B.SC.,
CHEMISTRY

SYLLABUS

FROM THE ACADEMIC YEAR
2023-2024

TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION, CHENNAI – 600 005

Contents

1. INTRODUCTION

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

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

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

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

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

	PO9: Reflective thinking: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society. **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability toembrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstratingthe ability to identify ethical issues related to one‟s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn‟, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

Programme Specific Outcomes:	On successful completion of Bachelor of Physics with Computer Applications programme, the student should be able to: **PSO1: Disciplinary Knowledge:** Understand the fundamental principles, concepts, and theories related to physics and computer science. Also, exhibit proficiency in performing experiments in the laboratory. **PSO2: Critical Thinking:** Analyse complex problems, evaluate information, synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions and communicate effectively **PSO3: Problem Solving:** Employ theoretical concepts and critical reasoning ability with physical, mathematical and technical skills to solve problems, acquire data, analyze their physical significance and explore new design possibilities. **PSO4: Analytical & Scientific Reasoning:** Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models. **PSO5: Research related skills:** Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects. **PSO6: Self-directed & Lifelong Learning:** Set learning goals, manage their own learning, reflect on their learning, adapt to new contexts, seek out new knowledge, collaborate with others and to continuously improve their skills and knowledge, through ongoing learning and professional development, and contribute to the growth and development of their field.

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

2. Highlights of the Revamped Curriculum:

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

Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	**Foundation Course** To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract Statistics and simulating mathematical concepts to real world.	• Instil confidence among students • Create interest for the subject
I, II, III, IV	**Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial)	• Industry ready graduates • Skilled human resource • Students are equipped with essential skills to make them employable
		• Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects
		• Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc.
		• Entrepreneurial skill training will provide an opportunity for independent livelihood • Generates self – employment • Create small scale entrepreneurs • Training to girls leads to women empowerment
		• Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools
III, IV, V & VI	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	• Strengthening the domain knowledge • Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature • Students are exposed to Latest topics on Computer Science / IT, that require strong statistical background • Emerging topics in higher education / industry / communication network / health sector etc. are introduced with hands-on-training, facilitates designing of statistical models in the respective sectors

IV	DBMS and Programming skill, Biostatistics, Statistical Quality Control, Official Statistics, Operations Research	• Exposure to industry moulds students into solution providers • Generates Industry ready graduates • Employment opportunities enhanced
II year Vacation activity	Internship / Industrial Training	• Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.
V Semester	Project with Viva – voce	• Self-learning is enhanced • Application of the concept to real situation is conceived resulting in tangible outcome
VI Semester	Introduction of Professional Competency component	• Curriculum design accommodates all category of learners; 'Statistics for Advanced Explain' component will comprise of advanced topics in Statistics and allied fields, for those in the peer group / aspiring researchers; • 'Training for Competitive Examinations' –caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, ISS, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.
Extra Credits: **For Advanced Learners / Honors degree**		• To cater to the needs of peer learners / research aspirants

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

ALAGAPPA UNIVERSITY, KARAIKUDI
NEW SYLLABUS UNDER CBCS PATTERN (W.E.F.2023-24)
UG - CHEMISTRY – PROGRAMME STRUCTURE

Sem.	Part	Course Code	Course Code	Title of the Paper	T/P	Credit	Hours/ Week	Max. Marks		
								Int.	Ext.	Total
I	I	2311T	T/OL	**தமிழ் இலக்கிய வரலாறு-I** /Other Languages-I	T	3	6	25	75	100
	II	2312E	E	General English -I	T	3	6	25	75	100
	III	23BCH1C1	CC1	General Chemistry – I	T	5	5	25	75	100
		23BCH1P1	CC2	Practical-I Quantitative Inorganic Estimation and Inorganic Preparation	P	3	4	25	75	100
		-	Generic Elective (Allied)	Mathematics /Botany/ Zoology	T	3	3	25	75	100
		-		Practical-IA- Respective Allied Theory	P	2	2	25	75	100
	IV	23BCH1S1/ 23BCH1S2	SEC	Food Chemistry **or** Role of Chemistry In Daily Life	T	2	2	25	75	100
		23BCH1FC	FC	Foundation of Course for Chemistry	T	2	2	25	75	100
				TOTAL	**-**	**23**	**30**	**200**	**600**	**800**
II	I	2321T	T/OL	தமிழ் இலக்கிய வரலாறு-2 /Other Languages-II	T	3	6	25	75	100
	II	2322E	E	General English - II	T	3	6	25	75	100
	III	23BCH2C1	CC-3	General Chemistry –II	T	5	5	25	75	100
		23BCH2P1	CC -4	Practical-II- Qualitative Organic Analysis & Preparation of Organic compounds	P	3	4	25	75	100
		--	Allied	Theory-IB Maths (or) Botany/ Zoology	T	3	3	25	75	100
		--	Allied	Practical-IB - Respective Allied Theory Course	P	2	2	25	75	100
	IV	23BCH2S1	SEC-2	Dairy Chemistry	T	2	2	25	75	100
		23BCH2S2	SEC-3	Cosmetics and Personal Grooming.	T	2	2	25	75	100
			NMC							
				Total		**23**	**30**	**200**	**600**	**800**
III	I	2331T	T/OL	**தமிழக வரலாறும் பண்பாடும்** / Other Languages-III	T	3	6	25	75	100
	II	2332E	E	General English– III	T	3	6	25	75	100
	III	23BCH3C1	CC-5	General Chemistry – III	T	5	5	25	75	100
		23BCH3P1	CC-6	Practical-III- Qualitative Inorganic Analysis	P	3	4	25	75	100
		--	Allied	Theory– Physics EC-3	T	3	3	25	75	100
		--	Allied	Allied Practical	P	2	2	25	75	100
	IV	23BCH3SP	SEC-4	Entrepreneurial Skills in Chemistry	P	2	2	25	75	100
		233AT/ 23BCH3S1	SEC-5	Adipadai Tamil/ Pesticide Chemistry	T	2	2	25	75	100
			NMC							
				Total		**23**	**30**	**200**	**600**	**800**

IV	I	2341T	T/OL	**தமிழும் அறிவியலும்** /Other Languages –IV	T	3	6	25	75	100
	II	2342E	E	General English-IV	T	3	6	25	75	100
	III	23BCH4C1	CC-7	General Chemistry – IV	T	4	4	25	75	100
		23BCH4P1	CC-8	Practical IV - Physical Chemistry I	P	3	3	25	75	100
		--	Allied	Theory–Physics	T	3	3	25	75	100
		--	Allied	Practical	P	2	2	25	75	100
	IV	23BCH4S1	SEC-6	Instrumental methods of chemical Analysis	**T**	2	2	25	75	100
		234AT/ 23BCH4S2	SEC -7	Adipadai Tamil/ Forensic science	T	2	2	25	75	100
		23BES4		EVS	T	2	2	25	75	100
			NMC							
						24	**30**	**225**	**675**	**900**

V	III	23BCH5C1	CC-9	Organic Chemistry-I	T	4	5	25	75	100
		23BCH5C2	CC-10	Inorganic Chemistry – I	T	4	5	25	75	100
		23BCH5C3	CC-11	Physical Chemistry – I	T	4	5	25	75	100
		23BCH5E1	DSE-I	Biochemistry	T	3	4	25	75	100
		23BCH5E2	DSE-II	Industrial chemistry	T	3	4	25	75	100
		23BCH5PR	CC-12	Project with viva-voce	PR	4	5	25	75	100
	IV	23BVE5		Value Education	T	2	2	25	75	100
		23BCH5IV/ 23BCH5FV		Industrial Visit / Field Visit (Carried out in II Year Summer Vacation) (30 hours)	PR	2	-	25	75	100
			NMC							
						26	**30**	**200**	**600**	**800**
VI	**III**	23BCH6C1	CC-13	Organic Chemistry-II	T	4	6	25	75	100
		23BCH6C2	CC-14	Inorganic Chemistry – II	T	4	6	25	75	100
		23BCH6C3	CC-15	Physical Chemistry – II	T	4	6	25	75	100
		23BCH6P1	CC-16	Practical V- Physical Chemistry II	P	4	5	25	75	100
		23BCH6E1	DSE-III	Fundamentals of Spectroscopy	T	3	5	25	75	100
	IV	23BCH6S1	-	Essential Reasoning and Quantitative Aptitude	T	2	2	25	75	100
	V	23BEA6		Extension Activity	P	1	-	25	75	100
			NMC							
				Total		**22**	**30**	**150**	**550**	**700**
				Grand Total		**140**	**--**	**--**	**-**	**4800**

Title of the Course	GENERAL CHEMISTRY-I						
Paper No.	Core I						
Category	Core	Year	I	Credits	5	Course Code	23BCH1C1
		Semester	I				
Instructional hours per week	Lecture	Tutorial	Lab Practice			Total	
	4	1	-			5	
Prerequisites	Higher secondary chemistry						
Objectives ofthe course	The course aims at giving an overall view of the • various atomic models and atomic structure • wave particle duality of matter • periodic table, periodicity in properties and its application in explaining the chemical behaviour • nature of chemical bonding, and • fundamental concepts of organic chemistry						
Unit I	**Atomic structure and Periodic trends** 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'exclusion principle and Aufbau principle; Numerical problems involving the core concepts**.**						
Unit II	**Introduction to Quantum mechanics** Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wave functions, Formulation of Schrodinger wave equation - Probability and electron density-visualizing the orbitals -Probability density and significance of Ψ and Ψ^2. **Modern Periodic Table** **Cause of periodicity**; Features of the periodic table; classification of elements - Periodic trends for atomic size- Atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electro negativity-electro negativity scales, applications of electronegativity. Problems involving the core concepts						
Unit-III	**Structure and bonding - I** **Ionic bond** Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle – lattice energies, Madelung constant; relative effect of lattice energy and solvation energy; Ion polarisation – polarising power and polarizability; Fajans' rules - effects of polarisation on properties of compounds; problems involving the core concepts. **Covalent bond** Shapes of orbitals, overlap of orbitals – σ and Π bonds; directed valency - hybridization; VSEPR theory - shapes of molecules of the type AB_2, AB_3, AB_4, AB_5, AB_6 and AB_7 Partial ionic character of covalent bond-dipole moment, application to molecules of the type A_2, AB, AB_2, AB_3, AB_4; percentage ionic character- numerical problems based on calculation of percentage ionic character.						

Unit-IV	**Structure and bonding - II** VB theory – application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species – CO_2, NO_2, CO_3^{2-}, NO_3^- ; limitations of VBT; MO theory - bonding, antibonding and nonbonding orbitals, bond order; MO diagrams of H_2, C_2, O_2, O_2^+, O^{2-}, O_2^{2-}, N_2, NO, HF, CO; magnetic characteristics, comparison of VB and MO theories. Coordinate bond: Definition, Formation of BF_3, NH_3, NH_4^+, H_3O^+ properties Metallic bond-electron sea model, VB model; Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor – types, applications of semiconductors Weak Chemical Forces - Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces; Hydrogen bonding – Types, special properties of water, ice, stability of DNA; Effects of chemical force, melting and boilingpoints.
Unit-V	**Basic concepts in Organic Chemistry and Electronic effects** Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction intermediates – carbanions, carbocations, carbenes, arynes and nitrynes. Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductomeric and electromeric effects. Resonance – resonance energy, conditions for resonance - acidity of phenols, basicity of aromatic amines, stability of carbonium ions, carbanions and free
	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 (isa part of internal component only, Not to beincluded in theexternal examination question paper)	Questions related to the above topics, from various competitive examinationsUPSC/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.
Recommended Text	1. Madan, R. D. and Sathya Prakash, *Modern Inorganic Chemistry,* 2nded.; S. Chand and Company: New Delhi, 2003. 2. Rao, C.N. R. University General Chemistry, Macmillan Publication: NewDelhi, 2000. *3.* Puri, B. R. and Sharma, L. R. *Principles of Physical Chemistry,* 38thed.;Vishal Publishing Company: Jalandhar, 2002. 4. Bruce, P. Y. and PrasadK. J. R. *Essential Organic Chemistry*, Pearson Education: New Delhi, 2008. 5. Dash UN, Dharmarha OP, Soni P.L. Textbook of Physical Chemistry, Sultan Chand & Sons: New Delhi,2016

ReferenceBooks	1. Maron, S. H. and Prutton C. P. *Principles of Physical Chemistry,* 4th ed.; The Macmillan Company: Newyork,1972. 2. Lee, J. D. *Concise Inorganic Chemistry,* 4th ed.; ELBS WilliamHeinemann: London,1991. 3. Gurudeep Raj, *Advanced Inorganic Chemistry,* 26th ed.; Goel Publishing House: Meerut, 2001. 4. Atkins, P.W. & Paula, J. *Physical Chemistry*, 10th ed.; Oxford University Press:New York, 2014. *5.* Huheey, J. E. *Inorganic Chemistry: Principles of Structure and Reactivity,* 4th ed .; Addison, Wesley Publishing Company: India,1993.
Website ande-learning source	1) https://onlinecourses.nptel.ac.in 2) http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm 3) http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html 4) https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding 5) https://www.chemtube3d.com/

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,Δx, Δp electronegativity, percentage ionic character and bond order.

CO4: evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects

CO5: construct MO diagrams, predict trends in periodic properties, assess the properties of elements, and explain hybridization in molecules, nature of H – bonding and organic reaction mechanisms.

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

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO 5
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'

<table>
<tr><td>Title of theCourse</td><td colspan="7">Quantitative Inorganic Estimation (titrimetry) and Inorganic Preparations</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td>Course Code</td><td rowspan="2">23BCH1P1</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>1</td><td>-</td><td colspan="3">3</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher secondary chemistry</td></tr>
<tr><td>Objectives ofthe course</td><td colspan="7">This course aims at providing knowledge on
laboratory safety
handling glasswares
Quantitative estimation
preparation of inorganic compounds</td></tr>
<tr><td>Unit-I</td><td colspan="7">Chemical Laboratory Safety in Academic Institutions
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.
Common Apparatus Used in Quantitative Estimation (Volumetric)
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.
Principle of Quantitative Estimation (Volumetric)
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.</td></tr>
<tr><td>Unit-II</td><td colspan="7">Quantitative Estimation(Volumetric)
Preparation of standard solution, dilution from stock solution
Permanganometry
Estimation of sodium oxalate using standard ferrous ammonium sulphate</td></tr>
</table>

	Dichrometry Estimation of ferric alum using standard dichromate (external indicator) Estimation of ferric alum using standard dichromate (internal indicator) **Iodometry** Estimation of copper in copper sulphate using standard dichromate **Argentimetry** Estimation of chloride in barium chloride using standard sodium chloride/ Estimation of chloride in sodium chloride (Volhard's method)
Unit-III	**Complexometry** Estimation of hardness of water using EDTA **Estimations** Estimation of iron in iron tablets Estimation of ascorbic acid. **Preparation of Inorganic compounds-** Potash alum Tetraammine copper (II) sulphate Hexamminecobalt (III) chloride Mohr's Salt
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	**Reference Books:** 1. Venkateswaran, V.; Veeraswamy, R.; Kulandivelu, A.R. *Basic Principles of Practical Chemistry,*2nd ed.; Sultan Chand &Sons: New Delhi, 1997. *2.* Nad, A. K.; Mahapatra, B.; Ghoshal, A.; *An advanced course in Practical Chemistry,* 3rd ed.; New Central Book Agency: Kolkata, 2007.
ReferenceBooks	1. Mendham, J.; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.; *Vogel's Textbook of Quantitative Chemical Analysis*, 6th ed.; Pearson Education Ltd: New Delhi, 2000.
Website and e-learning source	**Web References:** 1) http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis 2) https://chemdictionary.org/titration-indicator/

Course Learning Outcomes (for Mapping with POs and PSOs)

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

CO1: explain the basic principles involved in titrimetric analysis and inorganic preparations.
CO2: compare the methodologies of different titrimetric analysis.
CO3: calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution.
CO4: assess the yield of different inorganic preparations and identify the end point of various 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

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

<table>
<tr><td>Title of the Course</td><td colspan="7">FOOD CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC –I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">NME</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23BCH1S1</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per Week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher secondary Chemistry</td></tr>
<tr><td>Objectivesof the course</td><td colspan="7">This course aims at giving an overall view of the
● Types of food
● Food adulteration and poisons
● Food additives and preservation</td></tr>
<tr><td>Unit-I</td><td colspan="7">Food Adulteration
Sources of food, types, advantages and disadvantages. Food adulteration - contamination of wheat, rice, milk, butter etc. with clay stones, water and toxic chemicals -Common adulterants, Ghee adulterants and their detection. Detection of adulterated foods by simple analytical techniques.</td></tr>
<tr><td>Unit-II</td><td colspan="7">Food Poison
Food poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion) -Chemical poisons - First aid for poison consumed victims.</td></tr>
<tr><td>Unit-III</td><td colspan="7">Food Additives: Food additives -artificial sweeteners – Saccharin - Cyclomate a n d AspartateFood flavours -esters, aldehydes and heterocyclic compounds – Food colours– Emulsifying agents – preservatives -leavening agents. Baking powder –yeast – tastemakers – MSG - vinegar.</td></tr>
<tr><td>Unit-IV</td><td colspan="7">Beverages
Beverages-softdrinks-soda-fruitjuices-alcoholicbeverages-examples. Carbonation-addictionto alcohol– diseases ofliver andsocial problems.</td></tr>
<tr><td>Unit-V</td><td colspan="7">Edible Oils
Fats and oils - Sources of oils - production of refined vegetable oils - preservation.Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventing heartdiseases-determination of iodine value,RM value,saponification values and their significance.</td></tr>
<tr><td>Recommended Text</td><td colspan="7">1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co.Publishers, second edition, 2006.
3. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishning house, 2010.
4. Food Chemistry, Dr. L. Rakesh Sharma, Evincepub publishing, 2022.
5. Food processing and preservation, G. Subbulakshmi, Shobha A Udipi, Pdmini S Ghugre, New age international publishers, second edition, 2021.</td></tr>
</table>

Reference Books	1. H.-D. Belitz, Werner Grosch, Food Chemistry Springer Science & Business Media, 4th Edition, 2009. 2. M.Swaminathan, Food Science and Experimental Foods, Ganesh and Company,1979. 3. Hasenhuettl, Gerard. L.; Hartel, Richard. W. Food Emulsifiers and their applications Springer New York 2nd ed. 2008. 4. Food Chemistry, H.-D. Belitz, W. Grosch, P. Schieberle, Springer, fourth revised and extended edition, 2009. 5. Principles of food chemistry, John M. deMan, John W. Finley, W. Jefferey Hurst, Chang Yong Lee, Springer, Fourth edition, 2018.
Website and e-learning source	

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, Cyclomate 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

Title of the Course	**ROLE OF CHEMISTRY IN DAILY LIFE**						
Paper No.	**SEC-I**						
Category	**NME**	**Year**	I	**Credits**	2	**Course Code**	23BCH1S2
		Semester	I				
Instructional hours perweek	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	2	-	-			2	
Prerequisites	Higher secondary chemistry						
Objectives ofthe course	This course aims at providing an overall view of the • importance of Chemistry in everyday life • chemistry of building materials and food • chemistry of Drugs and pharmaceuticals						
UNIT-I	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						
Unit-II	Building materials - cement, ceramics, glass and refractories - definition, composition and application only. Plastics - polythene, PVC, bakelite, polyesters, melamine-formaldehyde resins -preparation and uses only.						
Unit-III	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.						
Unit-IV	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.						
Unit-V	Pharmaceutical drugs - analgesics and antipyretics - paracetamol and aspirin. Colour chemicals - pigments and dyes - examples and applications. Explosives - classification and examples.						
Recommended Text	1.Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010. 2.A textbook of pharmaceutical chemistry by Jayashree Ghosh, S Chand publishing, 2012. 3.S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. 4.B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.Introduction to forensic chemistry, Kelly M. Elkins, CRC Press Taylor & Francis Group, 2019. 5. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co.Publishers, second edition, 2006.						

ReferenceBooks	1.Randolph. Norris Shreve, Chemical Process Industries, McGraw-Hill, Texas, fourthedition, 1977. 2.W.A.Poucher,JosephA.Brink,Jr.Perfumes,Cosmetics and Soaps,Springer,2000. 3. A.K.De,EnvironmentalChemistry,NewAge InternationalPublicCo.,1990.
Website and e-learning source	

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

completion of the course the students should be able to

CO1: learn about the chemicals used in everyday life as well as air pollution and water pollution.

CO2: get knowledge on building materials cement, ceramics, glass and plastics, polythene,PVC bakelite, polyesters,

CO3: acquire information about Food and Nutrition. Carbohydrates, Proteins, Fats Alsohave an awareness about Cosmetics Tooth pastes, face powder, soaps and detergents.

CO4: discuss about the fertilizers like urea, NPK fertilizers and super phosphate. Fuelclassification solid, liquid and gaseous; nuclear fuel - examples and uses

CO5: have an idea about the pharmaceutical drugs analgesics and antipyretics likeparacetamol and aspirin and also about pigments and dyes and its applications.

	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

<table>
<tr><td>Title of theCourse</td><td colspan="8">Foundation of Course for Chemistry</td></tr>
<tr><td>Paper No.</td><td colspan="8">Foundation Course</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2"></td><td>Year</td><td>I</td><td>Credits</td><td>2</td><td>Course Code</td><td colspan="2">23BCH1FC</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours perweek</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="3">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8"></td></tr>
<tr><td>Objectives ofthe course</td><td colspan="8">To Understand the basic concept of Atoms, molecules and its types, elemental states, mixtures, symbols used and formulae.
To learn the fundamentals of atomic number and mass number, chemical species, symbols used in chemical equation and balancing the chemical equations.
To study about the mole concept, Avagadro number, interconversion of mole and stoichiometric calculations.
To know about solutions and it's components, types of electrolytes, theory of Volumetric analysis and the terms involved in Volumetric analysis
To equip learners with concept of significant figures, rules of rounding data, interconversion of standard and scientific notation and conversion between basic units.</td></tr>
<tr><td>Unit-I</td><td colspan="8">Atoms; molecules – monoatomic, diatomic, polyatomic, homoatomic and heteroatomic molecules; elements – metals, metalloids and non - metals – states of elements, Symbol of elements; valency - formulae of radicals; compounds - formulae of compounds; Mixture – Homogeneous and heterogeneous mixtures.</td></tr>
<tr><td>Unit-II</td><td colspan="8">Atomic number, Mass number – relativeatomic mass and atomic mass unit – molecularmass and formula mass – gram atomic, molecular and formula mass, chemical species – cations, anions, molecular ions, free radicals, chemical equations – symbol used in chemical equation and balancing chemical equations.</td></tr>
<tr><td>Unit-III</td><td colspan="8">Mole and Avagadro’s number – molar mass, molar volume, interconversion of mole and mass, interconversion of mole and number of particles – mole ratio and stoichiometric calculations – calculation based on mass – mass relationship, mass – volume relationship, volume – volume relationship.</td></tr>
<tr><td>Unit-IV</td><td colspan="8">Solutions – solutes, solvents, saturated solutions, unsaturated solutions, supersaturated solutions, dilute solutions and concentrated solutions.
Electrolytes – strong electrolytes and weak electrolytes Volumetric analysis - equivalent weight of elements, compounds and ions, molarity, normality, molality.</td></tr>
<tr><td>Unit-V</td><td colspan="8">Significant figures – rules of significant digits, rounding off data – rules for rounding off data – exponential notation, interconversion of standard and scientific notation – applications of exponential notations – addition, subtraction, multiplication division, powers and roots Physical quantities – Definition and format – seven base units – conversion between units.</td></tr>
<tr><td>Outcomes</td><td colspan="8">Students gain knowledge about the basic concept of Atoms, molecules and its types, elemental states, mixtures, symbols used and formulae.
They learn the fundamentals of atomic number and mass number, chemical species, symbols used in chemical equation and balancing the chemical equations.</td></tr>
</table>

	• Student can interpret the mole concept, Avagadro number, interconversion of mole and stoichiometric calculations. • They gain knowledge about solutions and it's components, types of electrolytes, theory of Volumetric analysis and the terms involved in Volumetric analysis • Students can learn the basics of significant figures, rules of rounding data, interconversion of standard and scientific notation and conversion between basic units.

<table>
<tr><td>Title of the Course</td><td colspan="7">GENERAL CHEMISTRY-II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core III</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>I</td><td>Credits</td><td>5</td><td>Course Code</td><td>23BCH2C1</td></tr>
<tr><td></td><td></td><td>Semester</td><td>II</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td>Total</td></tr>
<tr><td></td><td>4</td><td>1</td><td colspan="3">-</td><td>5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry I</td></tr>
<tr><td>Objectives ofthe course</td><td colspan="7">This course aims at providing an overall view of the
• chemistry of acids, bases and ionic equilibrium
• properties of s and p-block elements
• chemistry of hydrocarbons
• applications of acids and bases
• compounds of main block elements and hydrocarbons</td></tr>
<tr><td>UNIT-I</td><td colspan="7">Acids, bases and Ionic equilibria
Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant; dissociation of poly basic acids, ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degree of dissociation; acid base indicators, theory of acid base indicators – action of phenolphthalein and methyl orange, titration curves - use of acid base indicators;
Buffer solutions – types, mechanism of buffer action in acid and basic buffer, Henderson-Hasselbalch equation;
Salt hydrolysis - salts of weak acids and strong bases, weak bases and strong acids, weak acids and weak bases - hydrolysis constant, degree of hydrolysis and relation between hydrolysis constant and degree of hydrolysis;
Solubility product - determination and applications; numerical problems involving the core concepts.</td></tr>
<tr><td>Unit-II</td><td colspan="7">Chemistry of s - Block Elements
Hydrogen: Position of hydrogen in the periodic table. Alkali metals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Preparation, properties and uses of NaOH, Na2CO3, KBr, KClO3 alkaline earth metals. Anomalous behaviour of Be.
Chemistry of p- Block Elements (Group 13 & 14)
preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al.
comparison of carbon with silicon. Carbon-di-sulphide – Preparation, properties, structure and uses. Percarbonates, per monocarbonates and per dicarbonates.</td></tr>
<tr><td>UNIT-III</td><td colspan="7">Chemistry of p- Block Elements (Group 15-18)
General characteristics of elementsof Group 15; chemistry of H2N-NH2, NH2OH, HN3 and HNO3. Chemistry of PH3, PCl3, PCl5, POCl3, P2O5 and oxy acids of phosphorous (H3PO3 and H3PO4).
General properties of elements of group16 - 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).</td></tr>
</table>

	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 ($HClO_4$). Inter-halogen compounds (ICl, ClF_3, BrF_5 and IF_7), pseudo halogens [$(CN)_2$ and $(SCN)_2$] and basic nature of Iodine. Noble gases: Position in the periodic table. Preparation, properties and structure of XeF_2, XeF_4, XeF_6 and $XeOF_4$; uses of noble gases - clathrate compounds.
UNIT-IV	**Hydrocarbon Chemistry-I** **Petroproducts:** Fractional distillation of petroleum; cracking, isomerisation, alkylation, reforming and uses **Alkenes**-Nomenclature, general methods of preparation – Mechanism of □-elimination reactions – E1 and E2 mechanism - factors influencing – stereochemistry – orientation – Hofmann and Saytzeff rules. Reactions of alkenes – addition reactions – mechanisms – Markownikoff's rule, Kharasch effect, oxidation reactions – hydroxylation, oxidative degradation, epoxidation, ozonolysis; polymerization. **Alkadienes** Nomenclature - classification – isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2 and 1, 4 additions; free radical addition to conjugated dienes– Diels–Alder reactions – polymerisation – polybutadiene, polyisoprene (natural rubber), vulcanisation, polychloroprene. **Alkynes** Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerisation and isomerisation. **Cycloalkanes:** Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations. Conformational analysis of cyclohexane, mono and di substituted cyclohexanes. Geometrical isomerism in cyclohexanes.
UNIT V	**Hydrocarbon Chemistry - II** **Benzene:** Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's (4n+2) 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. **Polynuclear Aromatic hydrocarbons**: Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions – electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, preferential substitution at □ - 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.
Extended Professional Component (is a part of internal	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
component only,Not to be included in the external examination question paper)	

Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
RecommendedText	1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nded, S.Chand and Company, New Delhi. 2. Sathya Prakash, Tuli G D,Basu S K and Madan R D, (2003), Advanced Inorganic Chemistry, 17th ed., S.Chand and Company, New Delhi. 3. Bahl B S, Arul Bhal, (2003), Advanced Organic Chemistry, 3rd ed., S.Chand and Company, New Delhi. 4. Tewari K S, Mehrothra S N and Vishnoi N K, (1998), Text book of Organic Chemistry, 2nd ed., Vikas Publishing House, New Delhi. 5. Puri B R, Sharma L R, (2002), Principles of Physical Chemistry, 38th ed., Vishal Publishing Company, Jalandhar.
ReferenceBooks	1. Maron S H and Prutton C P, (1972), Principles of Physical Chemistry, 4th ed., The Macmillan Company, Newyork. 2. Barrow G M, (1992), Physical Chemistry, 5th ed., Tata McGraw Hill, NewDelhi. 3. Lee J D, (1991), Concise Inorganic Chemistry, 4thed., ELBS William Heinemann, London. 4. Huheey J E, (1993), Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed., Addison Wesley Publishing Company, India. 5. Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol – I, 26th ed.,Goel Publishing House, Meerut. 6. Agarwal O P, (1995), Reactions and Reagents in Organic Chemistry, 8thed., Goel Publishing House,Meerut.
Website ande-learning source	https://onlinecourses.nptel.ac.inhttp://cactus.dixie.edu/smblack/chem1010/lecture_notes/4B.html http://www.auburn.edu/~deruija/pdareson.pdfhttps://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding **MOOC components** http://nptel.ac.in/courses/104101090/ Lecture 1: Classification of elements and periodic properties http://nptel.ac.in/courses/104101090/

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 compoundsof 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	PSO 2	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	**PRACTICAL II - QUALITATIVE ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS (University examination only 3hrs)**						
Paper No.	**Core IV**						
Category	**Core**	**Year**	I	**Credits**	3	**Course Code**	23BCH2P1
		Semester	II				

Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**	**Total**
	-	-	4	4
Prerequisites	General Chemistry II			
Objectives ofthe course	This course aims at providing knowledge on • laboratory safety • handling glass wares • analysis of organic compounds • preparation of organic compounds			
UNIT I	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			
Unit II	**Qualitative Organic Analysis** Preliminary examination, detection of special elements - nitrogen, sulphur andhalogens Aromatic and aliphatic nature, Test for saturation and unsaturation, identification of functional groups using solubility tests Confirmation of functional groups • monocarboxylic acid, dicarboxylic acid • monohydric phenol, polyhydric phenol • aldehyde, ketone, ester • carbohydrate (reducing and non-reducing sugars) • primary, secondary, tertiary amine • monoamide, diamide, thioamide • anilide, nitro compound • Preparation of derivatives for functional groups			
UNIT III	**Preparation of Organic Compounds** i. Nitration - picric acid from Phenol ii. Halogenation - p-bromo acetanilide from acetanilide iii. Oxidation - benzoic acid from Benzaldehyde iv. Microwave assisted reactions in water: v. Methyl benzoate to Benzoic acid vi. Salicylic acid from Methyl Salicylate vii. Rearrangement - Benzil to Benzilic Acid viii. Hydrolysis of benzamide to Benzoic Acid			

	Separation and Purification Techniques (Not for Examination) 1. Purificationof organic compounds by crystallization (from water / alcohol)and distillation 2. Determination of melting and boiling points of organic compounds. 3.**Steam distillation** - Extraction of essential oil from citrus fruits/eucalyptusleaves. **4. Chromatography (any one) (Group experiment)** (i) Separation of amino acids by Paper Chromatography (ii)Thin Layer Chromatography - mixture of sugars / plant pigments /permanganatedichromate. (iii) Column Chromatography - extraction of carotene, chlorophyll and xanthophyll from leaves / separation of anthracene - anthracene picrate. 5. **Electrophoresis –** Separation of amino acids and proteins. **(Demonstration)** 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& 6–not for ESE)
	Distribution of Exterenal marks-75marks **Record -15** **Organic Analysis-35** **(a) Aromatic/Aliphatic-5** **(b) Saturated/Unsaturated-5** **(c) Elements present-5** **(d) Functional group present-10** **(e) Derivative-10** **Organic Preparation-25** **(a) Procedure -10** **(b)Crude sample-10** **(c)Recrystallized sample- 5**
Reference Books	1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. *Basic Principlesof Practical Chemistry*, 2nd ed.; Sultan Chand: New Delhi, 2012. 2. Manna, A.K. *Practical Organic Chemistry*, Books and Allied: India,2018. 3. Gurtu, J. N; Kapoor, R. *Advanced Experimental Chemistry (Organic)*,Sultan Chand: New Delhi, 1987. 4. Furniss,B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R. *Vogel'sTextbook of Practical Organic Chemistry*, 5th ed.; Pearson: India,1989.
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences

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

completion of the course the students should be able to

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

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

CO3: compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non-reducing sugars and explain the reactions behind it.

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

	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

<table>
<tr><td>Title of the Course</td><td colspan="7">DAIRY CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC- II</td></tr>
<tr><td>Category</td><td>SEC</td><td>Year</td><td>I</td><td>Credits</td><td>2</td><td>Course Code</td><td>23BCH2S1</td></tr>
<tr><td></td><td></td><td>Semester</td><td>II</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>2</td><td>-</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher secondary chemistry</td></tr>
<tr><td>Objectives ofthe course</td><td colspan="7">This course aims at providing an overall view of the
• chemistry of milk and milk products
• processing of milk
• preservation and formation of milk products.</td></tr>
<tr><td>UNIT I</td><td colspan="7">Composition of Milk
Milk-definition-general composition of milk- constituents of milk - lipids, proteins, carbohydrates, vitamins and minerals - physical properties of milk - colour, odour, acidity, specific gravity, viscosity and conductivity -Factors affecting the composition of milk - adulterants, preservatives with neutralizer-examples and their detection- estimation of fat, acidity and total solids in milk.</td></tr>
<tr><td>Unit II</td><td colspan="7">Processing of Milk
Microbiology of milk - destruction of micro - organisms in milk, physico – chemical changes taking place in milk due to processing - boiling, pasteurization – types of pasteurization - Bottle, Batch and HTST (High Temperature Short Time) – Vacuum pasteurization – Ultra High Temperature Pasteurization.</td></tr>
<tr><td>UNIT III</td><td colspan="7">Major Milk Products
Cream - definition - composition - chemistry of creaming process - gravitational and centrifugal methods of separation of cream - estimation of fat in cream. Butter - definition - composition - theory of churning – desi butter - salted butter, estimation of acidity and moisture content in butter. Ghee - major constituents - common adulterants added to ghee and their detection - rancidity- definition - prevention - antioxidants and synergists - natural and synthetic.</td></tr>
<tr><td>UNIT IV</td><td colspan="7">Special Milk
Standardised milk - definition - merits - reconstituted milk - definition - flowdiagram of manufacture - Homogenised milk - flavoured milk – vitaminised milk - toned milk -Incitation milk - Vegetable toned milk - humanized milk - condensed milk - definition, composition and nutritive value.</td></tr>
<tr><td>UNIT V</td><td colspan="7">Fermented and other Milk Products
Fermented milk products – fermentation of milk - definition, conditions,cultured milk - definition of culture - example, conditions - cultured cream,butter milk - Bulgarious milk -acidophilous milk – Yoheer Indigeneous products- khoa and chhena definition - Ice cream -definition-percentagecomposition-types-ingredients-manufacture of ice–cream, stabilizers -emulsifiers and their role-milk powder-definition- need formakingmilkpowder- dryingprocess-types of drying.</td></tr>
<tr><td>RecommendedText</td><td colspan="7">1. K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, first edition,2006.
2. K. S. Rangappa and K.T. Acharya, Indian Dairy Products, Asia PublishingHouse New Delhi, 1974.
3.Text book of dairy chemistry, M.P. Mathur, D. Datta Roy, P. Dinakar, IndianCouncil of Agricultural Research, 1 st edition, 2008.
4. A Text book of dairy chemistry, Saurav Singh, Daya Publishing house, 1 stedition,2013.
5. Text book of dairy chemistry, P. L. Choudhary, Bio-Green book publishers,2021.</td></tr>
</table>

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

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 andGhee

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 dryingprocess

	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

Title of theCourse	**COSMETICS AND PERSONAL GROOMING**						
Paper No.	**SEC-III (Discipline Specific)**						
Category	**SEC**	**Year**	I	**Credits**	2	**Course Code**	23BCH2S2
		Semester	II				
Instructional	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
hours per week	2	-	-			2	
Prerequisites	Higher secondary Chemistry						
Objectives ofthe course	This course aims at familiarizing the students with • formulations of various types of cosmetics and their significance • hair, skin and dental care • makeup preparations and personal grooming						
Unit I	**Skin care** 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.						
Unit II	**Hair care** Shampoos – types – powder, cream, liquid, gel – ingredients; conditioner – types – ingredients **Dental care** Tooth pastes – ingredients – mouth wash						
Unit III	**Make up** Base – foundation – types – ingredients; lipstick, eyeliner, mascara, eye shadow, concealers, rouge						
Unit IV	**Perfumes** 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						
Unit V	**Beauty treatments** 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						
Recommended Text	1. Thankamma Jacob, (1997) Foods, drugs and cometics – A consumer guide,Macmillan publication, London.						
ReferenceBooks	1. Wilkinson J B E and Moore R J, (1997) Harry's cosmeticology, 7th ed., Chemical Publishers, London. 2. George Howard, (1987) Principles and practiceof perfumes and cosmetics,						
	Stanley Therones, Chettenham						
Website ande-learning source	1. http://www.khake.com/page75.html 2. Net.foxsm/list/284						

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

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

	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

<table>
<tr><td>Title of the Course</td><td colspan="7">GENERAL CHEMISTRY -III</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core V</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>II</td><td>Credits</td><td>5</td><td>Course Code</td><td>23BCH3C1</td></tr>
<tr><td></td><td></td><td>Semester</td><td>III</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>5</td><td></td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry – I and II</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide a comprehensive knowledge on
• The physical properties of gases, liquids, solids and X-ray diffraction of solids.
• Fundamentals of nuclear chemistry and nuclear waste management.
• Applications of nuclear energy
• Basic chemistry of halo-organic compounds, phenol and other aromatic alcohols.
• Preparation and properties of phenols and alcohols.</td></tr>
<tr><td>UNIT I</td><td colspan="7">Gaseous state
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.
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 CO2- continuity of state–Van der waal's equation and the critical state; law of corresponding states-liquefaction of gases; numerical problems involving thecore concepts.</td></tr>
<tr><td>Unit-II</td><td colspan="7">Liquid and Solid State
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 Packing in atomic solids – simple cubic, body centered cubic, face centered and hexagonal close packing; Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO2; 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.</td></tr>
<tr><td>UNIT-III</td><td colspan="7">Nuclear Chemistry Natural radioactivity - □, □ and □ 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 t1/2 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.</td></tr>
</table>

UNIT-IV	**Halogen derivatives Aliphatic halogen derivatives** Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions – SN1, SN2 and SNi 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.
UNIT-V	**Phenols** 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. Resorcinol, quinol, picric acid – preparation, properties and uses. **Aromatic alcohols** 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.
Extended Professional Component (is apart of internal component only,Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinationsUPSC/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.
ecommended Text	1. B.R. Puri, L.R. Sharma, M.S. Pathania; *Principles of Physical Chemistry*, 46th edition, Vishal Publishing, 2020. 2. B.R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009. 3. 4. P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, Sultan Chand & amp; Sons, twentieth edition, 2006. 4. M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003. 5. S.M. Mukherji, and S.P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.

Reference Books	1. T. W. Graham Solomons, *Organic Chemistry*, John Wiley & Sons,fifth edition, 1992. 2. A. Carey Francis, *Organic Chemistry*, Tata McGraw-Hill Education Pvt., Ltd.,New Delhi, seventh edition, 2009. 3. I. L. Finar, *Organic Chemistry*, Wesley Longman Ltd, England, sixth edition, 1996.
	4. P. L. Soni, and H. M.Chawla - *Text Book of Organic Chemistry*, New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007. 5. J.D. Lee, *Concise Inorganic Chemistry*, Blackwell Science, fifth edition,2005.
Website ande-learning source	**MOOC components** https://nptel.ac.in/courses/104104101 Solid state chemistry https://nptel.ac.in/courses/103106071 Nuclear industries and safety https://nptel.ac.in/courses/104106119s Introduction to organic chemistry

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

CO1: explain the kinetic properties of gases by using mathematical concepts.

CO2: 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.

CO3: investigate the radioactivity, nuclear energy and it's production, also the nuclear waste management.

CO4: write the nomenclature, physical & chemical properties and basic mechanisms of halo organic compounds and alcohols.

CO5: 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
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

<table>
<tr><td>Title of the Course</td><td colspan="7">PRACTICAL III - QUALITATIVE INORGANIC ANALYSIS (University examination only 3hrs)</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td>Credits</td><td>3</td><td>Course Code</td><td>23BCH3P1</td></tr>
<tr><td>Semester</td><td>III</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructionalhours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>1</td><td>-</td><td colspan="3">3</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General chemistry</td></tr>
<tr><td>Objectives ofthe course</td><td colspan="7">To develop the skill on systematic analysis of simple inorganic salts and mixture of salts.</td></tr>
<tr><td>CourseOutline</td><td colspan="7">Semi - Micro Qualitative Analysis
1. Analysis of simple acid radicals: Carbonate, sulphide, sulphate, thiosulphite, chloride, bromide,iodide, nitrate
2. Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate, arsenate, arsenite.
3. Elimination of interfering acid radicals and Identifying the group of basic radicals
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
5. Analysis of a mixture - I to VIII containing two cations and two anions (of which one is interfering type)</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="7">Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</td></tr>
<tr><td></td><td colspan="7">Distribution of Exterenal marks-75marks
Record-10
Two Anions with correct procedure-15+15
Group separation-15
Two Cations with correct procedure-10+10</td></tr>
<tr><td>Recommended Text</td><td colspan="7">Reference Books:
V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997.</td></tr>
<tr><td>Website and e-learningsource</td><td colspan="7">https://www.vlab.co.in/broad-area-chemical-sciences</td></tr>
<tr><td colspan="8">Course Learning Outcomes (for Mapping with POs and PSOs)</td></tr>
</table>

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

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

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

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

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

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

CO-PO Mapping (Course Articulation Matrix)

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

Level of Correlation between PSO's and CO's

<table>
<tr><td>Title of theCourse</td><td colspan="7">ENTREPRENEURIAL SKILLS IN CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td>Credits</td><td>2</td><td>Course Code</td><td>23BCH3SP</td></tr>
<tr><td>Semester</td><td>III</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">2</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at providing training to
• develop entrepreneur skills in students
• to provide hands on experience to prepare and develop products
• develop start ups</td></tr>
<tr><td>UNIT -I</td><td colspan="7">Food Chemistry
Food adulteration-contamination of food items with clay stones, water andtoxicchemicals -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.
Dyes
Classification – Natural, synthetic dyes and their characteristics – basic methods and principles of dyeing</td></tr>
<tr><td>UNIT II</td><td colspan="7">Hands on Experience (Students can choose any four)
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.
Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, tooth paste/powde rand disinfectants in small scale.
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.</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="7">Entrepreneurial skills.</td></tr>
<tr><td>Recommended Text</td><td colspan="7">1. George S &Muralidharan V, (2007) Fibre to Finished Fabric – A SimpleApproach, Publication Division, University of Madras, Chennai.
2. Appaswamy G P, A Handbook on Printing and Dyeing of Textiles.</td></tr>
<tr><td>Reference Books</td><td colspan="7">Shyam Jha, Rapid detection of food adulterants and contaminants (Theory and Practice),Elsevier, e Book ISBN 9087128004289, 1st Edition,2015</td></tr>
<tr><td>Website and e-learning source</td><td colspan="7">https://www.vlab.co.in/broad-area-chemical-sciences</td></tr>
<tr><td colspan="8">Course Learning Outcomes (for Mapping with POs and PSOs)
On completion of the course the students should be able to
CO 1: identify adulterated food items by doing simple chemical tests.
CO 2: prepare cleaning products and become entrepreneurs
CO 3: educate others about adulteration and motivate them to become entrepreneurs.</td></tr>
</table>

	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

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

<table>
<tr><td>Title of the Course</td><td colspan="7">PESTICIDE CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Skill Enhancement Course V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">23BCH3S1</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>2</td><td>-</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Fundamentals in chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to providing the students
• knowledge about the various types of pesticides and their toxicity.
• to understand the accumulation of pesticides in in the form of residues and its analysis.
• knowledge on choice of alternate and eco-friendly pesticides.</td></tr>
<tr><td>Unit I</td><td colspan="7">Introduction: History of pesticides. Chemistry of Pesticides: Brief introduction to classes of pesticides (Chemical class, targets), structures, chemical names, physical and chemical properties.
Toxicity of pesticides: Acute and chronic toxicity in mammals, birds, aquatic species etc. Methods of analysis of pesticides.
Insecticides: 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.
Organophosphates and Phosphothionates: Acephate, Chlorpyriphos, Monocrotophos, and parathion-methyl. Organochlorine – Endosulfan, heptachlor; Carbamate: Cartap hydrochloride, Methomyl, Propoxur.</td></tr>
<tr><td>Unit II</td><td colspan="7">Pesticides residues: 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.
Pesticide Residues effect and analysis: 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.</td></tr>
<tr><td>Unit III</td><td colspan="7">Biopesticides: 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.</td></tr>
<tr><td colspan="2">Extended Professional Component (is a part of internal component only, Not to be includedin the external examination question paper)</td><td colspan="6">Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved
(To be discussed during the Tutorial hours)</td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</td></tr>
</table>

RecommendedText

1. Handa SK. Principles of pesticide chemistry. Agrobios (India); 2012.
2. Matolcsy G, Nádasy M, Andriska V. Pesticide chemistry. Elsevier; 1989.
3. J. Miyamoto and P. C. Kearney Pesticide Chemistry Human Welfare and the Environment vol. IV Pesticide Residue and Formulation Chemistry, Pergamon press,1985.
4. R. Cremlyn: Pesticides, John Wiley.

Reference Books

1. Roy N. K., Chemistry of Pesticides. CBS Publisher & Distributors PLtd; 1st Ed. (2010).
2. Nollet L.M., Rathore H.S., Handbook of pesticides: methods ofpesticide residues analysis. CRC press; 2016.
3. Ellerbrock R.H., Pesticide Residues: Significance, Management andAnalysis, 2005

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

CO 1: teach about the pesticides and their toxicity with respect to structure and category.
CO 2: explain the preparation and property of pesticides
CO 3: investigate the pesticide residues, prevention and care
CO 4: demonstrate the extraction and analytical methods of pesticide residues
CO 5: make awareness to the public on bio-pesticides

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 ofCourse Contribution toPSOs	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

<table>
<tr><td>Title of the Course</td><td colspan="7">GENERAL CHEMISTRY-IV</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core VII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23BCH4C1</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry III</td></tr>
<tr><td>Objectives ofthe course</td><td colspan="7">This course aims to provide a comprehensive knowledge on
thermodynamic concepts on chemical processes and applied aspects.
thermo chemical calculations
transition elements with reference to periodic properties and group study of transition metals.
the organic chemistry of ethers, aldehydes and ketones
the organic chemistry of carboxylic acids</td></tr>
<tr><td>UNIT I</td><td colspan="7">Thermodynamics I
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.</td></tr>
<tr><td>UNIT II</td><td colspan="7">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.</td></tr>
</table>

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, Nickeland 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 LiAH4 Thioethers - nomenclature, structure, preparation, properties and uses. **Aldehydes and Ketones** Nomenclatue, 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 – Pondorf Verley reduction, reduction with LiAlH4 and NaBH4. Addition reactions of unsaturated carbonyl compounds: Michael addition.
UNIT V	**Carboxylic Acids**: 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, Hunsdieckerreaction.Formic acid-reducing property. Reactions of dicarboxylic acids, hydroxy acids and unsaturated acids. **Carboxylic acid Derivatives:** Preparations of aliphatic and aromatic acid chlorides, esters, amides and anhydrides. Nucleophilic substitution reaction at the acyl carbon of acyl halide, anhydride, ester, amide. Schottan-Baumann reaction. Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann bromamide degradation and Curtius rearrangement. **Active methylene compounds:** Keto – enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate **Halogen substituted acids** – nomenclature; preparation by direct halogenation, iodination from unsaturated acids, alkyl malonic acids **Hydroxy acids** – nomenclature; preparation from halo, amino, aldehydicand ketonic acids, ethylene glycol, aldol acetaldehyde; reactions – action of heat on □, □ and □hydroxy acids.
Extended Professional Component (is a part of internal component only, Not to be included in the external	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)

examination question paper)	
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. B.R. Puri and L.R. Sharma, *Principles of Physical Chemistry*, Shoban Lal Nagin Chand and Co., thirty three edition, 1992. 2. K. L. Kapoor, *A Textbook of Physical chemistry*, (volume-2 and 3), Macmillan, India Ltd, third edition, 2009. 3. P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, Sultan Chand & Sons, twentieth edition, 2006. 4. M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003. 5. S.M. Mukherji, and S.P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.
ReferenceBooks	1. Maron, S. H. and Prutton C. P. *Principles of Physical Chemistry,* 4th ed.; The Macmillan Company: Newyork,1972. 2. Lee, J. D. *Concise Inorganic Chemistry,* 4th ed.; ELBS William Heinemann: London,1991. 3. Gurudeep Raj, *Advanced Inorganic Chemistry,* 26th ed.; GoelPublishing House: Meerut, 2001. 4. Atkins, P.W. & Paula, J. *Physical Chemistry*, 10th ed.; Oxford University Press:New York, 2014. 5. Huheey, J. E. *Inorganic Chemistry: Principles of Structure and Reactivity,* 4th ed; Addison Wesley Publishing Company: India,1993.
Website and e-learning source	**MOOC components** https://nptel.ac.in/courses/112102255 Thermodynamics https://nptel.ac.in/courses/104101136 Advanced transition metal chemistry

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

CO1: explain the terms and processes in thermodynamics; discuss the various laws of thermodynamics and thermo chemical calculations.

CO2: discuss the second law of thermodynamics and its application to heat engine; discuss third law and its application on heat capacity measurement.

CO3: investigate the chemistry of transition elements with respect to various periodic properties and group wise discussions.

CO4: discuss the fundamental organic chemistry of ethers, epoxides and carbonyl compounds including named organic reactions.

CO5: discuss the chemistry and named reactions related to carboxylic acids and their derivatives; discuss chemistry of active methylene compounds, halogen substituted acidsand hydroxyl acids.

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

CO-PO Mapping (Course Articulation Matrix)

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

Level of Correlation between PSO's and CO's

<table>
<tr><td>Title of theCourse</td><td colspan="7">PRACTICAL – IV PHYSICAL CHEMISTRY I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core VIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23BCH4P1</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">3</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at providing an understanding of
• the laboratory experiments in order to understand the conceptsof physical changes in chemistry
• the rates of chemical reactions
• colligative properties and adsorption isotherm</td></tr>
<tr><td>UNIT-I</td><td colspan="7">Chemical kinetics
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).
3. Polarimetry: Determination of rate constant of acid catalysedinversion of cane sugar
Thermochemistry
4. Determination of heat of neutralisation of a strong acid by a strongbase.
5. Determination of heat of hydration of copper sulphate.</td></tr>
<tr><td>UNIT II</td><td colspan="7">Electrochemistry – Conductance measurements
6. Determination of cell constant
7. Determination of molar conductance of strong electrolyte
8. Determination of dissociation constant of acetic acid
Colorimetry
9. Determination of concentration of copper sulphate solution</td></tr>
<tr><td>UNIT III</td><td colspan="7">Colligative property
10. Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent

Adsorption
11. Construction of Freundlich isotherm for the adsorption of aceticacid on activated charcoal</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="7">Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</td></tr>
<tr><td></td><td colspan="7">Distrribution marks-75 marks
Record-15
Experiment-60</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Sindhu, P.S.Practicals in Physical Chemistry, Macmillan India : New Delhi, 2005.
2. Khosla, B. D.Garg,V. C.; Gulati, A.; Senior Practical Physical Chemistry, R.Chand : New Delhi, 2011.
3. Gupta, Renu, Practical Physical Chemistry, 1st Ed.; New Age International: New Delhi, 2017.</td></tr>
<tr><td>Website and e-learning source</td><td colspan="7">https://www.vlab.co.in/broad-area-chemical-sciences</td></tr>
</table>

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

<table>
<tr><td>Title of the Course</td><td colspan="8">INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS</td></tr>
<tr><td>Paper No.</td><td colspan="8">SEC VI (Discipline specific)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">23BCH4S1</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="3">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">General Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at providing an overall view of the
• operation and troubleshooting of chemical instruments
• fundamentals of analytical techniques and its application in the characterization of compounds
• theory of chromatographic separation and
• theory of thermo / electro analytical techniques
• stoichiometry and the related concentration terms</td></tr>
<tr><td>UNIT-I</td><td colspan="8">Qualitative and Quantitative Aspects of Analysis
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
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.</td></tr>
<tr><td>UNIT II</td><td colspan="8">Atomic Absorption Spectroscopy: 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.</td></tr>
<tr><td>UNIT III</td><td colspan="8">UV-Visible and IR Spectroscopy
Origin of spectra, interaction of radiation with matter, fundamental lawsof spetroscopy and selection rules, validity of Beer-Lambert’s law.

UV-Visible Spectrometry: 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.
Infrared Spectroscopy: Basic principles of instrumentation (choice of source, monochromator& detector) for single and double beam instrument; sampling techniques.</td></tr>
<tr><td>UNIT IV</td><td colspan="8">Thermal and Electro-analytical Methods of Analysis
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.

Electroanalytical methods: polarography - principle, instrumentation and applications. Derivative polarography- Cyclic Voltammetry - principle.</td></tr>
</table>

UNIT V	**Separation and purification techniques** 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 & ion exchange. Development of chromatograms and Rf value.
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.
Recommended Text	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. 2. R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007 3. Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint (2017). 4. R. Speyer, Thermal Analysis of Materials, CRC Press, 1993. 5. R.A. Day and A.L. Underwood, Quantitative Analysis, 6thedn., Prentice Hall of India Private Ltd., New Delhi, 1993
Reference Books	1. D. A. Skoog, D. M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5thedn., Saunders college publishing, Philadelphia, 1998. 2. Dash U N, Analytical Chemistry; Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 2011. 3. Christian, Gary D; Analytical Chemistry, 6th Ed., John Wiley & Sons, New York, 2004. 4. Mikes, O. &Chalmes, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elles Harwood Ltd. London 5. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, sixth edition Pearson Education, 2000
Website and e-learning sources	1. http://www.epa.gov/rpdweb00/docs/marlap/402-b-04-001b-14-final.pdf 2. http://eric.ed.gov/?id=EJ386287 3. http://www.sjsu.edu/faculty/watkins/diamag.htm 4. http://www.britannica.com/EBchecked/topic/108875/separation-and-purification 5. http://www.chemistry.co.nz/stoichiometry.htm

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

CO1: apply error analysis in the calibration and use of analytical instruments, explain theory, instrumentation and application of flame photometry and Atomic Absorption spectrometry

CO2: explain theory, instrumentation and application of UV visible and Infrared spectroscopy.

CO3: able to discuss instrumentation, theory and applications of thermal and electrochemical techniques

CO4: explain the use of chromatographic techniques in the separation and identification of mixtures

CO5: explain preparation of solutions, stoichiometric calculations

	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

<table>
<tr><td>Title of the Course</td><td colspan="7">FORENSIC SCIENCE</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC-VII (Discipline Specific)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td>Credits</td><td>2</td><td>Course Code</td><td>23BCH4S2</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry</td></tr>
<tr><td>Objectives ofthe course</td><td colspan="7">This course aims at giving an overall view of
• crime detection through analytical instruments
• forgery and its detection
• medical aspects involved</td></tr>
<tr><td>UNIT I</td><td colspan="7">Poisons
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.</td></tr>
<tr><td>Unit-II</td><td colspan="7">Crime Detection
Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human bombs - possible explosives (gelatin sticks and RDX) - metal detector devices andother security measures for VVIP-composition of bullets and detecting powder burns.</td></tr>
<tr><td>UNIT-III</td><td colspan="7">Forgery and Counterfeiting
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.</td></tr>
<tr><td>UNIT-IV</td><td colspan="7">Tracks and Traces
Tracks and traces - small tracks and police dogs - foot prints - costing of 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.</td></tr>
<tr><td>UNIT-V</td><td colspan="7">Medical Aspects
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.</td></tr>
</table>

RecommendedText	1. SA Iqbal, M Liviu, Textbook of forensic chemistry, Discovery publishing house private limited, 2011. 2. Kelly M. Elkins, Introduction to Forensic Chemistry, CRC Press, Taylor & Francis Group, 2019. 3. Javed I. Khan, Thomas J. Kennedy, Donnell R. Christian, Jr., Basic principles of Forensic chemistry, Humana Press, first edition, 2012. 4. Bapuly AK, (2006) Forensic Science – Its application in crime investigation, Paras Medical Publisher, Hyderabad. 5. Sharma B.R., (2006) Scientific Criminal Investigation, Universal Law Publishing Co. Pvt. Ltd, New Delhi.
ReferenceBooks	1. Richard Saferst in and Criminalistics-An Introduction to Forensic Science (College Version), Sopfestein, Printice hall, eighth edition,2003 2. Suzanne Bell, Forensic Chemistry, Pearson, second international edition, 2014. 3. Jay Siegel, Forensic chemistry: Fundamentals and applications, Wiley-Blackwell, first edition, 2015. 4. Max M. Houck & Jay A. Segal, (2006) Fundamentals of Forensic Science, Elsevier Academic press. 5. Henry C. Lee, Timothy Palmbach, Marilyn T. Miller, (2006) Henry Lee's Crime Scene Book Elsevier Academic press.
Website ande-learning source	1. http://www.library.ucsb.edu/ist/03-spring/internet.html 2. http://www.wonder howto.com/topic/forensic-science/

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 deadorganisms 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 bulletsand 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 identificationand 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

<table>
<tr><td>Title of the Course</td><td colspan="7">ORGANIC CHEMISTRY - I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core IX</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23BCH5C1</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry I,II, III and IV</td></tr>
<tr><td>Objectives of thecourse</td><td colspan="7">This course aims to provide an understanding of
stereoisomerism in chirals and geometric isomerism in olefins, conformations of ethane and butane
preparation and properties of aromatic and aliphatic nitrocompounds and amines
preparation of different dyes, food colour and additives
preparation and properties of five membered heterocycles likepyrrole, furan and thiophene
preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline.</td></tr>
<tr><td>UNIT I</td><td colspan="7">Stereochemistry
Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions;
Geometrical isomerism:cis–trans, syn-anti isomerism, E/Z notations.
Optical Isomerism: 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.
Molecules with no asymmetric carbon atoms – allenes and biphenyls.Conformational analysis of ethane and butane.</td></tr>
<tr><td>UNIT II</td><td colspan="7">Chemistry of Nitrogen Compounds – I
Nitroalkanes
Nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes; physical properties; reactions – reduction, halogenations, Grignard reagent, Pseudo acid character. Nitro - aci nitro tautomerism.
Aromatic nitro compounds
Nomenclature, preparation – nitration, from diazonium salts, physicalproperties; reactions - reduction of nitrobenzene in different medium, Electrophilic substitution reactions, TNT.
Amines: Aliphatic amines
Nomenclature, isomerism, preparation – Hofmanns’ degradation reaction, Gabriel’s phthalimide synthesis, Curtius Schmidt rearrangement.
Physical properties, reactions – alkylation, acylation, carbylaminereaction, Mannich reaction, oxidation, basicity of amines.</td></tr>
</table>

UNIT III	**Chemistry of Nitrogen Compounds – II** **Aromatic amines** – 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. Distinction between primary, secondary and tertiary amines - aliphaticand aromatic Diazonium compounds Diazomethane, Benzene diazonium chloride - preparations andsynthetic applications. **Dyes** 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 Dyes Industry, Food colour and additives
UNIT IV	**Heterocyclic compounds** Nomenclature and classification. General characteristics - aromaticcharacter and reactivity. Five-membered heterocyclic compounds Pyrrole – preparation - from succinimide, Paal Knorr synthesis; reactions – reduction, basic character, acidic character, electrophilic substitution reactions, ring opening. Furan – preparation from mucic acid and pentosan; reactions – hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction. Thiophene synthesis - from acetylene; reactions –reduction; oxidation; electrophilic substitution reactions.
UNIT V	**Six-membered heterocyclic compounds** Pyridine – synthesis - from acetylene, Physical properties; reactions - basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution-uses Condensed ring systems Quinoline – preparation - Skraup synthesis and Friedlander's synthesis; reactions – basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions – Chichibabin reaction Isoquinoline – preparation by the Bischler – Napieralski reaction, reduction, oxidation; electrophilic substitution.

Extended Professional Component (is a part of internal component only, Not to be includedin the external examination question paper)	Questions related to the above topics, from various competitiveexaminations 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.

RecommendedText

1.M.K. Jain, S.C.Sharma, Modern Organic Chemistry, VishalPublishing, fourth reprint, 2009.
2.S.M. Mukherji, and S.P. Singh, Reaction Mechanism in OrganicChemistry, Macmillan India Ltd., third edition, 2009.
3. ArunBahl and B.S. Bahl, Advanced organic chemistry, New Delhi,S.Chand& Company Pvt. Ltd., Multicolour edition, 2012.
4.P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry,Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007.
5.C.N.Pillai, Text Book of Organic Chemistry, Universities Press(India) Private Ltd., 2009.

Reference Books

1.R. T. Morrison and R. N. Boyd, Organic Chemistry, PearsonEducation, Asia, sixth edition, 2012.
2. T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons ,eleventh edition, 2012.
3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill EducationPvt. Ltd., New Delhi, seventh edition,2009.
4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, WesleyLongman Ltd, sixth edition, 2006.
5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, Fifth Edition, 2010.

Website ande-learning sources	1.www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http:/swayam.gov.in 4. Virtual Textbook of Organic Chemistry

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

CO1: assign RS notations to chirals and EZ notations to olefins and explain conformations ofethane and butane.
CO2: explain preparation and properties of aromatic and aliphatic nitro compounds andamines
CO3: explain colour and constitution of dyes and food additives
CO4: discuss preparation and properties of five membered heterocycles like pyrrole, furanand thiophene
CO5: discuss preparation and properties of six membered heterocycles like pyridine,quinoline and isoquinoline

	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

<table>
<tr><td>Title of the Course</td><td colspan="7">INORGANIC CHEMISTRY -I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core X</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td>23BCH5C2</td></tr>
<tr><td></td><td></td><td>Semester</td><td>V</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td>Total</td></tr>
<tr><td></td><td>4</td><td>1</td><td colspan="3">-</td><td>5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry I , II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims to provide knowledge on
• nomenclature, isomerism and theory of coordination compounds, and chelate complexes
• crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect
• preparation and properties of metal carbonyls
• Lanthanoids and actinoids
• preparation and properties of inorganic polymers</td></tr>
<tr><td>UNIT I</td><td colspan="7">Co-ordination Chemistry - I
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 &6.

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 ofhardness of water using EDTA, metal ion indicators.

Role of metal chelates in living systems – haemoglobin and chlorophyll</td></tr>
<tr><td>Unit II</td><td colspan="7">Co-ordination Chemistry - II

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 $[Ti(H2O)6]^{3+}$ - 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.</td></tr>
<tr><td>UNIT III</td><td colspan="7">Organometallic compounds

Metal Carbonyls
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.
Ferrocene-Methods of preparation, physical and chemical properties</td></tr>
</table>

UNIT IV	**Inner transition elements (Lanthanoids and Actinoids)** 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.
UNIT V	**Inorganic polymers** 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 polyphophonitrilic chloride), sulphur based polymer (polysulfide and polymeric sulphur nitride), boron based polymers (borazine polymers) – industrial applications of inorganic 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.
Recommended Text	1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31thEdition, Milestone Publishers & Distributors, Delhi. 2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009),
	Advanced Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi 3. Lee J D, (1991), Concise Inorganic Chemistry, 4th Edition, ELBSWilliam Heinemann, London. 4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, S. Chand and Company Ltd. 5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992.
Reference Books	1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed ., S.Chand and Company, New Delhi. 2. Gopalan R, (2009) Inorganic Chemistry for Undergraduates, Ist Edition, University Press (India) Private Limited,Hyderabad 3. Sivasankar B, (2013) Inorganic Chemistry.Ist Edition, Pearson, Chennai 4. Alan G. Sharp (1992), Inorganic Chemistry, 3rd Edition, Addition-Wesley, England 5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.

Website and e-learning source	1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http:/swayam.gov.in

Course Learning Outcomes (for Mapping with POs and PSOs)
On completion of the course the students should be able to
CO1: explain isomerism, Werner's Theory and stability of chelate complexes
CO2: discuss crystal field theory, magnetic properties and spectral properties of complexes.
CO3: explain preparation and properties of metal carbonyls
CO4: give a comparative account of the characteristics of lanthanoids and actinoids
CO5: explain properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorous

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

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
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

<table>
<tr><td>Title of the Course</td><td colspan="7">PHYSICAL CHEMISTRY -I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core XI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td>23BCH5C3</td></tr>
<tr><td>Semester</td><td>V</td><td colspan="4"></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry I,II,III and IV</td></tr>
<tr><td>Objectives of thecourse</td><td colspan="7">The course aims at providing an overall view of
Gibbs free energy, Helmholtz free energy, Ellingham’s diagramand partial molar properties
chemical kinetics and different types of chemical reactions
adsorption, homogeneous and heterogeneous catalysis
colloids and macromolecules
photochemistry, fluorescence and phosphorescence</td></tr>
<tr><td>UNIT I</td><td colspan="7">Thermodynamics - III

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.

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.</td></tr>
<tr><td>UNIT II</td><td colspan="7">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.</td></tr>
</table>

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 Chemistr**y **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 Macromolecules: Molecular weight of Macromolecules-Number average molecular weight- average molecular weight, Determination of Molecular weight of molecules
UNIT V	**Photochemistry** Laws of photo chemistry – Lambert – Beer, Grotthus – Draper and Stark – Einstein. Quantum efficiency. Photochemical reactions – rate law – Kinetics of H_2-Cl_2, H_2-Br_2 and H_2-I_2 reactions, comparison between thermal and photochemical reactions. 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
Extended Professional Component (is a part of internal component only, Not to be includedin 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.

RecommendedText

1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry,Shoban Lal Nagin Chand and Co., forty eighth edition, 2021.
2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventhedition, 2018.
3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physicalchemistry, 28th edition 2019, S, Chand & Co.
4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996.
5. J. Rajaram and J.C. Kuriacose, Thermodynamics,ShobanLalNagin Chand and CO., 1986.

Reference Books

1. J. Rajaram and J.C. Kuriacose, Chemical Thermodynamics,Pearson, 1st edition, 2013.
2. Keith J. Laidler, Chemical kinetics, third edition, Pearson, 2003.
3. P. W. Atkins, and Julio de Paula, Physical Chemistry, OxfordUniversity press, seventh edition, 2002.
4. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan 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

Website and e-learning source	1. https://nptel.ac.in 2. https://swayam.gov.in 3. www.epgpathshala.nic.in

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain Gibbs and Helmholtz free energy functions, partial molar quantities andEllinghams

CO2: apply the concepts of chemical kinetics to predict the rate of the reaction and order ofthe reaction, demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation.

CO3: compare chemical and physical adsorption, Freundlich and Langmuir adsorptionisotherms, and differentiate between homogenous and heterogeneous catalysis.

CO4: demonstrate the types and characteristics of colloids, preparation of sols andemulsions, and determine the molecular weights of macromolecules.

CO5: 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
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

<table>
<tr><td>Title of the Course</td><td colspan="7">BIOCHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">EC V</td></tr>
<tr><td>Category</td><td>DSE-I</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>23BCH5E1</td></tr>
<tr><td></td><td></td><td>Semester</td><td>V</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td>Total</td></tr>
<tr><td></td><td>4</td><td>-</td><td colspan="3">-</td><td>4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Organic Chemistry - I</td></tr>
<tr><td>Objectives of the</td><td colspan="7">The course aims at providing knowledge on</td></tr>
<tr><td>course</td><td colspan="7">• relationship between biochemistry and medicine, composition of blood
• structure and properties of amino acids, peptides, enzyme, vitamins and proteins
• biological functions of proteins, enzymes, vitamins and hormones
• biochemistry of nucleic acids and lipids
• metabolism of lipids</td></tr>
<tr><td>UNIT I</td><td colspan="7">Logic of Living Organisms
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.</td></tr>
<tr><td>UNIT II</td><td colspan="7">Peptides and Proteins
Amino acids – nomenclature, classification – essential and Non-essential; Synthesis - Gabriel Phthalimide, Strecker; properties – zwitter ion and isoelectric point, electrophoresis and reactions.
Peptides – peptide bond – nomenclature – synthesis of simple peptides – solution and solid phase. Determination of structure of peptides, N-terminal analysis – Sanger’s & Edmann method; C terminal analysis - Enzymic method.
Proteins – 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.</td></tr>
<tr><td>UNIT III</td><td colspan="7">Enzymes and Vitamins
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.</td></tr>
</table>

UNIT IV	**Amino acids** Components of nucleic acids - nitrogenous bases and pentose sugars, structure of nucleosides and nucleotides, DNA- structure & functions; RNA –types– structure - functions; biosynthesis of proteins **Hormones** Adrenalin and thyroxine — chemistry, structure and functions (Nostructure elucidation).
UNIT V	**Lipids** Occurrence, biological significance of fats, classification of lipids. **Simple lipids** – 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. **Compound lipids** – Lipoproteins - VLDL, LDL, HDL, chylomicrons – biological significance. Cholesterol – occurrence, structure, test, physiological activity. Metabolism of lipids: β-oxidation of fatty acids.
Extended Professional Component (is a part of internal component only, Not to be includedin the external examination question paper)	Questions related to the above topics, from various competitiveexaminations 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.
RecommendedText	1. Bahl, B. S.; Bhal, A. *Advanced Organic Chemistry*, 3rd ed.; S. Chand: New Delhi, 2003. 2. Jain, M.K.; Sharma, S.C. *Modern Organic Chemistry*, Vishal Publications: New Delhi, 2017. 3. Shanmugam, A. *Fundamentals of Biochemistry for Medical Students*,6th ed.; Published by the author, 1999. 4. Veerakumari, L. *Biochemistry*, 1st ed.; MJP Publications: Chennai,2004. 5. Jain, J. L.; *Fundamentals of Biochemistry*, 2nd ed.; S.Chand: New Delhi, 1983.
Reference Books	1. Conn, E. E.; Stumpf, P. K. *Outline of Biochemistry*, 5th ed.; Wiley Eastern: New Delhi, 2002. 2. West, E. S.; Todd, W. R.; Mason, H. S.; Van Bruggen, J. T. *Text Bookof Biochemistry*, 4th ed.; Macmillan: New York, 1970. 3. Lehninger, A. L. *Principles of Biochemistry*, 2nd ed.; CBS Publisher: Delhi, 1993. 4. Rastogi, S. C. *Biochemistry*, 2nd ed.; Tata McGraw-Hill: New Delhi,
	2003. 5. Chatterjea, M. N.; Shinde, R. *Textbook of Medical Biochemistry*, 5thed.; Jaypee Brothers: New Delhi, 2002.

Website and e-learning source	1) http://library.med.utah.edu/NetBiochem/nucacids.html 2)http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/EnzymeKinetics.html 3) https://swayam.gov.in/courses/4384-biochemistry Biochemistry 4) https://onlinecourses.nptel.ac.in/noc19_cy07/preview Experimental Biochemistry

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

CO1: explain molecular logic of living organisms, composition of blood and bloodcoagulation
CO2: explain synthesis and properties of amino acids, determination of structure of peptidesand proteins
CO3: explain factors influencing enzyme activity and vitamins as coenzymes
CO4: explain RNA and DNA structure and functions
CO5: explain biological significance of simple and compound lipids

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage ofCourse 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

<table>
<tr><td>Title of theCourse</td><td colspan="7">INDUSTRIAL CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">EC VI</td></tr>
<tr><td>Category</td><td>DSE-II</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>23BCH5E2</td></tr>
<tr><td></td><td></td><td>Semester</td><td>V</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry I,II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course is designed to provide knowledge on
• classifications and characteristics of fuels
• preparation of cosmetics
• manufacture of sugar, paper, cement and leather and foodprocessing
• applications of abrasives, lubricants and other industrial products
• intellectual property rights</td></tr>
<tr><td>UNIT I</td><td colspan="7">Survey of Indian Industries and mineral resources in India
Fuels: Classification, characteristics of fuels. Solid fuels: coal - classification; analysis of coal- proximate analysis and ultimate analysis; calorific value-determination, carbonisation of coal.
Liquid fuels: Petroleum - characteristics; Gasoline aviation petrol- knocking in internal combustion engines, antiknock agents; unleaded petrol-octane number, cetane number.
Gaseous fuel: advantages over solid and liquid fuels; water gas, producergas, carburetted water gas - preparations - uses.
Natural gas: LPG-composition, advantages, application; gobar gas- production, composition, advantages, application. Propellants – rocket fuels (basic idea)</td></tr>
<tr><td>UNIT II</td><td colspan="7">Cosmetics
Skin care: powders, ingredients; creams and lotion-cleansing, moisturising, all purpose shaving cream, sunscreen; make up preparations.
Dental care: tooth pastes – ingredients.
Hair care: shampoos-types, ingredients; conditioners-types, ingredients. Perfumes: natural-plant origin-parts of the plant used, chief constituents;
animal origin-amber gries, civetone and musk; synthetic-classification- esters-amylsalicylate alcohols-citronellol; terpeneols-gereniol and nerol; ketones-muskone, coumarin; aldehydes-vanilin.

Soaps and Detergents

Soaps-properties, manufacture of soap-batch process; types-transparent soap, toilet soap, powder soap and liquid soap – ingredients.

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.</td></tr>
</table>

UNIT III	**Sugar Industry** Manufacture from sugar cane; recovery of sugar from molasses; testing and estimation of sugar. **Food Preservation and processing** 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.
UNIT IV	**Abrasives** 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. **Leather Industry** 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. **Paper Industry** Manufacture of pulp - mechanical, chemical processes; sulphate pulp, rag pulp; manufacture of paper- beating, refining, filling, sizing, colouring, calendaring; cardboard.
UNIT V	**Lubricants** 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. **Cement Industry** 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. **Intellectual Property Rights** 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
Extended Professional Component (is a part of internal component only, Not to be includedin 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.

RecommendedText

1. Sharma, B.K. *Industrial Chemistry*, 9th ed.; Goel Publishing House:Meerut, 1998.
2. Wilkinson, J.B.E. Moore, R.J. *Harry's Cosmeticology*, 7th ed.;Chemical Publishers : New York, 1982.
3. Alex V. Ramani, *Food Chemistry,* MJP publishers: Chennai, 2009.
4. Jayashree Ghosh, *Applied Chemsitry*, S. Chand : New Delhi, 2006.
5. Srilakshmi, B. *Food Science*, 4th ed.; New Age InternationalPublication, 2005.

Reference Books

1. Jain, P.C.; Jain, M. *Engineering Chemistry*, 16th ed.; Dhanapet Rai: Delhi, 1992
2. George Howard, *Principles and Practice of Perfumes and Cosmetics*,Stanley Therones, Cheltenham: UK, 1987.
3. Thankamma Jacob, *Foods, Drugs and Cosmetics - A ConsumerGuide*, Macmillan : London, 1997.
4. ShankuntalaManay, N.; Shadaksharaswamy, M. *Food Facts andPrinciples*, 3rd ed.; New Age Publication, 2008.
5. Neeraj Pandey, KhushdeepDharni, *Intellectual Property Rights*, PHILearning, 2014.

Website and e-learning source	1. http://www.sciencecases.org/irradiation/irradiation_notes.asp 2. http://discovery.kcpc.usyd.edu.au//9.5.5/ 3. https://www.wipo.int/about-ip/en/ 4.www.nptel.ac.in 5. http:/swayam.gov.in

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: summarize the properties of fuels which include petroleum, water gas, natural gas andpropellents

CO2: evaluate cosmetic products, soaps, detergents.

CO3: explain manufacture of sugar, food spoilages and food additives

CO4: explain properties of abrasives, manufacture of leather and paper

CO5: explain properties and manufacture of lubricants and cement, and intellectual propertyrights

	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 theCourse	**Project with vice-voce**						
Paper No.	**CC-12**						
Category		**Year**	III	**Credits**	4	**Course Code**	23BCH5PR
		Semester	V				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	2	-	3			5	
Prerequisites	General Chemistry I,II, III and IV						

Title of theCourse	**Part-IV Industrial visit/ Field visit (Carried out II Year Summer Vacation)**						
Paper No.							
Category		**Year**	III	**Credits**	2	**Course Code**	23BCH5IV/ 23BCH5FV
		Semester	V				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	-	-	-			-	

<table>
<tr><td>Title of theCourse</td><td colspan="7">ORGANIC CHEMISTRY - II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core XIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23BCH6C1</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>5</td><td>1</td><td colspan="3">-</td><td colspan="2">6</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Organic Chemistry – I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on
classification, isolation and discussing the properties ofalkaloids and terpenes
preparation and properties of saccharides
biomolecules
different molecular rearrangement
preparation and properties of organometallic compounds</td></tr>
<tr><td>UNIT I</td><td colspan="7">Alkaloids
Classification, isolation, general properties- Hofmann ExhaustiveMethylation; Structure elucidation – Coniine, piperine, nicotine.

Terpenes: Classification, Isoprene rule, isolation and structuralelucidation of Citral, alpha terpineol, Menthol, Geraniol and Camphor.</td></tr>
<tr><td>UNIT II</td><td colspan="7">Carbohydrates
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.

Monosaccharides– configuration – D and L hexoses – aldohexoses and ketohexoses.
Glucose, Fructose – Occurrence, preparation, properties, reactions,structural elucidation, uses.
Interconversions of sugar series – ascending, descending, aldose toketose and ketose to aldose.

Disaccharides – sucrose, lactose, maltose - preparation, properties anduses (no structural elucidation).

Polysaccharides – Source, constituents and biological importance of homopolysaccharides- starch and cellulose, heteropolysaccharides – hyaluronic acid, heparin.</td></tr>
</table>

UNIT III	**Molecular rearrangements:** Molecular Rearrangement: Type of rearrangements, Mechanism for Benzidine, Favorskii, Clasien, Fries, Hofmann, Curtius, Schmidt and Beckmann, Pinacol-pinacolone rearrangement
UNIT IV	**Special reagents in organic synthesis** AIBN, 9BBN, BINAP/BINOL, BOC, DABCO, DCC, DIBAL, DMAP,NBS/NCS, NMP, PCC, TBHP, TEMPO **Organometallic compounds in Organic Synthesis** Preparation, Properties and applications: Grignard Reagents, Organo Lithium Compounds, Ziegler – Natta,Wilkinson, Metal Carbonyl, Zeiss's Salt
UNIT V	**Green Chemistry:** Principles, chemistry behind each principle and applications in chemical synthesis. Green reaction media – green solvents, green reagents and catalysts; tools used like microwave andultra-sound in chemical synthesis.
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.
Recommended Text	1. M.K.Jain, S. C.Sharma, Modern Organic Chemistry, VishalPublishing, 4th reprint,2009. 2 S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan IndiaLtd., 3rd edition,2009 3. Arun Bahl and B.S. Bahl, Advanced organic chemistry, NewDelhi, S.Chand& Company Pvt. Ltd., Multicolour edition,2012. 4 P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, 29th edition, 2007. 5. C Bandyopadhya; An Insight into Green Chemistry; Published on2020
Reference Books	1. R. T. Morrison and R. N. Boyd, Organic Chemistry, PearsonEducation, Asia,6th edition, 2012. 2. T.W.Graham Solomons, Organic Chemistry, John Wiley &Sons,11th edition, 2012. 3. A. Carey Francis, Organic Chemistry, Tata McGraw-HillEducation Pvt. Ltd., New Delhi,7th edition,2009. 4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, WesleyLongman Ltd, 6th edition, 2006. 5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, 5th Edition, 2010.
Website and e-learning source	1.www.epgpathshala.nic.in 2.www.nptel.ac.in 3.http:/swayam.gov.in 4. Virtual Textbook of Organic Chemistry 5. https://vlab.amrita.edu/

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

CO1: explain isolation and properties of alkaloids and terpenes
CO2: explain preparation and reactions of mono and disachharides
CO3: classify biomolecules and natural products based on their structure, properties,reactions and uses.
CO4: explain molecular rearrangements like benzidine, Hoffmann etc.,
CO5: preparation and properties of organolithium compounds

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

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

Level of Correlation between PSO's and CO's

Title of theCourse	INORGANIC CHEMISTRY –II						
Paper No.	Core XIV						
Category	Core	Year	III	Credits	4	Course Code	23BCH6C2
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice			Total	
	5	1	-			6	
Prerequisites	Inorganic Chemistry – I						
Objectives of the course	The course aims to provide knowledge on • tracer elements and their role in the biological system. • iron transport and storage • metallo enzymes, oxygen transport. • silicates and their applications • industrial applications of refractories, alloys, paints and pigments						
UNIT I	**Bioinorganic Chemistry** Essential and trace elements: Role of Na^{+}, K^{+}, Mg^{2+}, Ca^{2+}, Fe^{3+}, Cu^{2+} and Zn^{2+} in biological systems. Effect of excess intake (Toxicity) of Metal ions – trace elements - As, Cd, Pb, Hg.						
UNIT II	**Metal ion transport and storage** Iron – storage, transport - Transferrin and Ferretin; Iron-porphyrins – myoglobin, haemoglobin – oxygen transport - Bohr effect; Sodium/potassium pump, calcium pump; transport and storage – copper and zinc.						
UNIT III	**Metallo enzymes** 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.						
UNIT IV	**Silicates** 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)						
UNIT V	**Industrial Applications of Inorganic Compounds** 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. Industrial visits and internship mandatory.						
Extended Professional Component (is a part of internal component only, Not to be includedin the external examination question paper)	Questions related to the above topics, from various competitiveexaminations 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.						

Recommended Text	1. Puri B R, Sharma L R, Kalia K C (2011), Principles of InorganicChemistry, 31th ed., Milestone Publishers & Distributors, Delhi. 2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), AdvancdInorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi 3. Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., ELBS William Heinemann, London. 4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics inInorganic Chemistry, Schand and Company Ltd. 5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventhedition, 1992
Reference Books	1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry,2nded., S.Chand and Company, New Delhi. 2. Gopalan R, (2009) Inorganic Chemistry for Undergraduates, IstEdition, University Press (India) Private Limited, Hyderabad 3. Sivasankar B, (2013) Inorganic Chemistry. Ist Edition, Pearson,Chennai 4. Alan G. Sharp (1992), Inorganic Chemistry, 3rd Edition, Addition-Wesley, England 5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.
Website and e-learning source	1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http:/swayam.gov.in

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_{12}, 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
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-II**						
Paper No.	**Core - XV**						
Category	**Core**	**Year**	III	**Credits**	4	**Course Code**	23BCH6C3
		Semester	VI				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	5	1	-			6	
Prerequisites	Physical Chemistry - I						
Objectives of the course	The course aims at providing an overall view of the • phase diagram of one and two component systems • chemical equilibrium, • separation techniques for binary liquid mixtures. • electrical conductance and transport number. • galvanic cells, EMF and significance of electrochemical series.						
UNIT-I	**Phase rule** 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.						
UNIT II	**Chemical equilibrium** Law of mass action – thermodynamic derivation – relationship between Kpand Kc – application to the homogeneous equilibria – dissociation of PCl_5 gas,N_2O_4 gas – equilibrium constant and degree of dissociation - formation of HI, NH_3 ,and SO_3 – 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 – Clausius Clayperon equation and its applications						
UNIT III	**Binary liquid mixtures** 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.						
UNIT IV	**Electrical Conductance and Transference** 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.						

Unit V	**Galvanic Cells and Applications** 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 ΔG, ΔH, and ΔS 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; **Applications of EMF measurements** applications of EMF measurements – determination of activity 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. **Industrial component** Galvanic cells- lead storage, Ni-Cd, Li and Zn-air, Al-air batteries Fuel cells – H_2-O_2 cell – efficiency of fuel cells. corrosion –mechanism, types and methods of prevention.
Extended Professional Component (is a part of internal component only, Not to be includedin 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.
Recommended Text	1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry,ShobanLalNagin Chand and Co., forty eighth edition, 2021. 2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventhedition, 2018. 3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physicalchemistry, 28th edition 2019, S, Chand & Co. 4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996. 5. J. Rajaram and J.C. Kuriacose, Thermodynamics,ShobanLalNagin Chand and CO., 1986.
Reference Books	1. K. L. Kapoor, A Textbook of Physical Chemistry, MacmillanIndia Ltd, third edition,2009. 2. Gilbert. W. Castellen, Physical Chemistry, Narosa PublishingHouse, third edition, 1985. 3. P. W. Atkins, and Julio de Paula, Physical Chemistry, OxfordUniversity press, seventh edition, 2002. 4. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles ofPhysical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001 5. D.N.Bajpai, Advanced Physical Chemistry, S.Chand&Co.,2001

Website and e-learning source	https://nptel.ac.in https://swayam.gov.in https://archive.nptel.ac.in/content/storage2/courses/112108150/pdf/PPTs/MTS_07_m.pdf Thermodynamics - NPTEL https://www.youtube.com/watch?v=f0udxGcoztE Introduction to chemical equilibrium – MIT opencourse ware

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

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

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

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

CO4: Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equationand 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

<table>
<tr><td>Title of theCourse</td><td colspan="7">PRACTICAL V - PHYSICAL CHEMISTRY II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core XVI</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td>23BCH6P1</td></tr>
<tr><td></td><td></td><td>Semester</td><td>VI</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>-</td><td>-</td><td colspan="3">5</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Theoretical knowledge on physical chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing
• basic principles of physical chemistry experiments
• hands on experience in carrying out the experiments</td></tr>
<tr><td></td><td colspan="7">Phase diagrams
1. Simple eutectic - determination of eutectic temperature andcomposition 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 – watersystem
5. Determination of concentration of sodium chloride using phenol-sodium chloride system</td></tr>
<tr><td>Unit II</td><td colspan="7">Distribution law
6. Determination of the distribution coefficient of iodine betweencarbon tetrachloride and water.
7. Determination of equilibrium constant of the reaction
 
8. Determination of concentration of the given potassium iodidesolution using the above equilibrium constant.</td></tr>
<tr><td>UNIT III</td><td colspan="7">Electrochemistry
9. Conductometric titration of hydrochloric acid against sodiumhydroxide
10. Potentiometric titration of ferrous ion against potassium dichromateusing quinhydronde electrode.</td></tr>
<tr><td></td><td colspan="7">Distrribution marks-75 marks
Record-15
Experiment-60</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</td><td colspan="7">Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved
(To be discussed during the Tutorial hours)</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="7">Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</td></tr>
</table>

Reference Books	1. Sindhu, P.S. *Practicals in Physical Chemistry*, Macmillan India :New Delhi, 2005. 2. Khosla, B. D. Garg,V. C.; Gulati, A. *Senior Practical Physical Chemistry,* R. Chand : New Delhi, 2011. 3. Gupta, Renu, *Practical Physical Chemistry*, 1st Ed.; New Age International : New Delhi, 2017.
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences

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

CO1: 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 phase rule and electrochemistry for carrying out the practicalwork
CO4: Demonstrate laboratory skills for safe handling of the equipment and chemicals

CO /PSO	PSO1	PSO2	PSO 3	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 toPSOs	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

<table>
<tr><td>Title of the Course</td><td colspan="7">FUNDAMENTALS OF SPECTROSCOPY</td></tr>
<tr><td>Paper No.</td><td colspan="7">EC VII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE-III</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23BCH6E1</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry I,II,III and IV</td></tr>
<tr><td>Objectives of thecourse</td><td colspan="7">This course is designed to provide knowledge on
• electrical and magnetic properties of organic and inorganiccompounds
• basic principles of microwave, UV-Visible, infrared, Raman,NMR and Mass spectrometry
• instrumentation of microwave, UV-Visible, infrared, Raman,NMR and Mass spectrometry
• applications of various spectral techniques in structuralelucidation
• solving combined spectral problems</td></tr>
<tr><td>UNIT I</td><td colspan="7">Electrical and Magnetic properties of molecules
Dipole moment – polar and nonpolar molecules – polarisability of molecules. Application of dipole moments in the study of organic and inorganic molecules.
Magnetic permeability, volume susceptibility, mass susceptibility and molar susceptibility; diamagnetism, paramagnetism – determination of magnetic susceptibility using Guoy balance, ferromagnetism, anti ferromagnetism
Microwave spectroscopy
Rotation spectra - diatomic molecules (rigid rotator approximation)selection rules – determination of bond length, effect of isotopic substitution – instrumentation and applications</td></tr>
<tr><td>UNIT II</td><td colspan="7">Ultraviolet and Visible spectroscopy
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 - σ -σ *, π-π*, n-σ*, n-π* transitions.
Applications of UV-Woodward – Fieser rules as applied to conjugated dienes and α, β - unsaturated ketones. Elementary Problems.
Colorimetry - principle and applications (estimation of Fe^{3+})</td></tr>
<tr><td>UNIT III</td><td colspan="7">Infrared spectroscopy
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)
Raman Spectroscopy
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.</td></tr>
</table>

UNIT IV	**Nuclear magnetic resonance spectroscopy:** 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.
UNIT V	**Mass spectrometry** 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. Solving structure elucidation problems using multiple spectroscopic data (NMR, MS, IR and UV-Vis).
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.
Recommended Text	1. Gopalan, R.; Subramaniam, P. S.; Rengarajan, K. *Elements ofAnalytical Chemistry*; S Chand: New Delhi, 2003. 2. Usharani, S. *Analytical Chemistry*, 1st ed.; Macmillan: India, 2002. 3. Banwell, C.N.; Mc Cash, E. M. *Fundamentals of Molecular Spectroscopy*, 4th ed.; Tata McGraw Hill, New Delhi, 2017. 4. U.N.Dash, Analytical Chemistry Theory and Practice, Sultan Chand&Sons,2nd Ed., 2005 5. B.K.Sharma, Spectroscopy,22nd ed., Goel Publishing House, 2011.
Reference Books	1. Srivastava, A. K.; Jain, P. C. *Chemical Analysis an Instrumental Approach*, 3rd ed.; S.Chand, New Delhi, 1997. 2. Robert D Braun. *Introduction to Instrumental Analysis*; Mc.Graw Hill: New York, 1987. 3. Skoog, D. A.; Crouch, S. R.; Holler, F.J.; West, D. M. *Fundamentals of Analytical Chemistry*, 9th ed.; Harcourt college Publishers: USA, 2013. 4. Madan, R. L.; Tuli, G. D. *Physical Chemistry*, 2nd ed.; S.Chand: New Delhi, 2005. 5. Puri, B. R.; Sharma, L. R.; Pathania, M.S. *Principles of Physical Chemistry*, 43rd ed.; Vishal Publishing: Delhi, 2008.
Website and e-learning source	1. http://vallance.chem.ox.ac.uk/pdfs/SymmetryLectureNotes2004.pdf 2.http://chemistry.rutgers.edu/undergrad/chem207/SymmetryGroupThe ory.html 3. www.epgpathshala.nic.in

	4. www.nptel.ac.in 5.. http:/swayam.gov.in

Course Learning Outcomes (for Mapping with POs and PSOs)
On completion of the course the students should be able to
CO1: explain electrical and magnetic properties of materials and microwave spectroscopy **CO2:** explain theory, instrumentation and applications of Infrared and Raman spectroscopy**CO3:** apply selection rules to understand spectral transitions, explain Woodward – Fieser's rule for the calculation of wavelength maximum of conjugated dienes **CO4:** explain theory, instrumentation and applications of NMR spectroscopy **CO5:** explain theory, instrumentation and applications of Mass spectrometry

	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	**Part-IV Professional Competency Skill**						
Paper No.							
Category		**Year**	III	**Credits**	2	**Course Code**	23BCH6S1
		Semester	VI				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	2	-	-			2	

Title of the Course	**ESSENTIAL REASONING AND QUANTITATIVE APTITUDE**
Objectives of the Course	• Develop Problem solving skills for competitative examinations • Understand the concepts of averages , simple interest , compound interest
UNIT-I:	**Quantitative Aptitude:** Simplifications=averages-Concepts –problem-Problems on numbers-Short cuts- concepts –Problems
UNIT-II:	Profit and Loss –short cuts-Concepts –Problems –Time and work -Short –uts -Concepts -Problems.
UNIT-III:	Simple interest –compound interest- Concepts- Prolems
UNIT-IV:	**Verbal Reasoning :** Analogy- coding and decoding –Directions and distance –Blood Relation
UNIT-V:	**Analytical Reasoning :**Data sufficiency Non-Verbal Reasoning : Analogy ,Classification and series
Skills acquired from this course	Studnets relating the concepts of compound interest and simple interest
Recommended Text	1.”Quantitative Aptitude” by R.S aggarwal ,S.Chand & Company Ltd 2007
Website and e-Learning Source	https://nptel.ac.in

Title of the Course	**Part-IV Extension Activity**						
Paper No.							
Category		**Year**	III	**Credits**	1	**Course Code**	23BEA6
		Semester	VI				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	-	-	-			-	

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 ofchemistry.
PSO2: disseminate the basics of chemistry and advanced topics and analytical skillsin organic, inorganic and physical chemistry.
PSO3: uphold ethical values in personal life, research and career.

PSO4: demonstrate laboratory skills, analytical acumen, creatively in academics andresearch.
PSO5: apply digital tools to collect, analyze and interpret data and presents cientificfindings.
PSO6: gain competence to pursue higher education and career opportunities inchemistry 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 greenlaboratory practices.

PO-PSO MAPPING MATRIX:

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