>1</b>	<b>Course Code</b>	<b>U23CH3S4</b>
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	-	-	1		1		
<b>Prerequisites</b>	General Chemistry						
<b>Objectives of the course</b>	<p>The course aims at providing training to</p> <ul style="list-style-type: none"> <li>• develop entrepreneur skills in students</li> <li>• to provide hands on experience to prepare and develop products</li> <li>• develop start ups</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT -I</b></p> <p><b>Food Chemistry</b>  Food adulteration-contamination of food items with clay stones, water and toxic chemicals -Common adulterants.  Food additives, Natural and synthetic anti-oxidants, glazing agents (hazardous effect), food colourants, Preservatives, leavening agents, Baking powder and baking soda, yeast, MSG, vinegar.</p> <p><b>Dyes</b></p> <p>Classification – Natural, synthetic dyes and their characteristics – basic methods and principles of dyeing</p> <hr/> <p><b>UNIT II</b></p> <p><b>Hands on Experience (Students can choose any four)</b></p> <p>Detection of adulterants in food items like coffee, tea, pepper, chilli powder, turmeric powder, butter, ghee, milk, honey etc., by simple techniques.  Preparation of Jam, squash and Jelly, Gulkand, cottage cheese.</p> <p>Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, tooth paste/powder and disinfectants in small scale.</p> <p>Extraction of oils from spices and flowers.</p> <p>Testing of water samples using testing kit.  Dyeing – cotton fabrics with natural and synthetic dyes  Printing – tie and dye, batik.</p>						

Skills acquired from this course	<b>Entrepreneurial</b> skills.
<b>Recommended Text</b>	1. George S &Muralidharan V, (2007) Fibre to Finished Fabric – A Simple Approach, Publication Division, University of Madras, Chennai. 2. Appaswamy G P, A Handbook on Printing and Dyeing of Textiles.
<b>Reference Books</b>	Shyam Jha, Rapid detection of food adulterants and contaminants (Theory and Practice),Elsevier, e Book ISBN 9087128004289, 1 <sup>st</sup> Edition,2015
<b>Website and e-learning source</b>	<a href="https://www.vlab.co.in/broad-area-chemical-sciences">https://www.vlab.co.in/broad-area-chemical-sciences</a>
<b>Course Learning Outcomes (for Mapping with POs and PSOs)</b>	
<b>On completion of the course the students should be able to</b>	
<b>CO 1:</b> identify adulterated food items by doing simple chemical tests.	
<b>CO 2:</b> prepare cleaning products and become entrepreneurs	
<b>CO 3:</b> educate others about adulteration and motivate them to become entrepreneurs.	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
<b>CO1</b>	S	S	S	S	S	S	S	M	S	M
<b>CO2</b>	M	S	S	S	M	S	S	M	M	M
<b>CO3</b>	S	S	S	M	S	S	S	M	S	M

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>Weightage</b>	6	6	6	6	6
<b>Weighted percentage of Course Contribution to POs</b>	3.0	3.0	3.0	3.0	3.0



Title of the Course	PESTICIDE CHEMISTRY						
Paper No.	SEC V (Discipline specific)						
Category	Skill Enhancement Course	Year Semester	II III	Credits	2	Course Code	U23CH3S5
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	-	-		2		
Prerequisites	Fundamentals in chemistry						
Objectives of the course	<p>This course aims to providing the students</p> <ul style="list-style-type: none"> <li>• knowledge about the various types of pesticides and their toxicity.</li> <li>• to understand the accumulation of pesticides in in the form of residues and its analysis.</li> <li>• knowledge on choice of alternate and eco-friendly pesticides.</li> </ul>						
Course Outline	<p><b>Unit I</b></p> <p><b>Introduction:</b> History of pesticides. Chemistry of Pesticides: Brief introduction to classes of pesticides (Chemical class, targets), structures, chemical names, physical and chemical properties.</p> <p><b>Toxicity of pesticides:</b> Acute and chronic toxicity in mammals, birds, aquatic species etc. Methods of analysis of pesticides.</p> <p><b>Insecticides:</b> Classification and study of following insecticides with respect to structure, chemical name, physical properties, chemical properties, synthesis, degradation, metabolism, formulations, Mode of action, uses, toxicity.</p> <p>Organophosphates and Phosphothionates: Acephate, Chlorpyrifos, Monocrotophos, and parathion-methyl. Organochlorine – Endosulfan, heptachlor; Carbamate: Cartap hydrochloride, Methomyl, Propoxur.</p>						
	<p><b>Unit II</b></p> <p><b>Pesticides residues:</b> Introduction- application of agrochemicals, dissemination pathways of pesticides, causes of pesticide residues,remedies. Pesticides residues in atmosphere- entry into atmosphere, action of pesticides, effects on environments. Pesticides residues in water - entry into water systems, action and effect in aquatic environment. Pesticides residues in soil. entry into soil, absorption, retention and transport in soil, effects on microorganism, soil condition and fertility, decomposition and degradation by climatic factors and microorganism.</p> <p><b>Pesticide Residues effect and analysis:</b> Effects of pesticides residue on human life, birds and animals- routes for exposure to pesticides, action of pesticides on living system. Analysis of pesticides residues- sample preparation, extraction of pesticides residues (soil, water and vegetables/fruits) simple methods and schemes of analysis, multi-residue analysis.</p>						

	<p><b>Unit III</b>  <b>Biopesticides:</b> Pheromones, attractants, repellents – Introduction, types and application (8- Dodecen-1-ol, 10-cis-12-hexadecadienoic, Trimedlure, Cue-lure, methyl eugenol, N,N- Diethyl-m-toluamide, Dimethyl phthalate, Icaridin). Baits- Metaldehyde, Iron (II) phosphate, Indoxacarb, Zinc Phosphide, Bromadiolone.</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. Handa SK. Principles of pesticide chemistry. Agrobios (India); 2012.</li> <li>2. Matolcsy G, Nádasz M, Andriská V. Pesticide chemistry. Elsevier; 1989.</li> <li>3. J. Miyamoto and P. C. Kearney Pesticide Chemistry Human Welfare and the Environment vol. IV Pesticide Residue and Formulation Chemistry, Pergamon press, 1985.</li> <li>4. R. Cremling: Pesticides, John Wiley.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Roy N. K., Chemistry of Pesticides. CBS Publisher &amp; Distributors P Ltd; 1st Ed. (2010).</li> <li>2. Nollet L.M., Rathore H.S., Handbook of pesticides: methods of pesticide residues analysis. CRC press; 2016.</li> <li>3. Ellerbrock R.H., Pesticide Residues: Significance, Management and Analysis, 2005</li> </ol>
<p><b>Course Learning Outcomes (for Mapping with POs and PSOs)</b>  <b>On completion of the course the students should be able to</b>  <b>CO 1:</b> teach about the pesticides and their toxicity with respect to structure and category.  <b>CO 2:</b> explain the preparation and property of pesticides  <b>CO 3:</b> investigate the pesticide residues, prevention and care  <b>CO 4:</b> demonstrate the extraction and analytical methods of pesticide residues  <b>CO 5:</b> make awareness to the public on bio-pesticides</p>	

<b>CO /PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to PSOs</b>	3.0	3.0	3.0	3.0	3.0

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

<b>CO /PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to POs</b>	3.0	3.0	3.0	3.0	3.0

**Level of Correlation between PO's and CO's**

<b>Title of the Course</b>	<b>GENERAL CHEMISTRY-IV</b>						
<b>Paper No.</b>	<b>Core IV</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	II	<b>Credits</b>	5	<b>Course Code</b>	U23CH404
		<b>Semester</b>	I V				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	5	-	-		5		
<b>Prerequisites</b>	General Chemistry III						
<b>Objectives of the course</b>	<p>This course aims to provide a comprehensive knowledge on</p> <ul style="list-style-type: none"> <li>• thermodynamic concepts on chemical processes and applied aspects.</li> <li>• thermo chemical calculations</li> <li>• transition elements with reference to periodic properties and group study of transition metals.</li> <li>• the organic chemistry of ethers, aldehydes and ketones</li> <li>• the organic chemistry of carboxylic acids</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT I</b></p> <p><b>Thermodynamics I</b> Terminology – Intensive, extensive variables, state, path functions; isolated, closed and open systems; isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible processes; First law of thermodynamics – Concept and significance of heat (q), work (w), internal energy (E), enthalpy (H); calculations of q, w, E and H for reversible, irreversible expansion of ideal and real gases under isothermal and adiabatic conditions; relation between heat capacities (C<sub>p</sub> &amp; C<sub>v</sub>); Joule Thomson effect- inversion temperature.</p> <p>Thermochemistry - heats of reactions, standard states; types of heats of reactions and their applications; effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions; Hess's law and its applications; determination of bond energy; Measurement of heat of reaction – determination of calorific value of food and fuels Zeroth law of thermodynamics-Absolute Temperature scale.</p>						
	<p><b>Unit II</b></p> <p><b>Thermodynamics II</b> Second Law of thermodynamics - Limitations of first law, spontaneity and randomness; Carnot's cycle; Concept of entropy, entropy change for reversible and irreversible processes, entropy of mixing, calculation of entropy changes of an ideal gas and a van der Waals gas with changes in temperature, volume and pressure, entropy and disorder.</p>						

Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application.

Third law of thermodynamics - Nernst heat theorem; Applications of third law - evaluation of absolute entropies from heat capacity measurements, exceptions to third law.

### UNIT III

#### General Characteristics of d-block elements

**Transition Elements**- Electronic configuration - General periodic trend variable valency, oxidation states, stability of oxidation states, colour, magnetic properties, catalytic properties and tendency to form complexes. Comparative study of transition elements and non transition elements – comparison of II and III transition series with I transition series. Group study of Titanium, Vanadium, Chromium, Manganese, Iron, Cobalt, Nickel and Zinc groups

### UNIT IV

#### Ethers, Thio ethers and Epoxides

Nomenclature, isomerism, general methods of preparations, reactions involving cleavage of C-O linkages, alkyl group and ethereal oxygen. Zeisel's method of estimation of methoxy group.

Reactions of epoxides with alcohols, ammonia derivatives and  $\text{LiAlH}_4$   
Thioethers - nomenclature, structure, preparation, properties and uses.

#### Aldehydes and Ketones

Nomenclature, structure and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. Nucleophilic addition reactions, base catalysed reactions with mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes. Baeyer - Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf - Kishner reduction, Meerwein – Ponnordorf Verley reduction, reduction with  $\text{LiAlH}_4$  and  $\text{NaBH}_4$ .

Addition reactions of unsaturated carbonyl compounds: Michael addition.

### UNIT V

	<p><b>Carboxylic Acids:</b> Nomenclature, structure, preparation and reactions of aliphatic and aromatic monocarboxylic acids. Physical properties, acidic nature, effect of substituent on acidic strength. HVZ reaction, Claisen ester condensation, Bouveault Blanc reduction, decarboxylation, Hunsdiecker reaction. Formic acid-reducing property. Reactions of dicarboxylic acids, hydroxy acids and unsaturated acids.</p> <p><b>Carboxylic acid Derivatives:</b> Preparations of aliphatic and aromatic acid chlorides, esters, amides and anhydrides. Nucleophilic substitution reaction at the acyl carbon of acyl halide, anhydride, ester, amide. Schottan- Baumann reaction. Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann bromamide degradation and Curtius rearrangement.</p> <p><b>Active methylene compounds:</b> Keto – enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate</p> <p><b>Halogen substituted acids</b> – nomenclature; preparation by direct halogenation, iodination from unsaturated acids, alkyl malonic acids</p> <p><b>Hydroxy acids</b> – nomenclature; preparation from halo, amino, aldehydic and ketonic acids, ethylene glycol, aldol acetaldehyde; reactions – action of heat on <math>\alpha</math>, <math>\beta</math> and <math>\gamma</math> hydroxy acids.</p>
<p>Extended Professional Component (is a part of internal component only, Not to be included in the external</p>	<p>Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)</p>

examination question paper)	
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. B.R. Puri and L.R. Sharma, <i>Principles of Physical Chemistry</i>, Shoban Lal Nagin Chand and Co., thirty three edition, 1992.</li> <li>2. K. L. Kapoor, <i>A Textbook of Physical chemistry</i>, (volume-2 and 3), Macmillan, India Ltd, third edition, 2009.</li> <li>3. P.L. Soni and Mohan Katyal, <i>Textbook of Inorganic Chemistry</i>, Sultan Chand &amp; Sons, twentieth edition, 2006.</li> <li>4. M. K. Jain, S. C. Sharma, <i>Modern Organic Chemistry</i>, Vishal Publishing, fourth reprint, 2003.</li> <li>5. S.M. Mukherji, and S.P. Singh, <i>Reaction Mechanism in Organic Chemistry</i>, Macmillan India Ltd., third edition, 1994.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Maron, S. H. and Prutton C. P. <i>Principles of Physical Chemistry</i>, 4<sup>th</sup>ed.; The Macmillan Company: Newyork, 1972.</li> <li>2. Lee, J. D. <i>Concise Inorganic Chemistry</i>, 4th ed.; ELBS William Heinemann: London, 1991.</li> <li>3. Gurudeep Raj, <i>Advanced Inorganic Chemistry</i>, 26<sup>th</sup>ed.; Goel Publishing House: Meerut, 2001.</li> <li>4. Atkins, P.W. &amp; Paula, J. <i>Physical Chemistry</i>, 10th ed.; Oxford University Press: New York, 2014.</li> <li>5. Huheey, J. E. <i>Inorganic Chemistry: Principles of Structure and Reactivity</i>, 4<sup>th</sup> ed; Addison Wesley Publishing Company: India, 1993.</li> </ol>
<b>Website and e-learning source</b>	<b>MOOC components</b> <a href="https://nptel.ac.in/courses/112102255">https://nptel.ac.in/courses/112102255</a> Thermodynamics <a href="https://nptel.ac.in/courses/104101136">https://nptel.ac.in/courses/104101136</a> Advanced transition metal chemistry
<b>Course Learning Outcomes (for Mapping with POs and PSOs)</b> <b>On completion of the course the students should be able to</b> <b>CO1:</b> explain the terms and processes in thermodynamics; discuss the various laws of thermodynamics and thermo chemical calculations.  <b>CO2:</b> discuss the second law of thermodynamics and its application to heat engine; discuss third law and its application on heat capacity measurement.  <b>CO3:</b> investigate the chemistry of transition elements with respect to various periodic properties and group wise discussions.  <b>CO4:</b> discuss the fundamental organic chemistry of ethers, epoxides and carbonyl compounds including named organic reactions.  <b>CO5:</b> discuss the chemistry and named reactions related to carboxylic acids and their	
derivatives; discuss chemistry of active methylene compounds, halogen substituted acids and hydroxyl acids.	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

**CO-PO Mapping (Course Articulation Matrix)**

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

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



<b>Title of the Course</b>	<b>PHYSICAL CHEMISTRY PRACTICAL – I</b>						
<b>Paper No.</b>	<b>Core Practical - IV</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	II	<b>Credits</b>	3	<b>Course Code</b>	U23CH4P4
		<b>Semester</b>	IV				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	-	-	3		3		
<b>Prerequisites</b>	General Chemistry						
<b>Objectives of the course</b>	<p>The course aims at providing an understanding of</p> <ul style="list-style-type: none"> <li>• the laboratory experiments in order to understand the concepts of physical changes in chemistry</li> <li>• the rates of chemical reactions</li> <li>• colligative properties and adsorption isotherm</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT-I</b> <b>Chemical kinetics</b></p> <p>1. Determination of rate constant of acid catalysed hydrolysis of an ester (methyl acetate).</p> <p>2. Determination of order of reaction between iodide and persulphate (initial rate method).</p> <p>3. Polarimetry: Determination of rate constant of acid catalysed inversion of cane sugar</p> <p><b>Thermochemistry</b></p> <p>4. Determination of heat of neutralisation of a strong acid by a strong base.</p> <p>5. Determination of heat of hydration of copper sulphate.</p> <p><b>UNIT II</b></p> <p><b>Electrochemistry – Conductance measurements</b></p> <p>6. Determination of cell constant</p> <p>7. Determination of molar conductance of strong electrolyte</p> <p>8. Determination of dissociation constant of acetic acid</p> <p><b>Colorimetry</b></p> <p>9. Determination of concentration of copper sulphate solution</p> <p><b>UNIT III</b> <b>Colligative property</b></p>						

	10. Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent  <b>Adsorption</b> 11. Construction of Freundlich isotherm for the adsorption of acetic acid on activated charcoal
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Reference Books	1. Sindhu, P.S. <i>Practicals in Physical Chemistry</i> , Macmillan India : New Delhi, 2005. 2. Khosla, B. D. Garg, V. C.; Gulati, A.; <i>Senior Practical Physical Chemistry</i> , R. Chand : New Delhi, 2011. 3. Gupta, Renu, <i>Practical Physical Chemistry</i> , 1 <sup>st</sup> Ed.; New Age International: New Delhi, 2017.
Website and e-learning source	<a href="https://www.vlab.co.in/broad-area-chemical-sciences">https://www.vlab.co.in/broad-area-chemical-sciences</a>
<b>Course Learning Outcomes (for Mapping with POs and PSOs)</b>	
<b>On completion of the course the students should be able to</b>	
<b>CO1:</b> describe the principles and methodology for the practical work	
<b>CO2:</b> explain the procedure, data and methodology for the practical work.	
<b>CO3:</b> apply the principles of electrochemistry, kinetics for carrying out the practical work.	
<b>CO4:</b> demonstrate laboratory skills for safe handling of the equipment and chemicals	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M

CO / PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

<b>Title of the Course</b>	<b>INTRODUCTION TO LIFE SKILLS</b>						
<b>Paper No.</b>	<b>SEC VI (Discipline specific)</b>						
<b>Category</b>	<b>Skill</b>	<b>Year</b>	<b>II</b>	<b>Credits</b>	<b>2</b>	<b>Course Code</b>	<b>U23CH4S6</b>
	<b>Enhancement Course</b>	<b>Semester</b>	<b>IV</b>				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	<b>2</b>	<b>-</b>	<b>-</b>		<b>2</b>		
<b>Prerequisites</b>							
<b>Objectives of the course</b>	<p>This course aims to provide overall view on the following headings</p> <ul style="list-style-type: none"> <li>• <b>Develop Effective Communication Skills:</b> Enhance verbal, nonverbal, and written communication skills to express ideas, thoughts, and emotions clearly and confidently. Learn active listening techniques and adapt communication style to different contexts and audiences.</li> <li>• <b>Foster Critical Thinking and Problem-Solving Abilities:</b> Cultivate the ability to analyze situations, evaluate information, and make well-informed decisions. Develop problem-solving strategies to overcome challenges and approach situations with a creative and logical mindset.</li> <li>• <b>Enhance Emotional Intelligence:</b> Gain an understanding of emotions, their impact on behavior, and effective ways to manage and regulate them. Develop empathy and interpersonal skills to build healthy relationships and navigate conflicts constructively.</li> <li>• <b>Strengthen Time Management and Organization Skills:</b> Learn strategies to effectively manage time, set priorities, and achieve personal and professional goals. Develop techniques for organizing tasks, delegating responsibilities, and maintaining a healthy work-life balance.</li> </ul>						

<b>Course Outline</b>	<p><b>Unit I</b></p> <p><b>PERSONAL SKILLS</b></p> <p><b>1. Wellness and Mental Health Skills -Copying with Emotions</b></p> <ol style="list-style-type: none"> <li>a. Managing emotions (Mindfulness/ Managing&amp; Controlling anger, stress, anxiety, Peer pressure/ Depression &amp; Suicidal tendencies – signs &amp; prevention) – Resilience/ Coping strategies</li> <li>b. Emotional Quotient</li> </ol> <p><b>2. Health and Hygiene/ Self Care</b></p> <ol style="list-style-type: none"> <li>a. Food and Nutrition/ Dietary guidance and lifestyle/ Calories count/ Healthy weight range/ Simple Recipes</li> <li>b. Staying healthy and fit –Importance of Sleep/ Health risk / Basic First Aid</li> </ol>
	<p><b>Unit II</b></p> <p><b>SOCIAL AND INTERPERSONAL SKILLS</b></p> <ol style="list-style-type: none"> <li>1. Effective communication – barriers to communication – oratorical skills- need for listening skill</li> <li>2. Building Relationship skills <ol style="list-style-type: none"> <li>(a) Healthy Relationship - Parents, siblings (sibling rivalry), friends (peer pressure), in place of study and work</li> </ol> </li> <li>3. Media Influence -Issue and concerns</li> <li>4. Basic Etiquette <ol style="list-style-type: none"> <li>(a) Phone Etiquette / Table Manners / Giving and accepting Compliments</li> </ol> </li> <li>5. Leadership skills / Conflict management / Team work / Empathy</li> </ol>
	<p><b>Unit III</b></p> <p><b>EMPLOYABILITY SKILLS</b></p> <ol style="list-style-type: none"> <li>1. Study skills and memory technique / Examinations preparation</li> <li>2. Priorities &amp; Goal setting</li> <li>3. Time management – Time Log</li> <li>4. Career planning, importance and steps</li> <li>5. Interview – types of Interviews (face to face, online, telephonic etc, preparation (FAQ in interviews, Attire &amp; Accessories etc), dos and don'ts</li> <li>6. Job application and resume</li> </ol>

	<p><b>Unit IV</b></p> <p><b>NUMERICAL SKILLS</b></p> <ol style="list-style-type: none"> <li>1. Creative and critical thinking / Lateral thinking &amp; Problem solving</li> <li>2. Aptitude and Numerical Ability</li> <li>3. Need and ways to save money – Budgeting, Investment</li> <li>4. Calculating discount percentages and promotional offers</li> <li>5. Tax calculation</li> </ol>
	<p><b>Unit V</b></p> <p><b>ACTIVITIES AND OUT BOUND TRAINING</b></p> <ol style="list-style-type: none"> <li>1. Activities <ol style="list-style-type: none"> <li>a. Case study</li> <li>b. Role play</li> <li>c. Sharing experience</li> <li>d. Audio – Visual models</li> <li>e. Connect to your community</li> <li>f. Contributing to your community</li> <li>g. Puzzles and teasers</li> <li>h. Self assessment Questionnaires</li> <li>i. Me charts</li> <li>j. Field trips and report</li> <li>k. Out Bound Training</li> </ol> </li> <li>2. Work Book</li> </ol>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. <b>Sophrosyne (A Primer on Life Skills for Undergraduate Students)</b></li> <li>2. It's Me (Work Book)</li> </ol>
<b>Reference Books</b>	Course Book: For undergraduates of all Disciplines Edited and Published by: Training & Placement Division

<b>Website and e-learning sources</b>	<ol style="list-style-type: none"> <li>1. <a href="https://www.skillsyouneed.com/general/life-skills.html">https://www.skillsyouneed.com/general/life-skills.html</a></li> <li>2. <a href="https://onlinecourses.nptel.ac.in/noc21_hs02/preview">https://onlinecourses.nptel.ac.in/noc21_hs02/preview</a></li> <li>3. <a href="https://onlinecourses.swayam2.ac.in/cec20_ed20/preview">https://onlinecourses.swayam2.ac.in/cec20_ed20/preview</a></li> </ol>
<p><b>Course Learning Outcomes (for Mapping with POs and PSOs)</b></p> <p><b>On completion of the course the students should be able to</b></p> <p><b>CO1:</b> apply error analysis in the calibration and use of analytical instruments, explain theory, instrumentation and application of flame photometry and Atomic Absorption spectrometry</p> <p><b>CO2:</b> explain theory, instrumentation and application of UV visible and Infrared spectroscopy.</p> <p><b>CO3:</b> able to discuss instrumentation, theory and applications of thermal and electrochemical techniques</p> <p><b>CO4:</b> explain the use of chromatographic techniques in the separation and identification of mixtures</p> <p><b>CO5:</b> explain preparation of solutions, stoichiometric calculations</p>	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

<b>Title of the Course</b>	<b>Water Quality Assessment and Management.</b>						
<b>Paper No.</b>	<b>SEC-VII (Discipline Specific)</b>						
<b>Category</b>	<b>Skill Enhancement Course</b>	<b>Year</b>	II	<b>Credits</b>	2	<b>Course Code</b>	U23CH4S7
		<b>Semester</b>	IV				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	2	-	-		2		
<b>Prerequisites</b>	General Chemistry						
<b>Objectives of the course</b>	<p>This course aims at giving an overall view of</p> <ul style="list-style-type: none"> <li>• significance of water in life processes</li> <li>• water conservation strategies to the community</li> <li>•</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT I</b> UNIT-I</p> <p>Service-Learning – Definition, difference between community service and service-learning, Principles; Whole Person Education. Identifying Community Needs, Community Partners, Reflection, Reciprocity. Public Dissemination; Understanding of community dynamics. Project Planning Stages and report preparation</p> <p>Classroom Activity:</p> <p>i. Group discussion about Civic/Social responsibility (Display of Video/Documentary film (Through this activity Students should recognize civic responsibility of the society)</p> <p>ii. Conduct a role play/games/drawing to provide problem solving skill and ignites critical thinking.</p> <p>iii. Group activity to frame questionnaire for identify community needs Reflection on identify the need of the community (Students go to the community for identify the community needs and reflect their experience)</p>						



**Unit-II****UNIT II**

Importance of water- water in the household, industry, nature, physiological processes in the body- agriculture- water resources- freshwater and saline water.

Water conservation - rainwater harvesting, groundwater recharging and recycling of grey waters.

Water quality parameters - Hardness, TDS, pH, BOD, COD, DO, Fecal Coliform, Conductivity, Acidity, Alkalinity, Nitrate, Fluoride, Phosphate, Salinity, Turbidity, Calcium, Ammonia, Sulfate, Chloride - Permissible Limits

Classroom Activity:

i Watch a documentary on significance of water in our everyday lives and jot down in journal

ii Group discussion on the different water conservation techniques and recycling of water

iii Poster preparation on water quality testing – water quality parameters and their permissible limits

iv Review a journal article on existing water resources globally, nationally, and locally

**UNIT-III**

Waterborne Diseases- Diarrhoea, Typhoid, Jaundice, Kidney Stones, Fluorosis, Cavities- Water Pollution- Causes, Effects and Prevention. Desalinization, Electro dialysis, Osmosis, Electro-Osmosis, Reverse Osmosis, Ion Exchange, Zeolite Method, Instrumentation- pH meter, conductivity meter.

Classroom Activity:

i Preparation of Info gram on water-borne diseases

ii Web-based research in groups on different water treatment methods

iii Use of virtual lab in using pH meter and conductivity meter

iv Collection of newspaper clippings on water pollution and analyzing it's causes, effects and prevention

**UNIT-IV**

- Mapping of water sources in the community
- Analysis of water quality parameters in different water sources in the community
- Survey and analysis of effects of contaminants in water quality
- Conservation of existing water sources by the community
- Control measures of water pollution

	<p>Field Activity</p> <p>i. Village resource mapping of water sources in the community and Transect Walk</p> <p>ii Collection of water samples from different water sources in community and analysis</p> <p>iii Linkage diagrams and identification of community problems through Problem-Cause-Effect-Solution Trees</p> <p>iv Drawing a historical timeline and seasonal calendar of the community and identification of water conservation strategies existent in and suggested for the community</p> <p>v Analysis and survey of water pollutants and control measures to curtail water pollution</p>
	<p><b>UNIT-V</b></p> <p>UNITV</p> <ul style="list-style-type: none"> <li>• Analysis of water borne diseases suffered by community and mapping of possible causes through community engagement</li> <li>• Water analysis and selection of purification technique based on TDS measurements</li> <li>• Community involvement in waste management and mapping the causes of water pollution in the community</li> </ul> <p>Field Activity</p> <p>o iSurvey of water-borne diseases prevalent in the community and mapping of possible causes through community engagement</p> <p>o ii Water analysis and suggestion of suitable water treatment method based on TDS measurements</p> <p>o iii Survey of waste management strategies existent in community and correlation of waste management and levels of water pollution</p>
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. Environmental Chemistry by A.K. De</li> <li>2. Environmental Chemistry by B.K. Sharma</li> </ol>

<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. "Water Supply Engineering" by B.C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain.</li> <li>2. "Environmental Pollution Control Engineering" by C.S. Rao.</li> <li>3. "Environmental Pollution and Control" by P.A. Lakshmi Narasu.</li> <li>4. "Water Supply and Pollution Control" by Santosh Kumar Garg.</li> <li>5. "Environmental Science and Engineering" by P.N. Arora and S.K. Garg.</li> <li>6. "Water Quality and Treatment: A Handbook on Drinking Water" by American Water Works Association (AWWA) and James Edzwald.</li> <li>7. "Water Quality Engineering: Physical/Chemical Treatment Processes" by Mark M. Benjamin and Desmond F. Lawler.</li> <li>8. "Principles of Water Quality Control" by T.H. Yoon and W.W. Yoon.</li> <li>9. "Water Pollution Control" by Warren T. Viessman Jr., Mark J. Hammer, and Paul Chadik.</li> <li>10. "Wastewater Engineering: Treatment and Resource Recovery" by Metcalf &amp; Eddy, Inc., George Tchobanoglous, and Franklin L. Burton.</li> <li>11.</li> </ol>
<b>Website and e-learning source</b>	
<b>Course Learning Outcomes (for Mapping with POs and PSOs)</b>	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1										
CO2										
CO3										
CO4										
CO5										

**CO-PO Mapping (Course Articulation Matrix)**

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1					
CO2					
CO3					
CO4					
CO5					
Weightage					
Weighted percentage of Course Contribution to Pos					

Level of Correlation between PSO's and CO's

<b>Title of the Course</b>	<b>ORGANIC CHEMISTRY - I</b>						
<b>Paper No.</b>	<b>Core V</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	III	<b>Credits</b>	4	<b>Course Code</b>	U23CH505
		<b>Semester</b>	V				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	4	1	-		5		
<b>Prerequisites</b>	General Chemistry I,II, III and IV						
<b>Objectives of the course</b>	<p>This course aims to provide an understanding of</p> <ul style="list-style-type: none"> <li>• stereoisomerism in chirals and geometric isomerism in olefins, conformations of ethane and butane</li> <li>• preparation and properties of aromatic and aliphatic nitro compounds and amines</li> <li>• preparation of different dyes, food colour and additives</li> <li>• preparation and properties of five membered heterocycles like pyrrole, furan and thiophene</li> <li>• preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline.</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT I</b> <b>Stereochemistry</b></p> <p>Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism:cis–trans, syn-anti isomerism, E/Z notations.</p> <p><b>Optical Isomerism:</b> Optical activity, specific rotation, asymmetry, enantiomers, distereoisomers, meso structures - molecules with one and two chiral centres, racemisation- methods of racemisation; resolution-methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereogenic) centres.</p> <p>Molecules with no asymmetric carbon atoms – allenes and biphenyls. Conformational analysis of ethane and butane.</p>						
	<p><b>UNIT II</b> <b>Chemistry of Nitrogen Compounds – I</b></p> <p><b>Nitroalkanes</b> Nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes; physical properties; reactions – reduction, halogenations, Grignard reagent, Pseudo acid character. Nitro - aci nitro tautomerism.</p> <p><b>Aromatic nitro compounds</b> Nomenclature, preparation – nitration, from diazonium salts, physical properties; reactions - reduction of nitrobenzene in different medium, Electrophilic substitution reactions, TNT.</p>						

	<p><b>Amines: Aliphatic amines</b> Nomenclature, isomerism, preparation – Hofmanns’ degradation reaction, Gabriel’s phthalimide synthesis, Curtius Schmidt rearrangement.</p> <p>Physical properties, reactions – alkylation, acylation, carbylamine reaction, Mannich reaction, oxidation, basicity of amines.</p>
	<p><b>UNIT III</b> <b>Chemistry of Nitrogen Compounds – II</b></p> <p><b>Aromatic amines</b> – Nomenclature, preparation – from nitro compounds, Hofmann’s method; Schmidt reaction, properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid - zwitter ion formation.</p> <p>Distinction between primary, secondary and tertiary amines - aliphatic and aromatic Diazonium compounds</p> <p>Diazomethane, Benzene diazonium chloride - preparations and synthetic applications.</p> <p><b>Dyes</b> Theory of colour and constitution; classification based on structure and application; preparation – Martius yellow, aniline yellow, methyl orange, alizarin, indigo, malachite green. Industry oriented content</p> <p>Dyes Industry, Food colour and additives</p>
	<p><b>UNIT IV</b> <b>Heterocyclic compounds</b> Nomenclature and classification. General characteristics - aromatic character and reactivity. Five-membered heterocyclic compounds</p> <p>Pyrrole – preparation - from succinimide, Paal Knorr synthesis; reactions – reduction, basic character, acidic character, electrophilic substitution reactions, ring opening.</p> <p>Furan – preparation from mucic acid and pentosan; reactions – hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction.</p> <p>Thiophene synthesis - from acetylene; reactions – reduction; oxidation;</p>

	<p>electrophilic substitution reactions.</p> <p><b>UNIT V</b>  <b>Six-membered heterocyclic compounds</b></p> <p>Pyridine – synthesis - from acetylene, Physical properties; reactions - basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution- uses  Condensed ring systems</p> <p>Quinoline – preparation - Skraup synthesis and Friedlander’s synthesis; reactions – basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions – Chichibabin reaction</p> <p>Isoquinoline – preparation by the Bischler – Napieralski reaction, reduction, oxidation; electrophilic substitution.</p>
<p>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved  (To be discussed during the Tutorial hours)</p>
<p>Skills acquired from this course</p>	<p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>
<p><b>Recommended Text</b></p>	<p>1.M.K. Jain, S.C.Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2009.</p> <p>2.S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 2009.</p> <p>3. ArunBahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand&amp; CompanyPvt. Ltd., Multicolour edition, 2012.</p> <p>4.P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand &amp; Sons, New Delhi, twenty ninth edition, 2007.</p> <p>5.C.N.Pillai, Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009.</p>
<p><b>Reference Books</b></p>	<p>1.R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia, sixth edition, 2012.</p> <p>2. T.W.Graham Solomons, Organic Chemistry, John Wiley &amp; Sons, eleventh edition, 2012.</p>

	<p>3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, seventh edition, 2009.</p> <p>4. I. L. Finar, Organic Chemistry, Vol. (1&amp; 2), England, Wesley Longman Ltd, sixth edition, 2006.</p> <p>5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, Fifth Edition, 2010.</p>
<b>Website and e-learning sources</b>	<p>1. www.epgpathshala.nic.in</p> <p>2. www.nptel.ac.in</p> <p>3. http://swayam.gov.in</p> <p>4. Virtual Textbook of Organic Chemistry</p>
<p><b>Course Learning Outcomes (for Mapping with POs and PSOs)</b></p> <p><b>On completion of the course the students should be able to</b></p> <p><b>CO1:</b> assign RS notations to chirals and EZ notations to olefins and explain conformations of ethane and butane.</p> <p><b>CO2:</b> explain preparation and properties of aromatic and aliphatic nitro compounds and amines</p> <p><b>CO3:</b> explain colour and constitution of dyes and food additives</p> <p><b>CO4:</b> discuss preparation and properties of five membered heterocycles like pyrrole, furan and thiophene</p> <p><b>CO5:</b> discuss preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline</p>	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
<b>CO1</b>	S	S	S	S	S	S	S	M	S	M
<b>CO2</b>	M	S	S	S	M	S	S	M	M	M
<b>CO3</b>	S	S	S	M	S	S	S	M	S	M
<b>CO4</b>	S	S	S	S	S	S	S	M	M	M
<b>CO5</b>	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to Pos</b>	3.0	3.0	3.0	3.0	3.0

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

<b>Title of the Course</b>	<b>INORGANIC CHEMISTRY -I</b>						
<b>Paper No.</b>	<b>Core VI</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>III</b>	<b>Credits</b>	4	<b>Course Code</b>	U23CH506
		<b>Semester</b>	<b>V</b>				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	4	1	-		5		
<b>Prerequisites</b>	General Chemistry I , II, III and IV						
<b>Objectives of the course</b>	<p>The course aims to provide knowledge on</p> <ul style="list-style-type: none"> <li>• nomenclature, isomerism and theory of coordination compounds, and chelate complexes</li> <li>• crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect</li> <li>• preparation and properties of metal carbonyls</li> <li>• Lanthanoids and actinoids</li> <li>• preparation and properties of inorganic polymers</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT I</b> <b>Co-ordination Chemistry - I</b></p> <p>IUPAC Nomenclature of coordination compounds, Isomerism in coordination compounds. Werner's coordination theory – effective atomic number –interpretation of geometry and magnetic properties by Pauling's theory – geometry of co-ordination compounds with co-ordination number 4 &amp;6.</p> <p>Chelates – types of ligands forming chelates – stability of chelates, applications of chelates in qualitative and quantitative analysis– application of DMG and oxine in gravimetric analysis –estimation of hardness of water using EDTA, metal ion indicators.</p> <p>Role of metal chelates in living systems – haemoglobin and chlorophyll</p> <p><b>Unit II</b> <b>Co-ordination Chemistry - II</b></p> <p>Crystal field theory –Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy (CFSE), spectrochemical series - calculation of CFSE in octahedral and tetrahedral complexes - factors influencing the magnitude of crystal field splitting, crystal field effect on ionic radii, lattice energies, heats of ligation with water as a ligand (heat of hydration), interpretation of magnetic properties, spectra of <math>[\text{Ti}(\text{H}_2\text{O})_6]^{3+}</math> - Jahn – Teller effect. Stability of complexes in aqueous solution, stability constants- factors affecting the stability of a complex ion, thermodynamic and kinetic stability (elementary idea). Comparison of VBT and CFT.</p>						



	<p><b>UNIT III</b> <b>Organometallic compounds</b></p> <p><b>Metal Carbonyls</b> Mono and polynuclear carbonyls, General methods of preparation of carbonyls – general properties of binary carbonyls – bonding in carbonyls – structure and bonding in carbonyls of Ni, Fe, Cr, Co, Mn, Ru and Os. EAN rule as applied to metal carbonyls.</p> <p>Ferrocene-Methods of preparation, physical and chemical properties</p>
	<p><b>UNIT IV</b> <b>Inner transition elements (Lanthanoids and Actinoids)</b></p> <p>General characteristics of f-block elements - Comparative account of lanthanoids and actinoids - Occurrence, Oxidation states, Magnetic properties, Colour and spectra - Lanthanoids and Actinoids, Separation by ion-Exchange and Solvent extraction methods - Lanthanoids contraction-Chemistry of thorium and Uranium-Occurrence, Ores, Extraction, properties and uses - Preparation, Properties and uses of ceric ammonium sulphate, thorium dioxide and uranyl acetate.</p>
	<p><b>UNIT V</b> <b>Inorganic polymers</b></p> <p>General properties – classification of inorganic polymers based on element in the backbone (Si, S, B and P) - preparation and properties of silicones (polydimethylsiloxane and polymethylhydrosiloxane) phosphorous based polymer (polyphosphazines and polyphosphonitrilic chloride), sulphur based polymer (polysulfide and polymeric sulphur nitride), boron based polymers (borazine polymers) – industrial applications of inorganic polymers.</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31<sup>th</sup> Edition, Milestone Publishers &amp; Distributors, Delhi.</li> <li>2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009),</li> </ol>

	<p>Advanced Inorganic Chemistry, 18<sup>th</sup> Edition, S. Chand &amp; Co., New Delhi</p> <p>3. Lee J D, (1991), Concise Inorganic Chemistry, 4<sup>th</sup> Edition, ELBS William Heinemann, London.</p> <p>4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, S. Chand and Company Ltd.</p> <p>5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992.</p>
<b>Reference Books</b>	<p>1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2<sup>nd</sup> ed ., S.Chand and Company, New Delhi.</p> <p>2. Gopalan R, (2009) <u>Inorganic Chemistry for Undergraduates</u>, Ist Edition, University Press (India) Private Limited,Hyderabad</p> <p>3. Sivasankar B, (2013) <u>Inorganic Chemistry</u>.Ist Edition, Pearson, Chennai</p> <p>4. Alan G. Sharp (1992), <u>Inorganic Chemistry</u>, 3<sup>rd</sup> Edition, Addition-Wesley, England</p> <p>5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.</p>
<b>Website and e-learning source</b>	<p>1. www.epgpathshala.nic.in</p> <p>2. www.nptel.ac.in</p> <p>3. http://swayam.gov.in</p>

**Course Learning Outcomes (for Mapping with POs and PSOs)**

**On completion of the course the students should be able to**

**CO1:** explain isomerism, Werner's Theory and stability of chelate complexes

**CO2:** discuss crystal field theory, magnetic properties and spectral properties of complexes.

**CO3:** explain preparation and properties of metal carbonyls

**CO4:** give a comparative account of the characteristics of lanthanoids and actinoids

**CO5:** explain properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorous

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to Pos</b>	3.0	3.0	3.0	3.0	3.0

<b>Title of the Course</b>	<b>PHYSICAL CHEMISTRY -I</b>						
<b>Paper No.</b>	<b>Core VII</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>III</b>	<b>Credits</b>	4	<b>Course Code</b>	U23CH507
		<b>Semester</b>	<b>V</b>				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	5	1	-		6		
<b>Prerequisites</b>	General Chemistry I,II,III and IV						
<b>Objectives of the course</b>	<p>The course aims at providing an overall view of</p> <ul style="list-style-type: none"> <li>• Gibbs free energy, Helmholtz free energy, Ellingham's diagram and partial molar properties</li> <li>• chemical kinetics and different types of chemical reactions</li> <li>• adsorption, homogeneous and heterogeneous catalysis</li> <li>• colloids and macromolecules</li> <li>• photochemistry, fluorescence and phosphorescence</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT I</b> <b>Thermodynamics - III</b></p> <p>Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application.</p> <p>Partial molar properties – chemical potential, Gibbs Duhem equation, variation of chemical potential with temperature and pressure, chemical potential of a system of ideal gases, Gibbs- Duhem-Margules equation.</p>						

## **UNIT II**

### **Chemical Kinetics**

**Rate of reaction** - Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction - rate equation - order of reaction. order and molecularity of simple and complex reactions, Rate laws - Rate constants – derivation of rate constants and characteristics for zero, first order, second and third order (equal initial concentration)  
– Derivation of time for half change with examples. Methods of determination of order of Volumetry, manometry and polarimetry.

Effect of temperature on reaction rate – temperature coefficient - concept of activation energy - Arrhenius equation. Theories of reaction rates – Collision theory – derivation of rate constant of bimolecular gaseous reaction – Failure of collision theory. Lindemann's theory of unimolecular reaction. Theory of absolute reaction rates – Derivation of rate constant for a bimolecular reaction – significance of entropy and free energy of activation. Comparison of collision theory and ARRT.

Complex reactions – reversible and parallel reactions (no derivation and only examples)  
– kinetics of consecutive reactions – steady state approximation.

## **UNIT III**

Adsorption – Chemical and physical adsorption and their general characteristics- distinction between them Different types of isotherms – Freundlich and Langmuir. Adsorption isotherms and their limitations – BET theory, kinetics of enzyme catalysed reaction – Michaelis- Menten and Briggs- Haldene equation – Lineweaver- Burk plot – inhibition – reversible – competitive, noncompetitive and uncompetitive (no derivation of rate equations)

Catalysis – general characteristics of catalytic reactions, auto catalysis, promoters, negative catalysis, poisoning of a catalyst – theories of homogenous and heterogeneous catalysis – Kinetics of Acid – base and enzyme catalysis. Heterogenous catalysis

## **UNIT IV**

### **Colloids and Surface Chemistry**

**Colloids:** Types of Colloids, Characteristics Colloids (Lyophilic and Lyophobic sols), Preparation of Sols- Dispersion methods, aggregation methods, Properties of Sols- Optical properties, Electrical properties - Electrical double layer, Electro Kinetic properties- Electro-osmosis, Electrophoresis,

Coagulation or precipitation, Stability of sols, associated colloids, Emulsions, Gels-preparation of Gels, Applications of colloids

	<p>Macromolecules: Molecular weight of Macromolecules-Number average molecular weight- average molecular weight, Determination of Molecular weight of molecules</p>
	<p><b>UNIT V</b> <b>Photochemistry</b></p> <p>Laws of photo chemistry – Lambert – Beer, Grotthus – Draper and Stark – Einstein. Quantum efficiency. Photochemical reactions – ratelaw – Kinetics of H<sub>2</sub>-Cl<sub>2</sub>, H<sub>2</sub>-Br<sub>2</sub> and H<sub>2</sub>-I<sub>2</sub> reactions, comparison between thermal and photochemical reactions.</p> <p>Fluorescence – applications including fluorimetry – sensitised fluorescence, phosphorescence – applications - chemiluminescence and photosensitisation – examples Chemistry of Vision – 11 cis retinal – vitamin A as a precursor - colour perception of vision</p>
<p>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)</p>
<p>Skills acquired from this course</p>	<p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>
<p><b>Recommended Text</b></p>	<ol style="list-style-type: none"> <li>1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., forty eighth edition, 2021.</li> <li>2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.</li> <li>3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28<sup>th</sup> edition 2019, S, Chand &amp; Co.</li> <li>4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996.</li> <li>5. J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNagin Chand and CO., 1986.</li> </ol>
<p><b>Reference Books</b></p>	<ol style="list-style-type: none"> <li>1. J. Rajaram and J.C. Kuriacose, Chemical Thermodynamics, Pearson, 1<sup>st</sup> edition, 2013.</li> <li>2. Keith J. Laidler, Chemical kinetics, third edition, Pearson, 2003.</li> <li>3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002.</li> <li>4. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan</li> </ol>

	India Ltd, third edition, 2009.  5. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001
<b>Website and e-learning source</b>	1. <a href="https://nptel.ac.in">https://nptel.ac.in</a> 2. <a href="https://swayam.gov.in">https://swayam.gov.in</a> 3. <a href="http://www.epgpathshala.nic.in">www.epgpathshala.nic.in</a>
<b>Course Learning Outcomes (for Mapping with POs and PSOs)</b>	
<b>On completion of the course the students should be able to</b>	
<b>CO1:</b> explain Gibbs and Helmholtz free energy functions, partial molar quantities and Ellinghams	
<b>CO2:</b> apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction, demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation.	
<b>CO3:</b> compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogenous and heterogeneous catalysis.	
<b>CO4:</b> demonstrate the types and characteristics of colloids, preparation of sols and emulsions, and determine the molecular weights of macromolecules.	
<b>CO5:</b> utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision.	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to Pos</b>	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

**CORE:PROJECT**

<b>Title of the Course</b>	<b>In house project</b>						
<b>Paper No.</b>	<b>EC I</b>						
<b>Category</b>	<b>Elective</b>	<b>Year</b>	III	<b>Credits</b>	4	<b>Course Code</b>	<b>U23CH5PJ</b>
		<b>Semester</b>	V				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>LabPractice</b>		<b>Total</b>		
		0	4		4		
<b>Pre requisites</b>	Basic Laboratory skill to carry out research work						
<b>Objectives of the</b>	The course aims at providing knowledge to develop their research skill.						
<b>Course Learning OutComes</b>	<p>Identify Simple scientific problems in the real-life situation related Chemical science</p> <p>Search relevant background Literature ensure the credibility of the research problem</p> <p>Develop a smart and achievable strategy solve the problem</p> <p>Develop a feasible, fool-proof and accurate method analyze the problem</p> <p>Critically analyze, corroborate with previously available knowledge And arrive at scientific findings from the observed results</p> <p>Document, Publish and Present the findings scientifically in the relevant forums by taking Cognizance of the ethical &amp; IPR related issues</p>						

Title of the Course	BIOCHEMISTRY						
Paper No.	EC I						
Category	Elective	Year	III	Credits	3	Course Code	U23CH5:A
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4		-		4		
Prerequisites	Organic Chemistry - I						
Objectives of the course	<p>The course aims at providing knowledge on</p> <ul style="list-style-type: none"> <li>relationship between biochemistry and medicine, composition of blood</li> <li>structure and properties of amino acids, peptides, enzyme, vitamins and proteins</li> <li>biological functions of proteins, enzymes, vitamins and hormones</li> <li>biochemistry of nucleic acids and lipids</li> <li>metabolism of lipids</li> </ul>						
Course Outline	<p><b>UNIT I</b>  <b>Logic of Living Organisms</b>  Relationship of Biochemistry and Medicine  Blood - Composition of Blood, Blood Coagulation – Mechanism.  Hemophilia and Sickle Cell Anaemia  Maintenance of pH of Blood – Bicarbonate Buffer, Acidosis, Alkalosis.</p>						
	<p><b>UNIT II</b>  <b>Peptides and Proteins</b>  <b>Amino acids</b> – nomenclature, classification – essential and Non-essential; Synthesis - Gabriel Phthalimide, Strecker; properties – zwitter ion and isoelectric point, electrophoresis and reactions.</p> <p><b>Peptides</b> – peptide bond – nomenclature – synthesis of simple peptides – solution and solid phase. Determination of structure of peptides, N-terminal analysis – Sanger's &amp; Edmann method; C terminal analysis - Enzymic method.</p> <p><b>Proteins</b> – classification based on composition, functions and structure; properties and reactions – colloidal nature, coagulation, hydrolysis, oxidation, denaturation, renaturation; colour tests for proteins; structure of proteins – primary, secondary, tertiary and quaternary.  Metabolism of Amino acids – general aspects of metabolism (a brief outline); urea cycle.</p>						
	<p><b>UNIT III</b>  <b>Enzymes and Vitamins</b>  Nomenclature and classification, characteristics, factors influencing enzyme activity – mechanism of enzyme action – Lock and key hypothesis, Koshland's induced fit model.  Proenzymes, antienzymes, coenzymes and isoenzymes; allosteric enzyme</p>						



	<p>regulation.</p> <p>Vitamins as coenzymes – functions of TPP, lipoic acid, NAD, NADP, FMN, FAD, pyridoxal phosphate, CoA, folic acid, biotin, cyanocobalamin.</p>
	<p><b>UNIT IV</b></p> <p><b>Amino acids</b></p> <p>Components of nucleic acids - nitrogenous bases and pentose sugars, structure of nucleosides and nucleotides, DNA- structure &amp; functions;</p>
	<p>RNA –types– structure - functions; biosynthesis of proteins</p> <p><b>Hormones</b></p> <p>Adrenalin and thyroxine — chemistry, structure and functions (No structure elucidation).</p>
	<p><b>UNIT V</b></p> <p><b>Lipids</b></p> <p>Occurrence, biological significance of fats, classification of lipids.</p> <p><b>Simple lipids</b> – Oils and fats, chemical composition, properties, reactions – hydrolysis, hydrogenation, trans-esterification, saponification, rancidity; analysis of oils and fats – saponification number, iodine number, acid value, R.M. value. Distinction between animal and vegetable fats.</p> <p><b>Compound lipids</b> – Lipoproteins - VLDL, LDL, HDL, chylomicrons – biological significance.</p> <p>Cholesterol – occurrence, structure, test, physiological activity.</p> <p>Metabolism of lipids: <math>\beta</math>-oxidation of fatty acids.</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)</p>
Skills acquired from this course	<p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. Bahl, B. S.; Bhal, A. <i>Advanced Organic Chemistry</i>, 3<sup>rd</sup> ed.; S. Chand: New Delhi, 2003.</li> <li>2. Jain, M.K.; Sharma, S.C. <i>Modern Organic Chemistry</i>, Vishal Publications: New Delhi, 2017.</li> <li>3. Shanmugam, A. <i>Fundamentals of Biochemistry for Medical Students</i>, 6<sup>th</sup> ed.; Published by the author, 1999.</li> <li>4. Veerakumari, L. <i>Biochemistry</i>, 1<sup>st</sup> ed.; MJP Publications: Chennai, 2004.</li> <li>5. Jain, J. L.; <i>Fundamentals of Biochemistry</i>, 2<sup>nd</sup> ed.; S.Chand: New Delhi, 1983.</li> </ol>

<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Conn, E. E.; Stumpf, P. K. <i>Outline of Biochemistry</i>, 5<sup>th</sup> ed.; Wiley Eastern: New Delhi, 2002.</li> <li>2. West, E. S.; Todd, W. R.; Mason, H. S.; Van Bruggen, J. T. <i>Text Book of Biochemistry</i>, 4<sup>th</sup> ed.; Macmillan: New York, 1970.</li> <li>3. Lehninger, A. L. <i>Principles of Biochemistry</i>, 2<sup>nd</sup> ed.; CBS Publisher: Delhi, 1993.</li> <li>4. Rastogi, S. C. <i>Biochemistry</i>, 2<sup>nd</sup> ed.; Tata McGraw-Hill: New Delhi, 2003.</li> <li>5. Chatterjea, M. N.; Shinde, R. <i>Textbook of Medical Biochemistry</i>, 5<sup>th</sup> ed.; Jaypee Brothers: New Delhi, 2002.</li> </ol>
<b>Website and e-learning source</b>	<ol style="list-style-type: none"> <li>1) <a href="http://library.med.utah.edu/NetBiochem/nucacids.html">http://library.med.utah.edu/NetBiochem/nucacids.html</a></li> <li>2) <a href="http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/EnzymeKinetics.html">http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/EnzymeKinetics.html</a></li> <li>3) <a href="https://swayam.gov.in/courses/4384-biochemistry">https://swayam.gov.in/courses/4384-biochemistry</a> Biochemistry</li> <li>4) <a href="https://onlinecourses.nptel.ac.in/noc19_cy07/preview">https://onlinecourses.nptel.ac.in/noc19_cy07/preview</a> Experimental Biochemistry</li> </ol>

**Course Learning Outcomes (for Mapping with POs and PSOs)**

**On completion of the course the students should be able to**

**CO1:** explain molecular logic of living organisms, composition of blood and blood coagulation

**CO2:** explain synthesis and properties of amino acids, determination of structure of peptides and proteins

**CO3:** explain factors influencing enzyme activity and vitamins as coenzymes

**CO4:** explain RNA and DNA structure and functions

**CO5:** explain biological significance of simple and compound lipids

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to PSOs</b>	3.0	3.0	3.0	3.0	3.0

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

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to POs</b>	3.0	3.0	3.0	3.0	3.0

<b>Title of the Course</b>	<b>INDUSTRIAL CHEMISTRY</b>						
<b>Paper No.</b>	<b>EC II</b>						
<b>Category</b>	<b>Elective</b>	<b>Year</b>	III	<b>Credits</b>	3	<b>Course Code</b>	U23CH5:B
		<b>Semester</b>	V				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	4	-	-		4		
<b>Prerequisites</b>	General Chemistry I,II, III and IV						
<b>Objectives of the course</b>	<p>This course is designed to provide knowledge on</p> <ul style="list-style-type: none"> <li>• classifications and characteristics of fuels</li> <li>• preparation of cosmetics</li> <li>• manufacture of sugar, paper, cement and leather and food processing</li> <li>• applications of abrasives, lubricants and other industrial products</li> <li>• intellectual property rights</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT I</b>  <b>Survey of Indian Industries and mineral resources in India</b></p> <p><b>Fuels:</b> Classification, characteristics of fuels. Solid fuels: coal - classification; analysis of coal- proximate analysis and ultimate analysis; calorific value-determination, carbonisation of coal.</p> <p>Liquid fuels: Petroleum - characteristics; Gasoline aviation petrol- knocking in internal combustion engines, antiknock agents; unleaded petrol-octane number, cetane number.</p> <p>Gaseous fuel: advantages over solid and liquid fuels; water gas, producer gas, carburetted water gas - preparations - uses.</p> <p>Natural gas: LPG-composition, advantages, application; gobar gas- production, composition, advantages, application. Propellants – rocket fuels (basic idea)</p>						
	<p><b>UNIT II</b>  <b>Cosmetics</b></p> <p>Skin care: powders, ingredients; creams and lotion-cleansing, moisturising, all purpose shaving cream, sunscreen; make up preparations.</p> <p>Dental care: tooth pastes – ingredients.</p> <p>Hair care: shampoos-types, ingredients; conditioners-types, ingredients.  Perfumes: natural-plant origin-parts of the plant used, chief constituents;</p>						

	<p>animal origin-amber gries, civetone and musk; synthetic-classification-esters-amylsalicylate alcohols-citronellol; terpeneols-geraniol and nerol; ketones-muskone, coumarin; aldehydes-vanilin.</p> <p><b>Soaps and Detergents</b></p> <p>Soaps-properties, manufacture of soap-batch process; types-transparent soap, toilet soap, powder soap and liquid soap – ingredients.</p> <p>Detergents-definition, properties-cleansing action; soapless detergents-anionic, cationic and non-ionic (general idea only); uses of detergents as surfactants. Biodegradability of soaps and detergents.</p> <hr/> <p><b>UNIT III</b> <b>Sugar Industry</b></p> <p>Manufacture from sugar cane; recovery of sugar from molasses; testing and estimation of sugar.</p> <p><b>Food Preservation and processing</b></p> <p>Food spoilage – causes; Food preservation - methods – high temperature, low temperature, drying, radiation; Food additives – preservatives, flavours, colours, anti-oxidants, sweetening agents; hazards of using food additives; Food standards – Agmark and Codex alimentarius.</p> <hr/> <p><b>UNIT IV</b> <b>Abrasives</b></p> <p>Definition, characteristics, types-natural and synthetic; natural abrasives – diamond, corundum, emery, garnet, quartz – composition, uses; synthetic abrasives – carborundum, aluminium carbide, boron carbide, boronitride, synthetic graphite – composition and uses.</p> <p><b>Leather Industry</b></p> <p>Structure and composition of skin, hide; Manufacture of leather – pre-tanning process – curing, liming, beating, pickling; methods of tanning-vegetable, chrome – one bath, two bath process; finishing.</p> <p><b>Paper Industry</b></p> <p>Manufacture of pulp - mechanical, chemical processes; sulphate pulp, rag pulp; manufacture of paper- beating, refining, filling, sizing, colouring, calendaring; cardboard.</p> <hr/> <p><b>UNIT V</b> <b>Lubricants</b> Definition, classification-liquid, semi-solid, solid and synthetic; properties-viscosity index, flash point, cloud point, pour point, aniline point and drop point; greases-properties, types; cutting fluids,</p>
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	<p>selection of lubricants.</p> <p><b>Cement Industry</b></p> <p>Cement – types, raw materials; manufacture-wet process, constituent of cement, setting of cement; properties of cement-quality, setting time, soundness, strength; mortar, concrete, RCC; curing and decay of concrete.</p> <p><b>Intellectual Property Rights</b></p> <p>Introduction to Intellectual Property Rights – Patents - Factors for patentability - Novelty, Non obviousness, Industrial applications - Patent offices in India: Trademark - Types of trademarks- Certification marks, logos, brand names, signatures, symbols and service marks</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)</p>
Skills acquired from this course	<p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. Sharma, B.K. <i>Industrial Chemistry</i>, 9<sup>th</sup> ed.; Goel Publishing House: Meerut, 1998.</li> <li>2. Wilkinson, J.B.E. Moore, R.J. <i>Harry's Cosmeticology</i>, 7<sup>th</sup> ed.; Chemical Publishers : New York, 1982.</li> <li>3. Alex V. Ramani, <i>Food Chemistry</i>, MJP publishers: Chennai, 2009.</li> <li>4. Jayashree Ghosh, <i>Applied Chemistry</i>, S. Chand : New Delhi, 2006.</li> <li>5. Srilakshmi, B. <i>Food Science</i>, 4<sup>th</sup> ed.; New Age International Publication, 2005.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Jain, P.C.; Jain, M. <i>Engineering Chemistry</i>, 16<sup>th</sup> ed.; Dhanapet Rai: Delhi, 1992</li> <li>2. George Howard, <i>Principles and Practice of Perfumes and Cosmetics</i>, Stanley Therones, Cheltenham: UK, 1987.</li> <li>3. Thankamma Jacob, <i>Foods, Drugs and Cosmetics - A Consumer Guide</i>, Macmillan : London, 1997.</li> <li>4. ShankuntalaManay, N.; Shadaksharaswamy, M. <i>Food Facts and Principles</i>, 3<sup>rd</sup> ed.; New Age Publication, 2008.</li> <li>5. Neeraj Pandey, KhushdeepDharni, <i>Intellectual Property Rights</i>, PHI Learning, 2014.</li> </ol>

<b>Website and e-learning source</b>	<ol style="list-style-type: none"> <li>1. <a href="http://www.sciencecases.org/irradiation/irradiation_notes.asp">http://www.sciencecases.org/irradiation/irradiation_notes.asp</a></li> <li>2. <a href="http://discovery.kcpc.usyd.edu.au/9.5.5/">http://discovery.kcpc.usyd.edu.au/9.5.5/</a></li> <li>3. <a href="https://www.wipo.int/about-ip/en/">https://www.wipo.int/about-ip/en/</a></li> <li>4. <a href="http://www.nptel.ac.in">www.nptel.ac.in</a></li> <li>5. <a href="http://swayam.gov.in">http://swayam.gov.in</a></li> </ol>
<b>Course Learning Outcomes (for Mapping with POs and PSOs)</b>	
<b>On completion of the course the students should be able to</b>	
<b>CO1:</b> summarize the properties of fuels which include petroleum, water gas, natural gas and propellents	
<b>CO2:</b> evaluate cosmetic products, soaps, detergents.	
<b>CO3:</b> explain manufacture of sugar, food spoilages and food additives	
<b>CO4:</b> explain properties of abrasives, manufacture of leather and paper	
<b>CO5:</b> explain properties and manufacture of lubricants and cement, and intellectual property rights	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
<b>CO1</b>	S	S	S	S	S	S	S	M	S	M
<b>CO2</b>	M	S	S	S	M	S	S	M	M	M
<b>CO3</b>	S	S	S	M	S	S	S	M	S	M
<b>CO4</b>	S	S	S	S	S	S	S	M	M	M
<b>CO5</b>	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to Pos</b>	3.0	3.0	3.0	3.0	3.0

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

<b>Title of the Course</b>	<b>ORGANIC CHEMISTRY - II</b>						
<b>Paper No.</b>	<b>Core VIII</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	III	<b>Credits</b>	4	<b>Course Code</b>	U23CH608
		<b>Semester</b>	VI				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	5	1	-		6		
<b>Prerequisites</b>	Organic Chemistry – I						
<b>Objectives of the course</b>	<p>This course aims at providing knowledge on</p> <ul style="list-style-type: none"> <li>• classification, isolation and discussing the properties of alkaloids and terpenes</li> <li>• preparation and properties of saccharides</li> <li>• biomolecules</li> <li>• different molecular rearrangement</li> <li>• preparation and properties of organometallic compounds</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT I</b>  <b>Alkaloids</b>  Classification, isolation, general properties- Hofmann Exhaustive Methylation; Structure elucidation – Coniine, piperine, nicotine.</p> <p><b>Terpenes:</b> Classification, Isoprene rule, isolation and structural elucidation of Citral, alpha terpineol, Menthol, Geraniol and Camphor.</p>						

	<p><b>UNIT II</b>  <b>Carbohydrates</b>  Definition and Classification of Carbohydrates with examples. Relative configuration of sugars. Determination of configuration (Fischer's Proof). Definition of enantiomers, diastereomers, epimers and anomers with suitable examples.</p> <p><b>Monosaccharides</b> – configuration – D and L hexoses – aldohexoses and ketohexoses.  Glucose, Fructose – Occurrence, preparation, properties, reactions, structural elucidation, uses.  Interconversions of sugar series – ascending, descending, aldose to ketose and ketose to aldose.</p> <p><b>Disaccharides</b> – sucrose, lactose, maltose - preparation, properties and uses (no structural elucidation).</p> <p><b>Polysaccharides</b> – Source, constituents and biological importance of homopolysaccharides- starch and cellulose, heteropolysaccharides – hyaluronic acid, heparin.</p>
	<p><b>UNIT III</b>  <b>Molecular rearrangements:</b>  Molecular Rearrangement: Type of rearrangements, Mechanism for Benzidine, Favorskii, Claisen, Fries, Hofmann, Curtius, Schmidt and Beckmann, Pinacol-pinacolone rearrangement</p> <hr/> <p><b>UNIT IV</b>  <b>Special reagents in organic synthesis</b>  AIBN, 9BBN, BINAP/BINOL, BOC, DABCO, DCC, DIBAL, DMAP, NBS/NCS, NMP, PCC,  TBHP, TEMPO</p> <p><b>Organometallic compounds in Organic Synthesis</b>  Preparation, Properties and applications:  Grignard Reagents, Organo Lithium Compounds, Ziegler – Natta, Wilkinson, Metal Carbonyl, Zeiss's Salt</p> <hr/> <p><b>UNIT V</b>  <b>Green Chemistry:</b> Principles, chemistry behind each principle and applications in chemical synthesis. Green reaction media – green solvents, green reagents and catalysts; tools used like microwave and ultra-sound in chemical synthesis.</p>
Extended Professional	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved



Component (is a part of internal component only, Not to be included in the external examination question paper)	(To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1 M.K.Jain, S. C.Sharma, Modern Organic Chemistry, Vishal Publishing, 4<sup>th</sup> reprint,2009.</li> <li>2 S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan IndiaLtd., 3<sup>rd</sup> edition,2009</li> <li>3 Arun Bahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand&amp; Company Pvt. Ltd., Multicolour edition,2012.</li> <li>4 P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand &amp; Sons, New Delhi, 29<sup>th</sup> edition, 2007.</li> </ol>
	5. C Bandyopadhyaya; An Insight into Green Chemistry; Published on 2020
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia,6<sup>th</sup> edition, 2012.</li> <li>2. T.W.Graham Solomons, Organic Chemistry, John Wiley &amp; Sons,11<sup>th</sup> edition, 2012.</li> <li>3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi,7<sup>th</sup> edition,2009.</li> <li>4. I. L. Finar, Organic Chemistry, Vol. (1&amp; 2), England, Wesley Longman Ltd, 6<sup>th</sup> edition, 2006.</li> <li>5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, 5<sup>th</sup> Edition, 2010.</li> </ol>
<b>Website and e-learning source</b>	<ol style="list-style-type: none"> <li>1.www.epgpathshala.nic.in</li> <li>2.www.nptel.ac.in</li> <li>3.http://swayam.gov.in</li> <li>4.Virtual Textbook of Organic Chemistry</li> <li>5.https://vlab.amrita.edu/</li> </ol>

**Course Learning Outcomes (for Mapping with POs and PSOs)**

**On completion of the course the students should be able to**

**CO1:** explain isolation and properties of alkaloids and terpenes

**CO2:** explain preparation and reactions of mono and disachharides

**CO3:** classify biomolecules and natural products based on their structure, properties, reactions and uses.

**CO4:** explain molecular rearrangements like benzidine, Hoffmann etc.,

**CO5:** preparation and properties of organolithium compounds

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

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

<b>Title of the Course</b>	<b>INORGANIC CHEMISTRY –II</b>						
<b>Paper No.</b>	<b>Core IX</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	III	<b>Credits</b>	4	<b>Course Code</b>	U23CH609
		<b>Semester</b>	VI				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	5	1	-		6		
<b>Prerequisites</b>	Inorganic Chemistry – I						
<b>Objectives of the course</b>	<p>The course aims to provide knowledge on</p> <ul style="list-style-type: none"> <li>• tracer elements and their role in the biological system.</li> <li>• iron transport and storage</li> <li>• metallo enzymes, oxygen transport.</li> <li>• silicates and their applications</li> <li>• industrial applications of refractories, alloys, paints and pigments</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT I</b>  <b>Bioinorganic Chemistry</b>  Essential and trace elements: Role of Na<sup>+</sup>, K<sup>+</sup>, Mg<sup>2+</sup>, Ca<sup>2+</sup>, Fe<sup>3+</sup>, Cu<sup>2+</sup> and Zn<sup>2+</sup> in biological systems. Effect of excess intake (Toxicity) of Metal ions – trace elements - As, Cd, Pb, Hg.</p>						
	<p><b>UNIT II</b>  <b>Metal ion transport and storage</b></p> <p>Iron – storage, transport - Transferrin and Ferretin; Iron-porphyrins – myoglobin, haemoglobin – oxygen transport - Bohr effect; Sodium/potassium pump, calcium pump; transport and storage - copper and zinc.</p>						
	<p><b>UNIT III</b>  <b>Metallo enzymes</b></p> <p>Isomerase and synthetases, structure of cyanocobalamin (Vitamin B12), nature of Co-C bond; Metalloenzymes - functions of carboxy peptidase A, zinc metalloenzyme – mechanism and uses, Zn-Cu enzyme - structure and function, carbonic anhydrase, Vitamin B-12 as transferase and isomerase - Iron-sulphur proteins - 2Fe-2S – rubredoxin, 4Fe-2S – ferridoxin, Iron sulphur cluster enzymes.  Invivo and Invitro nitrogen fixation – biological functions of nitrogenase and molybdo enzymes.</p>						

	<p><b>UNIT IV</b> <b>Silicates</b></p> <p>Introduction – general properties of silicates, structure – types of silicates – ortho silicates(zircon), pyrosilicates (thortveitite), chain silicates(pyroxenes), ring silicates(beryl), sheet silicates(talc, mica, asbestos), silicates having three dimensional structure (feldspars, zeolites, ultramarines)</p>
	<p><b>UNIT V</b> <b>Industrial Applications of Inorganic Compounds</b></p> <p>Refractories, pyrochemical, explosives. Alloys, Paints and pigments - requirements of a good paint; classification, constituents of paints – pigments, vehicles, thinners, driers, extenders, anti-knocking agents, anti-skinning agents, plasticizers, binders-application; varnishes- oils, spirit; enamels.</p> <p>Nanocomposite Hydrogels: synthesis, characterization and uses.</p> <p>Industrial visits and internship mandatory.</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
<b>Recommended Text</b>	1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31 <sup>th</sup> ed., Milestone Publishers & Distributors, Delhi.
	2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advanced Inorganic Chemistry, 18 <sup>th</sup> Edition, S. Chand & Co., New Delhi
	3. Lee J D, (1991), Concise Inorganic Chemistry, 4 <sup>th</sup> ed., ELBS William Heinemann, London.
	4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, Schand and Company Ltd.
	5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992

<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2<sup>nd</sup>ed., S.Chand and Company, New Delhi.</li> <li>2. Gopalan R, (2009) <u>Inorganic Chemistry for Undergraduates</u>, Ist Edition, University Press (India) Private Limited, Hyderabad</li> <li>3. Sivasankar B, (2013) <u>Inorganic Chemistry</u>. Ist Edition, Pearson, Chennai</li> <li>4. Alan G. Sharp (1992), <u>Inorganic Chemistry</u>, 3<sup>rd</sup> Edition, Addition-Wesley, England</li> <li>5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.</li> </ol>
<b>Website and e-learning source</b>	<ol style="list-style-type: none"> <li>1. www.epgpathshala.nic.in</li> <li>2. www.nptel.ac.in</li> <li>3. http://swayam.gov.in</li> </ol>

**Course Learning Outcomes (for Mapping with POs and PSOs)**

**On completion of the course the students should be able to**

**CO1:** ability to explain the importance of tracer elements on biological system.

**CO2:** explain the metal ion transport, Bohr effect, Na, K, Ca pump.

**CO3:** explain the function of Vitamin B<sub>12</sub>, Zn-Cu enzyme, ferredoxin, cluster enzymes.

**CO4:** classification and structure of silicates.

**CO5:** explain the manufacture of refractories, explosives, paints and pigments

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
<b>CO1</b>	S	S	S	S	S	S	S	M	S	M
<b>CO2</b>	M	S	S	S	M	S	S	M	M	M
<b>CO3</b>	S	S	S	M	S	S	S	M	S	M
<b>CO4</b>	S	S	S	S	S	S	S	M	M	M
<b>CO5</b>	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to Pos</b>	3.0	3.0	3.0	3.0	3.0

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

title of theCourse	PHYSICAL CHEMISTRY PRACTICAL – II						
Paper No.	Core Practical V						
Category	Core	Year	III	Credits	2	Course Code	U23CH6P5
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	3		3		
Prerequisites	Theoretical knowledge on physical chemistry						
Objectives of the course	<p>This course aims at providing</p> <ul style="list-style-type: none"> <li>• basic principles of physical chemistry experiments</li> <li>• hands on experience in carrying out the experiments</li> </ul>						
Course Outline	<b>UNIT I</b> <b>Phase diagrams</b> 1. Simple eutectic - determination of eutectic temperature and composition of naphthalene-diphenyl amine or naphthalene-diphenyl system 2. Determination of transition temperature of a salt hydrate. 3. Determination of upper critical solution temperature of phenol – water system 4. Effect of an electrolyte on miscibility temperature of phenol – water system 5. Determination of concentration of sodium chloride using phenol-sodium chloride system						
	<b>Unit II</b> <b>Distribution law</b> 6. Determination of the distribution coefficient of iodine between carbon tetrachloride and water. 7. Determination of equilibrium constant of the reaction $I_2 + I^- \rightleftharpoons I_3^-$ 8. Determination of concentration of the given potassium iodide solution using the above equilibrium constant.						
<b>UNIT III</b> <b>Electrochemistry</b> 9. Conductometric titration of hydrochloric acid against sodium hydroxide 10. Potentiometric titration of ferrous ion against potassium dichromate using quinhydrone electrode.							
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)						

Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Reference Books	1. Sindhu, P.S. <i>Practicals in Physical Chemistry</i> , Macmillan India : New Delhi, 2005. 2. Khosla, B. D. Garg, V. C.; Gulati, A. <i>Senior Practical Physical Chemistry</i> , R. Chand : New Delhi, 2011. 3. Gupta, Renu, <i>Practical Physical Chemistry</i> , 1 <sup>st</sup> Ed.; New Age International : New Delhi, 2017.
Website and e-learning source	<a href="https://www.vlab.co.in/broad-area-chemical-sciences">https://www.vlab.co.in/broad-area-chemical-sciences</a>
<b>Course Learning Outcomes (for Mapping with POs and PSOs)</b> <b>On completion of the course the students should be able to</b> <b>CO1:</b> Describe the principles and methodology for the practical work. <b>CO2:</b> Explain the procedure, data and methodology for the practical work <b>CO3:</b> Apply the principles of phase rule and electrochemistry for carrying out the practical work <b>CO4:</b> Demonstrate laboratory skills for safe handling of the equipment and chemicals	

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

<b>Title of the Course</b>	<b>Applications of Computer in Chemistry</b>						
<b>Paper No.</b>	<b>Core Practical VII</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	III	<b>Credits</b>	2	<b>Course Code</b>	U23CH6P6
		<b>Semester</b>	VI				
<b>Instructional Hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	-	-	3		3		
<b>Prerequisites</b>	Theoretical knowledge on Operations of Computers						
<b>Objectives of the course</b>	<p>This course aims at providing</p> <ul style="list-style-type: none"> <li>• Basic Components of Computers</li> <li>• Hands on experience in carrying out the experiments</li> </ul>						
<b>Course Outline</b>	<b>UNIT I</b>						
	<ol style="list-style-type: none"> <li>1. Calculation of Heat of formation of conformers using ARGUS Lab Software.</li> <li>2. Calculation of Strain energies of alicyclic rings using ARGUS Lab Software.</li> <li>3. Visualization of Molecular orbitals and lone pairs in simple molecules using ARGUS Lab Software.</li> <li>4. Calculation of bond energies, bond orders and bond lengths of delocalized and resonance stabilized bonds.</li> </ol>						
<b>Unit II</b>							
<ol style="list-style-type: none"> <li>5. Introduction to chemistry drawing tools - <i>ISIS draw, Chemsketch, Chemdraw, Chemdoodle</i> - Drawing chemical structure, writing chemical equation.</li> <li>6. Drawing the structure of alkanes from methane to dodecane. Calculation of their Properties and Comparing their Melting and Boiling Points.</li> <li>7. Construction of Linear and Branched chain alkanes containing 5, 6, 7 &amp; 8 carbons and Tabulating their properties like Melting and Boiling Points.</li> <li>8. Drawing the cis- and trans- isomers of 1,2-dichloroethene, 1,2-dicarboxyethene and 1,2-diphenylethene. Calculation and Comparison of their dipole moments.</li> </ol>							



**Unit III**

1. Sketch the apparatus setup for distillation process using Chemdraw.
2. Draw the molecular structure of the given Natural Product and get its physical Properties:  
(a) Caffeine (b) Nicotine.
3. Depict the mechanism of a simple  $S_N1$  reaction using Chemdraw. Indicate the mobility of electrons by arrows.
4. Using the template oldraw any 5 fused aromatic ring systems and find their IUPAC Names using 'structure name' option

Title of the Course	PHARMACEUTICAL CHEMISTRY						
Paper No.	Elective Course III						
Category	Elective	Year	III	Credits	3	Course Code	U23CH6:A
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4		-		4		
Prerequisites	Knowledge on active chemical compounds and biochemistry						
Objectives of the course	The course aims at providing an overall view of						
	<ul style="list-style-type: none"> <li>• drugs design and drug metabolism</li> <li>• important Indian medicinal plants, common diseases and antibiotics</li> </ul>						
	<ul style="list-style-type: none"> <li>• drugs for major diseases like cancer, diabetes and AIDS</li> <li>• analgesics and antipyretic agents</li> <li>• significance of clinical tests</li> </ul>						
Course Outline	<p><b>UNIT I</b></p> <p><b>Introduction</b>            Important terminologies – drug, pharmacognosy, pharmacy, pharmacology, pharmacodynamics, pharmacokinetics, clinical pharmacology, pharmacotherapeutics, chemotherapy, toxicology, pharmacophore, antimetabolites, mutation, bacteria, virus, fungi, actinomycetes, vaccines, pharmacopeia, posology and therapeutic index.</p> <p>Sources of drugs – dosage forms – bio availability – routes of administration – absorption, distribution and elimination of drugs – drug metabolism – prescription terms.</p> <p><b>Structure and pharmacological activity</b>            Effect of – unsaturation, chain length, isomerism; groups - halogens amino, nitro, nitrite, cyano, acidic, aldehydic, keto, hydroxyl and alkyl groups.</p> <p><b>Development of Drugs</b>            Development of a drug – classic steps- lead compounds- comparison of traditional and modern methods of development of drugs – drug design by method of variation – disjunction and conjunction methods.</p> <p><b>Unit II</b></p> <p><b>Indian medicinal plants</b>            Some important Indian medicinal plants – tulsi, neem, kizhanelli, mango, semparuthi, adadodai, turmeric and thoothuvalai – uses.</p> <p><b>Common diseases and their treatment</b>            Causes, prevention and treatment of the following diseases:            Insect borne diseases– malaria, filariasis, plague; Air borne diseases– diphtheria, whooping cough, influenza, measles, mumps, common cold, tuberculosis; Water borne diseases – cholera, typhoid, dysentery.            Digestive system – jaundice; Respiratory system – asthma; Nervous system – epilepsy.</p>						

	<p><b>Antibiotics</b>  Definition – classification – structure and therapeutic uses of chloramphenicol, penicillins , structure activity relationship of chloramphenicol ; therapeutic uses of ampicillin, streptomycin, erythromycin, tetracycline, rifamycin.</p>
	<p><b>UNIT III</b>  <b>Drugs for major diseases</b>  Cancer – common causes – chemotherapy – anti neoplastic agents - classification –adverse effects of cytotoxic agents ; alkylating agents – chlorambucil ; anti metabolites – methotrexate, fluouracil ; Vinca alkaloids – vincristine, vinblastine.Diabetes– types –</p>
	<p>management of diabetes – insulin ; oral hypoglycemic agents - sulphonyl ureas – chlorpropamide ; biguanides - metformin – thiazolidinediones .Cardiovascular drugs– cardio glycosides ; anti arrhythmic agents – quinidine, propranolol hydrochloride ; anti-hypertensive drugs - Aldomet, pentoliniumtartarate; vasodilator-tolazoline hydrochloride, sodium nitroprusside.AIDS – causes, symptoms and prevention – anti HIV drugs - AZT, DDC.</p> <p><b>UNIT IV</b>  <b>Analgesics and antipyretic agents</b>  Classification – action of analgesics – narcotic analgesics –morphine; synthetic analgesics – pethidine, methadone; antipyretic analgesics – salicylic acid derivatives, indolyl derivatives, p-aminophenol derivatives.</p> <p><b>Anaesthetics</b>  Definition, characteristics, classification - general anaesthetics – volatile anaesthetics – nitrous oxide, ethers, cyclopropane, chloroform,halothane, trichloro ethylene– storage, advantages and disadvantages ; non volatileanaesthetics – thiopental sodium ; local anaesthetics – requisites – advantages- esters – cocaine, benzocaine ; amides – lignocaine, cinchocaine.</p> <p><b>Blood and haematological agents</b>  Blood– composition, grouping – physiological functions of plasma proteins – mechanism of clotting; Coagulants – vitamin K, protamine sulphate, dry thrombin; Anti coagulants – coumarins, citric acid and heparin; antifibrinolytic agents – aminocaproic acid and tranexamic acid. Anaemia– causes, types and control – anti anaemic drugs.</p>
	<p><b>UNIT V</b>  <b>Clinical Chemistry</b>  Blood tests – blood count – complete haemotogram – Hb, RBC, GTT, TC, DC, platelets, PCV, ESR; bleeding and clotting time — glucose tolerance test.  <b>Significance of Clinical Tests</b>  Serum electrolytes - blood Glucose - orthotoluidine method; Renal</p>

	functions tests - blood urea, creatinine; liver function tests - serum proteins, albumin globulin ratio, serum bilirubin, enzymes SGOT, SGPT; lipid profile – cholesterol, triglycerides, HDL, LDL, coronary risk index. Urine examination – pH, tests for glucose, albumin and bile pigment.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. Jayashree Ghosh, (1999), A text book of pharmaceutical chemistry, 2<sup>nd</sup> ed., S.Chand&amp; company, New Delhi.</li> <li>2. Lakshmi S, (2004), Pharmaceutical chemistry, 3<sup>rd</sup> ed., Sultan chand&amp; sons, Delhi.</li> <li>3. Tripathi K D, (2018), Essentials of medical pharmacology, 8<sup>th</sup> ed., Jaypee brothers medical publishers ( P ) Limited, New Delhi.</li> <li>4. Ashutosh Kar, (2018), Medicinal chemistry, 7<sup>th</sup> ed., New age international ( P ) Limited, Publishers, New Delhi.</li> </ol>
<b>Reference Books</b>	<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Chatwal G R, (2013), Pharmaceutical chemistry, inorganic ( vol-I ) 6<sup>th</sup>ed ., Himalaya publishing house, Bombay.</li> <li>2. Chatwal G R, (1991), Pharmaceutical chemistry, organic ( vol-II ), Himalaya publishing house, Bombay.</li> <li>3. Patrick G, (2002), Instant Notes Medicinal Chemistry, Viva Books Private Limited, New Delhi.</li> <li>4. Intellectual Property Rights, NeerajPandey, Khushdeep Dharni. Publisher: PHI Learning Pvt. Ltd., 2014 ISBN: 812034989X, 9788120349896.</li> </ol>
<b>Website and e-learning source</b>	<ol style="list-style-type: none"> <li>1. <a href="http://www.pharmacy.umaryland.edu/faculty/amackere/courses/phar531_delete/lectures/qsar_1.pdf">http://www.pharmacy.umaryland.edu/faculty/amackere/courses/phar531_delete/lectures/qsar_1.pdf</a></li> <li>2. <a href="http://www.indianmedicinalplants.info/">http://www.indianmedicinalplants.info/</a></li> <li>3. <a href="https://www.wipo.int/about-ip/en/">https://www.wipo.int/about-ip/en/</a></li> </ol>

**Course Learning Outcomes (for Mapping with POs and PSOs)****On completion of the course the students should be able to**

- CO1:** Define the pharmaceutical terminologies; describe the principles in pharmacological activity, drug development, clinical chemistry, hematology, therapeutic drugs and treatment of diseases; list the types of IPR and trademarks.
- CO2:** Discuss the development of drugs, structural activity, disease types, physio-chemical properties of therapeutic agents, significance of medicinal plants, clinical tests and factors for patentability.
- CO3:** Apply the principles involved in structural activity and drug designing, functions of haematological agents; estimation of clinical parameters and therapeutic application of drugs for major diseases.
- CO4:** explain classification of analgesics and anesthetics, and physiological functions of plasma proteins
- CO5:** explain the significance of clinical tests like blood urea, serum proteins and coronary risk index

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to PSOs</b>	3.0	3.0	3.0	3.0	3.0

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

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to Pos</b>	3.0	3.0	3.0	3.0	3.0

**Level of Correlation between PO's and CO's**

<b>Title of the Course</b>	<b>PHYSICAL CHEMISTRY-II</b>						
<b>Paper No.</b>	<b>Elective IV</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	III	<b>Credits</b>	3	<b>Course Code</b>	U23CH6:B
		<b>Semester</b>	VI				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>			<b>Total</b>	
	4	1	-			5	
<b>Prerequisites</b>	Physical Chemistry - I						
<b>Objectives of the course</b>	<p>The course aims at providing an overall view of the</p> <ul style="list-style-type: none"> <li>• phase diagram of one and two component systems</li> <li>• chemical equilibrium,</li> <li>• separation techniques for binary liquid mixtures.</li> <li>• electrical conductance and transport number.</li> <li>• galvanic cells, EMF and significance of electrochemical series.</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT-I</b>  <b>Phase rule</b>  Definition of terms; derivation of phase rule ; application to one component systems – water and sulphur - super cooling, sublimation ; two component systems – solid liquid equilibria- simple eutectic (lead - silver and bismuth - cadmium), freezing mixtures (potassium iodide-water), compound formation with- congruent melting points (magnesium – zinc and ferric chloride – water system), peritectic change (sodium – potassium), solid solution (gold-silver); copper sulphate – water system.</p> <p><b>UNIT II</b>  <b>Chemical equilibrium</b>  Law of mass action – thermodynamic derivation – relationship between <math>K_p</math> and <math>K_c</math> - application to the homogeneous equilibria – dissociation of <math>PCl_5</math> gas, <math>N_2O_4</math> gas – equilibrium constant and degree of dissociation - formation of HI, <math>NH_3</math>, and <math>SO_3</math> – heterogeneous equilibrium – decomposition of solid calcium carbonate – Lechatelier principle – van't Hoff reaction isotherm – temperature dependence of equilibrium constant – van't Hoff reaction isochore – Clayperon equation – ClausiusClayperon equation and its applications</p> <p><b>UNIT III</b>  <b>Binary liquid mixtures</b>  Ideal liquid mixtures – non ideal solutions – azeotropic mixtures – fractional distillation – partially miscible mixtures – phenol-water, triethylamine-water, nicotine-water – effect of impurities on critical solution temperature; immiscible liquids- steam distillation; Nernst distribution law – applications.</p>						

	<p><b>UNIT IV</b>  <b>Electrical Conductance and Transference</b>  Arrhenius theory of electrolytic dissociation – Ostwald’s dilution law, limitations of Arrhenius theory; behavior of strong electrolytes – interionic effects – Debye Huckel theory –Onsager equation (no derivation), significance of Onsager equation, Debye Falkenhagen effect, Wien effect. Ionic mobility – Discharge of ions on electrolysis (Hittorf’s theoretical device), transport number –determination – Hittorf’s method, moving boundary method – factors affecting transport number – determination of ionic mobility; Kohlrausch’s law- applications; molar ionic conductance and viscosity (Walden’s rule); applications of conductance measurements – determination of - degree of dissociation of weak electrolyte, dissociation constant of weak acid and weak base, ionic product of water, solubility and solubility product of sparingly soluble salts - conductometric titrations – acid base titrations.</p> <p><b>UNIT V</b>  <b>Galvanic Cells and Applications</b>  Galvanic cell, representation, reversible and irreversible cells, EMF and its measurement – standard cell; relationship between electrical energy and chemical energy; sign of EMF and spontaneity of a reaction, thermodynamics and EMF – calculation of <math>\Delta G</math>, <math>\Delta H</math>, and <math>\Delta S</math> from EMF data; reversible electrodes, electrode potential, standard electrode potential, primary and secondary reference electrodes, Nernst equation for electrode potential and cell EMF; types of electrodes – metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode, redox electrode; electrochemical series – applications of electrochemical series. Chemical cells with and without transport, concentration cells with and without transport;  <b>Applications of EMF measurements</b>  applications of EMF measurements – determination of activity</p>
	<p>coefficient of electrolytes, transport number, valency of ions, solubility product, pH using hydrogen gas electrode, quinhydrone electrode and glass electrode, potentiometric titrations – acid base titrations, redox titrations, precipitation titrations, ionic product of water and degree of hydrolysis; redox indicators - use of diphenylamine indicator in the titration of ferrous iron against dichromate.  <b>Industrial component</b>  Galvanic cells- lead storage, Ni-Cd, Li and Zn-air, Al-air batteries  Fuel cells – <math>H_2-O_2</math> cell – efficiency of fuel cells.  corrosion –mechanism, types and methods of prevention.</p>

<p>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)</p>
<p>Skills acquired from this course</p>	<p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>
<p><b>Recommended Text</b></p>	<ol style="list-style-type: none"> <li>1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, ShobanLalNagin Chand and Co., forty eighth edition, 2021.</li> <li>2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.</li> <li>3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28<sup>th</sup> edition 2019, S, Chand &amp; Co.</li> <li>4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996.</li> <li>5. J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNagin Chand and CO., 1986.</li> </ol>
<p><b>Reference Books</b></p>	<ol style="list-style-type: none"> <li>1. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition,2009.</li> <li>2. Gilbert. W. Castellen, Physical Chemistry, Narosa Publishing House, third edition, 1985.</li> <li>3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002.</li> <li>4. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001</li> <li>5. D.N.Bajpai, Advanced Physical Chemistry, S.Chand&amp;Co., 2001</li> </ol>



<b>Website and e-learning source</b>	<a href="https://nptel.ac.in">https://nptel.ac.in</a> <a href="https://swayam.gov.in">https://swayam.gov.in</a> <a href="https://archive.nptel.ac.in/content/storage2/courses/112108150/pdf/PPTs/MTS_07_m.pdf">https://archive.nptel.ac.in/content/storage2/courses/112108150/pdf/PPTs/MTS_07_m.pdf</a> Thermodynamics - NPTEL <a href="https://www.youtube.com/watch?v=f0udxGcoztE">https://www.youtube.com/watch?v=f0udxGcoztE</a> Introduction to chemical equilibrium – MIT opencourse ware
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**Course Learning Outcomes (for Mapping with POs and PSOs)On**

**completion of the course the students should be able to**

**CO1:** construct the phase diagram for one component and two component systems, explain the properties of freezing mixture, component with congruent melting points and solidsolutions.

**CO2:** apply the concepts of chemical equilibrium in dissociation of  $PCl_5$ ,  $N_2O_4$  and formation of HI,  $NH_3$ ,  $SO_3$  and decomposition of calcium carbonate. Demonstrate important principles such as Le chatelier principle, van't Hoff reaction isotherm and Clausius-Clayperon equation.

**CO3:** Identify an appropriate distillation method for the separation of binary liquid mixtures such as azeotropic mixtures, partially miscible mixtures and immiscible liquids.

**CO4:** Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equation and Kohlrausch's law in conductance.

**CO5:** Construct electrochemical cell with the help of electrochemical series and calculate cell EMF. Demonstrate the applications of EMF and significance of potentiometric titrations.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
<b>CO1</b>	S	S	S	S	S	S	S	M	S	M
<b>CO2</b>	M	S	S	S	M	S	S	M	M	M
<b>CO3</b>	S	S	S	M	S	S	S	M	S	M
<b>CO4</b>	S	S	S	S	S	S	S	M	M	M
<b>CO5</b>	S	M	S	S	S	S	S	M	M	S

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
<b>CO1</b>	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3
<b>Weightage</b>	15	15	15	15	15
<b>Weighted percentage of Course Contribution to Pos</b>	3.0	3.0	3.0	3.0	3.0

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

<b>Title of the Course</b>	<b>POLYMER CHEMISTRY</b>						
<b>Paper No.</b>	<b>EC iV</b>						
<b>Category</b>	<b>Elective</b>	<b>Year</b>	III	<b>Credits</b>	3	<b>Course Code</b>	U23CH6:C
		<b>Semester</b>	VI				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	4	1	-		5		
<b>Prerequisites</b>	Knowledge on functional groups and reaction mechanisms						
<b>Objectives of the course</b>	<p>The course aims at providing an overall view of</p> <ul style="list-style-type: none"> <li>• classification of polymers, preparation of polymers</li> <li>• kinetics of polymerization and characterization of polymers</li> <li>• analytical techniques used to characterize polymers</li> <li>• reactions of polymers</li> <li>• speciality polymers like PVC, PMMA</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT I</b>  <b>Introduction</b>  Difference between polymer and macromolecule – classification – synthetic and natural, organic and inorganic, thermoplastic and thermosetting. Plastics, elastomers, fibres and liquid resins.</p> <p><b>Techniques of polymerization</b>  Bulk, solution, emulsion and suspension polymerization</p> <p><b>Unit – II</b>  <b>Kinetics of polymerization</b>  Kinetics of condensation and addition polymerisation; ionic, free radical, copolymerisation and coordination polymerisation – reactivity ratios – block and graft copolymers.  <b>Characterisation of polymers</b>  Appearance, feel and hardness, density, effect of heat, solubility, combustion, tensile strength, shear, stress, impact strength, mechanical, thermomechanical and rheological properties of polymers in viscoelastic state.</p> <p><b>UNIT III</b>  <b>Molecular Weight and Properties of Polymers</b>  Molecular Weight of Polymers-Number Average and Weight Average, Molecular Weight Distribution, Determination of Molecular Weight polydispersity index – membrane and vapour phase osmometry, light scattering - Zimm plot, ultracentrifuge – sedimentation velocity and sedimentation equilibrium – viscometry – gel permeation chromatography  Thermal properties of polymers – Glass Transition Temperature-State of Aggregation and State of Phase Transitions, Factors Influencing Glass Transition Temperature, Importance of Glass Transition Temperature, Heat Distortion Temperature, TGA / DTA, Crystallinity of Polymers: Crystalline Behaviour, Degree of Crystallinity</p>						

	<p><b>UNIT IV</b> Reactions of Polymers-Hydrolysis, Acidolysis, Aminolysis, Addition and Substitution Reactions (One Example Each) Cyclisation, Cross-Linking and Reactions of Specific Functional Groups in the Polymer</p> <p><b>Polymer technology</b> Processing of polymers – casting, thermoforming, moulding – extrusion, compression, blow moulding – foaming, lamination, reinforcing – processing of fibres – melt, wet and dry spinning.</p>
	<p><b>UNIT V</b> <b>Speciality polymers</b> Polyelectrolytes, conducting polymers, polymeric supports for solid phase synthesis, biomedical polymers, liquid crystalline polymers, electroluminescent polymers – two examples of each of these polymers. Polyethylene, PVC, PMMA, polyester; rubber – synthetic and natural, vulcanisation of rubber.</p> <p><b>Polymer Degradation</b> Types of Degradation - Thermal, Mechanical, Ultra Sound, Photo</p>
	<p>Radiation and Chemical Degradation Methods. Rubber-Natural and Synthetic-Structure, Mechanism of Vulcanisation Biodegradable and Non-Biodegradable Polymers.</p>
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	<p>Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)</p>
Skills acquired from this course	<p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>1. Gowariker V.R, N.V. Viswanthan and Jayadev Sreedhar. Polymer Science.</li> <li>2. New Delhi: New Age International, 2015</li> <li>3. Misra G.S. Introductory Polymer Chemistry. New Delhi: Wiley Eastern, 2010.</li> <li>4. Bahadur P and Sastry N V. Principles of Polymer Science. New Delhi: Narosa Publishing House, 2005</li> <li>5. Ahluwalia, V.K. Anuradha Mishra, <i>Polymer Science A Text Book</i>, Ane Books India: New Delhi, 2008.</li> <li>6. Morrison, R. R.; Boyd, R. N.; Bhattacharjee, S. K. <i>Organic Chemistry</i>, 7<sup>th</sup> ed.; Pearson: New Delhi, 2011.</li> </ol>

<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Billmeyer, F.W. <i>Polymer Science</i>. India: Wiley-Interscience, 2007.</li> <li>2. Seymour, R. B.; Carraher Jr. C.E. <i>Polymer Chemistry: An Introduction</i>, Marcel Dckker Inc : New York, 1981.</li> <li>3. Sinha, R. <i>Outlines of Polymer Technology</i>, Prentice Hall of India: New Delhi, 2000.</li> <li>4. Joel R. Fried, <i>Polymer Science and Technology</i>, 3<sup>rd</sup> ed.; Prentice Hall of India: New Delhi, 2014.</li> </ol>
<b>Website and e-learning source</b>	<ol style="list-style-type: none"> <li>1. <a href="https://polymerdatabase.com">https://polymerdatabase.com</a></li> <li>2. <a href="http://amrita.vlab.co.in/?sub=2&amp;brch=190&amp;sim=603&amp;cnt=1">http://amrita.vlab.co.in/?sub=2&amp;brch=190&amp;sim=603&amp;cnt=1</a></li> <li>3. <a href="http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/polymers.htm">http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/polymers.htm</a></li> <li>4. <a href="http://nsdl.niscair.res.in/bitstream/123456789/406/2/Molecular+weights+of+polymers.pdf">http://nsdl.niscair.res.in/bitstream/123456789/406/2/Molecular+weights+of+polymers.pdf</a></li> </ol>
<p><b>Course Learning Outcomes (for Mapping with POs and PSOs)</b>  <b>On completion of the course the students should be able to</b>  <b>CO1:</b> explain classification of polymers, elastomers, fibres and liquid resins  <b>CO2:</b> explain addition and condensation polymerization, mechanical properties of polymers  <b>CO3:</b> determine the molecular weight of polymers, and explain the thermal properties of polymers  <b>CO4:</b> explain reactions of polymers and polymer processing  <b>CO5:</b> discuss speciality polymers like PVC, PMMA, rubbers, biodegradable polymers</p>	

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

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

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0