

**MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI**

**B.Sc.CHEMISTRY (Affiliated Colleges)**

**LEARNING OUTCOME BASED CURRICULUM**

**(For those who joined from 2023-2024 onwards)**

**VISION AND MISSION OF THE UNIVERSITY**

***VISION***

" To provide quality education to reach the unreached "

***MISSION***

- To conduct research, teaching and outreach programmes to improve conditions of human living
- To create an academic environment that honours women and men of all races, caste, creed, cultures and an atmosphere that values intellectual curiosity, pursuit of knowledge, academic freedom and integrity
- To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
- To develop partnership with industries and government so as to improve the quality of the workplace and to serve as <sup>catalyst</sup> for economic and cultural development
- To provide quality / inclusive education, especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled

**VISION AND MISSION OF DEPARTMENT**

***VISION***

To make the students excel in the fields of education, fundamental and advanced research in Chemistry by providing quality education so that they can compete and contribute to the varying *technology*.

***MISSION***

1. To teach the students to analyze problems ranging from the basics of Chemistry to advanced level.

2. To give the students adequate hands on experience to work in applied fields.
3. To train the students to act as a useful member or effective leader of a team in multidisciplinary setting.

### **PREAMBLE**

The B.Sc Chemistry programme is fundamental to the revolution taking place in Science and Technology. The aim of the programme is to impart basic skills and knowledge on the principles of all branches of Chemistry to cater to need of Society, Scientific Organization and Industries in the context of developing needs of our country by providing extensive coverage on the fundamental aspects of chemistry relating applications of chemistry to life systems. This course provides intensive practical training to develop associate and apply various aspects of chemistry in day to day life .The programme prepares the students to achieve success in competitive examinations and make developments of needs of their life.

### **Eligibility for the B.Sc Chemistry Programme**

B.Sc Chemistry is a three year Undergraduate course which one can apply after completing 12<sup>th</sup> from science stream. Eligibility for the course says that the interested must have science with subjects as Physics, Chemistry, Mathematics, Biology or Computer Science as their main subjects from any recognized board.

## **LEARNING OUTCOME BASED CURRICULUM FRAMEWORK**

### **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, healthcare, 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 soon.

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 learner 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 OUTCOMESBASED 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>
	<p><b>PO1 :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>PO2: 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>PO3 :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>PO 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>PO 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>PO 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>

**PO7:Cooperation/Team work:** 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

**PO 8 : Scientific reasoning:** 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.

**PO 9 : Reflective thinking:** Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society

**PO 10 : Information/digital literacy:** 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.

**PO 11 :Self-directed learning:** Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.

**PO 12 :Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

**PO 13 :Moral and ethical awareness/reasoning:** 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.

**PO 14 : Leadership readiness/qualities:** 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.

**PO 15 : Lifelong learning:** Ability to acquire knowledge and skills, including „learning

	<p>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>
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<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>
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PO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
PO 1	✓					
PO 2		✓				
PO 3			✓			
PO 4				✓		
PO 5					✓	
PO 6						✓

### 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:**

Semester	Newly introduced Components	Outcome / Benefits
<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>	<b>Elective papers</b> -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> <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</li> </ul>

		citizens.
<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>		<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,</li> <li>• 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>	<ul style="list-style-type: none"> <li>❖ Knowledge</li> <li>❖ Problem Solving</li> <li>❖ Analytical ability</li> <li>❖ Professional Competency</li> <li>❖ Professional Communication</li> <li>❖ Transferrable Skill</li> </ul>
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**Credit Distribution for I year UG Programmes**

<b>Sem I</b>	<b>Credit</b>	<b>H</b>	<b>Sem II</b>	<b>Credit</b>	<b>H</b>
Part 1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6
Part.2 English	3	6	Part..2 English	3	6
1.3 Core Course – CC I	5	5	2..3 Core Course – CC III	5	5
1.4 Core Course – CC II	3	3	2.4 Core Course – CC IV	3	3
1.5 Elective I Generic/ Discipline Specific	3	4	2.5 Elective I Generic/ Discipline Specific	3	4
1.6 Elective II Generic/ Discipline Specific	2	2	2.6 Elective II IGeneric/ Discipline Specific	2	2
1.7 Skill Enhancement Course SEC-1	2	2	2.7 Skill Enhancement Course SEC-2	2	2
1.8 Skill Enhancement - (Foundation Course)	2	2	2.8 Skill Enhancement Course –SEC-3	2	2
	<b>23</b>	<b>30</b>		<b>23</b>	<b>30</b>

**Template for Curriculum Design for UG Programme in Chemistry**

**Credit Distribution for UG Programme in Chemistry**

**B.Sc CHEMISTRY FIRST YEAR**

**SEMESTER I**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>Hours per week (L/T/P)</b>
<b>Part I</b>	Language – Tamil	3	6
<b>Part II</b>	English	3	6
<b>Part III</b>	Core Courses & Elective Course 1 (Generic/Discipline Specific) EC1	13	14
<b>Part IV</b>	Skill Enhancement Course SEC-1 Foundation Course FC	2 2	2 2
		<b>23</b>	<b>30</b>

**SEMESTER II**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>Hours per week (L/T/P)</b>
<b>Part I</b>	Language	3	6
<b>Part II</b>	English	3	6
<b>Part III</b>	Core Courses & Elective Course 1 (Generic/Discipline Specific) EC2	13	14
<b>Part IV</b>	Skill Enhancement Course-SEC-2 Skill Enhancement Course-SEC-3 (Discipline/Subject Specific)	2 2	2 2
		<b>23</b>	<b>30</b>

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

<b>MethodsofEvaluation</b>		
<b>Internal Evaluation</b>	ContinuousInternalAssessmentTest	25 Marks
	Assignments	
	Seminars	
	AttendanceandClassParticipation	
<b>ExternalEvaluat ion</b>	EndSemesterExamination	75 Marks
	Total	100 Marks
<b>MethodsofAssessment</b>		
<b>Recall(K1)</b>	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions	
<b>Understand/Co mprehend(K2)</b>	MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryor Overview	
<b>Application (K3)</b>	Suggestidea/conceptwithexamples,Suggestformulae, Solveproblems, Observe,Explain	
<b>Analyze(K4)</b>	Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate betweenvariousideas,Mapknowledge	
<b>Evaluate(K5)</b>	Longer essay/Evaluationessay,Critiqueorjustifywithprosandcons	
<b>Create(K6)</b>	Checkknowledgeinspecificoroffbeatsituations,Discussion,Debatingor Presentations	

## B.Sc Chemistry Curriculum Design First Year

### SEMESTER-I

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	6
Part-III	General Chemistry – ICC1	5	5
	Quantitative Inorganic estimation (titrimetry) and Inorganic Preparations CC2	3	3
	Allied Chemistry for Physical sciences ( Mathematics and Physics) GE I	3	4
	Allied chemistry Practical I - Volumetric Analysis GE II	2	2
Part-IV	Skill Enhancement Course SEC-1	2	2
	Foundation Course FC	2	2
	Total	<b>23</b>	<b>30</b>

### SEMESTER - II

Part	List of Courses	Credit	Hours per week (L/T/P)
Part-I	Language	3	6
Part-II	English	3	6
Part-III	General Chemistry – IICC3	5	5
	Qualitative Organic Analysis and Preparation of Organic Compounds CC4	3	3
	Allied Chemistry for Physical sciences (Mathematics and Physics) GE III	3	4
	Allied chemistry Practical II - Systematic Analysis of Organic Compounds GE IV	2	2
Part-IV	Skill Enhancement Course SEC-2	2	2
	Skill Enhancement Course SEC-3 (Discipline / Subject Specific)	2	2
	Cosmetics and Personal care Products		
	Total	<b>23</b>	<b>30</b>

## SEMESTER I

<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>	I	<b>Credits</b>	5	<b>Course Code</b>	
		<b>Semester</b>	I				
<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>• periodictable, 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>	<p><b>UNIT I Atomic structure and Periodic trends</b></p> <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; Numerical problems involving the core concepts.</p>						

## **Unit II**

### **Introduction to Quantum mechanics**

Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wave functions, Formulation of Schrodinger wave equation - Probability and electron density - visualizing the orbitals - Probability density and significance of  $\Psi$  and  $\Psi^2$ .

### **Modern Periodic Table**

**Cause of periodicity**; 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.

Problems involving the core concepts

## **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 polarization - 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 –  $\text{CO}_2$ ,  $\text{NO}_2$ ,  $\text{CO}_3^{2-}$ ,  $\text{NO}_3^-$ ; limitations of VBT; MO theory – bonding, antibonding and nonbonding  $\text{H}_2$ ,  $\text{C}_2$ ,  $\text{O}_2$ ,  $\text{O}_2^+$ ,  $\text{O}_2^-$ ,  $\text{N}_2$ ,  $\text{NO}$ ,  $\text{HF}$ ,  $\text{CO}$ ,  $\text{CO}_2$  magnetic characteristics, comparison of VB and MO theories.

Coordinate bond: Definition, Formation of  $\text{BF}_3$ ,  $\text{NH}_3$ ,  $\text{NH}_4^+$ ,  $\text{H}_3\text{O}^+$  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 boiling points

**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; inductive 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>, 4<sup>th</sup> 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>, 10<sup>th</sup> 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://online.courses.nptel.ac.in">https://online.courses.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 student 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.



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

**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
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**

<b>Title of the Course</b>	<b>Quantitative Inorganic Estimation (titrimetry) and Inorganic Preparations</b>						
<b>Paper No.</b>	<b>Core II</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	
		<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>	<p><b>Unit I 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 ventilations 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> 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-</p>						

	<p>base, redox, complexometric, iodimetric and iodometric titrations; indicators— types, theory of acid–base, redox, metal ion and adsorption indicators, choice of indicators.</p>
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	<p><b>Unit II Quantitative Estimation (Volumetric)</b> Preparation of standard solution, dilution from stock solution</p> <p><b>Permanganometry</b> 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 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 Tetraamminecopper(II) sulphate Hexamminecobalt(III) chloride Mohr's Salt</p>
<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></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>



<b>Website and e-learning source</b>	<b>WebReferences:</b> 1) <a href="http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis">http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis</a> 2) <a href="https://chemdictionary.org/titration-indicator/">https://chemdictionary.org/titration-indicator/</a>
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### Course Learning Outcomes (for Mapping with POs and PSOs)

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

**CO1:** explain the basic principles involved in titrimetric analysis and inorganic preparations.

**CO2:** compare the methodologies of different titrimetric analysis.

**CO3:** 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.

**CO4:** assess the yield of different inorganic preparations and identify the endpoint of various titrations.

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

### 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
<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

<b>Title of the Course</b>	<b>ALLIED CHEMISTRY FOR PHYSICAL SCIENCES I (FOR MATHEMATICS &amp; PHYSICS STUDENTS)</b>						
<b>Paper No.</b>	<b>Generic Elective I</b>						
<b>Category</b>	<b>Generic Elective</b>	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>	
		<b>Semester</b>	I				
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>		
	4	-			4		
<b>Prerequisites</b>	Higher secondary chemistry						
<b>Objectives of the course</b>	<p>This course aims to provide knowledge on the</p> <ul style="list-style-type: none"> <li>• basics of atomic orbitals, chemical bonds, hybridization</li> <li>• concepts of thermodynamics and its applications.</li> <li>• concepts of nuclear chemistry</li> <li>• importance of chemical industries</li> <li>• Qualitative and analytical methods.</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT I Chemical Bonding and Nuclear Chemistry</b></p> <p>Chemical Bonding: Molecular Orbital Theory - bonding, antibonding, and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties. Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers - Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences - Stellar energy. Application of radioisotopes - carbon dating, rock dating and medicinal applications.</p>						
	<p><b>Unit III Industrial Chemistry</b></p> <p>Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required).</p> <p>Silicones: Synthesis, properties and uses of silicones.</p> <p>Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate,</p>						

triplesuperphosphate.

### **UNIT III Fundamental Concepts in Organic Chemistry**

Hybridization: Orbital overlap, hybridization and geometry of  $\text{CH}_4$ ,  $\text{C}_2\text{H}_4$ ,  $\text{C}_2\text{H}_2$  and  $\text{C}_6\text{H}_6$ . Electronic effects: Inductive effect and consequences on  $K_a$  and  $K_b$  of organic acids and bases, electromeric, mesomeric, hyperconjugation and steric-examples. Reaction mechanisms: Types of reactions – aromaticity (Huckel's rule) – aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

### **UNIT IV Thermodynamics and Phase Equilibria**

Thermodynamics: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Carnot's cycle and its significance. Free energy change and its importance (no derivation).

Conditions for spontaneity in terms of entropy and Gibbs free energy. Relationship between Gibbs free energy and entropy. Phase Equilibria: Phase rule – definition of terms in it. Applications of phase rule to water system. Two component system – Reduced phase rule and its application to a simple eutectic system (Pb-Ag).

**UNIT V Analytical Chemistry**

Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques—extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.

Extended	Questions related to the above topics, from various competitive
Professional	examinations UPSC/JAM/TNPSC other 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. V. Veeraiyan, Textbook of Ancillary Chemistry; Highmount publishing house, Chennai, first edition, 2009.</li><li>2. S. Vaithyanathan, Textbook of Ancillary Chemistry; Priya Publications, Karur, 2006.</li><li>3. S. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry; S. Chand and Company, New Delhi, twenty third edition, 2012.</li><li>4. P. L. Soni, H. M. Chawla, Text Book of Organic Chemistry; Sultan Chand &amp; sons, New Delhi, twenty ninth edition, 2007.</li></ol>

<b>Reference Books</b>	<p>5. P.L.Soni, Mohan Katyal, Textbook of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.</p> <p>6. B.R.Puri, L.R.Sharma, M.S.Pathania, Textbook Physical Chemistry; Vishal Publishing Co., New Delhi, fortyfourth edition, 2018.</p> <p>7. B.K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.</p>
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**Course Learning Outcomes (for Mapping with POs and PSOs)**

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

**CO1:** gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications.

**CO2:** evaluate the efficiencies and uses of various fuels and fertilizers

**CO3:** explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.

**CO4:** apply various thermodynamic principles, systems and phase rule.

**CO5:** explain various methods to identify an appropriate method for the separation of chemical components

CO/PO	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	S
CO3	S	S	S	M	S	S	S	S	S	M
CO4	S	S	M	S	S	S	S	M	M	S
CO5	S	M	S	S	S	M	S	S	M	S

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

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

<b>Title of the Course</b>	<b>ALLIED CHEMISTRY PRACTICAL FOR PHYSICAL SCIENCES I (For Mathematics and Physics – I Year / I Semester)</b>					
<b>Paper No.</b>	<b>Generic Elective II</b>					
<b>Category</b>	<b>Generic Elective</b>	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>
		<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>						
<b>Objectives of the course</b>	<p>This course aims to provide knowledge on the</p> <ul style="list-style-type: none"> <li>• basics of preparation of solutions.</li> <li>• principles and practical experience of volumetric analysis</li> </ul>					
<b>Course Outline</b>	<p><b>VOLUMETRIC ANALYSIS</b></p> <ol style="list-style-type: none"> <li>1. Estimation of sodium hydroxide using standard sodium carbonate.</li> <li>2. Estimation of hydrochloric acid using standard oxalic acid.</li> <li>3. Estimation of ferrous sulphate using standard Mohr's salt.</li> <li>4. Estimation of oxalic acid using standard ferrous sulphate.</li> <li>5. Estimation of potassium permanganate using standard sodium hydroxide.</li> <li>6. Estimation of magnesium using EDTA.</li> <li>7. Estimation of ferrous ion using diphenylamine as indicator.</li> </ol>					
<b>Reference Books</b>	V. Venkateswaran, R. Veerasamy, A. R. Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.					

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

CO1: gain an understanding of the use of standard flask and volumetric pipettes, burette.

CO2: design, carry out, record and interpret the results of volumetric titration.

CO3: apply their skill in the analysis of water/hardness.

CO4: analyze the chemical constituents in allied chemical products

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

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

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
<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 PO's and CO's**

<b>Title of the Course</b>	<b>FOOD CHEMISTRY</b>						
<b>Paper No</b>	<b>SEC I</b>						
<b>Category</b>	<b>SEC</b>	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	
		<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 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 Food Adulteration</b></p> <p>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 Food Poison</b></p> <p>Food poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion) - Chemical poisons - First aid for poison consumed victims.</p>						



	<p><b>Unit-III Food Additives</b></p> <p>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> <hr/> <p><b>UNIT-IV Beverages</b></p> <p>Beverages-soft drinks-soda-fruit juices-alcoholic beverages-examples. Carbonation-addiction to alcohol–diseases of liver and social problems</p> <hr/> <p><b>UNIT-V Edible Oils</b></p> <p>Fats and oils-Sources of oils-production of refined vegetable oils-preservation. Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventing heart diseases-determination of iodine value, RM value, saponification values and their significance.</p>
<p><b>Recommended Text</b></p>	<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, Dr. L. Rakesh Sharma, Evince publishing, 2022.</li> <li>4. 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 2<sup>nd</sup> edition, 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. de Man, John W. Finley, W. Jeffrey Hurst, Chang Yong Lee, Springer, Fourth edition, 2018.</li> </ol>
<b>Website and e-learning Source</b>	<p><a href="https://onlinecourses.nptel.ac.in/http://cactus.dixie.edu/sblack/chem1010/lec">https://onlinecourses.nptel.ac.in/http://cactus.dixie.edu/sblack/chem1010/lec</a></p>

<b>CO / PO</b>	<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/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 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>FOUNDATION COURSE</b>						
<b>Paper No.</b>	<b>SEC</b>						
<b>Category</b>	<b>SEC</b>	<b>Year</b>	I	<b>Credits</b>	2	<b>Course Code</b>	
		<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>• atom structure and electronic configuration</li> <li>• types of chemical bonding characters</li> <li>• different states of matter and their general properties</li> <li>• nomenclature of and isomerism in organic compounds</li> <li>• basic concepts of spectroscopy</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT-I</b></p> <p><b>Structure of atom and periodic classification of Elements and properties.</b></p> <p>Atom structure-Fundamental particles-Atomic mass- Atomic number – Isotopes –Isobars – Isotones – Orbitals-Quantum number and their significance. Shapes of s,p and d orbitals- Rules governing electronic configuration in various its atomic orbitals.</p> <p>Periodic table-periodic laws (Mendeleev and Mosley)- Classification of elements into s,p, d and f-blocks .Metals-Non metals-Periodic properties-Concept,Variation and factors affecting various periodic properties-Inert pair effect.</p>						
	<p><b>Unit-II</b></p> <p><b>Chemical Bonding</b></p> <p>Definition- Types of chemical bond-Ionic bond- Ion polarization - Dipole moment and Percentage of ionic character-Covalent bond-Definition –Postulates of Valence bond theory and Concept of hybridization (sp, sp<sup>2</sup>, sp<sup>3</sup>, sp<sup>3</sup>d, sp<sup>3</sup>d<sup>2</sup>, dsp<sup>2</sup>, d<sup>2</sup>sp<sup>3</sup>) –Magnetic properties –</p>						

Paramagnetic – Diamagnetic-Ferromagnetic. Co-ordinate covalent bond-Definition – Examples-Co-ordination compounds (basic concepts only).

### **UNIT III Nomenclature and Isomerism in Organic compounds**

Carbon compounds- Uniqueness of carbons- Classification of hydrocarbons - IUPAC Nomenclature of Organic compounds

Isomerism: Structural and Stereoisomerism

Structural Isomerism: Chain isomerism, Functional isomerism, Positional isomerism and Meta isomerism.

Stereoisomerism: Geometrical and Optical isomerism-Chiral molecule- Enantiomers- Diastereomers- Meso compounds-Racemic mixture.

### **UNIT IV States of Matter**

**Gaseous state:** Kinetic theory of gases- Ideal and Non-ideal gases- Ideal gas equation- Deviation of ideal gas from ideal behavior -vander Waal's equation and Liquification of gases.

**Liquids :**Intermolecular forces, Vapour pressure and Boiling point of liquid - Surface tension –Viscosity- Factors affecting surface tension and viscosity.

**Solids:** Definition - Characteristics of solids- Amorphous and Crystalline solids - Space lattice and unit cells - Close packed structure of solids-Radius ratio rule.

### **UNIT V Introduction to Spectroscopy**

Electromagnetic radiation- General characteristics of Wave – Wavelength – Frequency – Amplitude – Wave number - Electromagnetic spectrum- Absorption and Emission spectrum- Quantization of Energy level - Selection rule - Intensity of the Spectral lines – Width of Spectral lines. Types of spectroscopy: Microwave spectroscopy, Infrared spectroscopy, UV-Visible spectroscopy, Nuclear Magnetic Resonance spectroscopy, Electron spin resonance spectroscopy.

<b>Text Books</b>	<p>1. B.R Puri, L.R.Sharma, K.C. Kalia, Principles of Inorganic chemistry, Milestone Publishers and Distributors, New Delhi, 2012.</p> <p>2. B.R. Puri and L.R.Sharma, 38<sup>th</sup> edition, Vishal Publishing company, Jalendar 2002.</p> <p>3. K.S, Tewari, S.N. Mehrothra and N.K.Vishnoi, Text book of Organic Chemistry, 2<sup>nd</sup> edition Vikas publishing House, New Delhi, 1998.</p>
<b>Reference books</b>	<ol style="list-style-type: none"> <li>1. R.D. Madan, Sathya Prakash, Mordern Inorganic chemistry 2<sup>nd</sup> edition, S.Chand and company, New Delhi, 2003.</li> <li>2. B.S.Bhal, ArunBhal, Advanced Organic chemistry, 3<sup>rd</sup> edition, S.Chand and company, New Delhi, 2003.</li> <li>3. U.N.Dash, O.P.Dharmarha, P.L.Soni, Textbook of Physical Chemistry, Sultan Chand &amp; sons, New Delhi, 2016.</li> <li>4. Y.R.Sharma Organic spectroscopy Principles and Chemical applications, S.Chand&amp;Company PVT Ltd ,2002.</li> <li>5. C.N.Banwell, Fundamentals of spectroscopy Tata McGraw Hill, 1983.</li> </ol>
<b>Websiteand e-learning Source</b>	<p><a href="https://onlinecourses.nptel.ac.in/http://cactus.dixie.edu/smblack/chem1010/lec">https://onlinecourses.nptel.ac.in/http://cactus.dixie.edu/smblack/chem1010/lec</a></p>

**Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course**

**the student should be able to**

**CO1:** learn about atom structure and periodic properties.

**CO2:** gain knowledge on types of chemical bonding

**CO3:** explain different states of matter

**CO4:** discussion on nomenclature and isomerism in organic compounds

**CO5:** knowledge on electromagnetic radiation and its interaction with matter

<b>CO/PO</b>	<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	M	S	S	S	S	S	M	S	M
<b>CO2</b>	M	S	S	S	M	S	S	S	M	M
<b>CO3</b>	S	S	S	M	S	S	S	M	S	M
<b>CO4</b>	S	S	S	S	M	S	S	M	S	M
<b>CO5</b>	S	M	S	S	S	S	S	S	M	S

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

<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 Pos</b>	3.0	3.0	3.0	3.0	3.0

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

## SEMESTER II

Title of the Course	GENERAL CHEMISTRY-II			
Paper No.	Core III			
Category	Core	Year	I	Credits
		Semester	II	
Instructional hours per week	Lecture	Tutorial	Lab Practice	
	4	1	-	
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 Acids, bases and Ionic equilibria</b></p> <p>Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant; dissociation of polybasic 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;</p> <p>Buffer solutions – types, mechanism of buffer action in acid and basic buffer, Henderson-Hasselbalch equation;</p> <p>Salt hydrolysis - salts of weak acids and strong bases, of hydrolysis and relation between hydrolysis constant and degree of hydrolysis;</p> <p>Solubility product - determination and applications; numerical problems involving the core concepts.</p>			



### **Unit-II Chemistry of s-Block Elements**

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.

### **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, permonocarbonates and perdicarbonates.

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

General characteristics of elements of Group 15; chemistry of H<sub>2</sub>N-NH<sub>2</sub>, NH<sub>2</sub>OH, NH<sub>3</sub> and HNO<sub>3</sub>. Chemistry of PH<sub>3</sub>, PCl<sub>3</sub>, PCl<sub>5</sub>, POCl<sub>3</sub>, P<sub>2</sub>O<sub>5</sub> and oxyacids of phosphorous (H<sub>3</sub>PO<sub>3</sub> and H<sub>3</sub>PO<sub>4</sub>).

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 - Oxyacids of sulphur (Caro's and Marshall's acids).

Chemistry of Halogens: General characteristics of halogen with reference to electronegativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI), oxides and oxy acids (HClO<sub>4</sub>). Inter-halogen compounds (ICl, ClF<sub>3</sub>, BrF<sub>5</sub> and IF<sub>7</sub>), pseudohalogens [(CN)<sub>2</sub> and (SCN)<sub>2</sub>] and basic nature of Iodine.

Noble gases: Position in the periodic table. Preparation, properties and structure of XeF<sub>2</sub>, XeF<sub>4</sub>, XeF<sub>6</sub> and XeOF<sub>4</sub>; 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 elimination reactions – E1 and E2 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.

**Cycloalkanes:** Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations.

Conformational analysis of cyclohexane, mono and disubstituted cyclohexanes.

Geometrical isomerism in cyclohexanes.

## UNIT-V

### Hydrocarbon Chemistry-II

**Benzene:** Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's  $(4n+2)\pi e^-$  rule and its applications. Electrophilic substitution reactions –

General mechanism of aromatic electrophilic substitution – nitration, sulphonation, halogenations.

	<p>Friedel-Craft's alkylation and acylation. Monosubstituted and disubstituted benzene - Effect of substituent - orientation and reactivity.</p> <p><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 o-, p- or m-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	Questions related to the above topics, from various competitive examinations
Professional	UPSC/JAM/TNPSC other 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)
<b>Skills acquired from this course</b>	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), Textbook of Organic Chemistry, 2<sup>nd</sup> ed., Vikas Publishing House, New Delhi.</li> </ol>

	<p>5. PuriBR,SharmaLR,(2002),Principlesof Physical Chemistry,38<sup>th</sup>ed.,VishalPublishingCompany,Jalandhar.</p>
<p><b>Reference Books</b></p>	<ol style="list-style-type: none"> <li>1. MaronSHandPruttonCP,(1972),PrinciplesofPhysicalChemistry,4<sup>th</sup>ed.,TheMacmillanCompany,Newyork.</li> <li>2. BarrowGM,(1992),PhysicalChemistry,5<sup>th</sup>ed.,TataMcGrawHill,NewDelhi.</li> <li>3. LeeJD,(1991),ConciseInorganicChemistry,4<sup>th</sup>ed.,ELBSWilliamHeinemann,London.</li> <li>4. HuheeyJE,(1993),InorganicChemistry:PrinciplesofStructureandReactivity,4<sup>th</sup>ed.,Addison WesleyPublishingCompany,India.</li> <li>5. GurudeepRaj,(2001),AdvancedInorganicChemistryVol–I,26<sup>th</sup>ed.,GoelPublishing House, Meerut.</li> <li>6. AgarwalOP,(1995),ReactionsandReagentsinOrganicChemistry,8<sup>th</sup>ed.,GoelPublishing House,Meerut.</li> </ol>
<p><b>Websiteand-e-learningsource</b></p>	<p><a href="https://onlinecourses.nptel.ac.in">https://onlinecourses.nptel.ac.in</a>  <a href="http://cactus.dixie.edu/sblack/chem1010/lecture_notes/4B.html">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>MOOCcomponents</b></p> <p><a href="http://nptel.ac.in/courses/104101090/">http://nptel.ac.in/courses/104101090/</a>  Lecture1:Classificationofelementsandperiodicproperties</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 s and 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 of 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

CO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	M	S	S	S	M
CO2	M	S	S	S	M	S	S	M	M	S
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	S	M	M
CO5	S	M	S	S	M	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
<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
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**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 IV</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>2</b>	<b>Course Code</b>
<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 glasswares</li> <li>analysis of organic compounds</li> <li>preparation of organic compounds</li> </ul>					
<b>Course Outline</b>	<p><b>UNIT I</b></p> <p>Safety rules, symbols and first-aid in chemistry laboratory</p> <p>Basic ideas about Bunsen burner, its operation and parts of the flame. Chemistry laboratory glassware – basis information and uses.</p> <p><b>Unit II</b></p> <p><b>Qualitative Organic Analysis</b></p> <p>Preliminary examination, detection of special elements - nitrogen, sulphur and halogens</p> <p>Aromatic and aliphatic nature, Test for saturation and unsaturation, identification of functional groups using solubility tests</p>					

Confirmation of functional groups

- monocarboxylic acid, dicarboxylic acid
- monohydric phenol, polyhydric phenol
- aldehyde, ketone, ester
- carbohydrate (reducing and non-reducing sugars)
- primary, secondary, tertiary amine
- monoamide, diamide, thioamide
- anilide, nitro compound
- Preparation of derivatives for functional groups

**UNIT III**

**Preparation of Organic Compounds**

- i. Nitration - picric acid from Phenol
- ii. Halogenation - p-bromoacetanilide from acetanilide
- iii. Oxidation - benzoic acid from Benzaldehyde
- iv. Microwave assisted reactions in water:
- v. Methyl benzoate to Benzoic acid
- vi. Salicylic acid from Methyl Salicylate
- vii. Rearrangement - Benzil to Benzilic Acid
- viii. Hydrolysis of benzamide to Benzoic Acid

	<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> </ol>
	<p><b>4. Chromatography (anyone) (Group experiment)</b></p> <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> <p>5. <b>Electrophoresis</b>-Separation of amino acids and proteins.</p> <p><b>(Demonstration)</b></p> <p>6. Isolation of casein from milk/Determination of saponification value of oil or fat/ Estimation of acetic acid from commercial vinegar. (Anyone Group experiment)</p> <p>(4,5&amp;6-not for ESE)</p>
<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>



**Website and e-learning Source**

<https://www.vlab.co.in/broad-area-chemical-sciences>

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

**CO1:** observe the physical state, odour, colour and solubility of the given organic compound.

**CO2:** identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.

**CO3:** 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.

**CO4:** exhibit a solid derivative with respect to the identified functional group.

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

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

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	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**

<b>Title of the Course</b>	<b>ALLIED CHEMISTRY FOR PHYSICAL SCIENCES II (FOR MATHEMATICS &amp; PHYSICS STUDENTS)</b>					
<b>Paper No.</b>	<b>Generic Elective III</b>					
<b>Category</b>	<b>Generic Elective</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	3	<b>Course Code</b>
		<b>Semester</b>	<b>II</b>			
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>	
	4	-			4	
<b>Prerequisites</b>	Higher secondary chemistry					
<b>Objectives of the course</b>	<p>This course aims at providing knowledge on the</p> <ul style="list-style-type: none"> <li>• Co-ordination Chemistry and Water Technology</li> <li>• Carbohydrates and Amino acids</li> <li>• basics and applications of electrochemistry</li> <li>• basics and applications of kinetics and catalysis</li> <li>• Various photochemical phenomenon</li> </ul>					

<b>CourseOutline</b>	<p><b>UNIT I</b></p> <p><b>Co-ordination Chemistry and Water Technology</b></p> <p>Co-ordination Chemistry: Definition of terms - IUPAC Nomenclature - Werner's theory - EAN rule - Pauling's theory - Postulates - Application to <math>[\text{Ni}(\text{CO})_4]</math>, <math>[\text{Ni}(\text{CN})_4]^{2-}</math>, <math>[\text{Co}(\text{CN})_6]^{3-}</math> - Chelation - Biological role of Haemoglobin and Chlorophyll (elementary idea) - Applications in qualitative and quantitative analysis. Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method - Purification techniques - BOD, COD.</p>
	<p><b>Unit II Carbohydrates and Amino acids</b></p> <p>Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose.</p>

	<p>Discussion of open chain and ring structures of glucose and fructose. Glucose - fructose interconversion. Properties of starch and cellulose. Amino acids: Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).</p>
	<p><b>UNIT III Electrochemistry</b></p> <p>Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials - electrochemical series. Strong and weak electrolytes - ionic product of water - pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method - buffer solutions and its biological applications - electroplating - Nickel and chrome plating - Types of cells - fuel cells - corrosion and its prevention.</p>

	<p><b>UNIT IV Kinetics and Catalysis</b></p> <p>Order and molecularity. Integrated rate expression for I and II (2A)</p> <p>□ Product order reactions. Pseudo first order reaction, methods of determining order of a reaction – Half-life period – Catalysis – homogeneous and heterogeneous, catalyst used in Contact and Haber's processes. Concept of energy of activation and Arrhenius equation.</p> <p><b>UNIT V Photochemistry</b></p> <p>Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield – Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photo sensitization and photosynthesis (definition with examples).</p>
Extended	Questions related to the above topics, from various competitive
Professional	examinations UPSC/JAM/TNPSC other 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. V.Veeraiyan, Textbook of Ancillary Chemistry; Highmount publishing house, Chennai, first edition, 2009.</li> <li>2. S.Vaithyanathan, Textbook of Ancillary Chemistry; Priya Publications, Karur, 2006.</li> <li>3. Arun Bahl, B.S. Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.</li> <li>4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand &amp; sons, New Delhi, twenty ninth edition, 2007.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. P.L.Soni, Mohan Katyal, Textbook of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.</li> <li>2. R.Puri, L.R.Sharma, M.S.Pathania, Textbook Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.</li> <li>3. .K, Sharma, Industrial Chemistry; Meerut, sixteenth edition, 2014.</li> </ol>
<b>Website and e-learning source</b>	<p><a href="https://onlinecourses.nptel.ac.in">https://onlinecourses.nptel.ac.in</a></p> <p><a href="http://cactus.dixie.edu/smblack/chem1010/lecture_notes/4B.html">http://cactus.dixie.edu/smblack/chem1010/lecture_notes/4B.html</a></p>

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

**CO1:** write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology

**CO2:** explain the preparation and property of carbohydrate, amino acids and nucleic acids.

**CO3:** apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.

**CO4:** identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst.

**CO5:** outline the various types of photochemical process.

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

CO3	S	S	S	S	S	S	M	S	M	
CO4	S	M	S	S	S	M	S	S	S	
CO5	S	M	M	S	M	S	M	S	S	

**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
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**

<b>Title of the Course</b>	<b>CHEMISTRY PRACTICAL FOR PHYSICAL SCIENCES</b> (For Mathematics and Physics – I Year / II Semester)					
<b>Paper No.</b>	<b>Generic Elective IV</b>					
<b>Category</b>	<b>Generic Elective</b>	<b>Year</b>	I	<b>Credits</b>	3	<b>Course Code</b>
		<b>Semester</b>	II			
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>	
	-	-	2		2	
<b>Prerequisites</b>						
<b>Objectives of the course</b>	This course aims to provide knowledge on <ul style="list-style-type: none"> <li>• identification of organic functional groups</li> </ul>					

	<ul style="list-style-type: none"> <li>• different types of organic compounds with respect to their properties.</li> <li>• determination of elements in inorganic compounds..</li> </ul>
<b>Course Outline</b>	<p><b>SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS</b></p> <p>The analysis must be carried out as follows:</p> <ol style="list-style-type: none"> <li>Functional group tests [phenol, acids (mono &amp; di) aromatic primary amine, amides (mono &amp; di), aldehyde and glucose].</li> <li>Detection of elements (N, S, Halogens).</li> <li>To distinguish between aliphatic and aromatic compounds.</li> <li>To distinguish – Saturated and unsaturated compounds</li> </ol>
<b>Reference Books</b>	V. Venkateswaran, R. Veerasamy, A. R. Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.

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

CO1: gain an understanding of the use of standard flask and volumetric pipettes, burette.

CO2: design, carry out, record and interpret the results of volumetric titration.

CO3: apply their skill in the analysis of water/hardness.

CO4: analyze the chemical constituents in allied chemical products

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	M	S	S	S
CO2	S	S	S	S	M	S	S	S	M	S
CO3	S	S	S	M	S	M	S	M	S	M
CO4	S	S	S	M	S	S	M	S	S	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 PSOs	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	SEC	Year	I	Credits	2	Course Code	
		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>						



<b>CourseOutline</b>	<p align="center"><b>UNIT I</b></p> <p><b>Composition of Milk</b></p> <p>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.</p>
	<p align="center"><b>UNIT II</b></p> <p><b>Processing of Milk</b></p> <p>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.</p>

	<p><b>UNIT III</b></p> <p><b>Major Milk Products</b></p> <p>Cream-definition-composition-chemistry of creaming process-gravitational and centrifugal method 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.</p>
	<p><b>UNIT IV</b></p> <p><b>Special Milk</b></p> <p>Standardised milk-definition-merits-reconstituted milk-definition-flow diagram of</p>

	<p>manufacture-Homogenisedmilk-flavouredmilk–vitaminisedmilk-tonedmilk-Incitantmilk-Vegetabletonedmilk-humanizedmilk-condensedmilk-definition,composition andnutritivevalue.</p> <p><b>UNIT V</b></p> <p><b>FermentedandotherMilkProducts</b></p> <p>Fermentedmilkproducts–fermentationofmilk-definition,conditions,culturedmilk-definitionof culture-example,conditions-culturedcream,buttermilk-Bulgariouismilk-acidophilousmilk–YoheerIndigeneousproducts-khoaandchhenadefinition-Icecream-definition-percentage composition-types-ingredients-manufacture of ice–cream, stabilizers -emulsifiersandtheirrole-milkpowder-definition-needformakingmilkpowder -dryingprocess-typesofdrying.</p>
<b>RecommendedText</b>	<ol style="list-style-type: none"> <li>1. K.BagavathiSundari,AppliedChemistry,MJPPublishers,firstedition,2006.</li> <li>2. K.S.RangappaandK.T.Acharya,IndianDairyProducts,AsiaPublishingHouseNew Delhi, 1974.</li> <li>3. Textbookofdairychemistry,M.P.Mathur,D.DattaRoy,P.Dinakar,IndianCouncilofAgricultural Research,1stedition,2008.</li> <li>4. ATextbookofdairychemistry,SauravSingh,DayaPublishinghouse,1stedition,2013.</li> <li>5. Textbookofdairychemistry,P.L.Choudhary,Bio-Greenbookpublishers,2021.</li> </ol>
<b>ReferenceBooks</b>	<ol style="list-style-type: none"> <li>1. RobertJenessandS.Patom,PrinciplesofDairyChemistry,S.Wiley,NewYork,2005.</li> <li>2. F.P.Wond,FundamentalsofDairyChemistry,Springer,Singapore,2006.</li> <li>3. SukumarDe,OutlinesofDairyTechnology,OxfordUniversityPress,NewDelhi,1980.</li> <li>4. P.F.FoxandP.L.H.Mcsweeney,DairyChemistryandBiochemistry,Springer,Second edition,2016.</li> <li>5. Dairychemistryandbiochemistry,P.F.Fox,T.Uniacke-Lowe,P.L.H. McSweeney,J.A.OMahony,Springer,Secondedition,2015.</li> </ol>
<b>Websiteand e-learningsource</b>	e-pathshala

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

**CO1:** understand about general composition of milk – constituents and its physical properties.

**CO2:** acquire knowledge about pasteurization of Milk and various types of pasteurization -  
Bottle, Batch and HTST Ultra High Temperature Pasteurization.

**CO3:** learn about Cream and Butter their composition and how to estimate fat in cream and Ghee

**CO4:** explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk.

**CO5:** have an idea about how to make milk powder and its drying process - types of drying

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

**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
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**

<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>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>	This course aims at familiarizing the students with <ul style="list-style-type: none"> <li>• formulation 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>	<b>UNIT</b> <b>I Skincare</b> Nutrition of the skin, skincare 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 –						

	<p>key ingredients, skin lightness, depilatories.</p>
	<p><b>UNIT II</b></p> <p><b>Haircare</b> Shampoos – types – powder, cream, liquid, gel – ingredients; conditioner – types – ingredients</p> <p><b>Dentalcare</b> Toothpastes – ingredients – mouthwash</p>

	<p><b>UNIT III</b></p> <p><b>Makeup</b> Base – foundation – types – ingredients; lipstick, eyeliner, mascara, eyeshadow, concealers, rouge</p>
	<p><b>UNIT IV</b></p> <p><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></p> <p><b>Beauty treatments</b></p> <p>Facials-types-advantages-disadvantages; facemasks-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>	<ol style="list-style-type: none"> <li>1. Wilkinson JBE and Moore RJ, (1997) Harry's cosmeticology, 7<sup>th</sup> ed., Chemical Publishers, London.</li> <li>2. George Howard, (1987) Principles and practice of perfumes and cosmetics, Stanley Therones, Chettenham</li> </ol>
<b>Website and e-learning source</b>	<ol style="list-style-type: none"> <li>1. <a href="http://www.khake.com/page75.html">http://www.khake.com/page75.html</a></li> <li>2. Net.foxsm/list/284</li> </ol>

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

- **CO1:** know about the composition of various cosmetic products
- **CO2** understand chemical aspects and applications of hair care and dental care and skin care products.
- **CO3** understand chemical aspects and applications of perfumes and skin care products.
- **CO4** to understand the methods of beauty treatments their advantages and disadvantages
- **CO5** understand the hazards of cosmetic products.

	P O 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10
CO1	S	M	S	S	S	S	S	M	S	M

<b>CO2</b>	M	S	S	S	M	S	S	S	M	S
<b>CO3</b>	S	S	S	M	S	S	S	M	S	M
<b>CO4</b>	S	S	M	S	S	S	S	M	M	S
<b>CO5</b>	S	M	S	S	M	S	S	S	M	S

**CO-POMapping(CourseArticulationMatrix)**

<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>WeightedpercentageofCourseContributiontoPos</b>	3.0	3.0	3.0	3.0	3.0

**LevelofCorrelationbetweenPSO'sandCO'**

