

**MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI**  
**DEPARTMENT OF CHEMISTRY**  
**INTEGRATED M.Sc. CHEMISTRY PROGRAMME (CBCS) (3 + 2 = 5 years)**  
**PROGRAM STRUCTURE & SYLLABUS**  
**(Adapted from TANSICHE UG Chemistry Syllabus for first 3 Years)**

## **1. Vision & Mission of the University**

### Vision

1. To provide quality education to reach the un-reached

### Mission

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

## **2. Vision of the department**

### Vision

To develop a Centre of Excellence for teaching as well a research at par with national and international standards. Reach a position of distinction by offering first-class education and serving the community in relevant areas of interest to the rural areas.

### Mission

- Provide an educational environment where students can realize their full potential in chemistry and attain quality education to face the challenges of the future.
- Provide a dynamic, challenging and ethical environment for pursuing high-quality teaching, learning, research and service.

### 3. 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...

#### **PROGRAMME OUTCOMES (PO) OF B.SC DEGREE PROGRAMME IN CHEMISTRY**

- Students will possess basic subject knowledge required for higher studies, professional and applied courses
- Students will acquire basic Practical skills & Technical knowledge along with domain knowledge of different subjects in the science & humanities stream.
- Students will develop scientific aptitude Integrate skills of analysis, critiquing, application and creativity.
- Students will employ appropriate digital tools and techniques necessary in analysing data and creative design.

- Students will gain competence to pursue higher learning, research and careers or will be able to opt for entrepreneurship
- Students will interact meaningfully with others displaying leadership and coordination in executing projects.
- Students will demonstrate responsibility as citizens committed to national development through community outreach, wellness of self and a sustainable environment.

## **PROGRAMME SPECIFIC OUTCOMES**

**PSO1:** Students acquire in-depth knowledge of the fundamental concepts in all disciplines of chemistry.

**PSO2:** Students can disseminate the basics of chemistry and advanced topics and analytical skills in organic, inorganic and physical chemistry.

**PSO3:** Students will be able develop creativity in academics and research.

**PSO4:** Students will be able apply digital tools to collect, analyse and interpret data and present scientific findings.

**PSO5:** gain competence to pursue higher education and career opportunities in chemistry and allied fields.

**PSO6:** exhibit leadership qualities to work individually and within a team in organizing curricular, co-curricular and extracurricular activities.

**PSO7:** apply the concepts of chemistry to solve problems in the community, entrepreneurial and research pursuits.

**PSO8:** exhibit competence in educational, industrial and research pursuits that contribute towards the holistic development of self and community.

### **1. 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, enable the students to provide solutions to industry / real life situations. The curriculum also facilitates peer learning and research aptitude in the final semester by providing an opportunity do a project.
- The General Studies and Chemistry 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 Industrial internship is newly introduced in the fourth semester, to expose the students to real life working environment and train the students to face challenges
- The Internship during the second year vacation will help the students gain valuable work
- 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 an experiment collecting and interpreting data and finally presenting the findings 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 - Nanoscience

**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 chemistry.	<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 entrepreneurial skills enable the students to gain knowledge and make them ready for start-up.</li> <li>• Provides an opportunity for independent livelihood.</li> <li>• Generates self – employment.</li> <li>• Creates small scale entrepreneurs.</li> <li>• Training to girls leads to women empowerment.</li> </ul>
		<ul style="list-style-type: none"> <li>• Skill enhancement courses help the students to gain internships, apprenticeships, field work involving data collection, compilation, analysis etc.</li> <li>• Enables the students to learn the operations of instruments.</li> <li>• Improves self-confidence.</li> <li>• Learns different analytical techniques.</li> </ul>
		<ul style="list-style-type: none"> <li>• Discipline specific course helps to recognise, identify, examine and testify any and every kind of physical evidence mostly found in crime scenes.</li> <li>• It improves the technical knowhow of solving real life problems.</li> </ul>
<b>I, II, 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, physics and mathematics.</li> <li>• Emerging topics in higher education / industry /</li> </ul>

		<p>communication network / health sector etc. are introduced with hands-on-training.</p> <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/ Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.</li> </ul>
<b>V</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> <li>• Helps to explore industries and to have first-hand experience in industrial background.(when students carry out projects in industries)</li> <li>• Instil confidence and problem solving approach.</li> </ul>
<b>VI</b>	Introduction of Professional Competency component	<ul style="list-style-type: none"> <li>• Curriculum design accommodates all category of learners; ‘Training for Competitive Examinations’ – caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, NDA, Banking Services, CAT, JAM, 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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### Course Structure of the M. Sc. Integrated Program 2023-2024

Sl. No.	Part	Papers	Title	Credits	Hrs/Week
<b>Semester I</b>					
1	Part I	Language	Tamil	3	4
2	Part II	Language	English	3	4
3	Part III	CC-1	General Chemistry - I	5	5
4		CC-2	Quantitative Inorganic Estimation and Inorganic Preparation-Practical	2	4
5		Elective-1-EC1 Allied Theory	Allied I Mathematics/ Zoology	3	3
6		Elective-2-EC2 Allied practical	Allied Practical I Mathematics/ Zoology	2	4
7	Part IV	Skilled enhancement course SEC-1	Food Chemistry/Chemistry in daily life	2	2
8		Foundation Course FC1	Foundation Course in Chemistry	2	2
				<b>(22)</b>	<b>28</b>
<b>Semester II</b>					
9	Part I	Language	Tamil	3	4
10	Part II	Language	English	3	4
11	Part III	CC-3	General Chemistry - II	5	5
12		CC-4	Qualitative Organic Analysis and preparation of Organic Compounds-Practical	2	4
13		Elective-3-EC3 Allied Theory	Allied II Mathematics/ Zoology	3	3
14		Elective-4-EC4 Allied practical	Allied Practical II Mathematics/ Zoology	3	4
15	Part IV	Skilled enhancement course SEC-2	Dairy chemistry	2	2
16		Skilled enhancement course SEC-3	Cosmetics and personal grooming	2	2
				<b>(23)</b>	<b>28</b>
<b>Semester III</b>					
17	Part I	Language	Tamil	3	4
18	Part II	Language	English	3	4
19	Part III	CC-5	General Chemistry - III	5	5
20		CC-6	Qualitative inorganic analysis-Practical	2	4
21		Elective-5-EC5 Allied Theory	Allied III Physics	3	3
22		Elective-6-EC6 Allied practical	Allied practical III Physics	2	4
23	Part IV	Skilled enhancement course SEC-4	Entrepreneurial skills in chemistry - Practical	2	2

24		Skilled enhancement course SEC-5	Pesticide chemistry	2	2
		EVS	Environmental Studies	2	2
				<b>24</b>	<b>30</b>
<b>Semester IV</b>					
25	Part I	Language	Tamil	3	4
26	Part II	Language	English	3	4
27	Part III	CC-7	General Chemistry - IV	5	5
28		CC-8		2	4
29		Elective-7-EC7 Allied Theory	Allied IV Physics	3	3
30		Elective-8-EC8 Allied practical	Allied practical IV Physics	2	4
31	Part IV	Skilled enhancement course SEC-6	Instrumental methods of Chemical Analysis	2	2
32		Skilled enhancement course SEC-7	Forensic Science	2	2
33		Online course	Sustainable Development Goals	3	-
				<b>(24)</b>	<b>28</b>
<b>Semester V</b>					
34	Part III	CC-9	Organic Chemistry - I	5	5
35		CC-10	Inorganic Chemistry -I	5	5
36		CC-11	Physical Chemistry -I	5	5
37		Elective-9-EC9	Industrial Chemistry	3	3
38		Elective-10-EC10	Biochemistry	3	3
39		Core /Project with Viva voce CC12	Project	4	4
40	Part IV	Value Education	Value-Based Education	2	2
41		Internship / Industrial Training	(Carried out in II Year Summer vacation) (30 hours)	2	-
				<b>(29)</b>	<b>27</b>
<b>Semester VI</b>					
42	Part III	CC-13	Organic Chemistry - II	5	5
43		CC-14	Inorganic Chemistry -II	5	5
44		CC-15	Physical Chemistry -II	5	5
45		CC-16	Physical Chemistry Practical	2	4
46		Elective-11-EC11	Fundamentals of Spectroscopy	3	3
47		Elective-12-EC12	Nanoscience / Polymer Science / Pharmaceutical Chemistry	2	3
48	Part IV	Skilled enhancement course SEC-8	Professional Competency	2	4
49	Part V	Extension Activity	(Outside time-table hours)	1	-
				<b>(25)</b>	<b>29</b>
<b>Grand Total</b>				<b>145</b>	<b>170</b>



<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>• 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>	<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;</p> <p>Numerical problems involving the core concepts.</p>						

	<p><b>Unit II</b>  <b>Introduction to Quantum mechanics</b>  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> <p><b>Modern Periodic Table</b></p> <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>
	<p><b>UNIT-III: Structure and bonding - I</b></p> <p><b>Ionic bond</b></p> <p>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.</p> <p><b>Covalent bond</b></p> <p>Shapes of orbitals, overlap of orbitals – <math>\sigma</math> and <math>\Pi</math> bonds; directed valency - hybridization; VSEPR theory - shapes of molecules of the type <math>AB_2</math>, <math>AB_3</math>, <math>AB_4</math>, <math>AB_5</math>, <math>AB_6</math> and <math>AB_7</math></p> <p>Partial ionic character of covalent bond-dipole moment, application to molecules of the type <math>A_2</math>, <math>AB</math>, <math>AB_2</math>, <math>AB_3</math>, <math>AB_4</math>; percentage ionic character-numerical problems based on calculation of percentage ionic character.</p>

**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 orbitals, bond order; MO diagrams of  $\text{H}_2$ ,  $\text{C}_2$ ,  $\text{O}_2$ ,  $\text{O}_2^+$ ,  $\text{O}_2^-$ ,  $\text{O}_2^{2-}$ ,  $\text{N}_2$ ,  $\text{NO}$ ,  $\text{HF}$ ,  $\text{CO}$ ; 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; inductomeric and electromeric effects.

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

radicals, reactivity of vinyl chloride, dipole moment of vinyl chloride and nitrobenzene, bond lengths; steric inhibition to resonance.

Hyperconjugation - stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitromethane

Types of organic reactions- addition, substitution, elimination and rearrangements

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 and 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. 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. University General Chemistry, 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. Textbook of Physical Chemistry, 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
<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'**

<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>	<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  Hexaminecobalt (III) chloride  Mohr's Salt</p>
Skills acquired from this course	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>Reference Books</b>	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.
<b>Website and e-learning source</b>	<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>	<b>FOOD CHEMISTRY</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>	
		<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>	This course aims at giving an overall view of the <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>	<b>UNIT I</b> <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.						
	<b>Unit-II</b>						



	<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 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:** learn about Food adulteration - contamination of Wheat, Rice, Milk, Butter.**CO 2:** get an awareness about food poisons like natural poisons (alkaloids - nephrotoxin) pesticides, DDT, BHC, Malathion**CO 3:** get an exposure on food additives, artificial sweeteners, Saccharin, Cyclamate and Aspartate in the food industries.**CO 4:** acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages examples.**CO 5:** study about fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats –MUFA and PUFA

	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>	
		<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>	

	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>GENERAL CHEMISTRY-II</b>						
<b>Paper No.</b>	<b>Core III</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	5	<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>		
	4	1	-		5		
<b>Prerequisites</b>	General Chemistry I						
<b>Objectives of the course</b>	This course aims at providing an overall view of the <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>						
<b>Course Outline</b>	<b>UNIT-I</b> <b>Acids, bases and Ionic equilibria</b> Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept,						

	<p>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;</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, weak bases and strong acids, weak acids and weak bases - hydrolysis constant, degree 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>
	<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> <p><b>Chemistry of p- Block Elements (Group 13 &amp; 14)</b>  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.</p>
	<p><b>UNIT-III</b></p> <p><b>Chemistry of p- Block Elements (Group 15-18)</b>  General characteristics of elements of Group 15; chemistry of H<sub>2</sub>N-NH<sub>2</sub>, NH<sub>2</sub>OH, HN<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 oxy acids of phosphorous (H<sub>3</sub>PO<sub>3</sub> and H<sub>3</sub>PO<sub>4</sub>).</p> <p>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).</p> <p>Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, 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>), pseudo halogens [(CN)<sub>2</sub> and (SCN)<sub>2</sub>] and basic nature of Iodine.</p> <p>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.</p>

	<p><b>UNIT-IV</b></p> <p><b>Hydrocarbon Chemistry-I</b>  <b>Petroproducts:</b> Fractional distillation of petroleum; cracking, isomerisation, alkylation, reforming and uses</p> <p><b>Alkenes-</b>Nomenclature, general methods of preparation – Mechanism of <math>\beta</math>-elimination reactions – <math>E_1</math> and <math>E_2</math> 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.</p> <p><b>Alkadienes</b>  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.</p> <p><b>Alkynes</b>  Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerisation and isomerisation.</p> <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></p> <p><b>Hydrocarbon Chemistry - II</b>  <b>Benzene:</b> Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's <math>(4n+2)</math> 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.</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 <math>\alpha</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>
<p>Extended Professional Component (is a part of internal</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>

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, Mehrothra 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%20notes/4B.html">https://onlinecourses.nptel.ac.in/http://cactus.dixie.edu/sblack/chem1010/lecture notes/4B.html</a></p> <p><a href="http://www.auburn.edu/~deruija/pdaeson.pdf">http://www.auburn.edu/~deruija/pdaeson.pdf</a><a href="https://swayam.gov.in/course/64-atoms-structure-and-chemical-bonding">https://swayam.gov.in/course/64-atoms-structure-and-chemical-bonding</a></p> <p><b>MOOC components</b></p> <p><a href="http://nptel.ac.in/courses/104101090/">http://nptel.ac.in/courses/104101090/</a></p> <p>Lecture 1: Classification of elements and periodic properties</p> <p><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 IV</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	I	<b>Credits</b>	2	<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>		
	-	-	3		3		
<b>Prerequisites</b>	General Chemistry II						
<b>Objectives of the course</b>	This course aims at providing knowledge on <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>						
	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						
	<b>Unit II</b>						
	<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 <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>
<p><b>Website and e-learning source</b></p>	<p><a href="https://www.vlab.co.in/broad-area-chemical-sciences">https://www.vlab.co.in/broad-area-chemical-sciences</a></p>

**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.

	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>DAIRY CHEMISTRY</b>						
<b>Paper No.</b>	<b>SEC- II</b>						
<b>Category</b>	<b>NME</b>	<b>Year</b>	<b>I</b>	<b>Credits</b>	<b>2</b>	<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>		
	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>• chemistry of milk and milk products</li> <li>• processing of milk</li> <li>• preservation and formation of milk products.</li> </ul>						
<b>Course Outline</b>	<b>UNIT I</b>						
	<p><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.</p>						
	<p><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.</p>						
	<p><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.</p>						
<p><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>							

	<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>Semester</b>	<b>I/ II</b>			
<b>Instructional</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>	
<b>hours per week</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>	<b>Uni 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.					
	<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					
	<b>Unit III</b> <b>Make up</b> Base – foundation – types – ingredients; lipstick, eyeliner, mascara, eye shadow, concealers, rouge					
	<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					
	<b>Unit V</b> <b>Beauty treatments</b> 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					



<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. <a href="http://Net.foxsm/list/284">Net.foxsm/list/284</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>	
<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 V</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	II	<b>Credits</b>	5	<b>Course Code</b>	
		<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>						
	<p><b>Liquid and Solid State</b></p> <p>Properties of Liquids- Surface tension, viscosity and their applications. Crystalline and amorphous – differences - geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism. Crystals – size and shape; laws of crystallography; symmetry elements – plane, centre and axis; Miller indices, unit cells and space lattices; classification of crystal systems; Bravais lattices; X – ray diffraction – Bragg’s equation</p>						

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)	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>
	<ol style="list-style-type: none"> <li>4. P. L. Soni, and H. M.Chawla - <i>Text Book of Organic Chemistry</i>, New Delhi, Sultan Chand &amp; Sons, twenty ninth edition, 2007.</li> <li>5. J.D. Lee, <i>Concise Inorganic Chemistry</i>, Blackwell Science, fifth edition, 2005.</li> </ol>

<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 it's 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
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**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 VI</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	II	<b>Credits</b>	2	<b>Course Code</b>
		<b>Semester</b>	III			
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>	
		1	-	3		4
<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>	<b>Reference Books:</b> V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997.					
<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
<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	ENTREPRENEURIAL SKILLS IN CHEMISTRY						
Paper No.	SEC IV						
Category	Skill Enhancement Course	Year	II	Credits	1	Course Code	
		Semester	III				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	1		1		
Prerequisites	General Chemistry						
Objectives of the course	The course aims at providing training to <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> 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. 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 skills.</b>
<b>Recommended Text</b>	<ol style="list-style-type: none"> <li>George S &amp; Muralidharan V, (2007) Fibre to Finished Fabric – A Simple Approach, Publication Division, University of Madras, Chennai.</li> <li>Appaswamy G P, A Handbook on Printing and Dyeing of Textiles.</li> </ol>
<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>
<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> identify adulterated food items by doing simple chemical tests.</p> <p><b>CO 2:</b> prepare cleaning products and become entrepreneurs</p> <p><b>CO 3:</b> educate others about adulteration and motivate them to become entrepreneurs.</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>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>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

<b>Title of the Course</b>	<b>PESTICIDE CHEMISTRY</b>						
<b>Paper No.</b>	<b>Skill Enhancement Course V (Discipline specific)</b>						
<b>Category</b>	<b>Skill Enhancement Course</b>	<b>Year</b> II	<b>Semester</b> III	<b>Credits</b>	2	<b>Course Code</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>	Fundamentals in chemistry						
<b>Objectives of the course</b>	<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>						
<b>Course Outline</b>	<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)	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. Cremlyn: 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>	

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
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 PO's and CO's**

Title of the Course	GENERAL CHEMISTRY-IV						
Paper No.	Core VII						
Category	Core	Year	II	Credits	4	Course Code	
		Semester	I				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	-	-		4		
Prerequisites	General Chemistry III						
Objectives of the course	This course aims to provide a comprehensive knowledge on <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>						
Course Outline	<b>UNIT I</b> <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 (Cp & Cv); Joule Thomson effect- inversion temperature.						

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.

## **Unit II**

### **Thermodynamics II**

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.

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**

	<p>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 - Ponder Verley reduction, reduction with <math>\text{LiAlH}_4</math> and <math>\text{NaBH}_4</math>. Addition reactions of unsaturated carbonyl compounds: Michael addition.</p>
	<p><b>UNIT V</b></p> <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. Schotten-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>
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. 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>, 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>	<p><b>MOOC components</b></p> <p><a href="https://nptel.ac.in/courses/112102255">https://nptel.ac.in/courses/112102255</a> Thermodynamics</p> <p><a href="https://nptel.ac.in/courses/104101136">https://nptel.ac.in/courses/104101136</a> Advanced transition metal 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> 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.</p> <p><b>CO3:</b> investigate the chemistry of transition elements with respect to various periodic properties and group wise discussions.</p> <p><b>CO4:</b> discuss the fundamental organic chemistry of ethers, epoxides and carbonyl compounds including named organic reactions.</p> <p><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.</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>PHYSICAL CHEMISTRY PRACTICAL – I</b>					
<b>Paper No.</b>	<b>Core VIII</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	<b>II</b>	<b>Credits</b>	<b>2</b>	<b>Course Code</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>	
	-	-	3		3	
<b>Prerequisites</b>	General Chemistry					
<b>Objectives of the course</b>	The course aims at providing an understanding of <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>	<b>UNIT-I</b> <b>Chemical kinetics</b> 1. Determination of rate constant of acid catalysed hydrolysis of an ester (methyl acetate). 2. Determination of order of reaction between iodide and persulphate (initial rate method).					



	<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></p> <p><b>Colligative property</b></p> <p>10. Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent</p> <p><b>Adsorption</b></p> <p>11. Construction of Freundlich isotherm for the adsorption of acetic acid on activated charcoal</p>
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Reference Books	<p>1. Sindhu, P.S. <i>Practicals in Physical Chemistry</i>, Macmillan India : New Delhi, 2005.</p> <p>2. Khosla, B. D. Garg, V. C.; Gulati, A.; <i>Senior Practical Physical Chemistry</i>, R. Chand : New Delhi, 2011.</p> <p>3. Gupta, Renu, <i>Practical Physical Chemistry</i>, 1<sup>st</sup> Ed.; New Age International: New Delhi, 2017.</p>
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>

**Course Learning Outcomes (for Mapping with POs and PSOs)****On completion of the course the students should be able to****CO1:** describe the principles and methodology for the practical work**CO2:** explain the procedure, data and methodology for the practical work.**CO3:** apply the principles of electrochemistry, kinetics for carrying out the practical work.**CO4:** 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**

Title of the Course	INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS						
Paper No.	SEC VI (Discipline specific)						
Category	Skill Enhancement Course	Year	II	Credits	2	Course Code	
		Semester	IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	-	-		2		
Prerequisites	General Chemistry						
Objectives of the course	The course aims at providing an overall view of the <ul style="list-style-type: none"> <li>• operation and troubleshooting of chemical instruments</li> <li>• fundamentals of analytical techniques and its application in the characterization of compounds</li> <li>• theory of chromatographic separation and</li> </ul>						
	<ul style="list-style-type: none"> <li>• theory of thermo / electro analytical techniques</li> <li>• stoichiometry and the related concentration terms</li> </ul>						

<b>Course Outline</b>	<p><b>UNIT-I</b>  <b>Qualitative and Quantitative Aspects of Analysis</b>  S. I Units, Distinction between Mass and Weight. Moles, Millimoles, Milli equivalence, Molality, Molarity, Normality, Percentage by Weight and Volume, ppm, ppb. Density and Specific Gravity of Liquids. Stoichiometry Calculations</p> <p>Sampling, evaluation of analytical data, Errors – Types of Errors, Accuracy, Precision, Minimization of Errors. Significant Figures. Methods of Expressing Precision: Mean, Median, Average Deviation, Standard Deviation, Coefficient of Variation, Confidence Limits, Q-test, F-test, T-test. The Least Square Method for Deriving Calibration plots.</p>
	<p><b>UNIT II</b>  <b>Atomic Absorption Spectroscopy:</b> Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.</p>
	<p><b>UNIT III</b></p> <p><b>UV-Visible and IR Spectroscopy</b>  Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.</p> <p><b>UV-Visible Spectrometry:</b> Basic principles, instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers.  <b>Infrared Spectroscopy:</b> Basic principles of instrumentation (choice of source, monochromator &amp; detector) for single and double beam instrument; sampling techniques.</p>
	<p><b>UNIT IV</b></p> <p><b>Thermal and Electro-analytical Methods of Analysis</b>  TGA and DTA- Principle, Instrumentation, methods of obtaining Thermograms, factors affecting TGA/DTA, Thermal analysis of silver nitrate, calcium oxalate and calcium acetate  DSC- Principle, Instrumentation and applications.</p> <p>Electroanalytical methods: polarography - principle, instrumentation and applications. Derivative polarography- Cyclic Voltammetry - principle.</p>

	<p><b>UNIT V</b>  <b>Separation and purification techniques</b></p>
	<p>Classification, principle, Factors affecting - Solvent Extraction – Liquid - Liquid Extraction, Chromatography: Column, TLC, Paper, Gas, HPLC and Electrophoresis, Principle, Classification, Choice of Adsorbents, Solvents, Preparation of Column, Elution Mechanism of separation: adsorption, partition &amp; ion exchange. Development of chromatograms and R<sub>f</sub> value.</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. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed., The English Language Book Society of Longman.</li> <li>2. R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007</li> <li>3. Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint (2017).</li> <li>4. R. Speyer, Thermal Analysis of Materials, CRC Press, 1993.</li> <li>5. R.A. Day and A.L. Underwood, Quantitative Analysis, 6th edn., Prentice Hall of India Private Ltd., New Delhi, 1993</li> </ol>
<p><b>Reference Books</b></p>	<ol style="list-style-type: none"> <li>1. D. A. Skoog, D. M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5th edn., Saunders college publishing, Philadelphia, 1998.</li> <li>2. Dash U N, Analytical Chemistry; Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 2011.</li> <li>3. Christian, Gary D; Analytical Chemistry, 6th Ed., John Wiley &amp; Sons, New York, 2004.</li> <li>4. Mikes, O. &amp; Chalmes, R.A. Laboratory Handbook of Chromatographic &amp; Allied Methods, Elles Harwood Ltd. London</li> <li>5. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, sixth edition Pearson Education, 2000</li> </ol>

<b>Website and e-learning sources</b>	<ol style="list-style-type: none"> <li>1. <a href="http://www.epa.gov/rpdweb00/docs/marlap/402-b-04-001b-14-final.pdf">http://www.epa.gov/rpdweb00/docs/marlap/402-b-04-001b-14-final.pdf</a></li> <li>2. <a href="http://eric.ed.gov/?id=EJ386287">http://eric.ed.gov/?id=EJ386287</a></li> <li>3. <a href="http://www.sjsu.edu/faculty/watkins/diamag.htm">http://www.sjsu.edu/faculty/watkins/diamag.htm</a></li> <li>4. <a href="http://www.britannica.com/EBchecked/topic/108875/separation-and-purification">http://www.britannica.com/EBchecked/topic/108875/separation-and-purification</a></li> </ol>
	<ol style="list-style-type: none"> <li>5. <a href="http://www.chemistry.co.nz/stoichiometry.htm">http://www.chemistry.co.nz/stoichiometry.htm</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>	
<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>	

	<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

<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>FORENSIC SCIENCE</b>						
<b>Paper No.</b>	<b>SEC-VII (Discipline Specific)</b>						
<b>Category</b>	<b>Skill Enhancement Course</b>	<b>Year Semester</b>	<b>II IV</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>		
	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>• crime detection through analytical instruments</li> <li>• forgery and its detection</li> <li>• medical aspects involved</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT I</b></p> <p><b>Poisons</b> Poisons - types and classification - diagnosis of poisons in the living and the dead -clinical symptoms - postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of seafoods - use of neutron activation analysis in detecting arsenic in human hair. Treatment in cases of poisoning – use of antidotes for common poisons.</p> <p><b>Unit-II</b></p> <p><b>Crime Detection</b> Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human bombs - possible explosives (gelatin sticks and RDX) - metal detector devices and other security measures for VVIP-composition of bullets and detecting powder burns.</p> <p><b>UNIT-III</b></p> <p><b>Forgery and Counterfeiting</b> Documents - different types of forged signatures - simulated and traced forgeries -inherent signs of forgery methods - writing deliberately modified - uses of ultraviolet rays -comparison of type written letters – checking silver line water mark in currency notes – alloy analysis using AAS to detect counterfeit coins – detection of gold purity in 22 carat ornaments – detecting gold plated jewels -authenticity of diamond.</p> <p><b>UNIT-IV</b></p> <p><b>Tracks and Traces</b> Tracks and traces - small tracks and police dogs - foot prints - costing of</p>						

	<p>foot prints -residue prints, walking pattern or tyre marks – miscellaneous traces and tracks – glass fracture - tool marks - paints - fibres - Analysis of biological substances - blood, semen, saliva, urine and hair - Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and racehorses.</p>
	<p><b>UNIT-V</b></p> <p><b>Medical Aspects</b>  Aids - causes and prevention - misuse of scheduled drugs - burns and their treatment by plastic surgery. Metabolite analysis using mass spectrum - Gas chromatography-Arson -natural fires and arson - burning characteristics and chemistry of combustible materials -nature of combustion. Ballistics - classification - internal and terminal ballistics - small arms -laboratory examination of barrel washing and detection of powder residue by chemical tests.</p>
<p><b>Recommended Text</b></p>	<ol style="list-style-type: none"> <li>1. SA Iqbal, M Liviu, Textbook of forensic chemistry, Discovery publishing house private limited, 2011.</li> <li>2. Kelly M. Elkins, Introduction to Forensic Chemistry, CRC Press, Taylor &amp; Francis Group, 2019.</li> <li>3. Javed I. Khan, Thomas J. Kennedy, Donnell R. Christian, Jr., Basic principles of Forensic chemistry, Humana Press, first edition, 2012.</li> <li>4. Bapuly AK, (2006) Forensic Science – Its application in crime investigation, Paras Medical Publisher, Hyderabad.</li> <li>5. Sharma B.R., (2006) Scientific Criminal Investigation, Universal Law Publishing Co. Pvt. Ltd, New Delhi.</li> </ol>
<p><b>Reference Books</b></p>	<ol style="list-style-type: none"> <li>1. Richard Saferst in and Criminalistics-An Introduction to Forensic Science (College Version), Sopfestein, Printice hall, eighth edition,2003</li> <li>2. Suzanne Bell, Forensic Chemistry, Pearson, second international edition, 2014.</li> <li>3. Jay Siegel, Forensic chemistry: Fundamentals and applications, Wiley-Blackwell, first edition, 2015.</li> <li>4. Max M. Houck &amp; Jay A. Segal, (2006) Fundamentals of Forensic Science, Elsevier Academic press.</li> <li>5. Henry C. Lee, Timothy Palmbach, Marilyn T. Miller, (2006) Henry Lee’s Crime Scene Book Elsevier Academic press.</li> </ol>
<p><b>Website and e-learning source</b></p>	<ol style="list-style-type: none"> <li>1. <a href="http://www.library.ucsb.edu/ist/03-spring/internet.html">http://www.library.ucsb.edu/ist/03-spring/internet.html</a></li> <li>2. <a href="http://www.wonder_howto.com/topic/forensic-science/">http://www.wonder_howto.com/topic/forensic-science/</a></li> </ol>

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

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

**CO 1:** learn about the Poisons - types and classification of poisons in the living and the dead organisms and also get information about Postmortem.

**CO 2:** get awareness on Human bombs, possible explosives (gelatin sticks and RDX) and metal defector devices and other security measures for VVIP - composition of bullets and detecting powder burns

**CO 3:** detect the forgery documents, different types of forged signatures

**CO4:** have an idea about how to tracks and trace using police dogs, foot prints identification and gain the knowledge in analyzing biological substances - blood, semen, saliva, urine and hair - DNA Finger printing for tissue identification in dismembered bodies

**CO 5:** get the awareness on Aids - causes and prevention and also have an exposure on handling fire explodes.

	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>ORGANIC CHEMISTRY - I</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>
		<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>
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.M.K. Jain, S.C.Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2009.</li> <li>2. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 2009.</li> <li>3. ArunBahl 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, twenty ninth edition, 2007.</li> <li>5.C.N.Pillai, Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia, sixth edition, 2012.</li> <li>2. T.W.Graham Solomons, Organic Chemistry, John Wiley &amp; Sons, eleventh edition, 2012.</li> </ol>

	<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 X</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	III	<b>Credits</b>	4	<b>Course Code</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>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>, 1st Edition, University Press (India) Private Limited, Hyderabad</p> <p>3. Sivasankar B, (2013) <u>Inorganic Chemistry</u>, 1st Edition, Pearson, Chennai</p> <p>4. Alan G. Sharp (1992), <u>Inorganic Chemistry</u>, 3<sup>rd</sup> Edition, Addison-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. <a href="http://www.epgpathshala.nic.in">www.epgpathshala.nic.in</a></p> <p>2. <a href="http://www.nptel.ac.in">www.nptel.ac.in</a></p> <p>3. <a href="http://swayam.gov.in">http://swayam.gov.in</a></p>
<b>Course Learning Outcomes (for Mapping with POs and PSOs)</b>	
<p><b>On completion of the course the students should be able to</b></p> <p><b>CO1:</b> explain isomerism, Werner's Theory and stability of chelate complexes</p> <p><b>CO2:</b> discuss crystal field theory, magnetic properties and spectral properties of complexes.</p> <p><b>CO3:</b> explain preparation and properties of metal carbonyls</p> <p><b>CO4:</b> give a comparative account of the characteristics of lanthanoids and actinoids</p> <p><b>CO5:</b> explain properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorous</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
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

Title of the Course	PHYSICAL CHEMISTRY -I						
Paper No.	Core XI						
Category	Core	Year	III	Credits	4	Course Code	
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
		4	1	-		5	
Prerequisites	General Chemistry I,II,III and IV						
Objectives of the course	<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>						
Course Outline	<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 – rate law – 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>
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. 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>
<b>Reference Books</b>	<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**

<b>Title of the Course</b>	<b>INDUSTRIAL CHEMISTRY</b>						
<b>Paper No.</b>	<b>EC VI</b>						
<b>Category</b>	<b>Elective</b>	<b>Year</b>	III	<b>Credits</b>	3	<b>Course Code</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>
	<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>
	<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, boron nitride, 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>
	<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, 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)	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. 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 Chemsitry</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>	1. <a href="http://www.sciencecases.org/irradiation/irradiation_notes.asp">http://www.sciencecases.org/irradiation/irradiation_notes.asp</a> 2. <a href="http://discovery.kcpc.usyd.edu.au//9.5.5/">http://discovery.kcpc.usyd.edu.au//9.5.5/</a> 3. <a href="https://www.wipo.int/about-ip/en/">https://www.wipo.int/about-ip/en/</a> 4. <a href="http://www.nptel.ac.in">www.nptel.ac.in</a> 5. <a href="http://swayam.gov.in">http://swayam.gov.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> 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
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**

<b>Title of the Course</b>	<b>BIOCHEMISTRY</b>					
<b>Paper No.</b>	EC V					
<b>Category</b>	<b>Elective</b>	<b>Year</b>	III	<b>Credits</b>	4	<b>Course Code</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	1	-		5	
<b>Prerequisites</b>	Organic Chemistry - I					
<b>Objectives of the</b>	The course aims at providing knowledge on					

<b>course</b>	<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>
<b>Course Outline</b>	<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 regulation.  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>  <b>Amino acids</b>  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> Adrenalin and thyroxine -- chemistry, structure and functions (No structure elucidation).</p>
	<p><b>UNIT V</b></p> <p><b>Lipids</b> Occurrence, biological significance of fats, classification of lipids. <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. <b>Compound lipids</b> – Lipoproteins - VLDL, LDL, HDL, chylomicrons – biological significance. Cholesterol – occurrence, structure, test, physiological activity. 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)	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. 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,</li> </ol>

	2003. 5. Chatterjea, M. N.; Shinde, R. <i>Textbook of Medical Biochemistry</i> , 5 <sup>th</sup> ed.; Jaypee Brothers: New Delhi, 2002.
<b>Website and e-learning source</b>	1) <a href="http://library.med.utah.edu/NetBiochem/nucacids.html">http://library.med.utah.edu/NetBiochem/nucacids.html</a> 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> 3) <a href="https://swayam.gov.in/courses/4384-biochemistry">https://swayam.gov.in/courses/4384-biochemistry</a> Biochemistry 4) <a href="https://onlinecourses.nptel.ac.in/noc19_cy07/preview">https://onlinecourses.nptel.ac.in/noc19_cy07/preview</a> Experimental Biochemistry
<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></p> <p><b>CO1:</b> explain molecular logic of living organisms, composition of blood and blood coagulation  <b>CO2:</b> explain synthesis and properties of amino acids, determination of structure of peptides and proteins  <b>CO3:</b> explain factors influencing enzyme activity and vitamins as coenzymes  <b>CO4:</b> explain RNA and DNA structure and functions  <b>CO5:</b> explain biological significance of simple and compound lipids</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
<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>ORGANIC CHEMISTRY - II</b>					
<b>Paper No.</b>	<b>Core XIII</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	III	<b>Credits</b>	3	<b>Course Code</b>
		<b>Semester</b>	VI			
<b>Instructional hours per week</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Lab Practice</b>		<b>Total</b>	
	1	4	-		5	
<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>
	<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>
	<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 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 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> <li>5. C Bandyopadhyaya; An Insight into Green Chemistry; Published on 2020</li> </ol>

<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
<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
<b>Level of Correlation between PSO's and CO's</b>					

<b>Title of the Course</b>	<b>INORGANIC CHEMISTRY –II</b>						
<b>Paper No.</b>	<b>Core XIV</b>						
<b>Category</b>	<b>Core</b>	<b>Year</b>	III	<b>Credits</b>	3	<b>Course Code</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		-		4		
<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 Ferritin; 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. 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) Inorganic Chemistry for Undergraduates, 1st Edition, University Press (India) Private Limited, Hyderabad</li> <li>3. Sivasankar B, (2013) Inorganic Chemistry. 1st Edition, Pearson, Chennai</li> <li>4. Alan G. Sharp (1992), Inorganic Chemistry, 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**



<b>Title of the Course</b>	<b>PHYSICAL CHEMISTRY-II</b>					
<b>Paper No.</b>	<b>Core - XV</b>					
<b>Category</b>	<b>Core</b>	<b>Year</b>	III	<b>Credits</b>	3	<b>Course Code</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</math>-<math>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)</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>

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, 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>
<b>Reference Books</b>	<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>	<p> <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         </p>

**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 solid solutions.
- CO2:** apply the concepts of chemical equilibrium in dissociation of  $\text{PCl}_5$ ,  $\text{N}_2\text{O}_4$  and formation of  $\text{HI}$ ,  $\text{NH}_3$ ,  $\text{SO}_3$  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
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>FUNDAMENTALS OF SPECTROSCOPY</b>						
<b>Paper No.</b>	EC VII						
<b>Category</b>	<b>Elective Course</b>	<b>Year</b>	III	<b>Credits</b>	3	<b>Course Code</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>	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>• electrical and magnetic properties of organic and inorganic compounds</li> <li>• basic principles of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry</li> <li>• instrumentation of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry</li> <li>• applications of various spectral techniques in structural elucidation</li> <li>• solving combined spectral problems</li> </ul>						
<b>Course Outline</b>	<p><b>UNIT I</b></p> <p><b>Electrical and Magnetic properties of molecules</b></p> <p>Dipole moment – polar and nonpolar molecules – polarisability of molecules. Application of dipole moments in the study of organic and inorganic molecules.</p> <p>Magnetic permeability, volume susceptibility, mass susceptibility and molar susceptibility; diamagnetism, paramagnetism – determination of magnetic susceptibility using Guoy balance, ferromagnetism, anti ferromagnetism</p> <p><b>Microwave spectroscopy</b></p> <p>Rotation spectra - diatomic molecules (rigid rotator approximation) selection rules – determination of bond length, effect of isotopic substitution – instrumentation and applications</p>						
	<p><b>UNIT II</b></p> <p><b>Ultraviolet and Visible spectroscopy</b></p> <p>Electronic spectra of diatomic molecules (Born Oppenheimer approximation) - vibrational coarse structure – rotational fine structure of electronic vibration transitions – Frank Condon principle – dissociation in electronic transitions – BirgeSponer method of evaluation of dissociation energy – pre-dissociation transition - <math>\sigma - \sigma^*</math>, <math>\pi - \pi^*</math>, <math>n - \sigma^*</math>, <math>n - \pi^*</math> transitions.</p> <p>Applications of UV-Woodward – Fieser rules as applied to conjugated dienes and <math>\alpha</math>, <math>\beta</math> - unsaturated ketones. Elementary Problems. Colorimetry - principle and applications (estimation of <math>Fe^{3+}</math>)</p>						

	<p><b>UNIT III</b></p> <p><b>Infrared spectroscopy</b>  Vibration spectra –diatomic molecules – harmonic oscillator and anharmonic oscillator; Vibration – rotation spectra – diatomic molecule as rigid rotator and anharmonic oscillator (Born-Oppenheimer approximation oscillator) - selection rules, vibrations of polyatomic molecules – stretching and bending vibrations – applications – determination of force constant, moment of inertia and internuclear distance – isotopic shift – application of IR spectra to simple organic and inorganic molecules – (group frequencies)</p> <p><b>Raman Spectroscopy</b>  Rayleigh scattering and Raman scattering of light – Raman shift – classical theory of Raman effect – quantum theory of Raman effect – Vibrational Raman spectrum – selection rules – mutual exclusion principle – instrumentation (block diagram) – applications.</p> <p><b>UNIT IV</b></p> <p><b>Nuclear magnetic resonance spectroscopy:</b></p> <p>PMR – theory of PMR – instrumentation - number of signals – chemical shift – peak areas and proton counting – spin-spin coupling – applications. Problems related to shielding and deshielding of protons, chemical shifts of protons in hydrocarbons, and in simple monofunctional organic compounds; spin-spin splitting of neighbouring protons in vinyl and allyl systems.</p> <p><b>UNIT V</b></p> <p><b>Mass spectrometry</b>  Principle – different kinds of ionisation – instrumentation – the mass spectrum – types of ions – determination of molecular formula-fragmentation and structural elucidation – McLafferty rearrangement; Retro Diels Alder reaction - illustrations with simple organic molecules.</p> <p>Solving structure elucidation problems using multiple spectroscopic data (NMR, MS, IR and UV-Vis).</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. Gopalan, R.; Subramaniam, P. S.; Rengarajan, K. <i>Elements of Analytical Chemistry</i>; S Chand: New Delhi, 2003.</li> <li>2. Usharani, S. <i>Analytical Chemistry</i>, 1<sup>st</sup>ed.; Macmillan: India, 2002.</li> <li>3. Banwell, C.N.; Mc Cash, E. M. <i>Fundamentals of Molecular Spectroscopy</i>, 4<sup>th</sup> ed.; Tata McGraw Hill, New Delhi, 2017.</li> <li>4. U.N.Dash, <i>Analytical Chemistry Theory and Practice</i>, Sultan Chand &amp; Sons, 2<sup>nd</sup> Ed., 2005</li> <li>5. B.K.Sharma, <i>Spectroscopy</i>, 22<sup>nd</sup> ed., Goel Publishing House, 2011.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Srivastava, A. K.; Jain, P. C. <i>Chemical Analysis an Instrumental Approach</i>, 3<sup>rd</sup>ed.; S.Chand, New Delhi, 1997.</li> <li>2. Robert D Braun. <i>Introduction to Instrumental Analysis</i>; Mc.Graw Hill: New York, 1987.</li> <li>3. Skoog, D. A.; Crouch, S. R.; Holler, F.J.; West, D. M. <i>Fundamentals of Analytical Chemistry</i>, 9<sup>th</sup>ed.; Harcourt college Publishers: USA, 2013.</li> <li>4. Madan, R. L.; Tuli, G. D. <i>Physical Chemistry</i>, 2<sup>nd</sup>ed.; S.Chand: New Delhi, 2005.</li> <li>5. Puri, B. R.; Sharma, L. R.; Pathania, M.S. <i>Principles of Physical Chemistry</i>, 43<sup>rd</sup> ed.; Vishal Publishing: Delhi, 2008.</li> </ol>
<b>Website and e-learning source</b>	<ol style="list-style-type: none"> <li>1. <a href="http://vallance.chem.ox.ac.uk/pdfs/SymmetryLectureNotes2004.pdf">http://vallance.chem.ox.ac.uk/pdfs/SymmetryLectureNotes2004.pdf</a></li> <li>2. <a href="http://chemistry.rutgers.edu/undergrad/chem207/SymmetryGroupTheory.html">http://chemistry.rutgers.edu/undergrad/chem207/SymmetryGroupTheory.html</a></li> <li>3. <a href="http://www.epgpathshala.nic.in">www.epgpathshala.nic.in</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>
<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> explain electrical and magnetic properties of materials and microwave spectroscopy</p> <p><b>CO2:</b> explain theory, instrumentation and applications of Infrared and Raman spectroscopy</p> <p><b>CO3:</b> apply selection rules to understand spectral transitions, explain Woodward – Fieser’s rule for the calculation of wavelength maximum of conjugated dienes</p> <p><b>CO4:</b> explain theory, instrumentation and applications of NMR spectroscopy</p> <p><b>CO5:</b> explain theory, instrumentation and applications of Mass spectrometry</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

Title of the Course	PHYSICAL CHEMISTRY PRACTICAL – II						
Paper No.	Core XVI						
Category	Core	Year	III	Credits	2	Course Code	
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	3		3		
Prerequisites	Theoretical knowledge on physical chemistry						
Objectives of the course	This course aims at providing <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>						



	<p><b>Distribution law</b></p> <p>6. Determination of the distribution coefficient of iodine between carbon tetrachloride and water.</p> <p>7. Determination of equilibrium constant of the reaction</p> $I_2 + I^- \rightleftharpoons I_3^-$ <p>8. Determination of concentration of the given potassium iodide solution using the above equilibrium constant.</p>
	<p><b>UNIT III</b></p> <p><b>Electrochemistry</b></p> <p>9. Conductometric titration of hydrochloric acid against sodium hydroxide</p> <p>10. Potentiometric titration of ferrous ion against potassium dichromate using quinhydrone electrode.</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>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Sindhu, P.S. <i>Practicals in Physical Chemistry</i>, Macmillan India : New Delhi, 2005.</li> <li>2. Khosla, B. D. Garg, V. C.; Gulati, A. <i>Senior Practical Physical Chemistry</i>, R. Chand : New Delhi, 2011.</li> <li>3. Gupta, Renu, <i>Practical Physical Chemistry</i>, 1<sup>st</sup> Ed.; New Age International : New Delhi, 2017.</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>
<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> Describe the principles and methodology for the practical work.</p> <p><b>CO2:</b> Explain the procedure, data and methodology for the practical work</p> <p><b>CO3:</b> Apply the principles of phase rule and electrochemistry for carrying out the practical work</p> <p><b>CO4:</b> Demonstrate laboratory skills for safe handling of the equipment and chemicals</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
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>NANOSCIENCE</b>						
<b>Paper No.</b>	<b>E C VIII</b>						
<b>Category</b>	<b>Elective</b>	<b>Year</b>	III	<b>Credits</b>	3	<b>Course Code</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		-		4		
<b>Prerequisites</b>	Basics knowledge in physics and chemistry						
<b>Objectives of the course</b>	This course aims at providing knowledge on <ul style="list-style-type: none"> <li>• introduction to nanoparticles/clusters and nanocomposites</li> <li>• properties of nanomaterials</li> <li>• characterization of nanomaterials by different methods</li> <li>• synthesis of carbon nanotubes, graphene, quantum dots, self-assembled nanomaterials</li> <li>• applications of nanomaterials as sensors</li> </ul>						

<p><b>Course Outline</b></p>	<p><b>UNIT I</b>  <b>Introduction to nanoscience</b>  Definition of terms – nanoscience, nanoparticles, clusters, quantum dots, nanostructures and nanocomposites. Electron behaviour in free space, bulk material and nanomaterials.  Synthesis and stabilization of nanomaterials  Top down approach (physical methods), mechanical dispersion – ball milling, methods based on evaporation of a precursor-inert gas condensation, ion sputtering, spray pyrolysis, aerosol synthesis-nanolithography.  Bottom-up approach (chemical methods) - solvothermal synthesis, photochemical method, gamma radiolysis, sonochemical synthesis, electro deposition, sol-gel method, nanomaterials via chemical routes-solvents reducing agents, capping agents-stabilization of nanoparticles -electrostatic and steric</p>
	<p>stabilization, common stabilizers, nanoparticle growth in solution, templated growth, Langmuir – Blodgett (L-B) method, reverse micelles-emulsion method.</p>
	<p><b>Unit II</b>  <b>Properties of materials on a nanoscale</b>  Optical properties of metal and semiconductor nanomaterials- surface Plasmon resonance (SPR), surface enhanced Raman spectra (SERS), quantum confinement effect, tuning of optical spectrum. Magnetic properties - Fe<sub>3</sub>O<sub>4</sub> particle, supra magnetic properties, electronic properties, Chemical properties- chemical process on the surface of nanoparticles, catalysis, mechanical properties.</p>
	<p><b>UNIT III</b>  <b>Techniques employed for characterisation of nanomaterials</b>  Spectroscopy – UV-visible, Photoelectron spectroscopy – Electron microscopy – Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning probe microscopy (SPM) – Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Optical microscopy – confocal microscopy, X-ray diffraction (XRD) [Principle and Block diagram only].</p>
	<p><b>UNIT IV</b>  <b>Special nanomaterials</b>  Carbon Nano Structures Carbon nanotubes: Introduction - types - zigzag, armchair, helical, synthesis by CVD, Functionalization of Carbon Nanotubes, Reactivity of Carbon Nanotubes, Field emission, Fuel Cells, Display devices .  Other Important Carbon based materials: Preparation and Characterization Fullerene, Graphene, properties, DLC and nanodiamonds and Applications  Semiconductor nanoparticles: Quantum dots, synthesis – chemical synthesis using clusters, properties, porous silicon – electrochemical etching, aerogel – types – silica aerogel, resorcinol formaldehyde (RF) aerogels, zeolites – applications.  Self Assembled Nanomaterials: Self Assembled Monolayers (SAMS) – inorganic, organic molecules.</p>

	<p><b>UNIT V</b></p> <p><b>Application of nanomaterials</b></p> <p>Biomedical Applications- drug, drug delivery, biolabelling, artificial implants, cancer treatment. Sensors – Natural nanoscale sensors, chemical sensors, biosensors, electronic noses.</p> <p>Optics &amp; Electronics – Nanomaterials in the next generation computer technology, high definition TV, flat panel displays, quantum dot laser, single electron transistors [SET].</p> <p>Nanotechnology in agriculture – Fertilizer and pesticides nanomaterials for water purification, nanomaterials in food and packaging materials, fabric industry.</p> <p>Impacts of Nanotechnology – human &amp; environmental safety risks.</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. Sulabha K. Kulkarni, <i>Nanotechnology: Principles and Practices</i>, Capital Publishing Co., New Delhi.</li> <li>2. Pradeep. T, <i>Nano: The Essentials, Understanding Nanoscience and Nanotechnology</i>; Tata McGraw-Hill Publishing Company Limited, NewDelhi, 2007.</li> <li>3. Shah. M.A.; Tokeer Ahmad, <i>Principles of Nanoscince and Nanotechnology</i>; Narosa Publishing House, New Delhi, 2010.</li> <li>4. Murthy. B.S; Shankar. P, Baldev Raj.; Rath. B.B. JamesMurday, <i>Textbook of Nanoscience and Nanotechnology</i>;Universities press, India Ltd ,Hyderabad. 2012.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Sharma. P.K., <i>Understanding Nanotechnology</i>; Vista International Publishing House, Delhi. 2008.</li> <li>2. Charles P. Poole Jr.; Frank J. Owens. <i>Introduction to Nanotechnology</i>; A John Wiley &amp; Sons, INC., Publication, 2003.</li> <li>3. Viswanathan B., <i>Nano Materials</i>;Narosa Publishing House, New Delhi, 2009.</li> <li>4. Edited by C.N.R. Rao; Mu"ller.A; Cheetham, A.K.<i>Nanomaterials Chemistry Recent Developments and New Directions</i>, WILEY-VCH Verlag GMBH &amp; Co.,KGaA, Darmstad.</li> <li>5. Jing Zhong Zhang, <i>Optical properties and spectroscopy of Nanomaterials</i>; World Scientific Publishing Pvt. Ltd., Singapore.</li> </ol>
<b>Website and e-learning source</b>	<ol style="list-style-type: none"> <li>1) <a href="http://www.nanotechnology.com/docs/wtd015798.pdf">http://www.nanotechnology.com/docs/wtd015798.pdf</a></li> <li>2) <a href="http://nccr.iitm.ac.in/Nanomaterials.pdf">http://nccr.iitm.ac.in/Nanomaterials.pdf</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 general concepts and physical phenomena of relevance within the field of nanoscience.  
**CO2:** describe the properties, synthesis, characteristics of nanomaterials, special nanomaterials and applications.  
**CO3:** examine the structure, properties, applicability and characterization of nanomaterials.  
**CO4:** analyze various synthesis procedures, characterizations and uses of carbon nanotubes, fullerene and graphene  
**CO5:** discuss applications of nanomaterials of sensors and in optics and electronics

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

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

<b>Title of the Course</b>	<b>POLYMER SCIENCE</b>						
<b>Paper No.</b>	<b>EC VIII</b>						
<b>Category</b>	<b>Elective</b>	<b>Year</b>	<b>III</b>	<b>Credits</b>	3	<b>Course Code</b>	
		<b>Semester</b>	<b>VI</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>	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>						

**UNIT IV**

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

**Polymer technology**

Processing of polymers - casting, thermoforming, moulding - extrusion, compression, blow moulding - foaming, lamination, reinforcing - processing of fibres - melt, wet and dry spinning.

**UNIT V****Speciality polymers**

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.

**Polymer Degradation**

Types of Degradation - Thermal, Mechanical, Ultra Sound, Photo

	Radiation and Chemical Degradation Methods. Rubber-Natural and Synthetic-Structure, Mechanism of Vulcanisation Biodegradable and Non-Biodegradable Polymers.
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. 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. Polymer Science. 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>



<b>Course Learning Outcomes (for Mapping with POs and PSOs)</b> On completion of the course the students should be able to CO1: explain classification of polymers, elastomers, fibres and liquid resins CO2: explain addition and condensation polymerization, mechanical properties of polymers CO3: determine the molecular weight of polymers, and explain the thermal properties of polymers CO4: explain reactions of polymers and polymer processing CO5: discuss speciality polymers like PVC, PMMA, rubbers, biodegradable polymers					
<b>CO /PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>
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>CO /PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
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 PO's and CO's

<b>Title of the Course</b>	<b>PHARMACEUTICAL CHEMISTRY</b>					
<b>Paper No.</b>	<b>Elective Course VIII</b>					
<b>Category</b>	<b>Elective</b>	<b>Year</b>	III	<b>Credits</b>	3	<b>Course Code</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		-		4	
<b>Prerequisites</b>	Knowledge on active chemical compounds and biochemistry					
<b>Objectives of the course</b>	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>
<b>Course Outline</b>	<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> <hr/> <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> <hr/> <p><b>UNIT III</b></p> <p><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, fluorouracil; 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 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.</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>

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>
<b>Course Learning Outcomes (for Mapping with POs and PSOs)</b> <b>On completion of the course the students should be able to</b>	
<p><b>CO1:</b> 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.</p> <p><b>CO2:</b> 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.</p> <p><b>CO3:</b> 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.</p> <p><b>CO4:</b> explain classification of analgesics and anesthetics, and physiological functions of plasma proteins</p> <p><b>CO5:</b> explain the significance of clinical tests like blood urea, serum proteins and coronary risk index</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

Level of Correlation between PO's and CO's

### GENERIC ELECTIVE

Title of the Course	<b>CHEMISTRY FOR PHYSICAL SCIENCES I (FOR MATHEMATICS &amp; PHYSICS STUDENTS)</b>					
Paper No.	<b>Generic Elective I</b>					
Category	Generic Elective	Year Semester	I I	Credits	3	Course Code
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total	
	4	-			4	
Prerequisites	Higher secondary chemistry					
Objectives of the course	This course aims to provide knowledge on the <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>					
Course Outline	<b>UNIT I</b> <b>Chemical Bonding and Nuclear Chemistry</b> Chemical Bonding: Molecular Orbital Theory-bonding, antibonding					

	<p>and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.</p> <p>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. Applications of radioisotopes - carbon dating, rock dating and medicinal applications.</p>
	<p><b>Unit II</b>  <b>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). Silicones: Synthesis, properties and uses of silicones.</p> <p>Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.</p>
	<p><b>UNIT III</b>  <b>Fundamental Concepts in Organic Chemistry</b></p> <p>Hybridization: Orbital overlap, hybridization and geometry of CH<sub>4</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>2</sub>H<sub>2</sub> and C<sub>6</sub>H<sub>6</sub>. Electronic effects: Inductive effect and consequences on K<sub>a</sub> and K<sub>b</sub> of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric- examples.</p> <p>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.</p>
	<p><b>UNIT IV</b>  <b>Thermodynamics and Phase Equilibria</b></p> <p>Thermodynamics: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Carnot's cycle and efficiency of heat engine. Entropy and its</p>

	<p>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.</p> <p>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).</p>
	<p><b>UNIT V</b> <b>Analytical Chemistry</b></p> <p>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.</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. V.Veeraiyan, Text book of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009.</li> <li>2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006.</li> <li>3. S.ArunBahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, NewDelhi, 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>5. P.L.Soni, MohanKatyal, Textbook of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.</li> <li>6. B.R.Puri, L.R.Sharma, M.S.Pathania, Textbook Physical Chemistry; Vishal Publishing Co., New Delhi, fortyfourth edition, 2018.</li> <li>7. B.K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.</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>	

CO 1: gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications.
CO 2: evaluate the efficiencies and uses of various fuels and fertilizers
CO 3: explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.
CO 4: apply various thermodynamic principles, systems and phase rule.
CO 5: explain various methods to identify an appropriate method for the separation of chemical components

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

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

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

Title of the Course	<b>CHEMISTRY FOR PHYSICAL SCIENCES II (FOR MATHEMATICS &amp; PHYSICS STUDENTS)</b>					
Paper No.	<b>Generic Elective II</b>					
Category	Generic Elective	Year	I	Credits	3	Course Code
		Semester	II			
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total	
	4	-	-		4	
Prerequisites	Chemistry for physical sciences -I					



<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>Course Outline</b>	<p><b>UNIT I</b>  <b>Co-ordination Chemistry and Water Technology</b>  Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature - Werner's theory - EAN rule - Pauling's theory - Postulates - Applications 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> <hr/> <p><b>Unit II</b>  <b>Carbohydrates and Amino acids</b>  Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain 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> <hr/> <p><b>UNIT III</b>  <b>Electrochemistry</b>  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</b> <b>Kinetics and Catalysis</b></p> <p>Order and molecularity. Integrated rate expression for I and II (2A <math>\square</math> Products) order reactions. Pseudo first order reaction, methods of determining order of a reaction – Half-life period – Catalysis - homogeneous and heterogeneous, catalyst used in Contact and Haber’s processes. Concept of energy of activation and Arrhenius equation.</p>
	<p><b>UNIT V</b> <b>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 photosensitization and photosynthesis (definition with examples).</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. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009.</li> <li>2. S.Vaithyanathan, Text book 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, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.</li> <li>2. R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.</li> </ol>
	<ol style="list-style-type: none"> <li>3. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.</li> </ol>

<b>Website and e-learning source</b>	
<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> write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology <b>CO 2:</b> explain the preparation and property of carbohydrate, amino acids and nucleic acids. <b>CO 3:</b> apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells. <b>CO 4:</b> identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst. <b>CO 5:</b> outline the various type of photochemical process.	

<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>CHEMISTRY FOR BIOLOGICAL SCIENCES I (FOR BOTANY AND ZOOLOGY STUDENTS)</b>						
<b>Paper No.</b>	<b>Generic Elective III</b>						
<b>Category</b>	<b>Generic Elective</b>	<b>Year</b>	II	<b>Credits</b>	3	<b>Course Code</b>	
		<b>Semester</b>	III				
<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</p> <ul style="list-style-type: none"> <li>• basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry</li> <li>• nuclear chemistry and industrial chemistry</li> <li>• importance of speciality drugs and</li> <li>• separation and purification techniques.</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. M. O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.</p> <p>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. Applications of radioisotopes - carbon dating, rock dating and medicinal applications.</p>						
	<p><b>Unit II 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, triple superphosphate.</p>						
	<p><b>UNIT III Fundamental Concepts in Organic Chemistry</b></p> <p>Hybridization: Orbital overlap hybridization and geometry of CH<sub>4</sub>, C<sub>2</sub>H<sub>4</sub>, C<sub>2</sub>H<sub>2</sub> and C<sub>6</sub>H<sub>6</sub>. Polar effects: Inductive effect and</p>						

	<p>consequences on <math>K_a</math> and <math>K_b</math> of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation.</p> <p>Reaction mechanisms: Types of reactions- aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation.</p> <p>Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.</p>
	<p><b>UNIT IV</b> <b>Drugs and Speciality Chemicals</b></p> <p>Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen;</p> <p>Artificial Sweeteners viz., saccharin, Aspartame and cyclamate;</p> <p>Organic Halogen compounds viz., Freon, Teflon.</p>
	<p><b>UNIT V:</b> <b>Analytical Chemistry</b></p> <p>Introduction 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.</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. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009.</li> <li>2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006.</li> <li>3. ArunBahl, 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 Inorganic 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, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.</li> <li>2. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.</li> <li>3. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sultan &amp; Chand, Edition 2006.</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> state the theories of chemical bonding, nuclear reactions and its applications.  <b>CO 2:</b> evaluate the efficiencies and uses of various fuels and fertilizers.  <b>CO 3:</b> explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.  <b>CO 4:</b> demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.  <b>CO 5:</b> analyse various methods to identify an appropriate method for the separation of chemical components.</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
<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>CHEMISTRY FOR BIOLOGICAL SCIENCES II (FOR BOTANY AND ZOOLOGY STUDENTS)</b>					
<b>Paper No.</b>	<b>Generic Elective IV</b>					
<b>Category</b>	<b>Generic Elective</b>	<b>Year</b> II	<b>Semester</b> IV	<b>Credits</b>	3	<b>Course Code</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>	<b>Chemistry for Biological Sciences I</b>					
<b>Objectives of the course</b>	<p>This course aims to provide knowledge on</p> <ul style="list-style-type: none"> <li>• nomenclature of coordination compounds and carbohydrates.</li> <li>• Amino Acids and Essential elements of biosystem</li> <li>• understand the concepts of kinetics and catalysis</li> <li>• provide fundamentals of electrochemistry and photochemistry</li> </ul>					
<b>Course Outline</b>	<p><b>UNIT I</b> <b>Co-ordination Chemistry and Water Technology</b> Co-ordination Chemistry: Definition of terms - IUPAC Nomenclature - Werner's theory - EAN rule - Pauling's theory - Postulates - Applications 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 Hemoglobin 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 and COD.</p> <p><b>Unit II</b> <b>Carbohydrates</b> Classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose. Glucose-fructose interconversion. Preparation and properties of sucrose, starch and cellulose.</p> <p><b>UNIT III</b> <b>Amino Acids and Essential elements of biosystem</b> Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method - Proteins-classification - structure - Colour reactions - Biological functions - nucleosides -nucleotides - RNA and DNA - structure. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.</p>					

	<p><b>UNIT IV</b>  <b>Electrochemistry</b>  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 V</b>  <b>Photochemistry</b>  Grothus - Drapper’s law and Stark-Einstein’s law of photochemical equivalence, Quantum yield - Hydrogen -chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).</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. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009.</li> <li>2. S.Vaithyanathan, Text book 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. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.</li> <li>2. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand &amp; sons, New Delhi, twenty ninth edition, 2007.</li> <li>3. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry;</li> </ol>



	<p>Sultan Chand and Company, New Delhi, twentieth edition, 2007.</p> <p>4. B.R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.</p> <p>5. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.</p>
<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> write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology.  <b>CO 2:</b> explain the preparation and property of carbohydrate.  <b>CO 3:</b> enlighten the biological role of transition metals, amino acids and nucleic acids.  <b>CO 4:</b> apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.  <b>CO 5:</b> outline the various type of photochemical process.</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

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

Level of Correlation between PO's and CO's

<b>Title of the Course</b>	<b>CHEMISTRY PRACTICAL FOR PHYSICAL AND BIOLOGICAL SCIENCES</b> (for Mathematics and Physics – I Year/I Semester; for Botany and Zoology II Year/III Semester)						
<b>Paper No.</b>	Generic Elective V						
<b>Category</b>	<b>Generic Elective</b>	<b>Year</b>	I/ II	<b>Credits</b>	1	<b>Course Code</b>	
		<b>Semester</b>	I/III				
<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 diphenyl amine as indicator.</li> </ol>						
<b>Reference Books</b>	V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.						
<b>Course Learning Outcomes (for Mapping with POs and PSOs)</b>							
<b>On completion of the course the students should be able to</b>							
CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette.							
CO 2: design, carry out, record and interpret the results of volumetric titration.							
CO 3: apply their skill in the analysis of water/hardness.							
CO4: analyze the chemical constituents in allied chemical products							

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>CHEMISTRY PRACTICAL FOR PHYSICAL AND BIOLOGICAL SCIENCES</b> (For Mathematics and Physics – I year/II semester; For Botany and Zoology II year/IV semester)					
<b>Paper No.</b>	<b>Generic Elective VI</b>					
<b>Category</b>	<b>Generic Elective</b>	<b>Year</b>	<b>I/ II</b>	<b>Credits</b>	<b>1</b>	<b>Course Code</b>
		<b>Semester</b>	<b>II/IV</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>						
<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> <li>• different types of organic compounds with respect to their properties.</li> <li>• determination of elements in organic compounds..</li> </ul>					
	<b>SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS</b> The analysis must be carried out as follows:					

	<p>(a) Functional group tests [phenol, acids (mono &amp; di) aromatic primary amine, amides (mono &amp; di), aldehyde and glucose].</p> <p>(b) Detection of elements (N, S, Halogens).</p> <p>(c) To distinguish between aliphatic and aromatic compounds.</p> <p>(d) To distinguish – Saturated and unsaturated compounds.</p>
<b>Reference Books</b>	V.Venkateswaran, R.Veerasingam, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.
<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>          CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette.          CO 2: design, carry out, record and interpret the results of volumetric titration.          CO 3: apply their skill in the analysis of water/hardness.          CO4: analyze the chemical constituents in allied chemical products</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
<b>Weightage</b>	12	12	12	12	12
<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
<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**

**DEPARTMENT OF CHEMISTRY**  
**PROGRAMME SPECIFIC OUTCOMES**

**On successful completion of the programme the students will be able to**

**PSO1:** acquire in-depth knowledge of the fundamental concepts in all disciplines of chemistry.

**PSO2:** disseminate the basics of chemistry and advanced topics and analytical skills in organic, inorganic and physical chemistry.

**PSO3:** uphold ethical values in personal life, research and career.

**PSO4:** demonstrate laboratory skills, analytical acumen, creatively in academics and research.

**PSO5:** apply digital tools to collect, analyze and interpret data and presents scientific findings.

**PSO6:** gain competence to pursue higher education and career opportunities in chemistry and allied fields.

**PSO7:** exhibit leadership qualities to work individually and within a team in organizing curricular, co-curricular and extracurricular activities.

**PSO8:** apply the concepts of chemistry to solve problems in the community, entrepreneurial and research pursuits.

**PSO9:** exhibit competence in educational, industrial and research pursuits that contribute towards the holistic development of self and community.

**PSO10:** display proactive approach towards sustainable environment through green laboratory practices.

**PO-PSO MAPPING MATRIX:**

<b>PSOs</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PSO6</b>	<b>PSO7</b>	<b>PSO8</b>	<b>PSO9</b>	<b>PSO10</b>
<b>POs</b>										
<b>PO1</b>	<b>X</b>									
<b>PO2</b>		<b>X</b>								
<b>PO3</b>			<b>X</b>							
<b>PO4</b>				<b>X</b>						
<b>PO5</b>					<b>X</b>					
<b>PO6</b>						<b>X</b>				
<b>PO7</b>							<b>X</b>			
<b>PO8</b>								<b>X</b>		
<b>PO9</b>									<b>X</b>	
<b>PO10</b>										<b>X</b>