

Affiliated College

205- B. Sc. INDUSTRIAL CHEMISTRY

Programme Structure and Scheme of Examination (under CBCS)

(Applicable to the candidates admitted from the academic year 2023 -2024 onwards)

Course Code	Part	Study Components & Course Title	Credit	Hours/ week	Maximum Marks		
					CIA	ESE	Total
		SEMESTER – I					
23UTAML11/23 UHINL11/ 23UFREL11	I	Language – I: பொது தமிழ் – I: ஐந்தாண்டுத் தரம்-1/ Hindi-I/ French-I	3	6	25	75	100
23UENGL12	II	General English – I	3	6	25	75	100
23UICHC13	III	Core – I : General Chemistry – I	5	5	25	75	100
23UICHP14		Core –II : Practical-I: Quantitative Inorganic Estimation (Titrimetry) and Inorganic Preparations	5	4	25	75	100
23UICHE15		Elective - I Industrial Chemistry-I	2	3	25	75	100
23UICHEP1		Industrial chemistry Practicals-1	1	2	25	75	100
23UTAMB16 23UTAMA16	IV	Skill Enhancement Course – I* NME-I/ Basic Tamil – I / Advanced Tamil - I	2	2	25	75	100
23UICHF17		Foundation Course: Introductory Chemistry	2	2	25	75	100
		Total	23	30			800
		SEMESTER – II					
23UTAML21/23 UHINL21/ 23UFREL21	I	Language – II: பொது தமிழ் – II: ஐந்தாண்டுத் தரம்-2/ Hindi-II/ French-II	3	6	25	75	100
23UENGL22	II	General English – II	3	6	25	75	100
23UICHC23	III	Core – III: General Chemistry – II	5	5	25	75	100
23UICHP24		Core –IV Practical-II-Qualitative organic analysis And Preparation of Organic Compounds	5	4	25	75	100
23UICHE25		Elective - II Industrial Chemistry-II	2	3	25	75	100
23UICHEP2		Industrial Chemistry Practicals-II	1	2	25	75	100
23UTAMB26 23UTAMA26	IV	Skill Enhancement Course – II* NME-II/ Basic Tamil – II / Advanced Tamil - II	2	2	25	75	100
23USECG27		Skill Enhancement Course – III: Internet and its Applications (Common Paper)	2	2	25	75	100
23UNMSD01		Language Proficiency for employability: Overview of English Communication**	2	-	25	75	100
		Total	25	30			900

		SEMESTER – III					
23UTAML31/ 23UHINL31/ 23UFREL31	I	Language – III: பொது தமிழ் – III: □□□□□ □□□□□□□□, □□□□□□□□□/□ Hindi-III/ French-III	3	6	25	75	100
23UENGL32	II	General English – III	3	6	25	75	100
23UICHC33	III	Core – V: General Chemistry-III	5	5	25	75	100
23UICHP34		Core –VI: Core Practicals – III - Inorganic Qualitative Analysis	5	4	25	75	100
23UICHE35		Elective – III: Industrial Chemistry-III	2	3	25	75	100
23UICHEP3		Industrial Chemistry Practical -III	1	2	25	75	100
23UICHS36	IV	Skill Enhancement Course – IV: Entrepreneurial Skills in Food Chemistry	1	1	25	75	100
23UICHS37		Skill Enhancement Course – V: Pesticide Chemistry	2	2	25	75	100
		Environmental Studies		1			
		Total	22	30			800
		SEMESTER – IV					
23UTAML41/ 23UHINL41/ 23UFREL41	I	Language – IV: பொது தமிழ் – IV: □□□□□□□□ □□□□□□□□□□/□ Hindi-IV/ French-IV	3	6	25	75	100
23UENGL42	II	General English – IV	3	6	25	75	100
23UICHC43	III	Core – VII: General Chemistry-IV	5	4	25	75	100
23UICHP44		Core –VIII: Core Practical –IV: Physical Chemistry Practicals	5	4	25	75	100
23UICHE45		Elective – IV: Industrial Chemistry-IV	2	3	25	75	100
23UICHEP4		Industrial Chemistry Practicals-IV	1	2	25	75	100
23UICHE46	IV	Skill Enhancement Course – VI: Instrumental Methods of Chemical analysis (or)	2	2	25	75	100
23UICHE47		Skill Enhancement Course – VII: Forensic Science	2	2	25	75	100
23UEVSG48		Environmental Studies	2	1	25	75	100
		Total	25	30			900
		SEMESTER –V					
23UICHC51	III	Core –IX: Organic Chemistry-I	4	5	25	75	100
23UICHC52		Core –X: Inorganic Chemistry-I	4	5	25	75	100
23UICHC53		Core – XI: Physical Chemistry-I	4	5	25	75	100
23UICH54		Core –XII: Project with viva Voce	4	5	25	75	100
23UICHE55-1 23UICHE55-2 23UICHE55-3		Elective – V: Bio Chemistry/ Green Chemistry/ Agriculture Chemistry	3	4	25	75	100
23UICHE56-1		Elective-VI: Textile Chemistry/	3	4	25	75	100

23UICHE56-2 23UICHE56-3		C Language And Chemistry/ Applied Chemistry					
23 UVALG57	IV	Value Education	2	2	-	-	100
23UICHI58		Summer Internship ⁺⁺	2	-	25	75	100
		Total	26	30			800
		SEMESTER –VI					
23UICHC61	III	Core –XIII: Organic Chemistry-II	4	6	25	75	100
23UICHC62		Core –XIV: Inorganic Chemistry-II	4	6	25	75	100
23UICHC63		Core – XV: Physical Chemistry-II	4	6	25	75	100
23UICHE64-1 23UICHE64-2 23UICHE64-3		Elective – VII: Fundamentals of Spectroscopy / Organic Synthesis / Health Chemistry	3	5	25	75	100
23UICHE65-1 23UICHE65-2 23UICHE65-3		Elective-VIII: Nano Science / Polymer Science/ Pharmaceutical Chemistry	3	5	25	75	100
23UICHF66	IV	Professional Competency Skill: Cheminformatics	2	2	25	75	100
23UICHX67	V	Extension Activities	1	-	100		100
		Total	21	30			700
		Grand Total	142				4900

Non-major (NME) Electives offered to other Departments

Semester	Course Code	Course Title	H/W	C	CIA	ESE	Total
I	23UCHEN16	Role of Chemistry in Daily Life	2	2	25	75	100
II	23UCHEN26	Dairy Chemistry	2	2	25	75	100

* PART-IV: NME / Basic Tamil / Advanced Tamil (Any one)

Students who have not studied Tamil upto 12th Standard and have taken any Language other than Tamil in Part-I, must choose Basic Tamil-I in First Semester & Basic Tamil-II in Second Semester.

Students who have studied Tamil upto 10th & 12th Standard and have taken any Language other than Tamil in Part-I, must choose Advanced Tamil-I in First Semester and Advanced Tamil-II in Second Semester.

** The course “23UNMSD01: Overview of English Communication” is to be taught by the experts from Naan Mudhalvan Scheme team. However, the faculty members of Department of English should coordinate with the Naan Mudhalvan Scheme team for smooth conduct of this course.

⁺⁺Students should complete two weeks of internship before the commencement of V semester.

Choice Based Credit System (CBCS), Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credit and Hours Distribution System for all UG courses including Lab Hours

First Year – Semester-I

Part	List of Courses	Credit	No. of Hours
Part I	Language – Tamil	3	6
Part II	English	3	6
Part III	Core Theory, Practical & Elective Courses	13	14
Part IV	Skill Enhancement Course SEC-1 (NME-I)	2	2
	Foundation Course	2	2
		23	30

Semester-II

Part	List of Courses	Credit	No. of Hours
Part I	Language – Tamil	3	6
Part II	English	3	6
Part III	Core Theory, Practical & Elective Courses	13	14
Part IV	Skill Enhancement Course -SEC-2 (NME-II)	2	2
	Skill Enhancement Course -SEC-3 (Discipline / Subject Specific)	2	2
		23	30

Second Year – Semester-III

Part	List of Courses	Credit	No. of Hours
Part I	Language - Tamil	3	6
Part II	English	3	6
Part III	Core Theory, Practical & Elective Courses	13	14
Part IV	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	1	1
	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific)	2	2
	E.V.S	-	1
		22	30

Semester-IV

Part	List of Courses	Credit	No. of Hours
Part I	Language - Tamil	3	6
Part II	English	3	6
Part III	Core Theory, Practical & Elective Courses	13	13
Part IV	Skill Enhancement Course -SEC-6 (Discipline / Subject Specific)	2	2
	Skill Enhancement Course -SEC-7 (Discipline / Subject Specific)	2	2
	E.V.S	2	1
		25	30

Third Year

Semester-V

Part	List of Courses	Credit	No. of Hours
Part III	Core Theory, Practical, Project & Elective Courses	22	28
Part IV	Value Education	2	2
	Internship / Industrial Visit / Field Visit	2	-
		26	30

Semester-VI

Part	List of Courses	Credit	No. of Hours
Part III	Core Theory, Practical & Elective Courses	18	28
Part IV	Professional Competency Skill	2	2
Part V	Extension Activity	1	-
		21	30

Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	13	13	13	13	22	18	92
Part IV	4	4	3	6	4	2	23
Part V	-	-	-	-	-	1	1
Total	23	23	22	25	26	21	140

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

CREDIT DISTRIBUTION FOR U.G. PROGRAMME

Part	Course Details	No. of Courses	Credit per course	Total Credits
Part I	Tamil	4	3	12
Part II	English	4	3	12
Part III	Core Courses	15	4/5	68
	Elective Courses: Generic / Discipline Specific (3 or 2+1 Credits)	8	3	24
Part I, II and III Credits				116
Part IV	Skill Enhancement Courses / NME / Language Courses	7	1/2	15
	Professional Competency Skill Course	1	2	2
	Environmental Science (EVS)	1	2	2
	Value Education	1	2	2
	Internship	1	2	2
Part IV Credits				23
Part V	Extension Activity (NSS / NCC / Physical Education)	1	1	1
Total Credits for the UG Programme				140

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 off beat situations, Discussion, Debating or Presentations	

Programme Outcomes:	PO1: Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study PO2: 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. PO3: 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. PO4: 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. PO5: 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. PO6: 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 PO7: Cooperation/Team work: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team 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 to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple
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	perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. PO 14: Leadership readiness/qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. PO 15: Lifelong learning: Ability to acquire knowledge and skills, including „learning 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						✓

Title of the Course	GENERAL CHEMISTRY-I						
Paper No.	Core I						
Category	Core	Year	I	Credits	5	Course Code	23UICHHC13
		Semester	I				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		
Prerequisites	Higher secondary chemistry						
Objectives of the 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						
Course Outline	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 Hspectrum; Photoelectric effect, Compton effect; Dual nature of Matter- DeBroglie 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 wavefunctions, 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, electronegativity-electronegativity scales, applications of electronegativity. Problems involving the core concepts
	UNIT-III: Structure and bonding - I Ionic bond Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle – lattice energies, Madelung constant; relative effect of lattice energy and solvation energy; Ion 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^-, $\text{O}_2^{2-}\text{N}_2$, 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 boiling points. UNIT-V: Basic concepts in Organic Chemistry and Electronic effects Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction intermediates – carbanions, carbocations, carbenes, arynes and nitrynes. Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductomeric and electromeric effects. Resonance – resonance energy, conditions for resonance - acidity of phenols, basicity of aromatic amines, stability of carbonium ions, carbanions and free
	radicals, reactivity of vinyl chloride, dipole moment of vinyl chloride and nitrobenzene, bond lengths; steric inhibition to resonance. Hyperconjugation - stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitromethane Types of organic reactions- addition, substitution, elimination and rearrangements

Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
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: New Delhi, 2000. 3. Puri, B. R. and Sharma, L. R. Principles of Physical Chemistry, 38thed.; Vishal Publishing Company: Jalandhar, 2002. 4. Bruce, P. Y. and Prasad K. 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
Reference Books	1. Maron, S. H. and Prutton C. P. Principles of Physical Chemistry, 4thed.; The Macmillan Company: New York, 1972. 2. Lee, J. D. Concise Inorganic Chemistry, 4th ed.; ELBS William Heinemann: London, 1991. 3. Gurudeep Raj, Advanced Inorganic Chemistry, 26thed.; 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 and e-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	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'

Title of the Course	Quantitative Inorganic Estimation (titrimetry) and Inorganic Preparatiions						
Paper No.	Core II -Practical						
Category	Core	Year	I	Credits	5	Course Code	23UICHP14
		Semester	I				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
					4		
Prerequisites	Higher secondary chemistry						
Objectives of the course	This course aims at providing knowledge on • laboratory safety • handling glasswares • Quantitative estimation • preparation of inorganic compounds • To develop skill in finding out end points of various titrations						
Course Outline	Unit I 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.						

	Unit II Quantitative Estimation(Volumetric) Preparation of standard solution, dilution from stock solution Permanganometry Estimation of sodium oxalate using standard ferrous ammonium sulphate
	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) Complexometry Estimation of hardness of water using EDTA Estimation of iron in iron tablets Estimation of ascorbic acid
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.
Reference Books	1. Mendham, J.; Denney, R. C.; Barnes, J. D.; Thomas, M.; Sivasankar, B.; Vogel's Textbook of Quantitative Chemical Analysis, 6 th ed.; Pearson Education Ltd: New Delhi, 2000.
Website and e-learning source	Web References: 1) http://www.federica.unina.it/agraria/analytical-chemistry/volumetricanalysis 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. Indentify the end point of various titrations

CO5 acquire knowledge on the systematic analysis of Mixture of salts., identify the cations and anions in the unknown substance.

CO5: handle the common apparatus used in volumetric estimation.

	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	S	S	M	S	S	S	M	S	M

CO-PO Mapping (Course Articulation Matrix)

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

Note: Scheme for Practical Evaluation.

Inorganic prepararation:15 marks

Record:10 marks

Procedure:10 marks

Volumetric estimation:40 marks

< 2% - 40 marks

2-3% - 30 marks

3-4% - 20 marks

> 4% -10 marks

Title of the Course	Departmental elective- - I						
Paper No.	Allied Theory - I-(Industrial Chemistry-I)						
Category	Allied	Year	I	Credits	2	Course Code	23UICHE15
		Semester	I				
Instructional hours per week	Lecture	Tutorial		Lab Practice		Total	
	2	1		-		3	
Prerequisites	– Higher secondary Chemistry						
Objectives of the course	This course aims to provide a comprehensive knowledge to students and to enable them • To understand the significance of Inorganic Cementing Materials • To know the details of, Portland cement, Glass, Ceramics, and Plasticity of Clay. • To impart knowledge of Refractoriness and Portland cement. • To be familiar with the details of adhesives. • To understand the basic concepts and application of an Abrasives, Pulp and paper.						
Course Outline	UNIT - I INORGANIC CEMENTING MATERIALS Introduction - Lime and its manufacture - Gypsum Plaster - Cement - Types of cement. - Chemical Composition. Manufacture of Portland cement - Chemical Composition of Portland Cement - Setting and Hardening of Portland Cement. The Heat of Hydration of Cement - Special Cement – Concrete and RCC - Decay of Concrete.						
	UNIT-II GLASS AND CERAMICS Introduction - Manufacture of Glass - Varieties of Glasses. Plasticity of Clay - White wares - Glazing - applications - Earthenware ‘sand stoneware’ – Optical Fibres.						
	UNIT-III REFRATORIES Introduction - Classification - Manufacture of Refractoriness - Cermets - Insulating refractoriness - Requirements of a refractory. Combustion - Mass analysis from volume analysis and vice-versa Flue gas analysis- efficiency of combustion						
	UNIT-IV ADHESIVES Introduction - Classification of adhesives - Adhesive Action - Development of Adhesive Strength. Solvent Responsive, Adhesives - Uses of Solvent Responsive, Adhesives. Chemically reactive,						

	adhesives.
	UNIT-V: ABRASIVES Introduction - Natural Abrasives - Artificial Abrasives – Grinding Wheels. Pulp and paper - Introduction - Manufacture of pulp - Sulphate pulp - Soda pulp - Rag pulp - Beating, refining, filling, sizing and colouring - manufacture of paper.
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	Handbook of Industrial Chemistry, Cory Simmons, 2019 1. Ullmann's Encyclopedia of Industrial Chemistry, Vol. B1, Fundamentals of Chemical Engineering, Hans-Jürgen Arpe. 2. A.K. De, Environmental Chemistry, New Age International Pvt Ltd., 2 nd edition, New Delhi. 3. Industrial Chemistry, Clerk Ranken,. John A. Tyrell, 2014.
Reference Books	Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK 1. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi. 2. P. C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi. 3. Practical's and Calculation in Engineering Chemistry ñ S.S. Dara A. K. De, Environmental Chemistry: New Age, International Pvt, Ltd, New Delhi. 4. S.P. MAHAJAN: Pollution control in process industries, Tata McGraw-Hill publishing Company Limited, New Delhi. 5. C.k. Varshney: Water Pollution and Management, Wiley Eastern Limited, Chennai
Website and e-learning source	www.epgpathshala.nic.in www.nptel.ac.in http://swayam.gov.in

Course Outcomes: At the end of the course student will be able to
CO1: It aims at understanding the detailed specifications of Materials and analyzing
CO2: Write down the Applications of Glasses, ceramics.
CO3: Write down properties and testing of refractoriness and application in the steel industry.
CO4: Write down the development, Action, Strength and Uses of Adhesives
CO5: Describe the Manufacture of pulp and Paper.

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 PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO'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

Title of the Course	DEPARTMENTAL ELECTIVE-INDUSTRIAL CHEMISTRY PRACTICAL - I							
Paper No.	Allied Practical – I							
Category	ALLIED	Year	I	Credits	1	Course Code	23UICHEP1	
		Semester	1					
Instructional hours per week	Lecture	Tutorial		Lab Practice	Total			
	-	-		2	2			
Prerequisites	Core Practical-I& Industrial chemistry Practical - I							
Objectives of the course	- To know the percent purity of two commercially available Aspirin tablets using an acid-base titration. - To understand the <i>percentage of purity of sodium bicarbonate</i> by conversion to sodium carbonate. - To enable the learners to learn the principle of Thermo-gravimetric analysis, an accurate and responsive method of <i>moisture</i>. - To know the basic concepts of Volumetric analysis. - To train the students to become skilled person in saponification and also know the principles of chemical kinetics and to use them for stability testing and determination of expiry date of formulations.							
Course Outline	1.Limit test for a)Sulphate b)Chloride c)Iron d)Lead 2. Loss of moisture from any drug 3. Assay of Hydrogen peroxide 4. Assay of Sodium chloride or Potassium chloride 5.Assay of Zinc 6.*Determination of saponification value of oil. * Only for demonstration purposes. * Only for demonstration purposes.							
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. Samuel Rideal, 2017, Industrial Chemistry- Being a Series of Volumes Giving a Comprehensive Survey of the Chemical Industries, 2. James A. Audley, 2018, Industrial Chemistry, Being a Series of Volumes Giving a Comprehensive Survey of the Chemical Industries, 3. Cory Simmons, 2019, Handbook of Industrial Chemistry, 4. Ullmann's Encyclopedia of Industrial Chemistry, Vol. B1, Fundamentals of Chemical Engineering, Hans-Jürgen Arpe, 2021 5. Kent J.A., Riegel's Handbook of Industrial Chemistry, 6. Clerk Ranken, 2015, Industrial Chemistry, 7. Dr. Darshan V Chaudhary, 2015, Industrial Chemistry,
Reference Books	1. Vogel's textbook of chemical analysis 2. A.O. Thomas, 2003, Practical Chemistry, Scientific Book Centre, 8th Edition, Cannanore. 3. Practical Chemistry-3 Volumes-S. Sundaram and others. 4. Felder R. M., and Rousseau R. W., 2000, <i>Elementary Principles of Chemical Processes</i>, Wiley Publications, 3rd Edition, New York. 5. Crynes B. L., Fogler H. S., 1981, <i>AIChE Modular Instruction Series E: Kinetics</i>, Vols. 1 and 2., New York.
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences www.epgpathshala.nic.in www.nptel.ac.in http://swayam.gov.in
Course Outcomes:	On Completion of the Practical, the students should be able to CO1: Understand the chemical kinetics, physical and chemical properties, nature of pharmaceutical products and their stability. CO2: <i>Designed a method for the determination of hydrogen peroxide in aqueous solutions containing 20% to 705 hydrogen peroxide.</i> CO3: Exposed to experimental details of Assay of various chemical compounds. CO4: Describe the steps involved Determine the purity of Sodium bicarbonate.

	CO5: Determine Loss of moisture from any drug and also find out the Percentage of available chlorine present in the bleaching powder.
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Scheme of Valuation:

Internal assessment: 25 Marks

External assessment: 75 Marks

Total: 100 Marks

Record: 10 Marks

Procedure: 10 Mark

Estimation: 40 marks

Limit Test: 15 marks

For Estimation

Error upto

2 % : 40

2.1 – 3 % : 30

3.1 – 4 % : 20

4.1 – 5 % : 10

>5 %

For incomplete or wrong calculation deduction 20 % of total marks scored.

For no calculation deduct 40% of total marks scored.

For each arithmetic error deduct 1 mark.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	Level of Correlati on between PSO's and CO's
CO1	3	3	3	3	3	
CO2	3	3	3	3	3	
CO3	3	3	3	3	3	
CO4	3	3	3	3	3	
CO5	3	3	3	3	3	
Weightage	15	15	15	15	15	
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0	
CO/PO	PO1	PO2	PO3	PO4	PO5	
CO1	3	3	3	3	3	
CO2	3	3	3	3	3	
CO3	3	3	3	3	3	
CO4	3	3	3	3	3	
CO5	3	3	3	3	3	

Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

Title of the Course	ROLE OF CHEMISTRY IN DAILY LIFE						
Paper No.	SEC-I						
Category	NME-1	Year	I	Credits	2	Course Code	23UCHEN16
		Semester	I				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	-	-		2		
Prerequisites	Higher secondary chemistry						
Objectives of the 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						
Course Outline	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.
Reference Books	1. Randolph. Norris Shreve, Chemical Process Industries, McGraw-Hill, Texas, fourth edition, 1977. 2. W.A. Poucher, Joseph A. Brink, Jr. Perfumes, Cosmetics and Soaps, Springer, 2000. 3. A.K. De, Environmental Chemistry, New Age International Public Co., 1990.
Website and e-learning source	1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7044178/ 2. https://byjus.com/question-answer/name-the-element-which-is-important-component-of-ceramics-glass-and-cement-csialca-1/ 3. https://kids.britannica.com/students/article/food-and-nutrition/274373 4. https://study.com/academy/lesson/pharmaceutical-drugs-definition-types.html

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 Also have an awareness about Cosmetics Tooth pastes, face powder, soaps and detergents.

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

CO5: have an idea about the pharmaceutical drugs analgesics and antipyretics like paracetamol 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

Title of the Course	INTRODUCTORY CHEMISTRY						
Paper No.	SEC – I (Foundation Course)						
Category	SEC	Year	I	Credits	2	Course Code	22UICHF17
		Semester	I				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	0	-		2		
Prerequisites	Higher secondary chemistry						
Objectives of the Course	To give insights into chemistry experiments for a beginner in 1. Lab safety and Nature of chemicals. 2. Types of titrations and Concentration terms. 3. Semi micro analysis and precipitation techniques. 4. Organic analysis 5. Gravimetric Principles						
Course Outline	UNIT-I: LAB SAFETY, CHEMICALS AND GLASSWARE 1.1 laboratory hygiene and safety – first-aid techniques – general work culture inside the chemistry lab. 1.2 Nature of chemicals – toxic, corrosive, explosive, inflammable, carcinogenic, other hazardous chemicals – safe storing and handling of chemicals – disposal of chemical wastes. 1.3. Handling of glass wares- Calibration of pipette, standard measuring flask and burette. UNIT-II: TITRIMETRIC METHODS OF ANALYSIS 2.1 Definitions of Molarity and Normality. Primary and secondary standards, Criteria for primary standards- Preparation of standard solutions. 2.2 Concepts of Acids & Bases - pH of strong and weak acid solutions. Indicators-Theory and their choice.. 2.3 Types of titrations- Acid-base Titrations, Redox Titrations, Precipitation Titrations and Complexometric Titrations- Principles and theory. UNIT-III: SEMIMICRO METHODS 3.1. Identification of interfering & non-interfering acid radicals - removal of interfering radicals (any one test for each). 3.2 Separation of cations into groups-Reagents involved and their principle 3.3 Spot test analysis for ammonium, Pb, Cu, Mg, Mn and Ni.						

	UNIT-IV: BASICS OF ORGANIC ANALYSIS 4.1 Preliminary and solubility tests for identifying organic compounds. Test for Aliphatic/Aromatic – Saturated/Unsaturated compounds 4.2 Detection of Nitrogen, Sulphur and halogens 4.3– Test for functional groups: phenol, aldehyde, ketone, ester, carbohydrate, amine, amide & carboxylic acid (any one test for each). UNIT V: GRAVIMETRIC METHODS 5.1 Gravimetric analysis- principle, theory and calculation. 5.2 Steps of a gravimetric analysis: precipitation, digestion, filtration, washing, drying and weighing. 5.2 Conditions for precipitation-choice of precipitants-advantages and disadvantages of using organic precipitants.
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. U.N. Dash, 2005, Analytical Chemistry: Theory and Practice, Sultan Chand and sons. Educational Publishers, 2nd Edition, New Delhi, 2. J.Bassett, R.C.Denney, G.H.Jerrey and J.Mendham, 1994,Vogel's Text Book Of Inorganic Quantitative Analysis, ELBS, 5th Edition, London. 3. Gopalan R., Rangarajan K., Subramanian P.S. Elements of Analytical Chemistry, Sultan Chand & Sons, 2003 4. Svehla, 2012, Vogel's Qualitative Analysis, Pearson Education, 7thEdition,New Delhi. 5. Venkateswaran V, Veeraswamy R, Kulandaivelu A R,1997,Basic Principles Of Practical Chemistry, Sultan Chand and Sons, 2nd Edition, New Delhi. 6. D.A. Skoog, D.M. West and F. J.Holler, 1990, Analytical

	chemistry, Saunders college publishing, 5th Edition, Philadelphia.
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Reference Books	1. Svehla, 2012, Vogel's Qualitative Analysis, Pearson Education, 7th Edition, New Delhi. 2. Venkateswaran V, Veeraswamy R, Kulandaivelu A R, 1997, Basic Principles Of Practical Chemistry, Sultan Chand and Sons, 2nd Edition, New Delhi
	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Website and e-learning source	1. https://www.tees.ac.uk/parttime_courses/engineering_&_construction/certificate_of_credit_foundation_process_chemistry_(by_flexible_open_learning).cfm 2. https://le.ac.uk/courses/chemistry-with-foundation-year-bsc/2023 3. https://www.researchgate.net/publication/345381808_Foundations_for_Teaching_Chemistry_Chemical_Knowledge_for_Teaching 4. https://yuli-elearning.com/mod/resource/view.php?id=738 5. https://pubs.acs.org/doi/10.1021/acs.jchemed.1c00666
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: to understand laboratory safety and hygiene. CO2: to understand principle of titrations. CO3: to understand semi micro analysis. CO4: to understand basics of organic compound analysis. CO5: to understand about gravimetric analysis	

	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	2	2	2	2	2
CO2	2	2	2	2	2
CO3	2	2	2	2	2
CO4	2	2	2	2	2
CO5	2	2	2	2	2
Weightage	10	10	10	10	10
Weighted percentage of Course Contribution	2.0	2.0	2.0	2.0	2.0

to Pos					
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Level of Correlation between PSO's and CO's

Semester II

Title of the Course	GENERAL CHEMISTRY-II						
Paper No.	Core III						
Category	Core	Year	I	Credits	5	Course Code	23UICH23
		Semester	II				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	5	0	-		5		
Prerequisites	General Chemistry I						
Objectives of the course	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						
Course Outline	UNIT-I 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.						
	Unit-II Chemistry of s - Block Elements Hydrogen: Position of hydrogen in the periodic table. Alkali metals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Preparation, properties and uses of NaOH, 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.
	UNIT-III Chemistry of p- Block Elements (Group 15-18) General characteristics of elements of Group 15; chemistry of $\text{H}_2\text{N}-\text{NH}_2$, NH_2OH, HN_3 and HNO_3. Chemistry of PH_3, PCl_3, PCl_5, POCl_3, P_2O_5 and oxy acids of phosphorous (H_3PO_3 and H_3PO_4). General properties of elements of group 16 - Structure and allotropy of elements - chemistry of ozone - Classification and properties of oxides - oxides of sulphur and selenium – Oxy acids of sulphur (Caro's and Marshall's acids). Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI), oxides and oxy acids (HClO_4). Inter-halogen compounds (ICl, ClF_3, BrF_5 and IF_7), pseudo halogens [$(\text{CN})_2$ and $(\text{SCN})_2$] and basic nature of Iodine. Noble gases: Position in the periodic table. Preparation, properties and structure of 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 β elimination reactions – E_1 and E_2 mechanism - factors influencing – stereochemistry – orientation – Hofmann and Saytzeff rules. Reactions of alkenes – addition reactions – mechanisms – Markownikoff's rule, Kharasch effect, oxidation reactions – hydroxylation, oxidative degradation, epoxidation, ozonolysis; polymerization. Alkadienes Nomenclature - classification – isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2 and 1, 4 additions; free radical addition to conjugated dienes– Diels–Alder reactions – polymerisation – polybutadiene, polyisoprene (natural rubber), vulcanisation, polychloroprene. Alkynes Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerisation and isomerisation.

	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 β - 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 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. 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.
Reference Books	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, New Delhi. 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 and e-learning source	https://onlinecourses.nptel.ac.in/http://cactus.dixie.edu/smbblack/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 compounds of s-block elements

CO5: assess the application of hard and soft acids indicators, buffers, compounds of s and p-block elements and hydrocarbons

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

CO-PO Mapping (Course Articulation Matrix)

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

Level of Correlation between PSO&CO

Title of the Course	QUALITATIVE ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS						
Paper No.	Core IV -Practical						
Category	Core	Year	I	Credits	5	Course Code	23UICHP24
		Semester	II				

Instructional hours per week	Lecture	Tutorial	Lab Practice	Total
	-		-	4
Prerequisites	General Chemistry II			
Objectives of the course	This course aims at providing knowledge on - laboratory safety - handling glass wares - analysis of organic compounds - preparation of organic compounds			
Course Outline	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 and halogens 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 - Nitration - picric acid from Phenol - Halogenation - p-bromo acetanilide from acetanilide - Oxidation - benzoic acid from Benzaldehyde - Microwave assisted reactions in water: - Methyl benzoate to Benzoic acid - Salicylic acid from Methyl Salicylate - Rearrangement - Benzil to Benzilic Acid - Hydrolysis of benzamide to Benzoic Acid
	Unit-IV Separation and Purification Techniques (Not for Examination) - Purification of organic compounds by crystallization (from water / alcohol) and distillation - Determination of melting and boiling points of organic compounds. - Steam distillation - Extraction of essential oil from citrus fruits/eucalyptus leaves. - Chromatography (any one) (Group experiment) - Separation of amino acids by Paper Chromatography - Thin Layer Chromatography - mixture of sugars / plant pigments / permanganate dichromate. - Column Chromatography - extraction of carotene, chlorophyll and xanthophyll from leaves / separation of anthracene - anthracene picrate. - Electrophoresis – Separation of amino acids and proteins. (Demonstration) - 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)
Reference Books	- Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. Basic Principles of Practical Chemistry, 2nd ed.; Sultan Chand: New Delhi, 2012. - Manna, A.K. Practical Organic Chemistry, Books and Allied: India, 2018. - 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's Textbook of Practical Organic Chemistry, 5 th ed.; Pearson: India, 1989.	
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences	
Scheme of Valuation	Max. marks(75)	
Record	:10 Marks	
Preparation	:15 Marks	
Recrystallisation	:05 Marks	
Organic Qualitative Analysis	:45 Marks	
Preliminary Test	:05 Marks	
Detection of Elements	:05 Marks	
Detection of Functional Group	:05 Marks	
Identification of the compound	:05 Marks	
Confirmatory Test	:15 Marks	
Derivatives preparation and its m.pt determination	:10 Marks	

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

Title of the Course	ELECTIVE-II						
Paper No.	ALLIED-II (Industrial Chemistry – II)						
Category	Allied	Year	I	Credits	2	Course Code	23UICHE25
		Semester	II				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	1	-		3		
Prerequisites	Industrial chemistry I Practical						
Objectives of the Course	To give insights into chemistry experiments for a beginner						
Course Outline	1. To understand the elaborate study of Fuels Introduction.						
	2. To study the basic concepts and Classification of Coal by Rank.						
	3. To know about the basic concepts of coking and gaseous fuels.						
	4. To have a knowledge of Liquid fuels and Refining of Gasoline.						
Course Outline	5. To know the details of Residual fuel oils, Power alcohol.						
	UNIT-I: FUELS AND COMBUSTION:						
	1.1 Introduction - Classification of Fuels - Calorific Value – Theoretical Calculation of Calorific Value of a Fuel Gross calorific value and net calorific value – Characteristics of a Good Fuel - Solid fuels - Wood.						
	1.2 Coal - Classification of Coal by Rank - Selection of Coal - Analysis of Coal and its significance						
Course Outline	UNIT-II: SOLID AND GASEOUS FUELS:						
	2.1 Types of coking - Types of Carbonization of Coal - Role of Sulphur in Coal - Role of Ash in coal.						
	2.2Gaseous fuels - Producer Gas - Water Gas - Natural Gas – Oil Gas - Biogas - Components - Composition - preparation – advantages - disadvantages and applications of Coal gas - Gobar gas – LPG						
	UNIT-III: LIQUID FUELS:						
Course Outline	3.1 Petroleum-Cracking - Advantages of catalytic cracking over thermal cracking - Synthetic Petrol.						
	3.2Refining of Gasoline – Reforming - Knocking - Octane number of Gasoline - Diesel Engine Fuels - Diesel - Octane number of Diesel Oil - Diesel index.						

	UNIT-IV: RESIDUAL FUEL OILS AND ANALYSIS OF FUELS: 4.1 Asphalt - Aviation fuel - advantages -Kerosene as a fuel. 4.2Analysis and testing of liquid and gaseous fuels - Utilization of fuels - Solar power.
	UNIT V: 5.1 Other sources of energy – Electricity Power - Modern Concept of Fuel - Fuels for Metallurgy. 5.2Power Alcohol - Recent Advances In Fuel Technology. Alternative Fuels – Alcohols – Promising Bio fuel: An Alternative Source to Diesel and Gasoline - Control of Pollution in Refineries.
Extended Professional Component (is apart of internal componentonly, 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. E. Stocchi: 1990, Industrial Chemistry, Vol-I, Ellis Horwood Ltd; UK 2. J. A. Kent, 1997, Riegel's Handbook of Industrial Chemistry, CBS Publishers, 9 th edition, New Delhi. 3. P. C. Jain, M. Jain, Engineering Chemistry, Dhanpat Rai & Sons, 15 th edition, New Delhi. 4. A.K.De, Environmental Chemistry, New Age International Pvt; Ltd; 2 nd edition, New Delhi. 5. S.P. MAHAJAN: Pollution control in process industries, Tata McGraw-Hillpublishing Company Limited, New Delhi.
Reference Books	1. C.k. Varshney: Water Pollution and Management, Wiley Eastern Limited, Chennai. 2. Fundamentals of Industrial Chemistry, 2019, Pharmaceuticals, Polymers, and Business, Rachida El Morabet, in Encyclopedia of Environmental Health, Vol-II (Second Edition), 3 Future industrial coal utilization: forecasts and emerging technological and regulatory issues, J.K. Alderman, in The Coal Handbook: Towards Cleaner Production: Coal Utilisation, 2013.

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

CO1: Describe the types of Calorific Value of Fuels. The Octane number of fuels.

CO2: Demonstrate knowledge acquired in solar power.

CO3: Write down applications of Gaseous fuels.

CO4: Classify Alternative Fuels based on their function.

CO5: Describe the advantages of Residual fuel oil.

	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	ELECTIVE – II (INDUSTRIAL CHEMISTRY PRACTICAL – II)						
Paper No.	Allied Practical – II						
Category	Allied- Practical	Year	I	Credits	1	Course Code	23UICH EP2
		Semester	II				
Instructional hours per week	Lecture	Tutorial		Lab Practice		Total	
	-			2		2	
Prerequisites	Higher Secondary Chemistry Practical						
Objectives of the course	- To enable the learners to apply the principle in total dissolved solids, and suspended solids in the given water sample. - To analyze samples with the best utilization of techniques that provides structural information. - To get in-depth knowledge to determine the acid-neutralizing power of a commercially available antacid tablet. - To understand the principles of standardizing a solution of the base using the analytical technique known as titration. - To know about the practical applications of calcium in chalk - Permanganometry and pH .						
Course Outline	- Estimation of total dissolved solids in the given water sample (TDS) (Only for demonstration) - Estimation of total suspended solids in the given water sample (TSS) (Only for demonstration) . - Determination of total permanent and temporary hardness of water using EDTA. - Determination of acetic acid in commercial vinegar using NaOH. - Determination of alkali content in antacid tablet using HCl. - Estimation of calcium in chalk - Permanganometry.						

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. J.Bessett et al, Text Books of Quantitative Chemical Analysis, 5th edition ELBS, Longmann, UK,1989. 2. Practical Biochemistry- David Plummer-2005, Tata McGraw-Hills Publishing Company. 3. Vogel's textbook of chemical analysis 4. . Practical chemistry - A.O. Thomas - Scientific book centre, Cannonade. 5. Practical chemistry - S. Sundaram - 3 Volumes - S. Viswanathan 6. Vogel's text book of practical organic chemistry – Longman 7. V.V. Eamanujam, inorganic qualitative Analysis.
Reference Books	1. P. C. Jain, M. Jain: Engineering Practaical Chemistry, Dhanpat Rai & Sons, Delhi. 2. R. Gopalan, D. Venkappayya, S. Nagarajan: Engineering Chemistry, Vikas Publications, New Delhi. 3. B. K. Sharma: Engineering Chemistry, Goel Publishing House, Meerut. 4. S. C. Bhatia: Chemical Process Industries, Vol. I & II, CBS Publishers, New Delhi.
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences www.epgpathshala.nic.in www.nptel.ac.in http://swayam.gov.in
Course Outcomes:	Course Outcomes : On Completion of the Practical the students should be able to CO1: Understand the basic concepts of water pollution. CO2: Understand different types of solids in the given water sample. CO3: Understand various environmental factors that effect on water CO4: Analyse different type of model to understand antacid tablet CO5: Educated in various measurements and monitoring techniques of analytical titration.

Scheme of Valuation:

Internal assessment: 25 Marks

External assessment: 75 Marks

Total: 100 Marks

Record: 15 Marks

Procedure: 10 Marks

Error upto

2 % : 50

2.1 – 3 % : 40

3.1 – 4 % : 30

4.1 – 5 % : 20

>5 % : 10

For incomplete or wrong calculation deduction 20 % of total marks scored.

For no calculation deduct 40% of total marks scored.

For each arithmetic error deduct 1 mark.

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

Level of Correlation between PSO's and CO's

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

Level of Correlation between PO's and CO's

Title of the Course	DAIRY CHEMISTRY						
Paper No.	SEC- II						
Category	NME-II	Year	I	Credits	2	Course Code	23UCHEN26
		Semester	II				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	-	-		2		
Prerequisites	Higher secondary chemistry						
Objectives of the course	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.						
Course Outline	UNIT I						
	Composition of Milk Milk-definition-general composition of milk- constituents of milk - lipids, proteins, carbohydrates, vitamins and minerals - physical properties of milk - colour, odour, acidity, specific gravity, viscosity and conductivity -Factors affecting the composition of milk - adulterants, preservatives with neutralizer-examples and their detection- estimation of fat, acidity and total solids in milk.						
	Unit II Processing of Milk Microbiology of milk - destruction of micro - organisms in milk, physico – chemical changes taking place in milk due to processing - boiling, pasteurization – types of pasteurization -Bottle, Batch and HTST (High Temperature Short Time) – Vacuum pasteurization – Ultra High Temperature Pasteurization.						
	UNIT III						
	Major Milk Products Cream - definition - composition - chemistry of creaming process - gravitational and centrifugal methods of separation of cream - estimation of fat in cream. Butter - definition -composition - theory of churning – desi butter - salted butter, estimation of acidity and moisture content in butter. Ghee - major constituents - common adulterants added to ghee and their detection - rancidity - definition - prevention - antioxidants and synergists - natural and synthetic.						

	UNIT IV Special Milk Standardised milk - definition - merits - reconstituted milk - definition - flow diagram of manufacture - Homogenised milk - flavoured milk - vitaminised milk - toned milk - Incitation milk - Vegetable toned milk - humanized milk - condensed milk - definition, composition and nutritive value.
	UNIT V Fermented and other Milk Products Fermented milk products – fermentation of milk - definition, conditions, cultured milk - definition of culture - example, conditions - cultured cream, butter milk - Bulgariious milk -acidophilous milk – YoheerIndigeneous products- khoa and chhena definition - Ice cream -definition-percentage composition-types-ingredients-manufacture of ice-cream, stabilizers emulsifiersandtheirrole-milkpowder-definition-needformakingmilkpowderdryingprocess-types of drying.

Recommended Text	1. K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, first edition, 2006. 2. K. S. Rangappa and K.T. Acharya, Indian Dairy Products, Asia Publishing House New Delhi, 1974. 3. Text book of dairy chemistry, M.P. Mathur, D. Datta Roy, P. Dinakar, Indian Council of Agricultural Research, 1 st edition, 2008. 4. A Text book of dairy chemistry, Saurav Singh, Daya Publishing house, 1 st edition, 2013. 5. Text book of dairy chemistry, P. L. Choudhary, Bio-Green book publishers, 2021.
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Reference Books	1. Robert Jenness and S. Patom, Principles of Dairy Chemistry, S.Wiley, New York, 2005. 2. F.P.Wond, Fundamentals of Dairy Chemistry, Springer, Singapore, 2006. 3. Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi, 1980. 4. P.F.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.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: understand about general composition of milk – constituents and its physical properties. CO 2: acquire knowledge about pasteurization of Milk and various types of pasteurization - Bottle, Batch and HTST Ultra High Temperature Pasteurization.

CO 3: learn about Cream and Butter their composition and how to estimate fat in cream and Ghee

CO 4: explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk. CO 5: have an idea about how to make milk powder and its drying process - types of drying process.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
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
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Level of Correlation between PSO's and CO's

Title of the Course	GENERAL CHEMISTRY -III						
Paper No.	Core V						
Category	Core	Year	II	Credits	5	Course Code	23UICH33
		Semester	III				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		

Prerequisites	General Chemistry – I and II
Objectives of the course	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.
Course Outline	UNIT I 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 the core concepts.

	Unit-II 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.
	UNIT-III Nuclear Chemistry Natural radioactivity - α, β and γ rays; half-life period; Fajan–Soddy group displacement law; Geiger–Nattal rule; isotopes, isobars, isotones, mirror nuclei, iso diaphers; nuclear isomerism; radioactive decay series; magic numbers; units – Curie, Rutherford, Roentgen; nuclear stability - neutron- proton ratio; binding energy; packing fraction; mass defect. Simple calculations involving mass defect and B.E., decay constant and $t_{1/2}$ and radioactive series. Isotopes – uses – tracers – determination of age of rocks by radiocarbon dating. (Problems to be worked out) Nuclear energy; nuclear fission and fusion – major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures.

	UNIT-IV Halogen derivatives Aliphatic halogen derivatives Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions – S_N1, S_N2 and S_Ni 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, Gattermann 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 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. B.R. Puri, L.R. Sharma, M.S. Pathania; <i>Principles of Physical Chemistry</i>, 46th edition, Vishal Publishing, 2020. 2. B.R. Puri, L.R. Sharma and K.C. Kalia, <i>Principles of Inorganic Chemistry</i>, Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009. 3. 4. P.L. Soni and Mohan Katyal, <i>Textbook of Inorganic Chemistry</i>, Sultan Chand & amp; Sons, twentieth edition, 2006. 4. M. K. Jain, S. C. Sharma, <i>Modern Organic Chemistry</i>, Vishal Publishing, fourth reprint, 2003. 5. S.M. Mukherji, and S.P. Singh, <i>Reaction Mechanism in Organic Chemistry</i>, Macmillan India Ltd., third edition, 1994.
Reference Books	1. T. W. Graham Solomons, <i>Organic Chemistry</i>, John Wiley & amp; Sons, fifth edition, 1992. 2. A. Carey Francis, <i>Organic Chemistry</i>, Tata McGraw-Hill Education Pvt., Ltd., New Delhi, seventh edition, 2009. 3. I. L. Finar, <i>Organic Chemistry</i>, Wesley Longman Ltd, England, sixth edition, 1996. 4. P. L. Soni, and H. M. Chawla - <i>Text Book of Organic Chemistry</i>, New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007. 5. J.D. Lee, <i>Concise Inorganic Chemistry</i>, Blackwell Science, fifth edition, 2005.
Website and e-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/104106119 s 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

Title of the Course	INORGANIC QUALITATIVE ANALYSIS						
Paper No.	Core VI						
Category	Core	Year	II	Credits	5	Course Code	23UICHP34
		Semester	III				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	-	3		5		
Prerequisites	General chemistry						
Objectives of the course	To develop the skill on systematic analysis of simple inorganic salts and mixture of salts.						
Course Outline	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)						
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.						
Recommended Text	Reference Books: V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997.						
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences						
Course Learning Outcomes (for Mapping with POs and PSOs)							

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

Title of the Course	INDUSTRIAL CHEMISTRY-III						
Paper No.	ELECTIVE – III						
Category	Core	Year	II	Credits	3	Course Code	23UICHE35
		Semester	III				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4		-		4		
Objectives of the course	• To enable the students' in-depth study of high polymers and mechanisms. • To know the details of the structure, Physical and Mechanical Properties of Polymers. • To understand the concept of Introduction to Rubber and Synthetic rubbers. • To understand the principles of quantum chemistry and Macromolecules. • To enable the learners to acquire knowledge in plastic materials.						
Course Outline	UNIT I: HIGH POLYMERS						
	1.1 HIGH POLYMERS - Introduction - Nomenclature - Classification of Polymers - Homo and hetero chain polymers - Addition polymerization - Condensation polymerization.						
	1.2 Mechanism of Addition Polymerization - Cationic - Anionic polymerization - Free radical and Co-ordination or Ziegler-Natta polymerization.						
Course Outline	Unit-II: PROPERTIES OF POLYMERS						
	2.1 Physical and Mechanical Properties of Polymers - Crystallinity in Polymer - Polymer Reaction.						
	2.2 Polymer structure and properties - Strength, plastic deformation - chemical resistance– Physical state of polymer – Glass Transition Temperature						

	UNIT-III: RUBBER 3.1 Introduction to Rubber– Latex – Processing Latex – Compounding of Rubber - Vulcanizations of Rubber – Degradation stability. 3.2 Synthetic rubbers - Preparation and applications of SBR - Butyl rubber - Nitrile rubber – Neoprene and Silicone rubber. UNIT-IV: PLASTIC MATERIALS 4.1 Plastic Materials – Classification of Plastics (or Resins) - Moulding Constituents of a Plastic- Fabrication techniques used for thermoplastic resin (Moulding process). 4.2 Important thermo plastic Resins – Natural resins - Polyethylene - UNIT-V: RESINS 5.1 Important thermosetting resins - Phenol Formaldehyde Resin or Phenolic Resin –Amino Resins and Plastics - Epoxy Resins - Acrylic Resins and Plastics - Polyester resins. 5.2 Silicone Resins – Silicone fluids – Silicone greases –Polyurethane - Foamed or cellular Plastics.
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TEXTBOOKS: (IN API STYLE)	1. E. Stocchi: 1990, Industrial Chemistry, Vol-I, Ellis Horwood Ltd, London. 2. J. A. Kent, 1997, Riegel's Handbook of Industrial Chemistry, CBS Publishers, 9th edition, New Delhi. 3. P. C. Jain, M. Jain, Engineering Chemistry, Dhanpat Rai & Sons, 15th edition, New Delhi. 4. Practicals and Calculation in Engineering Chemistry ñ S.S. Dara 5. A.K. De, Environmental Chemistry, New Age International Pvt Ltd., 2nd Edition, New Delhi. 6. S.P. Mahajan, Pollution control in process industries, Tata McGraw-Hill publishing Company Limited, New Delhi. ,C.k. Varshney: Water Pollution and Management, Wiley Eastern Limited, Chennai,
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SUPPLEMENTARY READINGS:	1. Michael Ash, Irene Ash, 1998, Encyclopedia of Plastics Polymers and Resins: Chemical Publishing Company, USA. 2. Brydson's Plastics Materials, Eighth Edition. 3. www.umich.edu/~elements/5e/index.html . 4. CRYNES, B. L., and H. S. FOGLER, eds., 1981, <i>AICHE Modular Instruction Series E: Kinetics</i>, Vols. 1 and 2. New York. 5. AUSTIN, G. T., 2018, <i>Shreve's Chemical Process Industries</i>, McGraw Hill, 8th ed. New York.
	Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to 1. Isolate the key design features of a product which relate directly to the material(s) used in its construction. 2. Indicate how the properties of polymeric materials can be exploited by a product designer. 3. Describe the role of rubber-toughening in improving the mechanical properties of polymers. 4. Identify the repeat units of particular polymers and specify the isomeric structures which can exist for those repeat units. 5. Estimate the number- and weight-average molecular masses of polymer samples given the degree of polymerisation and mass fraction of chains present. 6. Students will be able to appraise the mechanism and kinetics of copolymer free radical the synthesis techniques for polymer.

OUTCOME MAPPING:

	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	INDUSTRIAL CHEMISTRY PRACTICAL - III						
Paper No.	Elective-III- Practical – III						
Category	Allied- Practical	Year Semester	II III	Credits	1	Course Code	23UICHEP3
Instructional hours per week	Lecture	Tutorial		Lab Practice	Total		
	-	-		1	1		
Prerequisites	Higher Secondary Chemistry Practical						
Objectives of the course	- To enable the learners to apply the principles of titrimetry to estimate the amount of metal ion present in tablets. - To understand the techniques of permanganometry and complexometry. - To understand the principles of standardizing the solutions used in titrimetry. - To know about the framing capacities of various soaps. - To get in-depth knowledge to determine the amount of calcium present in milk.						
Course Outline	1. Estimation of available chlorine in bleaching powder. 2. Estimation of available calcium in calcium tablet by complexometry 3. Estimation of available zinc in zinc tablet by permanganometry. 4. Estimation of available calcium in milk by complexometry. 5. Estimation of available calcium oxide as lime. Quantitative comparison of foaming capacities of different soaps using washing soda. (Not to be given for exam)						
Course Outcomes:	Course Outcomes: On Completion of the Practical the students should be able to CO1: Understand the principles behind titrimetry. CO2: Understand the principles behind indicator used in complexometry. CO3: Analyse different metals used in tablets. CO4: Educated in the reactions behind Washing soda and soap. CO5: To know the amount of available chlorine in bleaching powder.						

Scheme of Valuation:

Internal: 25 Marks

External: 75 Marks

Record: 10 Marks

Estimation: 65 Marks

Error upto:

2 % : 65 Marks

2 – 3 % : 45 Marks

3 – 4 % : 25 Marks

4 – 5 % : 15 Marks

>5 % : 5 Marks

For incomplete or wrong calculation deduction 20 % of total marks scored.

For no calculation deduct 40% of total marks scored.

For each arithmetic error deduct 1 mark.

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

Level of Correlation between PSO's and CO's

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

Level of Correlation between PSO's and CO's

Title of the Course	ENTREPRENEURIAL SKILLS IN FOOD CHEMISTRY						
Paper No.	SEC IV						
Category	Skill Enhancement Course	Year Semester	II III	Credits	1	Cours eCode	23UICH36-1
Instructional hours per week	Lecture 1	Tutorial -	Lab Practice		Total 1		
Prerequisites	General Chemistry						
Objectives of thecourse	• To learn about food adulterants and food additive • To detect the adulterants in food items • To gain knowledge about the preparation of simple food items and useful products of home appliances • To learn about nutritive values of pulses and cereals • To acquire knowledge about food preservation						
Course Outline	UNIT -I Food Chemistry Food adulteration-contamination of food items with clay stones, waterandtoxicchemicals -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.						

UNIT II

Detection of adulterants in food items like coffee, tea, pepper, chillipowder, turmeric powder, butter, ghee, milk, honey etc., by simple techniques.

UNIT III

Preparation of Jam, squash and Jelly, Gulkand, cottage cheese.

Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, tooth paste/powder and disinfectants in small scale.

UNIT IV

Cereals-Definition-Classification-Composition and Nutritive value- Pulses-Classification-composition-nutritive value-Medicinal value of pulses and cereals

UNIT V

Food Preservation-Definition—Classification-Preservatives- Sodium Benzoate- Benzoic Acid-Sodium Chloride-Methods Of preservation -By heating, Canning and Pasteurisation

Skills acquired from this course	Entrepreneurial skills.				
Recommended Text	1. Negi J.(2016)Food safety and Hygiene.ABD Publishers,India. 2. Food Science (2005) ,B.Srilakshmi,III Edition,New Age International Publishers. 3. Hand Book Of Food And Nutrition- M.Swaminathan- Bangalore Printing and Publishing Co.ltd; Bangalore				
Reference Books	Shyam Jha, Rapid detection of food adulterants and contaminants(Theory and Practice),Elsevier, e Book ISBN 9087128004289, 1 st Edition,2015				
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					
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.					
CO4: explain food preservation					
CO5: gain knowledge about cereals and pulses					
CO /PSO	PSO 1	PSO 2	PSO 3	PSO 4	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

Title of the Course	PESTICIDE CHEMISTRY						
Paper No.	Skill Enhancement Course V (Discipline specific)						
Category	Skill Enhancement Course	Year	II	Credits	2	Course Code	23UICH36-2
		Semester	III				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	-	-		2		
Prerequisites	Fundamentals in chemistry						
Objectives of the course	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.						
Course Outline	Unit I 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.						
	Unit II 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.						

	Unit III 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.
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. Handa SK. Principles of pesticide chemistry. Agrobios (India); 2012. 2. Matolcsy G, Nádas M, Andriská 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. Cremling: Pesticides, John Wiley.
Reference Books	1. Roy N. K., Chemistry of Pesticides. CBS Publisher & Distributors P Ltd; 1st Ed. (2010). 2. Nollet L.M., Rathore H.S., Handbook of pesticides: methods of pesticide residues analysis. CRC press; 2016. 3. Ellerbrock R.H., Pesticide Residues: Significance, Management and Analysis, 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 of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

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

Level of Correlation between PO's and CO's

Title of the Course	GENERAL CHEMISTRY-IV						
Paper No.	Core VII						
Category	Core	Year	II	Credits	5	Course Code	23UICH43
		Semester	IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	5	-	-		5		
Prerequisites	General Chemistry III						
Objectives of the course	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						
Course Outline	UNIT I 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 (C_p & C_v); Joule Thomson effect- inversion temperature. Thermochemistry - heats of reactions, standard states; types of heats of reactions and their applications; effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions; Hess's law and its applications; determination of bond energy; Measurement of heat of reaction – determination of calorific value of food and fuels Zeroth law of thermodynamics-Absolute Temperature scale.
	Unit II Thermodynamics II Second Law of thermodynamics - Limitations of first law, spontaneity and randomness; Carnot's cycle; Concept of entropy, entropy change for reversible and irreversible processes, entropy of mixing, calculation of entropy changes of an ideal gas and a van der Waals gas with changes in temperature, volume and pressure, entropy and disorder. Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application. Third law of thermodynamics - Nernst heat theorem; Applications of third law - evaluation of absolute entropies from heat capacity measurements, exceptions to third law.
	UNIT III General Characteristics of d-block elements Transition Elements- Electronic configuration - General periodic trend variable valency, oxidation states, stability of oxidation states, colour, magnetic properties, catalytic properties and tendency to form complexes. Comparative study of transition elements and non transition elements – comparison of II and III transition series with I transition series. Group study of Titanium, Vanadium, Chromium, Manganese, Iron, Cobalt, Nickel and Zinc groups
	UNIT IV Ethers, Thio ethers and Epoxides Nomenclature, isomerism, general methods of preparations, reactions involving cleavage of C-O linkages, alkyl group and ethereal oxygen. Zeisel's method of estimation of methoxy group.

	Reactions of epoxides with alcohols, ammonia derivatives and LiAlH_4 Thioethers - nomenclature, structure, preparation, properties and uses. Aldehydes and Ketones Nomenclature, structure and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. Nucleophilic addition reactions, base catalysed reactions with mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes. Baeyer - Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf - Kishner reduction, Meerwein - Ponnordorf Verley reduction, reduction with LiAlH_4 and NaBH_4. 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, Hunsdiecker reaction. 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. Schotten-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, aldehydic and ketonic acids, ethylene glycol, aldol acetaldehyde; reactions – action of heat on α, β and γ 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, <i>Principles of Physical Chemistry</i>, Shoban Lal Nagin Chand and Co., thirty three edition, 1992. 2. K. L. Kapoor, <i>A Textbook of Physical chemistry</i>, (volume-2 and 3), Macmillan, India Ltd, third edition, 2009. 3. P.L. Soni and Mohan Katyal, <i>Textbook of Inorganic Chemistry</i>, Sultan Chand & Sons, twentieth edition, 2006. 4. M. K. Jain, S. C. Sharma, <i>Modern Organic Chemistry</i>, Vishal Publishing, fourth reprint, 2003. 5. S.M. Mukherji, and S.P. Singh, <i>Reaction Mechanism in Organic Chemistry</i>, Macmillan India Ltd., third edition, 1994.
ReferenceBooks	1. Maron, S. H. and Prutton C. P. <i>Principles of Physical Chemistry</i>, 4thed.; The Macmillan Company: Newyork, 1972. 2. Lee, J. D. <i>Concise Inorganic Chemistry</i>, 4th ed.; ELBS William Heinemann: London, 1991. 3. Gurudeep Raj, <i>Advanced Inorganic Chemistry</i>, 26thed.; Goel Publishing House: Meerut, 2001. 4. Atkins, P.W. & Paula, J. <i>Physical Chemistry</i>, 10th ed.; Oxford University Press: New York, 2014. 5. Huheey, J. E. <i>Inorganic Chemistry: Principles of Structure and Reactivity</i>, 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 acids and hydroxyl acids.	

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

CO-PO Mapping (Course Articulation Matrix)

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

Level of Correlation between PSO's and CO's

Title of theCourse	PHYSICAL CHEMISTRY PRACTICAL – I						
Paper No.	Core VIII						
Category	Core	Year	II	Credits	5	Course Code	23UICHP44
		Semester	IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	4		5s		
Prerequisites	General Chemistry						
Objectives of the course	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						
Course Outline	UNIT-I 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 catalysed inversion of cane sugar UNIT II Phase diagrams 1. Simple eutectic - determination of eutectic temperature and composition of naphthalene-diphenyl amine or naphthalene-diphenyl system 2. Determination of transition temperature of a salt hydrate. 3. Determination of concentration of sodium chloride using phenol-sodium chloride system
	UNIT III 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
	UNIT IV 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 acetic acid on activated charcoal
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Reference Books	1. Sindhu, P.S. <i>Practicals in Physical Chemistry</i>, Macmillan India : New Delhi, 2005. 2. Khosla, B. D. Garg, V. C.; Gulati, A.; <i>Senior Practical Physical Chemistry</i>, R. Chand : New Delhi, 2011. 3. Gupta, Renu, <i>Practical Physical Chemistry</i>, 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 electrochemistry, kinetics for carrying out the practical work. CO4: demonstrate laboratory skills for safe handling of the equipment and chemicals	

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

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

Level of Correlation between PSO's and CO's

Title of the Course	INDUSTRIAL CHEMISTRY-IV						
Paper No.	Elective-IV						
Category	Allied	Year	II	Credits	2	Course Code	23UICHE45
		Semester	IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	1	-		3		
Objectives of the course	- To enable the learners to learn the principle of corrosion, galvanic corrosion, and its control. - To enable the students' in-depth study of metals and alloys, factors influencing corrosion. - To know the details of protective coatings. - To Provide an introduction to theory of Colour, classification of Inorganic pigments and its reaction chemistry, synthesis and its application. Understand the principles of chemical conversion, paints, and pigments. - To enable the learners to acquire knowledge in electrical insulating materials.						
Course Outline	UNIT-I: CORROSION AND ITS CONTROL 1.1 Introduction - Economic aspects of corrosion - Dry or Chemical Corrosion - Wet or electrochemical corrosion - Mechanism of Electrochemical Corrosion. Galvanic Corrosion - Concentration Cell Corrosion - Differential aeration corrosion - Pitting Corrosion - Underground or soil corrosion - Passivity.						
	UNIT-II: FACTORS INFLUENCING CORROSION 2.1 Microbiological Corrosion, Atmospheric corrosion – Corrosion Control - Proper designing - Using pure metal - Using metal alloys. 2.2 Chemical conversion – Coating - Phosphating - Chromising - Treatment of metal surfaces hot dipping - Use of inhibitors.						
	UNIT-III: PROTECTIVE COATINGS 3.1 Introduction - Metallic Coatings - Various methods of cleaning articles before electrode position – Electroplate and - Electroplating methods. 3.2 Pre-treatment of the surface – Metallic Coatings - Hot Dipping - Cementation or Impregnated Coatings - Sprayed Metal Coatings - Cladding – Vapour Deposition.						

	UNIT-IV: PAINTS 4.1 Ingredients and their functions Required Properties of Paint, Constituents and their Functions - Manufacturer of Paint. 4.2 Types of Pigments - Characteristics of pigment - Oils - Uses in Paint Emulsion Paints – Special Paints - Paint Remover Varnishes. UNIT-V: ELECTRICAL INSULATING MATERIALS 5.1 Dielectric properties - Requirements of an Electrical Insulating Material - Classification of insulating material - Electrical Rigid Insulations. 5.2 Semiconductors - Introduction - Classification – Degenerate semiconductors – Superconductors.
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TEXTBOOKS: (IN API STYLE)	1. E. Stocchi: 1990, Industrial Chemistry, Vol-I, Ellis Horwood Ltd, London. 2. J. A. Kent, 1997, Riegel's Handbook of Industrial Chemistry, CBS Publishers, 9th edition, New Delhi. 3. P. C. Jain, M. Jain, Engineering Chemistry, Dhanpat Rai & Sons, 15th edition, New Delhi. 4. A.K. De, Environmental Chemistry, New Age International Pvt Ltd., 2nd edition, New Delhi. 6. S.P. Mahajan, Pollution control in process industries, Tata McGraw-Hill Publishing Company Limited, New Delhi. 7. C. K. Varshney: Water Pollution and Management, Wiley Eastern Limited, Chennai.
SUPPLEMENTARY READINGS:	6. Felder R. M., and Rousseu R. W., 2000, <i>Elementary Principles of Chemical Processes</i>, Wiley Publications, 3rd Edition, New York. 7. Sanders R. J., 1976, <i>The Anatomy of Skiing</i>. Denver, CO: Golden Bell Press, New Delhi. 8. Crynes B. L., Fogler H. S., 1981, <i>AIChE Modular Instruction Series E: Kinetics</i>, Vols. 1 and 2., New York. 9. Austin G. T., 1984, <i>Shreve's Chemical Process Industries</i>, McGraw-Hill, 5th Edition, New York

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

7. Develop the availability of source, classification, modification of vegetable oils and its application in surface coating industry.
8. Understand Chemistry, Properties and Applications of White pigments like Titanium Dioxide, Zinc Oxide etc.
9. Understanding of various modern engineering materials and their properties.
10. Understanding of Principles of coating deposition and surface modification methods.
11. Appraisal of the Fundamental coating properties and their relationship - Introduction to corrosion and wear protection, and various functionalities obtainable by coatings and surface treatments.

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
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Level of Correlation between PSO's and CO's**OUTCOME MAPPING:**

	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

Title of the Course	INDUSTRIAL CHEMISTRY PRACTICAL - IV						
Paper No.	Elective-IV						
Category	Allied- Practical	Year	II	Credits	2	Course Code	23UICHEP4
		Semester	IV				
Instructional hours per week	Lecture	Tutorial		Lab Practice		Total	
	-	-		2		2	
Prerequisites	Higher Secondary Chemistry Practical						
Objectives of the course	• To enable the learners to learn the principle of pH meter • To analyse various sample of water to determine COD • To analyse water samples to determine metal ions by using calorimeter • To have a knowledge about viscosity and to know the principles behind the viscometer • To understand the principles of paper chromatography						
Course Outline	1. Determination of viscosity of the given sample by Ostwald viscometer. 2. Estimation of pH of given soil sample using pH meter. 3. Estimation of conductance of given soil sample using conductivity meter. 4. Estimation of chromium present in the given water sample – photo calorimeter. 5. Estimation of R_f Value of glycine using ninhydrin – paper chromatography. 6. Determination of COD in water sample.						
Course Outcomes:	Course Outcomes: On Completion of the Practical the students should be able to CO1: <i>Understand the estimation of metals using calorimeter</i> CO2: <i>Understand the basic concepts of pH meter</i> CO3: <i>Understand about acidity/alkalinity of soil sample</i> CO4: <i>Understand about COD in water samples</i> CO5: <i>Understand about R_f values of amino acids.</i>						

sScheme of Valuation:

Internal: 25 Marks

External: 75 Marks

Record: 10 Marks

Estimation: 65 Marks

Error upto:

2 % : 65 Marks

2 – 3 % : 45 Marks

3 – 4 % : 25 Marks

4 – 5 % : 15 Marks

>5 % : 5 Marks

For incomplete or wrong calculation deduction 20 % of total marks scored.

For no calculation deduct 40% of total marks scored.

For each arithmetic error deduct I mark.

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

Level of Correlation between PSO's and CO's

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

Level of Correlation between PSO's and CO's

Title of the Course	INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS						
Paper No.	SEC V (Discipline specific)						
Category	Skill Enhancement Course	Year	II	Credits	2	Course Code	23UICHS46-1
		Semester	IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	-	-		2		
Prerequisites	General Chemistry						
Objectives of the course	The course aims at providing an overall view of the • 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
Course Outline	UNIT-I 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. UNIT II 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. UNIT III UV-Visible and IR Spectroscopy Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy 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. UNIT IV 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. 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, 6th edn., 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, 5th edn., 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

Title of the Course	FORENSIC SCIENCE						
Paper No.	SEC-V (Discipline Specific)						
Category	Skill Enhancement Course	Year	II	Credits	2	Course Code	23UICHS46-2
		Semester	IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	2	-	-		2		
Prerequisites	General Chemistry						
Objectives of the course	This course aims at giving an overall view of • Crime detection through analytical instruments • Forgery and its detection • Medical aspects involved						
Course Outline	UNIT I 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.						
	Unit-II Crime Detection Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human bombs - possible explosives (gelatin sticks and RDX) - metal detector devices and other security measures for VVIP-composition of bullets and detecting powder burns.						
	UNIT-III 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.						
	UNIT-IV 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. UNIT-V 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.
Recommended Text	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 and e-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 dead organisms and also get information about Postmortem.

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

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

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

CO 5: get the awareness on Aids - causes and prevention and also have an exposure on

	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	ORGANIC CHEMISTRY - I						
Paper No.	Core IX						
Category	Core	Year	III	Credits	4	Course Code	23UINCC51
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		
Prerequisites	General Chemistry I,II, III and IV						
Objectives of the course	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 nitro compounds and amines • Preparation of different dyes, food colour and additives • Preparation and properties of five membered heterocycles like pyrrole, furan and thiophene • Preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline.						
Course Outline	UNIT I 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.						

UNIT II**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, physical properties; 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, carbylamine reaction, Mannich reaction, oxidation, basicity of amines.
	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 - aliphatic and aromatic Diazonium compounds Diazomethane, Benzene diazonium chloride - preparations and synthetic 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 - aromatic character 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 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, Vishal Publishing, fourth reprint, 2009. 2.S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, 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, Pearson Education, 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 Education Pvt. Ltd., New Delhi, seventh edition, 2009. 4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, sixth edition, 2006. 5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, Fifth Edition, 2010.
Website and e-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 of ethane and butane. CO2: explain preparation and properties of aromatic and aliphatic nitro compounds and amines CO3: explain colour and constitution of dyes and food additives CO4: discuss preparation and properties of five membered heterocycles like pyrrole, furan and 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

Title of the Course	INORGANIC CHEMISTRY -I						
Paper No.	Core X						
Category	Core	Year	III	Credits	4	Course Code	23UICH52
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		
Prerequisites	General Chemistry I , II, III and IV						
Objectives of the course	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						
Course Outline	UNIT I 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 of hardness of water using EDTA, metal ion indicators. Role of metal chelates in living systems – haemoglobin and chlorophyll						
	Unit II 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 $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ - 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.						

	UNIT III 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
	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 (polyphosphazenes and polyphosphonitrilic 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, 31th Edition, 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, ELBS William 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) <u>Inorganic Chemistry for Undergraduates</u>, Ist Edition, University Press (India) Private Limited, Hyderabad 3. Sivasankar B, (2013) <u>Inorganic Chemistry</u>. Ist Edition, Pearson, Chennai 4. Alan G. Sharp (1992), <u>Inorganic Chemistry</u>, 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

Title of the Course	PHYSICAL CHEMISTRY -I						
Paper No.	Core XI						
Category	Core	Year	III	Credits	4	Course Code	23UICH53
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		
Prerequisites	General Chemistry I,II,III and IV						
Objectives of the course	The course aims at providing an overall view of • Gibbs free energy, Helmholtz free energy, Ellingham’s diagram and partial molar properties • Chemical kinetics and different types of chemical reactions • Adsorption, homogeneous and heterogeneous catalysis • Colloids and macromolecules • Photochemistry, fluorescence and phosphorescence						
Course Outline	UNIT I 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.						

	UNIT II Chemical Kinetics Rate of reaction - Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction - rate equation - order of reaction. order and molecularity of simple and complex reactions, Rate laws - Rate constants – derivation of rate constants and characteristics for zero, first order, second and third order (equal initial concentration) – Derivation of time for half change with examples. Methods of determination of order of Volumetry, manometry and polarimetry. Effect of temperature on reaction rate – temperature coefficient - concept of activation energy - Arrhenius equation. Theories of reaction rates – Collision theory – derivation of rate constant of bimolecular gaseous reaction – Failure of collision theory. Lindemann's theory of unimolecular reaction. Theory of absolute reaction rates – Derivation of rate constant for a bimolecular reaction – significance of entropy and free energy of activation. Comparison of collision theory and ARRT. Complex reactions – reversible and parallel reactions (no derivation and only examples) – kinetics of consecutive reactions – steady state approximation.
	UNIT III Adsorption – Chemical and physical adsorption and their general characteristics- distinction between them Different types of isotherms – Freundlich and Langmuir. Adsorption isotherms and their limitations – BET theory, kinetics of enzyme catalysed reaction –Michaelis- Menten and Briggs- Haldene equation – Lineweaver- Burk plot – inhibition – reversible – competitive, noncompetitive and uncompetitive (no derivation of rate equations) Catalysis – general characteristics of catalytic reactions, auto catalysis, promoters, negative catalysis, poisoning of a catalyst – theories of homogenous and heterogeneous catalysis – Kinetics of Acid – base and enzyme catalysis. Heterogeneous catalysis
	UNIT IV Colloids and Surface Chemistry Colloids: Types of Colloids, Characteristics Colloids (Lyophilic and Lyophobic sols), Preparation of Sols- Dispersion methods, aggregation methods, Properties of Sols- Optical properties, Electrical properties - Electrical double layer, Electro Kinetic properties- Electro-osmosis, Electrophoresis, Coagulation or precipitation, Stability of sols, associated colloids, Emulsions, Gels-preparation of Gels, Applications of colloids

	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 $\text{H}_2\text{-Cl}_2$, $\text{H}_2\text{-Br}_2$ and $\text{H}_2\text{-I}_2$ 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 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. 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 eleventh edition, 2018. 3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 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, Oxford University 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 and Ellinghams	
CO2: apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction, demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation.	
CO3: compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogenous and heterogeneous catalysis.	
CO4: demonstrate the types and characteristics of colloids, preparation of sols and emulsions, 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

Title of the Course	PROJECT WITH VIVA VOCE						
Paper No.	Core XII						
Category	Core	Year	III	Credits	4	Course Code	23UICHD54
		Semester	V				
Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total			
		1	4	5			

(Refer to the Regulations)

Title of the Course	BIOCHEMISTRY						
Paper No.	EC V						
Category	Elective	Year	III	Credits	3	Course Code	23UICHE55-1
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	3	1	-		4		
Prerequisites	Organic Chemistry - I						
Objectives of the	The course aims at providing knowledge on						

course	• 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
Course Outline	UNIT I 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. UNIT II 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. UNIT III 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. 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 (No structure 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 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. Bahl, B. S.; Bhal, A. <i>Advanced Organic Chemistry</i>, 3rd ed.; S. Chand: New Delhi, 2003. 2. Jain, M.K.; Sharma, S.C. <i>Modern Organic Chemistry</i>, Vishal Publications: New Delhi, 2017. 3. Shanmugam, A. <i>Fundamentals of Biochemistry for Medical Students</i>, 6th ed.; Published by the author, 1999. 4. Veerakumari, L. <i>Biochemistry</i>, 1st ed.; MJP Publications: Chennai, 2004. 5. Jain, J. L.; <i>Fundamentals of Biochemistry</i>, 2nd ed.; S.Chand: New Delhi, 1983.
Reference Books	1. Conn, E. E.; Stumpf, P. K. <i>Outline of Biochemistry</i>, 5th ed.; Wiley Eastern: New Delhi, 2002. 2. West, E. S.; Todd, W. R.; Mason, H. S.; Van Bruggen, J. T. <i>Text Book of Biochemistry</i>, 4th ed.; Macmillan: New York, 1970. 3. Lehninger, A. L. <i>Principles of Biochemistry</i>, 2nd ed.; CBS Publisher: Delhi, 1993. 4. Rastogi, S. C. <i>Biochemistry</i>, 2nd ed.; Tata McGraw-Hill: New Delhi,

	2003. 5. Chatterjea, M. N.; Shinde, R. <i>Textbook of Medical Biochemistry</i> , 5 th ed.; 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 blood coagulation CO2: explain synthesis and properties of amino acids, determination of structure of peptides and proteins CO3: explain factors influencing enzyme activity and vitamins as coenzymes CO4: explain RNA and DNA structure and functions CO5: explain biological significance of simple and compound lipids	

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

Level of Correlation between PSO's and CO's

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

Level of Correlation between PO's and CO's

Title of the Course	GREEN CHEMISTRY						
Paper No.	EC V						
Category	Elective	Year	III	Credits	3	Course Code	23UICHE55-2
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	3	1	-		4		
Prerequisites	Organic Chemistry-I						
Objectives of the Course	The course aims at providing knowledge on 1. To know the basics of Green Chemistry and its developments. 2. To know the principles of green chemistry. 3. To know the goals of Green Chemistry. 4. To understand Limitations of green chemistry. 5. To study the obstacles in the pursuit of the goals of Green Chemistry.						
Course Outline	UNIT-I: GREEN CHEMISTRY – INTRODUCTION HOURS: 9 Need for green chemistry – principles of green chemistry – atom economy – definition with example (ibuprofen synthesis) – green oxidant – hydrogen peroxide. Microwave assisted organic synthesis – apparatus required – examples of MAOS (synthesis of fused anthroquinones, Leukart reductive amination of ketones) – advantages and disadvantages of MAOS. Organic reactions by sonication method – apparatus required – examples of sonochemical reactions (Heck, Hundsdiecker and Wittig reactions). UNIT-II: PRINCIPLES OF GREEN CHEMISTRY HOURS: 9 Twelve principles of Green Chemistry with their explanations and special emphasis on the following with examples: Designing a Green Synthesis using these principles; Prevention of Waste/byproducts, maximum incorporation of the materials used in the process into the final products, Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions. UNIT-III: GREEN REACTIONS HOURS: 9 Acetylation of primary amine, base catalyzed aldol condensation (synthesis of dibenzalpropanone), halogen addition to C=C bond (bromination of trans-stilbene), [4+2] cycloaddition reaction						

	(Diels-Alder reaction between furan and maleic acid). Electrophilic aromatic substitution reactions (nitration of phenol, bromination of acetanilide) – green oxidation reactions (synthesis of adipic acid, preparation of manganese (III) acetylacetonate) – zeolite catalyzed Friedel-Crafts acylation.
	UNIT-IV: GREEN SOLVENTS HOURS: 9 Ionic liquids: simple preparation – types – properties and application – ionic liquids in organic reactions (Heck reaction, Suzuki reactions, epoxidation), industrial (battery) and analytical chemistry (matrices for MALDI-TOF MS, gas chromatography stationary phases – advantages and disadvantages. Super critical CO₂ – preparation, properties, applications and environmental impact.
	UNIT-V: FUTURE TRENDS IN GREEN CHEMISTRY HOURS: 9 Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; co crystal controlled solid state synthesis (C²S³); Green chemistry in sustainable development.
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 UPS C/JAM/TNPSC other 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	R. Sanghi and M.M. Srinivastava, Green Chemistry: Environmental alternatives, Narosa Publishing House, New Delhi. 2. V.K. Ahluwalia, M. Kidwai, 2007, New Trends in Green Chemistry, Anamaya Publishers, 2nd Edition, New Delhi.

Reference Books	1. P. Tundo, A. Perosa, F. Zechini, 2007, Methods and Reagents for Green Chemistry, John Wiley & Sons Inc., New Jersey. 2. Ahluwalia, Kidwai, 2005, New Trends in Green Chemistry, Anamalaya Publishers, Puducherry. 3. Anastas P.T. Warner J.K. 1998, Green Chemistry -Theory and Practical, University 4. Press, London. 5. Cann M.C., Connely M.E., 2000, World Cases in Green Chemistry, American Chemical Society, Washington. 6. Ryan, M.A. and Tinneland, 2002, Introduction to Green Chemistry, American Chemical Society, Washington.
Website and e-learning source	1. https://www.epa.gov/greenchemistry/basics-green-chemistry 2. https://www.sciencedozer.com/2021/01/green-solvents-definition-examples-types-of-green-solvents.html 3. https://www.organic-chemistry.org/topics/green-chemistry.shtm
Course Learning Outcomes (for Mapping with Pos and PSOs) On completion of the course the students should be able to CO1: Able to understand the need of green chemistry. CO2: Able to explain the principles of green chemistry. CO3: Able to explain green synthesis and reactions. CO4: Able to understand about green solvents. CO5: Able to explain the future trends in green chemistry.	

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

Level of Correlation between PSO's and CO's

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3

CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

Title of the Course	AGRICULTURAL CHEMISTRY						
Paper No.	EC V						
Category	Elective	Year	III	Credits	3	Course Code	23UICHE55-3
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	3	1	-		4		
Prerequisites	General Chemistry						
Objectives of the Course	The course aims at providing knowledge on • Importance of agricultural chemistry • Role of fertilizers • Effect of fertilizers and manures • Pesticides • Fungicides and herbicides						
Course Outline	UNIT I: Soil science Soil-Definition of soil, Properties of soil – Physical Property Components – Soil Structure and texture. Soil water, Soil air and Soil temperature .Chemical properties – Soil mineral matter – Soil colloid, ion- Exchange reactions – Soil fertility and its evaluations, Soil organic matter and their transformation into soil. Soil reactions – Soil pH – soil acidity and buffer action .						
	UNIT II: Fertilizers Fertilizers-Primary nutrients -Nitrogen fertilizers: Effect of Nitrogen on plant growth and development. deficiency of nitrogenous fertilizers classification – of nitrogenous fertilizers – Nitrates, urea and cyanamide. Commercial method of preparing urea. Phosphate fertilizers: Effect of phosphorus on plant growth and development – kinds of phosphate fertilizers – Super phosphate – Bone meal – basic slag – rock phosphate – dicalcium phosphate – tricalcium phosphate and other phosphates – Manufacture of super phosphate.						
	UNIT III Fertilizers And Manures Potassium fertilizers: function of potassium on plant growth and development – classification into chloride and nonchloride forms manufacturing processes and properties of potassium fertilizers. Complex fertilizers and mixed fertilizers: their manufacture and composition. Secondary nutrients – micronutrients – their function in plants – materials containing micronutrients. Manures: bulky organic manures – Farm yard manure handling and storage – method of composting green manuring, concentrated organic manures and their chemical composition – oil cakes Blood meal – fish manures.						
	UNIT IV Pesticides And Insecticides Pesticides: Classification of Pesticides – mode of action – general methods of application and toxicity, safety measures when using pesticides. Insecticides: plant products – Nicotine, pyrethrum, rotenone, and petroleum						

	oils, Inorganic pesticides – arsenical fluorides, borates. Organic pesticides – organochlorine compounds – D.D.T. B.H.C., methoxychlor, chlordane, and endosulfon UNIT V Fungicides And Herbicides: Fungicides Inorganic – Sulphur compounds – Copper compounds – Mercuric compounds Organic – dithiocarbamates – Dithane, Bordeaux mixture. Herbicides: Inorganic herbicides – Arsenical compounds Boron compounds – Cyanamide – Cyanides and thiocyanates chlorates and sulphamates. Organic herbicides and Nitro – compounds – chlorinated compounds – 2,4D compounds – Propionic and acid derivatives – urea herbicides.
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 UPS C/JAM/TNPSC other 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. Nelson S.L., Beaton, W.L. Tisdale J. D, 1990, Soil Fertility and Fertilizers, Macmillan Publishing Company, New York. 2. Buchel K.H., 2008, Chemistry of Pesticides, John Wiley & Sons, New York.
Reference Books	1. N.C. Brady, 1984, The Nature and properties of soils, Eurasia publishing House (P) Ltd., 9th Edition 2. U.S. Jones, 1987, Fertilizers and soil Fertility Prentice, Hall of India, 2nd Edition, New Delhi. 3. A.K. De, Environmental Chemistry, New Age International Pvt Ltd., 2nd Edition, New Delhi.
Web site and e-learning source	1. https://en.wikipedia.org/wiki/Soil_science 2. https://www.britannica.com/topic/fertilizer 3. https://opjsrgh.in/Content/Worksheet/PRACTICE-WS/2021-2022/day32/12-AGRICULTURE.pdf 4. https://byjus.com/chemistry/pesticides/ 5. https://extension.psu.edu/fungicides-herbicides-and-insecticides

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

CO1: Understand the basics of soil.

CO2: Classify and explain plant nutrients and fertilizers

CO3: Differentiate fertilizers and manures.

CO4: Explain the classification of pesticides

CO5: Describe the Fungicides and herbicides

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

Level of Correlation between PSO's and CO's

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

Level of Correlation between PO's and CO's

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Title of the Course	TEXTILE CHEMISTRY						
Paper No.	Elective - VI						
Category	Elective	Year	III	Credits	3	Course Code	23UICHsE56-1
		Semester	V				
Instructional hours per week	Lecture	Tutorial		Lab Practice		Total	04 Hours
	3	1		-		4	
Prerequisites	General chemistry						
Objectives of the course	This course aims to provide a piece of comprehensive knowledge: To enable the learners. - To know the basics of fibers. - To realize the properties of fibers. - To learn the processing of fibers. - To understand the dye chemistry. - To learn the dyeing process						
Course Outline	UNIT - I INTRODUCTION TO FIBRES General Classification of Fibers – Chemical structure – Production – Properties – Count, Denier, Tex, Staple Length, Spinning Properties, Strength, Elasticity, and Creep. Applications of the following Natural Cellulose Fibers (Cotton and Jute). Natural Protein Fibers (Wool and Silk) – General characters						
	UNIT-II PROPERTIES OF FIBRES Chemical Structure, Production, and Properties of Synthetic Fibers – Man-made Cellulose Fibers (Rayon and Modified cellulose fibers). Polyamide Fibers (Different types of Nylons) - Preparation – Nylon degradation – Polyester Fibers – Preparation - Degradation – Polyacrylonitrile fiber - Preparation and Properties – Viscose fiber - Preparation and Properties. Identification tests for Cellulose, Cotton, Wool, Silk, Rayon, Acrylic, Viscose, Polyamide and Polyester Fibers						
	UNIT-III PROCESSING OF FIBERS Impurities in Raw Cotton and Grey Cloth, Wool, and Silk. General principles of the Removal, Scouring - Purpose, Alkali Scouring and Acid Scouring – Bleaching (Methods - Hypochlorite, Peroxide, and Bleaching Powder) - Desizing (Hydrolytic and Enzymatic), Kier Boiling and Chemicking. Dyeing of Polyester and Blends – Functions of Dispersing agents - Fiber swelling – Carrier dyeing - High temperature dyeing - Selection of dyestuff.						

	UNIT-IV DYE CHEMISTRY Colour and Constitution – A general treatment – Chromophores – Auxochromes - Bathochromes and Hypso-chromes. Classification of dyes – Acidic, Basic, Direct, Mordant, Azoic, Ingrain, Vat, and Reactive Dyes - Classification as per Chemical constitution – Azo dyes – Triphenyl Methane Dyes, Phthalein Dyes, Indigo and Anthraquinone Dyes. Structure, Preparation and Uses – Methyl Orange, Phenolphthalein and Malachite Green.
	UNIT-V: DYEING PROCESS Dyeing - Dyeing of Wool and Silk – Fastness properties of dyed materials. Dyeing of Nylon, Terylene and other Synthetic Fibers – Finishing – Finishes given to Fabrics – Mechanical finishes on Cotton, Wool and Silk. Method used in process of Mercerizing – Anticrease and Antishrink finishes – Water Proofing.
Extended Professional Component (is a part of the 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. F. Sadov, M. Horchagin and A. Matetshy, 1973, Chemical Technology Of Fibrous Materials, Mir Publishers, 1st edition, Moscow. 2. R. H. Peters, 1963, Textile Chemistry-Vol-II, Elsevier, 1st Edition, New York.
Reference Books	1. E.R.Trotman, Dyeing and Chemical Technology of Textile Fibres Charles, Griffin & Co Ltd, London. 2. V.A.Shenai, Chemistry of dyes & Principles of Dyeing, Sevak Publications, Chennai. 3. E. R. Trotman, Scouring and Bleaching, Charles Griffin & Co Ltd., London.
Website and e-learning source	www.epgpathshala.nic.in www.nptel.ac.in http://swayam.gov.in
Course Outcomes: At the end of the course student will be able to CO1: Understand the basics of fibers. CO2: Realize the properties of fibers CO3: Describe the processing of Fibers CO4: Explain the dye chemistry CO5: Describe the dyeing process	

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Title of the Course	“C “ LANGUAGE AND CHEMISTRY						
Paper No.	EC-VI						
Category	Elective	Year	III	Credits	3	Course Code	23UICHE56-2
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	3	1	-		4		
Prerequisites	Computer Literacy Programme & Basic Knowledge In Computers						
Objectives of the Course	The course aims at providing knowledge on						
	1. To acquire knowledge about the basic components of a computer and the operating system. 2. To understand Hardware and Software. 3. To understand Algorithm and Flowchart. 4. To familiarize the students in C language. 5. To understand the applications of computer software in Chemistry.						
Course Outline	UNIT – I: BASIC COMPUTER ORGANISATION HOURS: 9 1.1 Basic Computer Organisation -Types Of Data-Simple model Of A Computer-Data Processing Using A Computer ,Desktop Computer. 1.2 Input Unit, Output Unit, Data Storage: Random Access Memory, Read Only memory, Secondary Storage, Central Processing Unit. 1.3 Computer Software-programming Languages- Classification Of Programming languages based on Applications-Planning The Computer Program- algorithm and Flowcharts. UNIT – II: INTRODUCTION TO C PROGRAMMING HOURS:9 2.1Introduction to C Language –Introduction-C Compiler-Preprocessor Directives. 2.3Variables, Constants, Operators, Input and Output Functions. UNIT – III: CONTROL STRUCTURES HOURS: 9 3.1 Control Structures –Conditional, Looping, Goto, Break, Switch and Continue Statements, 3.2 Functions, Arrays and Pointers.						

	UNIT – IV: APPLICATIONS IN CHEMISTRY-I 4.1 Calculation of the Radius of the first Bohr orbit for an Electron. 4.2 Calculation of Half-life Time for an integral order reaction- Calculation of Molarity, Molality and Normality of a solution. 4.3 Calculation of Pressure of Ideal Gases and Vander Waal's gases- Calculation of Electronegativity of an Element using Pauling's relation.
	UNIT – V: APPLICATIONS IN CHEMISTRY-II 5.1 Applications in Chemistry- Calculation of Empirical Formulae of Hydrocarbons- Calculation of Reduced Mass of a few Diatomic Molecules. 5.2 Determination of the Wave Numbers of Spectral lines of Hydrogen atom - Calculation of Work of Expansion in Adiabatic Process. 5.3 Calculation of pH, Solubility Product and Bond Energy using Born-Landee equation- Calculation of Standard Deviation and Correlation Coefficient.
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 UPS C/JAM/TNPSC other 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. K.V.Raman, 2005, Computers In Chemistry, Tata McGraw Hill Publishers, 8th edition, New Delhi. 2. Venugopal and Prasad, 1971, Programming with C, Tata McGraw Hill Publishers 11th Edition, New Delhi. 3. E.Balaguruswamy, 2017, Programming in C, Tata McGraw Hill Publishers, 2nd Edition, New Delhi.

Reference Books	1. Yashavan Kanetkar, Authentic guide to C programming, BPB Publications, 18th Edition, New Delhi. 2. Byron Gottfried, Programming with C, McGraw Hill Education, 4th Edition, New Delhi.
Website and e-learning source	1. https://unacademy.com/content/question-answer/gk/what-are-the-basic-organization-of-a-computer-system/ 2. https://www.geeksforgeeks.org/c-language-introduction/ 3. https://study.com/academy/lesson/molality-definition-formula.html
Course Learning Outcomes (for Mapping with Pos and PSOs) On completion of the course the students should be able to CO1: The students will be able to understand the basic computer architecture. CO2: The students will be able to understand about the operating system. CO3: The students will be able to understand the algorithm and programme. CO4: The students will be able to describe the basic terminologies used in C language and explain the basic concepts of programming. CO5: The students will be able to understand the applications of computer software in various areas in Chemistry.	

	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

sTitle of the Course	APPLIED CHEMISTRY						
Paper No.	EC VI						
Category	Elective	Year	III	Credits	3	Course Code	23UICHE56-3
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	3	1	-		4		
Prerequisites	General Chemistry						
Objectives of the Course	The course aims at providing knowledge on						

	UNIT – IV: EXPLOSIVES HOURS:6 4.1 Explosives-Introduction-Classification-Detonating or High Explosives-Deflagrating or Low Explosives-Characteristics of Explosives-Nitrocellulose, TNB,TNT, Picric acid, Cordite, Nitroglycerine and Gun Powder, Lead Azide-Precautions during storage of Explosives.
	UNIT – V: LEATHER CHEMISTRY HOURS:6 5.1 Leather Chemistry-Main Process Used in leather Manufacture-Structure of Hide and Skin,Leather Processing-Process before tannage. . 5.2 Tanning Process-Vegetable tanning and Chrome tanning- Tannery Effluent and by product-treatment.
Extended Professional Component (is a part of internal component only, Not to be include 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. B.K. Sharma, 2008, Industrial Chemistry including Chemical engineering, Goel Publishing house, 13 th Edition, Meerut. 2. Jain and Jain, 2019 Chemistry of Engineering Materials, Dhanpat Rai Publishing Company (P) LTD, (K.K.Group), 17 th Edition, New Delhi.
Reference Books	1. Jayashree Ghosh, 2006, Fundamentals Concepts of Applied Chemistry, Sultan Chand and Sons, 1 st Edition, New Delhi.
Web site and e-learning source	2. https://en.wikipedia.org/wiki/Petroleum 3. https://www.pulpandpaper-technology.com/articles/pulp-and-paper-manufacturing-process-in-the-paper-industry 4. https://www.haberwater.com/post/sugar-manufacturing-process 5. https://en.wikipedia.org/wiki/Explosive 6. https://www.chemistryislife.com/t-13

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

CO1: Able to understand the concept of Petrochemicals.

CO2: Prepare alcohol from Molasses.

CO3: Understand the processes involved in paper technology.

CO4: Extensive Knowledge about the Explosives and Leather Chemistry.

CO5: Able to understand the concepts involved in tanning process.

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

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

Level of Correlation between PSO's and CO's

Title of theCourse	Summer Internship						
Paper No.	Core XIII						
Category	Core	Year	III	Credits	2	Course Code	23UICHI58
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	-		-		

(Refer to the Regulations)

Title of the Course	ORGANIC CHEMISTRY – II						
Paper No.	Core XIII						
Category	Core	Year	III	Credits	4	Course Code	23UICH61
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	6	-	-		6		
Prerequisites	Organic Chemistry – I						
Objectives of the course	This course aims at providing knowledge on • Classification, isolation and discussing the properties of alkaloids and terpenes • Preparation and properties of saccharides • Biomolecules • Different molecular rearrangement • Preparation and properties of organometallic compounds						
Course Outline	UNIT I Alkaloids Classification, isolation, general properties- Hofmann Exhaustive Methylation; Structure elucidation – Coniine, piperine, nicotine. Terpenes: Classification, Isoprene rule, isolation and structural elucidation of Citral, alpha terpineol, Menthol, Geraniol and Camphor.						

UNIT II**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 to ketose and ketose to aldose.

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

Polysaccharides – Source, constituents and biological importance of homopolysaccharides- starch and cellulose, heteropolysaccharides – hyaluronic acid, heparin.

	UNIT III Molecular rearrangements: Molecular Rearrangement: Type of rearrangements, Mechanism for Benzidine, Favorskii, Claisen, 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 and ultra-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, Vishal Publishing, 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, 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, 29th edition, 2007.

	5. C Bandyopadhyaya; An Insight into Green Chemistry; Published on 2020
Reference Books	1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, 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-Hill Education Pvt. Ltd., New Delhi, 7th edition, 2009. 4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman 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	23UICH62
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	6		-		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						
Course Outline	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. In vivo and In vitro 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 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, 31th ed., Milestone Publishers & Distributors, Delhi.

	- Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advanced Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi - Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., ELBS William Heinemann, London. - W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, Schand and Company Ltd. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992
Reference Books	- Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nded., S.Chand and Company, New Delhi. - Gopalan R, (2009) <u>Inorganic Chemistry for Undergraduates</u>, Ist Edition, University Press (India) Private Limited, Hyderabad - Sivasankar B, (2013) <u>Inorganic Chemistry</u>. Ist Edition, Pearson, Chennai - Alan G. Sharp (1992), <u>Inorganic Chemistry</u>, 3rd Edition, Addition-Wesley, England - Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.
Website and e-learning source	www.epgpathshala.nic.in www.nptel.ac.in 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 theCourse	PHYSICAL CHEMISTRY-II						
Paper No.	Core - XV						
Category	Core	Year	III	Credits	4	Course Code	23UICH63
		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 electrochemicalseries.						
Course Outline	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 K_p and K_c – 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 – H₂-O₂ 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 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. 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 eleventh edition, 2018. 3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 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, Macmillan India Ltd, third edition, 2009. 2. Gilbert. W. Castellen, Physical Chemistry, Narosa Publishing House, third edition, 1985. 3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002. 4. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001 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 solid solutions. CO2: apply the concepts of chemical equilibrium in dissociation of PCl_5, N_2O_4 and formation of HI, NH_3, SO_3 and decomposition of calcium carbonate. Demonstrate important principles such as Le chatelier principle, van't Hoff reaction isotherm and Clausius-Clayperon equation. CO3: Identify an appropriate distillation method for the separation of binary liquid mixtures such as azeotropic mixtures, partially miscible mixtures and immiscible liquids. CO4: Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equation and Kohlrausch's law in conductance. CO5: Construct electrochemical cell with the help of electrochemical series and calculate cell EMF. Demonstrate the applications of EMF and significance of potentiometric titrations.	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
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	FUNDAMENTALS OF SPECTROSCOPY						
Paper No.	EC VII						
Category	Elective Course	Year	III	Credits	3	Course Code	23UICHE64-1
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		
Prerequisites	General Chemistry I,II,III and IV						
Objectives of the course	This course is designed to provide knowledge on • Electrical and magnetic properties of organic and inorganic compounds • 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 structural elucidation • Solving combined spectral problems						
Course Outline	UNIT I 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						

	UNIT II 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 - $\sigma-\sigma^*$, $\pi-\pi^*$, $n-\sigma^*$, $n-\pi^*$ 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+}) 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.
	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. <i>Elements of Analytical Chemistry</i>; S Chand: New Delhi, 2003. 2. Usharani, S. <i>Analytical Chemistry</i>, 1sted.; Macmillan: India, 2002. 3. Banwell, C.N.; Mc Cash, E. M. <i>Fundamentals of Molecular Spectroscopy</i>, 4th ed.; Tata McGraw Hill, New Delhi, 2017. 4. U.N.Dash, <i>Analytical Chemistry Theory and Practice</i>, Sultan Chand & Sons, 2nd Ed., 2005 B.K.Sharma, <i>Spectroscopy</i> , 22 nd ed., Goel Publishing House, 2011.
Reference Books	1. Srivastava, A. K.; Jain, P. C. <i>Chemical Analysis an Instrumental Approach</i>, 3rded.; S.Chand, New Delhi, 1997. 2. Robert D Braun. <i>Introduction to Instrumental Analysis</i>; Mc.Graw Hill: New York, 1987. 3. Skoog, D. A.; Crouch, S. R.; Holler, F.J.; West, D. M. <i>Fundamentals of Analytical Chemistry</i>, 9thed.; Harcourt college Publishers: USA, 2013. 4. Madan, R. L.; Tuli, G. D. <i>Physical Chemistry</i>, 2nded.; S.Chand: New Delhi, 2005. Puri, B. R.; Sharma, L. R.; Pathania, M.S. <i>Principles of Physical Chemistry</i> , 43 rd 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/SymmetryGroupTheory.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

sTitle of the Course	ORGANIC SYNTHESIS						
Paper No.	E C VII						
Category	Elective	Year	III	Credits	3	Course Code	23UICHE64-2
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		
Prerequisites	General Chemistry I,II,III and IV						
Objectives of the course	The course aims to provide knowledge on ➤ To introduce the basics of disconnection approach. ➤ To learn about protecting groups. ➤ To introduce one group C-C disconnections. ➤ To introduce two group C-C disconnections. ➤ To learn about ring synthesis.						
Course Outline	UNIT I DISCONNECTION APPROACH An introduction to synthons and synthetic equivalent. Disconnection approach, functional group interconversion, The importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections. Chemo selectivity, reversal of polarity. UNIT II PROTECTING GROUPS Principle of protection of alcohol group and amine group. Principle of protection of carbonyl group and carboxyl group. Activation of functional group. UNIT III ONE GROUP C-C DISCONNECTIONS Alcohols and carbonyl compounds. Regioselectivity and Alkene synthesis. Use of acetylenes and aliphatic nitrocompounds in organic synthesis. UNIT IV TWO GROUP C-C DISCONNECTIONS Diels-Alder reaction, 1, 3 - difunctionalised compounds. α,β unsaturated carbonyl compounds, Control in carbonyl condensations. 1, 5 - difunctionalised compounds, Michael addition and Robinson annulation. UNIT V RING SYNTHESIS Saturated heterocycles. Synthesis of 3-,4-,5- and 6- membered rings,aromatic heterocycles.in organic synthesis. Application of the above in the synthesis of camphor, longifolene, cortisone & reserpine.						

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. Herbert O House, 1965, Modern synthetic reactions, W.A. Benjamin, 1st Edition, New York. 2. Warren Stuart, 2008, Organic Synthesis: The Disconnection Approach, Wiley, 2nd Edition, New Jersey, USA. 3. W. Carruthers, 1987, Some modern methods of Organic synthesis, Cambridge University Press, 3rd Edition, UK.
Reference Books	1. Michael B. Smith, 1994, Organic Synthesis, McGraw-Hill Inc., 1st Edition, US 2. C.K. Charles, 2012, Organic Synthesis, Alpha Science International Ltd, 1st Edition, Oxford, UK. 3. F.A. Carey and R.J. Sundberg, 1977, Advanced Organic Chemistry, Part-B, Plenum Press, 1st Edition, New York.
Website and e-learning source	1. https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004101314199439sangeeta_sriv_chem_Disconnection_Approach.pdf 2. https://profiles.uonbi.ac.ke/andakala/files/sch_504_protecting_groups_in_organic_synthesis.pdf 3. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000005CH/P000669/M026476/ET/1515666017CHE_P14_M3_etext.pdf 4. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000005CH/P000669/M026477/ET/1515666038CHE_P14_M4_etext.pdf 5. https://en.wikipedia.org/wiki/Ring_forming_reaction
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: To describe methods for organic synthesis. CO2: To understand transformation of the most common functional groups. CO3: To understand the principles of disconnection approach. CO4: To learn strategic approaches for organic Synthesis. CO5: To provide theoretical understanding of heterocyclic chemistry which includes various methods for ring synthesis.	

	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	HEALTH CHEMISTRY						
Paper No.	E C VII						
Category	Elective	Year	III	Credits	3	Course Code	23UICHE64-3
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1			5		
Prerequisites	General Chemistry I,II,III and IV						
Objectives of the course	The course aims to provide knowledge on ➤ To recognize the causes of common diseases, their control and treatment ➤ To understand the first aid for accidents ➤ To study the organic pharmaceutical aids ➤ To know about organic diagnostic agents ➤ To have an idea about diabetes and cancer.						
Course Outline	UNIT I CAUSES, CONTROL AND TREATMENT OF COMMON DISEASES Insect borne diseases- Malaria, Filariasis, Plague. Air-borne diseases-Diphtheria, whooping cough, influenza, measles, mumps, tuberculosis (TB), and common cold, Water borne diseases- cholera, typhoid, dysentery. Some other common diseases-Jaundice, Asthma, Epilepsy, Piles, Leprosy.						
	UNIT II FIRST AID FOR ACCIDENTS Important rules of First Aid – Cuts and Wounds, Abrasions, Bruises, Bleeding , Fractures, Burns, Fainting Poisonous bites. First Aid Box. Detection of Hallucinogens and poisons-Antidotes for Poisoning-Some common Poisons-Symptoms and their antidotes-Acid poisoning, Alkali poisoning, Disinfectant poisoning, Alcohol poisoning, Mercury poisoning and Salicylate poisoning.						
	UNIT III ORGANIC PHARMACEUTICAL AIDS Preservatives, Antioxidants, Emulsifying agent, Sequestrants, Colouring, Flavouring and Sweetening agent, Ointment bases, Solvents, Stabilizing and Suspending agents.						
	UNIT IV ORGANIC DIAGNOSTIC AGENTS Drug used as X-rays contrast media, Drugs used to test organ functions, Drugs used to determine blood volume, Hemopoietic functions, Drugs used for miscellaneous diagnostic tests.						
	UNIT V DIABETES AND CANCER Diabetes and hypoglycemic drugs: Blood sugar level –Diabetes						

	causes, symptoms and control- Preliminary ideas about the structure and sources of insulin- oral hypoglycemic drugs- sulphonylureas and biguanides (synthesis not expected) Antineoplastic drugs: Causes of cancer- treatment methods-alkylating or cytotoxic agent-antimetabolite drugs.
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. Jayashree Ghosh, 2003, A Text Book of Pharmaceutical Chemistry, S.Chand& Company Ltd, 3rd revised Edition, New Delhi. 2. Lakshmi S, 1995, Pharmaceutical Chemistry, S.Chand& Company Ltd, 1st edition, New Delhi. 3. A. L. Leninger, 1998, Biochemistry, Kalyani Publishers, 2nd Edition, Ludhiana
Reference Books	1. Chatwal G.R, 1991, Pharmaceutical Chemistry-Organic- Volume II, Himalaya Publishing House, New Delhi. 2. Ashutoshkar and Mehta S.C, 2018, Essentials of Pharmacology, New Age International Publishers, New Delhi. 3. Gurdeep Chatwal, 2012 ,Medicinal Chemistry, Himalaya Publishing house private Ltd., Mumbai.
Website and e-learning source	1. https://my.clevelandclinic.org/health/diseases/17724-infectious-diseases 2. https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_extension_trainees/In_hew_first_aid_mgmt_final.pdf 3. https://noteskarts.com/wp-content/uploads/2022/01/Pharmaceutics_Chapter_3_Pharmaceutical_aids_Organoleptic_Colouring.pdf 4. https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/downloads/DIAGNOSTIC_AGENTS.pdf 5. https://www.diabetes.org.uk/diabetes-the-basics/related-

[conditions/diabetes-and-cancer](#)

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

CO1: Describe the causes, control and treatment of common diseases.

CO2: Understand the concepts of first aid for accidents.

CO3: Classify different organic pharmaceutical aids.

CO4: Explain organic diagnostic agents.

CO5: Describe diabetes, cancer and their control and treatment.

	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
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	NANOSCIENCE						
Paper No.	E C VIII						
Category	Elective	Year	III	Credits	3	Course Code	23UICHE65-1
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	5		-		5		
Prerequisites	Basics knowledge in physics and chemistry						
Objectives of the course	This course aims at providing knowledge on Introduction to nanoparticles/clusters and nanocomposites • Properties of nanomaterials • Characterization of nanomaterials by different methods • Synthesis of carbon nanotubes, graphene, quantum dots, self-assembled nanomaterials • Applications of nanomaterials as sensors						
Course Outline	UNIT I Introduction to nanoscience Definition of terms – nanoscience, nanoparticles, clusters, quantum dots, nanostructures and nanocomposites. Electron behaviour in free space, bulk material and nanomaterials. Synthesis and stabilization of nanomaterialsTop down approach(physical methods), mechanical dispersion – ball milling, methods based on evaporation of a precursor-inert gas condensation, ion sputtering, spray pyrolysis, aerosol synthesis-nanolithography. Bottom–up approach (chemical methods) - solvothermal synthesis, photochemical method, gamma radiolysis, sonochemical synthesis, electro deposition, sol-gel method, nanomaterials via chemical routes- solvents reducing agents, capping agents-stabilization of nanoparticles -electrostatic and steric stabilization, common stabilizers, nanoparticle growth in solution, templated growth, Langmuir – Blodgett (L-B) method, reverse micelles-emulsion method.						
	Unit II Properties of materials on a nanoscale Optical properties of metal and semiconductor nanomaterials- surface Plasmon resonance (SPR), surface enhanced Raman spectra (SERS), quantum confinement effect, tuning of optical spectrum. Magnetic properties - Fe₃O₄ particle, supra magnetic properties, electronic properties, Chemical properties- chemical process on the surface of nanoparticles, catalysis, mechanical properties.						
	UNIT III Techniques employed for characterisation of nanomaterials Spectroscopy – UV-visible, Photoelectron spectroscopy – Electron microscopy – Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning probe microscopy (SPM) – Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Optical microscopy – confocal microscopy, X-ray diffraction (XRD) [Principle and Block diagram only].						

	UNIT IV Special nanomaterials Carbon Nano Structures Carbon nanotubes: Introduction - types - zigzag, armchair, helical, synthesis by CVD, Functionalization of Carbon Nanotubes, Reactivity of Carbon Nanotubes, Field emission, Fuel Cells, Display devices . Other Important Carbon based materials: Preparation and Characterization Fullerene, Graphene, properties, DLC and nanodiamonds and Applications Semiconductor nanoparticles: Quantum dots, synthesis – chemical synthesis using clusters, properties, porous silicon – electrochemical etching, aerogel – types – silica aerogel, resorcinol formaldehyde (RF) aerogels, zeolites – applications. Self Assembled Nanomaterials: Self Assembled Monolayers (SAMS) – inorganic, organic molecules.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	UNIT V Application of nanomaterials Biomedical Applications- drug, drug delivery, biolabelling, artificial implants, cancer treatment. Sensors – Natural nanoscale sensors, chemical sensors, biosensors, electronic noses. Optics & Electronics – Nanomaterials in the next generation computer technology, high definition TV, flat panel displays, quantum dot laser, single electron transistors [SET]. Nanotechnology in agriculture – Fertilizer and pesticides nanomaterials for water purification, nanomaterials in food and packaging materials, fabric industry. Impacts of Nanotechnology – human & environmental safety risks. 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. Sulabha K. Kulkarni, <i>Nanotechnology: Principles and Practices</i>, Capital Publishing Co., New Delhi. 2. Pradeep. T, <i>Nano: The Essentials, Understanding Nanoscience and Nanotechnology</i>; Tata McGraw-Hill Publishing Company Limited, NewDelhi, 2007. 3. Shah. M.A.; Tokeer Ahmad, <i>Principles of Nanoscience and Nanotechnology</i>; Narosa Publishing House, New Delhi, 2010. 4. Murthy. B.S; Shankar. P, Baldev Raj.; Rath. B.B. JamesMurday, <i>Textbook of Nanoscience and Nanotechnology</i>;Universities press, India Ltd ,Hyderabad. 2012.
Reference Books	1. Sharma. P.K., <i>Understanding Nanotechnology</i>; Vista International Publishing House, Delhi. 2008. 2. Charles P. Poole Jr.; Frank J. Owens. <i>Introduction to Nanotechnology</i>; A John Wiley & Sons, INC., Publication, 2003. 3. Viswanathan B., <i>Nano Materials</i>;Narosa Publishing House, New Delhi, 2009. 4. Edited by C.N.R. Rao; Mu'ller.A; Cheetham. A.K.<i>Nanomaterials Chemistry Recent Developments and New Directions</i>, WILEY-VCH Verlag GMBH & Co.,KGaA, Darmstad. 5. Jing Zhong Zhang, <i>Optical properties and spectroscopy of Nanomaterials</i>; World Scientific Publishing Pvt. Ltd., Singapore.
Website and e-learning source	1) http://www.nanotechnology.com/docs/wtd015798.pdf 2) http://nccr.iitm.ac.in/Nanomaterials.pdf
Course Learning Outcomes (for Mapping with POs and PSOs)On completion of the course the students should be able to CO1: explain the general concepts and physical phenomena of relevance within the field of nanoscience. CO2: describe the properties, synthesis, characteristics of nanomaterials, special nanomaterials and applications. CO3: examine the structure, properties, applicability and characterization of nanomaterials. CO4: analyze various synthesis procedures, characterizations and uses of carbon nanotubes, fullerene and graphene CO5: discuss applications of nanomaterials of sensors and in optics and electronics	

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

Level of Correlation between PSO's and CO's

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

Level of Correlation between PO's and CO's

Title of the Course	POLYMER SCIENCE						
Paper No.	EC VIII						
Category	Elective	Year	III	Credit	3	Course Code	23UCICHE65-2
		Semester	VI	s			
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	5		-		5		
Prerequisites	Knowledge on functional groups and reaction mechanisms						
Objectives of the course	The course aims at providing an overall view of • Classification of polymers, preparation of polymers • Kinetics of polymerization and characterization of polymers • Analytical techniques used to characterize polymers • Reactions of polymers • Speciality polymers like PVC, PMMA						
Course Outline	UNIT I Introduction Difference between polymer and macromolecule – classification – synthetic and natural, organic and inorganic, thermoplastic and thermosetting. Plastics, elastomers, fibres and liquid resins. Techniques of polymerization Bulk, solution, emulsion and suspension polymerization						
	Unit – II Kinetics of polymerization Kinetics of condensation and addition polymerisation; ionic, freeradical, copolymerisation and coordination polymerisation – reactivity ratios – block and graft copolymers. Characterisation of polymers Appearance, feel and hardness, density, effect of heat, solubility,combustion, tensile strength, shear, stress, impact strength, mechanical, thermomechanical and rheological properties of polymers in viscoelastic state.						
	UNIT III Molecular Weight and Properties of Polymers Molecular Weight of Polymers-Number Average and Weight Average, Molecular Weight Distribution, Determination of Molecular Weight polydispersity index – membrane and vapour phase osmometry, light scattering - Zimm plot, ultracentrifuge – sedimentation velocity and sedimentation equilibrium – viscometry – gel permeation chromatography Thermal properties of polymers – Glass Transition Temperature-State of Aggregation and State of Phase Transitions, Factors Influencing Glass Transition Temperature, Importance of Glass Transition Temperature, Heat Distortion Temperature, TGA / DTA,Crystallinity of Polymers: Crystalline Behaviour, Degree of Crystallinity						

	UNIT IV Reactions of Polymers-Hydrolysis, Acidolysis, Aminolysis, Addition and Substitution Reactions (One Example Each) Cyclisation, Cross-Linking and Reactions of Specific Functional Groups in the Polymer Polymer technology Processing of polymers – casting, thermoforming, moulding – extrusion, compression, blow moulding – foaming, lamination, reinforcing – processing of fibres – melt, wet and dry spinning. UNIT V Speciality polymers Polyelectrolytes, conducting polymers, polymeric supports for solid phase synthesis, biomedical polymers, liquid crystalline polymers, electroluminescent polymers – two examples of each of these polymers. Polyethylene, PVC, PMMA, polyester; rubber – synthetic and natural, vulcanisation of rubber. Polymer Degradation Types of Degradation - Thermal, Mechanical, Ultra Sound, Photo Radiation and Chemical Degradation Methods. Rubber-Natural and Synthetic-Structure, Mechanism of Vulcanisation Biodegradable and Non-Biodegradable Polymers.
Reference Books	1. Billmeyer, F.W. Polymer Science. India: Wiley-Interscience, 2007. 2. Seymour, R. B.; Carraher Jr.C.E. <i>Polymer Chemistry: An Introduction</i>, Marcel Dckker Inc : New York, 1981. 3. Sinha, R. <i>Outlines of Polymer Technology</i>, Prentice Hall of India: New Delhi, 2000. 4. Joel R. Fried, <i>Polymer Science and Technology</i>, 3rd ed.; Prentice Hall of India: New Delhi, 2014.
Website and e-learning source	1. https://polymerdatabase.com 5. http://amrita.vlab.co.in/?sub=2&brch=190&sim=603&cnt=1 3. http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/polymers.htm 4. http://nsdl.niscair.res.in/bitstream/123456789/406/2/Molecular+weight+of+polymers.pdf

Course Learning Outcomes (for Mapping with POs and PSOs)On completion of the course the students should be able to CO1: explain classification of polymers, elastomers, fibres and liquid resins CO2: explain addition and condensation polymerization, mechanical properties of polymers CO3: determine the molecular weight of polymers, and explain the thermal properties of polymers CO4: explain reactions of polymers and polymer processing CO5: discuss speciality polymers like PVC, PMMA, rubbers, biodegradable polymers					
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sCO /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

Title of the Course	PHARMACEUTICAL CHEMISTRY						
Paper No.	Elective Course VIII						
Category	Elective	Year	III	Credits	3	Course Code	23UICHE65-3
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	5		-		5		
Prerequisites	Knowledge on active chemical compounds and biochemistry						
Objectives of the course	The course aims at providing an overall view of • Drugs design and drug metabolism • Important Indian medicinal plants, common diseases and antibiotics Drugs for major diseases like cancer, diabetes and AIDS • Analgesics and antipyretic agents • Significance of clinical tests						
Course Outline	UNIT I Introduction Important terminologies – drug, pharmacognosy, pharmacy, pharmacology, pharmacodynamics, pharmacokinetics, clinical pharmacology, pharmacotherapeutics, chemotherapy, toxicology, pharmacophore, antimetabolites, mutation, bacteria, virus, fungi, actinomycetes, vaccines, pharmacopeia, posology and therapeutic index. Sources of drugs – dosage forms – bio availability – routes of administration – absorption, distribution and elimination of drugs – drug metabolism – prescription terms. Structure and pharmacological activity Effect of – unsaturation, chain length, isomerism; groups - halogens amino, nitro, nitrite, cyano, acidic, aldehydic, keto, hydroxyl and alkyl groups. Development of Drugs Development of a drug – classic steps- lead compounds- comparison of traditional and modern methods of development of drugs – drug design by method of variation – disjunction and conjunction methods.						

Unit II**Indian medicinal plants**

Some important Indian medicinal plants – tulsi, neem, kizhanelli, mango, semparuthi, adadodai, turmeric and thoothuvalai – uses.

Common diseases and their treatment

Causes, prevention and treatment of the following diseases:

Insect borne diseases– malaria, filariasis, plague; Air borne diseases– diphtheria, whooping cough, influenza, measles, mumps, common cold, tuberculosis; Water borne diseases – cholera, typhoid, dysentery.

Digestive system – jaundice; Respiratory system – asthma; Nervous system – epilepsy.

Antibiotics

Definition – classification – structure and therapeutic uses of chloramphenicol, penicillins, structure activity relationship of chloramphenicol; therapeutic uses of ampicillin, streptomycin, erythromycin, tetracycline, rifamycin.

UNIT III**Drugs for major diseases**

Cancer – common causes – chemotherapy – anti neoplastic agents - classification –adverse effects of cytotoxic agents; alkylating agents – chlorambucil; anti metabolites – methotrexate, fluouracil; Vinca alkaloids – vincristine, vinblastine. Diabetes– types – management of diabetes – insulin; oral hypoglycemic agents - sulphonyl ureas – chlorpropamide; biguanides - metformin – thiazolidinediones. Cardiovascular drugs– cardio glycosides; anti arrhythmic agents – quinidine, propranolol hydrochloride; anti-hypertensive drugs - Aldomet, pentoliniumtartrate; vasodilator-tolazoline hydrochloride, sodium nitroprusside. AIDS – causes, symptoms and prevention – anti HIV drugs - AZT, DDC.

	UNIT IV Analgesics and antipyretic agents Classification – action of analgesics – narcotic analgesics –morphine; synthetic analgesics – pethidine, methadone; antipyretic analgesics – salicylic acid derivatives, indolyl derivatives, p-aminophenol derivatives. Anaesthetics Definition, characteristics, classification - general anaesthetics – volatile anaesthetics – nitrous oxide, ethers, cyclopropane, chloroform,halothane, trichloro ethylene– storage, advantages and disadvantages ; non volatileanaesthetics – thiopental sodium ; local anaesthetics – requisites – advantages- esters – cocaine, benzocaine ; amides – lignocaine, cinchocaine. Blood and haematological agents Blood– composition, grouping – physiological functions of plasma proteins – mechanism of clotting; Coagulants – vitamin K, protamine sulphate, dry thrombin; Anti coagulants – coumarins, citric acid and heparin; antifibrinolytic agents – aminocaproic acid and tranexamic acid. Anaemia– causes, types and control – anti anaemic drugs. UNIT V Clinical Chemistry Blood tests – blood count – complete haemogram – Hb, RBC, GTT, TC, DC, platelets, PCV, ESR; bleeding and clotting time — glucose tolerance test. Significance of Clinical Tests Serum electrolytes - blood Glucose - orthotoluidine method; Renal functions tests - blood urea, creatinine; liver function tests - serum proteins, albumin globulin ratio, serum bilirubin, enzymes SGOT, SGPT; lipid profile – cholesterol, triglycerides, HDL, LDL, coronaryrisk index. Urine examination – pH, tests for glucose, albumin and bile pigment.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)

Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Jayashree Ghosh, (1999), A text book of pharmaceutical chemistry, 2nd ed., S.Chand& company, New Delhi. 2. Lakshmi S, (2004), Pharmaceutical chemistry, 3rd ed., Sultan chand& sons, Delhi. 3. Tripathi K D, (2018), Essentials of medical pharmacology, 8th ed., Jaypee brothers medical publishers (P) Limited, New Delhi. 4. Ashutosh Kar, (2018), Medicinal chemistry, 7th ed., New age international (P) Limited, Publishers, New Delhi.
Reference Books	Reference Books: 1. Chatwal G R, (2013), Pharmaceutical chemistry, inorganic (vol-I) 6thed ., Himalaya publishing house, Bombay. 2. Chatwal G R, (1991), Pharmaceutical chemistry, organic (vol-II), Himalaya publishing house, Bombay. 3. Patrick G, (2002), Instant Notes Medicinal Chemistry, Viva Books Private Limited, New Delhi. 4. Intellectual Property Rights, NeerajPandey, Khushdeep Dharni. Publisher: PHI Learning Pvt. Ltd., 2014 ISBN: 812034989X, 9788120349896.
Website and e-learning source	1. http://www.pharmacy.umaryland.edu/faculty/amackere/courses/phar531_delete/lectures/qsar_1.pdf 2. http://www.indianmedicinalplants.info/ 3. https://www.wipo.int/about-ip/en/
Course Learning Outcomes (for Mapping with POs and PSOs)On completion of the course the students should be able to CO1: Define the pharmaceutical terminologies; describe the principles in pharmacological activity, drug development, clinical chemistry, hematology, therapeutic drugs and treatment of diseases; list the types of IPR and trademarks. CO2: Discuss the development of drugs, structural activity, disease types, physio-chemical properties of therapeutic agents, significance of medicinal plants, clinical tests and factors for patentability. CO3: Apply the principles involved in structural activity and drug designing, functions of haematological agents; estimation of clinical parameters and therapeutic application of drugs for major diseases. CO4: explain classification of analgesics and anesthetics, and physiological functions of plasma proteins CO5: explain the significance of clinical tests like blood urea, serum proteins and coronary risk index	

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

Level of Correlation between PSO's and CO's

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

Level of Correlation between PO's and CO's

	UNIT – V: Structure-Based Drug Design Introduction to drugs, Chemical structural data files- Structure based drug design- Drug action & enzymes- Drug action & receptors- Drug Design- Ligand Based Design and De Novo Drug Design Virtual screening/docking of ligands.-Pharmacophore Design, Molecular similarity and molecular descriptors.
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	3. Stereochemistry, by David G. Morris, Eddie Abel 4. Computer-Aided Drug Design: Methods and Applications, T.J. Perun C.L. Propst 5. Chemical Information Sources (Mcgraw-Hill Series in Advanced Chemistry), Gary Wiggins. 6. Trends in Bioinformatics. By Dr. P. Shanmughavel. 2006 Pointer publishers, Jaipur, India. 7. Principles Of Bioinformatics, Dr.P.Shanmugavel,2005,Pointer Publishers, Jaipur, India.
Reference Books	1. Thomas Engel (2006). "Basic Overview of Chemoinformatics". J. Chem. Inf. Model. 46 (6): 2267–77. doi:10.1021/ci600234z. PMID 17125169 2. Molecular Modeling: Basic Principles and Applications, 3rd Edition,Hans-Dieter Höltje, Wolfgang Sippl, Didier Rognan, Gerd Folkers 3. Martin, Yvonne Connolly (1978). Quantitative Drug Design: A Critical Introduction. Medicinal Research series. Vol. 8 (1st ed.). New York, NY: Marcel Dekker. ISBN 9780824765743. 4. Schaum's Outline of Probability and Statistics, Murray R Spiegel, John J. Schiller, R. Alu Srinivasan. 5. Gasteiger J.; Engel T., eds. (2004). Chemoinformatics: A Textbook. New York, NY: Wiley. ISBN 3527306811.

Website and e-learning source	1. https://www.sciencedirect.com/topics/chemistry/chemoinformatics 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7432360/ 3. https://chem.libretexts.org/Courses/Intercollegiate_Courses/Cheminformatics 4. https://github.com/PatWalters/resources/blob/main/cheminformatics_resources.md
Course Learning Outcomes (for Mapping with Pos and PSOs) On completion of the course the students should be able to CO1: Understand the mathematical implementation in molecular networks. CO2: Evaluate the importance of protein structure in drug designing CO3: Describe chemical data retrieval from the databases. CO4: Know the various tools in proteomics, genomics and metabolomics. CO5: Structure based designing of ligand with a help of QSAR.	

	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	EXTENSION ACTIVITIES						
Paper No.	Core XIII						
Category	Core	Year	III	Credits	2	Course Code	23UICHX67
		Semester	VI				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	-	-		-		

(Refer to the Regulations)