B.Sc. CHEMISTRY

(Effective from the academic year 2024 - 2025)

Vision of the Department:

To inculcate a keen interest in learning Chemistry, acquiring skills in carrying out tasks systematically with perseverance and precision, motivating towards research, inspiring to lead a life with scientific approach and promote the standard of personal and societal living.

Objectives:

- To provide an in-depth knowledge in Chemistry.
- To acquire skill and competency in practical.
- To expose the students to the recent trends in Chemistry and related sciences.
- To motivate the students for life-long learning and train students towards research.
- To train economically backward students and make them eligible for higher education and job opportunities.
- To tap out the talents through extracurricular and co-curricular activities.
- To get sensitized to social and environmental realities.

Eligibility for admission to B.Sc. Chemistry:

- A pass in higher secondary with Mathematics, Physics, Chemistry and Biology (Category I).
- A pass in higher secondary with Mathematics, Physics, Chemistry and Computer Science (Category II).
- A pass in higher secondary with Physics, Chemistry, Zoology and Botany (Category III).

Allied Subjects:

1. Mathematics/Botany
2. Physics

Eligibility to take Allied Subjects:

Students who belong to category I and II are eligible to take Mathematics as one of the Allied papers. Students who belong to category III are eligible to take Botany as one of the Allied papers.

Highlights of the Revamped Curriculum:

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application-oriented content wherever required.

- The Core subjects include latest developments in the education and scientific front, practical training, catering to the needs of stakeholders with research aptitude.

- The curriculum is designed to strengthen the industry-academia interface and provide more job opportunities for the students.

- The Internship during the second-year vacation will help the students gain valuable work experience, that connects classroom knowledge to real world experience and to narrow down and focus on the career path.

- Project with viva-voce component in the fifth semester enables the students to apply their conceptual knowledge to practical situations. Such innovative provisions of the industrial training/project/internships will give students an edge over the counterparts in the job market.

- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective and Skill Enhancement Courses, covering conventional topics to the application oriented.

Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome/Benefits
I	**Foundation Course: Fundamentals of Chemistry** To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning Chemistry and its concepts.	• Instil confidence among students • Create interest for the subject
I, II, III & IV	**Skill Enhancement Courses** (Discipline centric/ Generic / Entrepreneurial)	• Industry ready graduates • Skilled human resource • Students are equipped with essential skills to make them employable • Entrepreneurial skill training will provide an opportunity for independent livelihood • Generates self-employment • Create small scale entrepreneurs • Skill training to girls leads to women empowerment • Discipline centric skill will improve the technical knowhow of solving real life problems
I, II, III, IV, V & VI	**Elective Courses** - An open choice of topics categorized under Generic and Discipline Centric	• Strengthening the domain knowledge • Introducing the stakeholders to the state-of art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature • Emerging topics related to industry are introduced to facilitate advanced learning in the respective domains
II Year Vacation activity	Internship / Industrial Training	• Practical training at the Industry/ Chemical Companies/Educational institutions, enable the students gain professional experience and become responsible citizens.
V Semester	Project with Viva-voce	• Self-learning is enhanced • Application of the concept to real situation is conceived resulting in tangible outcome
VI Semester	Introduction of Professional Competency component	• 'Chemistry for Competitive Examinations' caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, ISS, CDS, NDA, JAM, TNPSC group services, etc.
Skills acquired from the Courses		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

TANSCHE BASED PROGRAMME STRUCTURE FOR B.Sc. CHEMISTRY (For the candidates admitted from the academic year 2024-2025)									
Sem	**Part**	**Category**	**Paper Code**	**Title**	**Hours/ Week**	**Exam**		**Credits**	**Marks**
						Th	Pr		
I	I	Tamil/Language	ULTAA24	Tamil Paper-I	**5**	3	-	**3**	40 + 60
	II	English	UENGA24	English Paper-I	**6**	3	-	**3**	40 + 60
	III	Core Course I	UCCHA24	General Chemistry-I	**5**	3	-	**5**	40 + 60
		Core Course II	UCCHB24	Practical-I: Quantitative Inorganic Estimation (Titrimetry) and Inorganic Preparations	**3**	-	3	**3**	40 + 60
		Generic Elective I	UAMAA24	Allied-I: Mathematics-I	**6**	3	-	**5**	40 + 60
			UABTA24	Allied-I: Botany -I	4	3	-	3	40 + 60
			UABTB24	Allied Practical: Botany - I	2	-	3	2	40 + 60
	IV	Skill Enhancement Course SEC1/1A	USCHA124	SEC: Role of Chemistry in Daily Life	**2**	-	-	**2**	100
			USCHB124	SEC: Food Chemistry					
		Foundation Course FC	UFCH24	FC: Fundamentals of Chemistry	**2**	2	-	**2**	40 + 60
		Value Education	UVEDA22*	Value Education	**1**	-	-	-	-
Total					**30**			**23**	**700/800**
II	I	Tamil/Language	ULTAB24	Tamil Paper-II	**6**	3	-	**3**	40+ 60
	II	English	UENGB24	English Paper-II	**5**	3	-	**3**	40 + 60
	III	Core Course III	UCCHC24	General Chemistry-II	**5**	3	-	**5**	40 + 60
		Core Course IV	UCCHD24	Practical-II: Qualitative Organic Analysis and Preparation of Organic Compounds	**3**	-	3	**3**	40 + 60
		Generic Elective II	UAMAB24	Allied-II: Mathematics-II	**6**	3	-	**5**	40 + 60
			UABTC24	Allied-II: Botany -II	4	3	-	3	40 + 60
			UABTD24	Allied Practical: Botany - II	2	-	3	2	40 + 60
	IV	Skill Enhancement Course SEC II	USCH224	SEC: Dairy Chemistry	**2**	-	-	**2**	100
		Skill Enhancement Course SEC III	USCH324	SEC: Cosmetics and Personal Grooming	**2**	-	-	**2**	100
		Value Education	UVEDA22**	Value Education	**1**	-	-	-	-
Total					**30**			**23**	**700/800**
III	I	Tamil/Language	ULTAC24	Tamil Paper-III	**5**	3	-	**3**	40+ 60
	II	English	UENGC24	English Paper-III	**6**	3	-	**3**	40 + 60
	III	Core Course V	UCCHE24	General Chemistry-III	**5**	3	-	**5**	40 + 60
		Core Course VI	UCCHF24	Practical-III: Qualitative Inorganic Analysis	**3**	-	3	**3**	40 + 60
		Generic Elective III	UAPHA324	Allied-III: Physics-I	**4**	3	-	**3**	40 + 60
			UAPHB324	Allied Practical: Physics Practical-I	**2**	-	3	**2**	40 + 60
	IV	Skill Enhancement Course SEC IV	USCH424	SEC: Entrepreneurial Skills in Chemistry	**1**	-	-	**1**	100
		Skill Enhancement Course SEC V	USCH524	SEC: Pesticide Chemistry	**2**	-	-	**2**	100
		EVS	UNEVS24*	Environmental Studies	**1**	-	-	-	-
		Value Education	UVEDA22***	Value Education	**1**	-	-	-	-
Total					**30**			**22**	**800**

Sem	Part	Category	Paper Code	Title	Hours / Week	Exam		Credits	Marks
						Th	Pr		
IV	I	Tamil/Language	ULTAD24	Tamil Paper-IV	**6**	3	-	**3**	40+ 60
	II	English	UENGD24	English Paper-IV	**5**	3	-	**3**	40 + 60
	III	Core Course VII	UCCHG24	General Chemistry-IV	**5**	3	-	**5**	40 + 60
		Core Course VIII	UCCHH24	Practical-IV: Physical Chemistry Practical-I	**3**	-	3	**3**	40 + 60
		Generic Elective IV	UAPHC424	Allied-IV: Physics-II	**4**	3	-	**4**	40 + 60
			UAPHD424	Allied Practical: Physics Practical-II	**2**	-	3	**2**	40 + 60
	IV	Skill Enhancement Course SEC VI	USCH624	SEC: Instrumental Methods of Chemical Analysis	**2**	-	-	**2**	100
		Skill Enhancement Course SEC VII	USCH724	SEC: Forensic Science	**1**	-	-	**1**	100
		EVS	UNEVS24	Environmental Studies	**1**	2	-	**2**	40 + 60
		Value Education	UVEDA22****	Value Education	**1**	-	-	-	-
Total					**30**			**25**	**900**
V	III	Core Course IX	UCCHI24	Organic Chemistry-I	**5**	3	-	**4**	40 + 60
		Core Course X	UCCHJ24	Inorganic Chemistry-I	**5**	3	-	**4**	40 + 60
		Core Course XI	UCCHK24	Physical Chemistry-I	**5**	3	-	**4**	40 + 60
		Core Course XII	UCCHL24	Project	**5**	-	-	**4**	40 + 60
		Discipline Specific Elective I/IA	UECHA24	Elective: Biochemistry	**5**	3	-	**3**	40 + 60
			UECHB24	Elective: Gravimetric Analysis					
		Discipline Specific Elective II/IIA	UECHC24	Elective: Industrial Chemistry	**4**	3	-	**3**	40 + 60
			UECHD24	Elective: Applied Chemistry					
	IV	Value Education	UVEDA22*****	Value Education	**1**	-	-	-	-
		Summer Internship/Industrial Training	UICH24	Internship	-	-	-	**2**	40 + 60
Total					**30**			**24**	**700**
VI	III	Core Course XIII	UCCHM24	Organic Chemistry-II	**5**	3	-	3	40 + 60
		Core Course XIV	UCCHN24	Inorganic Chemistry-II	**5**	3	-	3	40 + 60
		Core Course XV	UCCHO24	Physical Chemistry-II	**5**	3	-	4	40 + 60
		Core Course XVI	UCCHP24	Practical-V: Physical Chemistry Practical-II	**3**	-	3	2	40 + 60
		Discipline Specific Elective III/IIIA	UECHE24	Elective: Fundamentals of Spectroscopy	**5**	3	-	3	40 + 60
			UECHF24	Elective: Nano Science					
		Discipline Specific Elective IV/IVA	UECHG24	Elective: Pharmaceutical Chemistry	**4**	3	-	3	40 + 60
			UECHH24	Elective: Polymer Science					
	IV	Professional Competency SEC VIII	UPCH24	Chemistry for Competitive Examinations	**2**	2	-	2	40 + 60
		Value Education	UVEDA22	Value Education	**1**	2	-	2	40 + 60
	V	Extension Activity	-	Extension Activity (90 hours)	-	-	-	1	-
Total					**30**			**23**	**800**
Grand Total					**180**			**140 +2***	**4800/ 4600**

- Any one course of the following to be completed during III semester (15 hours teaching and 15 hours activities):

  i) Fundamentals of Computer and MS Office (Computer Science & B.C.A)

  - Advanced Excel
  - Multimedia Using Flash
  - Photoshop

ii) Health and Fitness (Physical Education)

Methods of Evaluation						
S. No.	**Category**	**Assessment Tool**	**Maximum Marks**	**Exam Theory**	**Weightage**	
1	Core Courses/Generic & Discipline Specific Electives	I Continuous Assessment (ICA)	50	1 ½ h	35	40
		II Continuous Assessment (IICA)	50	1 ½ h		
		Innovative Component (IC)	5	-	5	
		End Semester Examination	100	3 h		60
2	Foundation Course/Professional Competency	I Continuous Assessment (ICA)	30	1 h	35	40
		II Continuous Assessment (IICA)	30	1 h		
		Innovative Component (IC)	5	-	5	
		End Semester Examination	60	2 h		60
3	EVS	Continuous Assessment (IICA)	25	1 h		40
		Innovative Component (IC)	25	-		
		End Semester Examination	60	2 h		60

Activity-based Assessment for Skill Enhancement Courses:

Activity 1 for Unit I: (Nature of Activity) – 20 marks
Activity 2 for Unit II: (Nature of Activity) – 20 marks
Activity 3 for Unit III: (Nature of Activity) – 20 marks
Activity 4 for Unit IV: (Nature of Activity) – 20 marks
Activity 5 for Unit V: (Nature of Activity) – 20 marks

Nature of Activity – Field visit/Industrial visit/Project (individual or group)/Exhibits/Model making/Hands on training/Lab practice/Product making/Extempore/Block and Tackle/Debate/Report writing/Case study/Interpretation of data or results/Transcription/Quiz (LMS)/Problem solving/ Designing/Role play/Start-up proposal/Research proposal/Poster presentation/Oral presentation (live or video recorded)/Survey (Field or Online)/Group discussion/Problem solving/Problem formulation/Interviews/Concept mapping/Mind mapping /Promoting public awareness etc.
Record of Assessment will be maintained by the course instructors and verified by the Head of the department.

Cognitive Levels of Assessment	
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, short summary or Overview
Application (K3)	Suggest idea/concept with examples, suggest formulae, Solve problems, Observe, Explain
Analyze (K4)	Problem-solving questions, finish a procedure in many steps, Differentiate between various ideas, Map knowledge
Evaluate (K5)	Longer essay/Evaluation essay, Critique or justify with pros and cons
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

PROGRAMME OUTCOMES (PO)

On completion of the UG Programme, the students will be able to:

PO1: Attain knowledge and understand the principles and concepts in the respective discipline.

PO2: Acquire and apply analytical, critical and creative thinking, and problem-solving skills.

PO3: Effectively communicate general and discipline-specific information, ideas and opinions.

PO4: Appreciate biodiversity and enhance eco-consciousness for sustainable development of the society.

PO5: Emulate positive social values and exercise leadership qualities and team work.

PO6: Pursue higher knowledge, qualify professionally, enhance entrepreneurial skills and contribute towards the needs of the society.

PROGRAMME SPECIFIC OUTCOMES (PSO)

On completion of the UG Programme in Chemistry, the students will be able to:

PSO1: Demonstrate a firm foundation in fundamentals and gain an in-depth knowledge in different fields of Chemistry such as Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Analytical Chemistry, Pharmaceutical Chemistry, Food Chemistry and Small Scale Chemistry.

PSO2: Apply laboratory skills, carry out experiments, record observations and inferences and analyze the results and follow the correct procedures and regulations for safe handling and usage of chemicals.

PSO3: Communicate effectively chemistry specific information, ideas and opinions and be able to comprehend and write reports effectively.

PSO4: Develop an interest in pursuing higher studies in Chemistry and related subjects which are relevant to employment and entrepreneurship.

PSO5: Demonstrate the knowledge of professional and ethical practices.

PSO6: Integrate the knowledge and skills developed in multidisciplinary environments and function effectively as an individual or a leader and contribute towards the needs of the society.

PO	**PSO**					
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
PO1	H	H	H	H	H	H
PO2	H	H	H	H	H	M
PO3	H	H	H	M	M	M
PO4	H	H	H	M	M	M
PO5	H	H	M	M	M	M
PO6	M	M	M	M	M	M

(HIGH - 3, MODERATE - 2, LOW - 1)

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	14	22	18	93
Part IV	4	4	3	5	2	4	22
Part V	-	-	-	-	-	1	1
Other	-	-	2	-	-	-	2
Total	23	23	24	25	24	23	**142**

***** Part I, II, and Part III components will be separately considered for CGPA calculation and classification for the undergraduate programme and the other components. IV, V must be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.

<table>
<tr><td>Title of the Course</td><td colspan="7">GENERAL CHEMISTRY-I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2">UCCHA24</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">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 thechemical behaviour
• nature of chemical bonding, and
• fundamental concepts of organic chemistry</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3, K4)
Atomic structure and Periodic trends
1.1 History of atom (J. J. Thomson, Rutherford); Moseley’s Experiment and atomic number.
1.2 Atomic spectra; black-body radiation and Planck’s quantum theory.
1.3 Bohr's model of atom; The Franck-Hertz Experiment; Interpretation of hydrogen spectrum.
1.4 Photoelectric effect, Compton effect; Dual nature of matter-de Broglie wavelength - Davisson and Germer experiment.
1.5 Heisenberg’s uncertainty principle; Electronic configuration of atoms and ions.
1.6 Hund’s rule, Pauli’s exclusion principle and Aufbau principle.
Numerical problems involving the core concepts.</td></tr>
<tr><td></td><td colspan="7">Unit II (15 hours) (K1, K2, K3, K4)
Introduction to Quantum mechanics
2.1 Classical mechanics, wave mechanical model of atom, distinction between a Bohr orbit and orbital.
2.2 Postulates of quantum mechanics; Probability interpretation of wavefunctions. Formulation of Schrodinger wave equation.
2.3 Probability and electron density-visualizing the orbitals-probability density and significance of Ψ and Ψ^2.
Modern Periodic Table
2.4 Cause of periodicity; features of the periodic table; classification of elements.
2.5 Periodic trends for atomic size-atomic radii, ionic, crystal and covalent radii.
2.6 Ionization energy, electron affinity, electronegativity-electronegativity scales, applications of electronegativity.</td></tr>
</table>

	UNIT III (15 hours) (K1, K2, K3, K4) **Structure and bonding - I** **Ionic bond** 3.1 Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds. 3.2 Born Haber cycle-lattice energies, Madelung constant; relative effect of lattice energy and solvation energy. 3.3 Ion polarization-polarising power and polarizability; Fajans' rules-effects of polarisation on properties of compounds; problems involving the core concepts. **Covalent bond** 3.4 Shapes of orbitals, overlap of orbitals-σ and Π bonds; directed valency-hybridization. 3.5 VSEPR theory-shapes of molecules-XeF_2, BF_3, XeF_4, PCl_5, XeF_6 and IF_7. 3.6 Partial ionic character of covalent bond-dipole moment, application to molecules H_2, HF, BeF_2, BF_3, CH_4; percentage ionic character-numerical problems based on calculation of percentage ionic character.
	UNIT IV (15 hours) (K1, K2, K3, K4) **Structure and bonding - II** 4.1 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. 4.2 MO theory-bonding, antibonding and nonbonding orbitals, bond order; MO diagrams of H_2, C_2, O_2, O_2^+, O_2^-, O_2^{2-}, N_2, NO, HF, CO; magnetic characteristics, comparison of VB and MO theories. 4.3 Coordinate bond: definition, formation of $H_3N\rightarrow BF_3$, NH_4^+, H_3O^+ and properties. 4.4 Metallic bond-electron sea model, Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor-types, applications of semiconductors. 4.5 Weak Chemical Forces-Van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. 4.6 Repulsive forces; Hydrogen bonding-types, special properties of water, ice, stability of DNA; Effects of chemical force, melting and boiling points.
	UNIT V (15 hours) (K1, K2, K3, K4) **Basic concepts in Organic Chemistry and Electronic effects** 5.1 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, nitrene and benzyne. 5.2 Inductive effect-reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductomeric and electromeric effects. 5.3 Resonance-resonance energy, conditions for resonance-acidity of phenols, basicity of aromatic amines, stability of carbonium ions, carbanions and free radicals. 5.4 Reactivity of vinyl chloride, dipole moment of vinyl chloride and

	nitrobenzene, bond lengths; steric inhibition to resonance. 5.5 Hyperconjugation-stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitromethane. 5.6 Types of organic reactions-addition, substitution, elimination and rearrangements.

Extended Professional Component (is a part of internal component only, not to beincluded in theexternal examination question paper)	Questions related to the above topics, from various competitive examinationsUPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. R. D. Madan, and Sathya Prakash, Modern Inorganic Chemistry, 2nd Edition, S. Chand and Company, New Delhi, 2004. 2. C.N. R. Rao, University General Chemistry, Macmillan Publication, New Delhi, 2000. 3. P. Y. Bruce, and K. J. R. Prasad, Essential Organic Chemistry, Pearson Education, New Delhi, 2008. 4. UN Dash, OP Dharmarha, P.L. Soni, Textbook of Physical Chemistry, Sultan Chand & Sons, New Delhi, 2016. 5. B.S. Bahl and Arun Bahl, Advanced Organic Chemistry, Sultan Chand and Co. Ltd., Reprint 2008. 6. B. R. Puri, L. R. Sharma and M. S. Pathania, Principles of Physical Chemistry, 43rd Edition, Vishal Publishing Co., 2008.
Reference Books	1. S. H. Maron, and C. P. Prutton, Principles of Physical Chemistry,4th Edition, The Macmillan Company, New York, 1972. 2. J. D. Lee, Concise Inorganic Chemistry, 4th Edition, ELBS William Heinemann, London, 1991. 3. Gurdeep Raj, Advanced Inorganic Chemistry, 26th Edition, Goel Publishing House, Meerut, 2001. 4. P.W. Atkins, & J. Paula, Physical Chemistry, 10th Edition, Oxford University Press, New York, 2014. 5. J. E. Huheey, Inorganic Chemistry: Principles of Structure and Reactivity, 4th Edition, Addison, Wesley Publishing Company, India,1993. 6. P. L. Soni and Mohan Katyal, Textbook of Inorganic Chemistry, 20th Edition, Sultan Chand & Sons, 2001. 7. Arun Bahl and B. S. Bahl, Advanced Organic Chemistry, 1st Revised Multi Colour Edition, Sultan Chand and Company Ltd., 2012. 8. M.K. Jain and S.C. Sharma, Modern Organic Chemistry, Golden Jubilee Year Edition, Vishal Publishing Co., New Delhi, 2017. 9. K.S Tewari and M. K. Vishnoi, A Textbook of Organic Chemistry, 3rd Edition, Vikas Publishing House Pvt. Ltd., 2006. 10. M. K. Jain and S. C. Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2004.

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 Outcomes:

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

CO1: Describe the atomic structure and wave particle duality of matter. (K1, K2, K3, K4)

CO2: Classify the elements in the periodic table, predict trends in periodic properties, and explain the basic aspects of quantum mechanics. (K1, K2, K3, K4)

CO3: Explain the nature of ionic and covalent bonding, geometry of molecules, and to calculate the percentage ionic character. (K1, K2, K3, K4)

CO4: Apply the theories of atomic structure for bonding, construct MO diagrams, and explain the nature of weak chemical forces. (K1, K2, K3, K4)

CO5: Explain the types of bond cleavage, reaction intermediates, types of reagents and electronic effects in organic compounds. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">PRACTICAL-I: QUANTITATIVE INORGANIC ESTIMATION (TITRIMETRY) AND INORGANIC PREPARATIONS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">UCCHB24</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">3</td><td>3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on
laboratory safety
handling glass wares
quantitative estimation
preparation of inorganic compounds</td></tr>
<tr><td>Course Outline</td><td colspan="7">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 (Material Safety Data Sheet); importance and care of PPE (Personal Protective Equipment); 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 gauze and tripod stand.
Principle of Quantitative Estimation (Volumetric)
Equivalent weight of an acid, base, salt, reducing agent, oxidizing agent; concept of mole, molality, molarity, normality; primary and secondary standards, preparation of standard solutions; theories of acid-base, redox, complexometric, iodimetric and iodometric titrations; indicators – types, theory of acid–base, redox, metal ion and adsorption indicators, choice of indicators.</td></tr>
<tr><td></td><td colspan="7">Unit II
Quantitative Estimation (Volumetric)
Preparation of standard solution, dilution from stock solution
Acidimetry
Estimation of sodium hydroxide using standard sodium carbonate
Estimation of borax using standard sodium carbonate
Permanganometry
Estimation of oxalic acid using standard ferrous ammonium sulphate
Dichrometry
Estimation of ferrous ion using standard ferrous ammonium sulphate (internal indicator)
Iodometry
Estimation of copper in copper sulphate using standard dichromate
Argentimetry
Estimation of chloride in barium chloride using standard sodium chloride</td></tr>
</table>

	Unit III Complexometry Estimation of hardness of water using EDTA (Not for Examination) **Preparation of Inorganic compounds** Tetraammine copper (II) sulphate Hexamminecobalt (III) chloride Mohr's Salt
Recommended Text	1. V. Venkateswaran, R. Veeraswamy, A.R. Kulandaivelu, Basic Principles of Practical Chemistry, 2nd Edition, Sultan Chand & Sons, New Delhi, 1997. 2. A. K. Nad, B. Mahapatra, A. Ghoshal, An Advanced Course in Practical Chemistry, 3rd Edition, New Central Book Agency, Kolkata, 2007.
Reference Books	1. J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas, B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson Education Ltd., New Delhi, 2000. 2. Peter A C McPherson, Practical Volumetric Analysis, 4th Edition, Cambridge, The Royal Society of Chemistry, 2015.
Website and e-learning source	1) http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis 2) https://chemdictionary.org/titration-indicator/ 3) http://rohmatchemistry.staff.ipb.ac.id/files/2015/07/vogels-textbook-of-quantitative-chemical-analysis.pdf
Method of Evaluation	**Continuous Assessment - 40 marks** I C.A. - 50 II C.A. - 50 Average - 25 Performance during regular practicals -10 Regularity in submission of observation note-book and Record - 5 **Semester Practical Examination - 60 marks** Short Procedure writing - 5 Viva-voce - 5 (Unit I) + 5 (Unit II and III) Record - 10 Preparation - 5 Volumetric Analysis: ≤ 1% - 30 marks > 1 upto 2% - 25 marks >2 upto 3% - 15 marks >3 upto 4% - 10 marks > 4% - 7 marks

Course Outcomes:

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 skillto estimate the amount of a substance present in a given solution.

CO4: Assess the yield of different inorganic preparations.

CO5: Identify the end point of various titrations.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	M	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">SKILL ENHANCEMENT COURSE: ROLE OF CHEMISTRY IN DAILY LIFE</td></tr>
<tr><td>Paper No.</td><td colspan="7">Skill Enhancement Course SEC I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">USCHA124</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours perweek</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="2">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">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</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="7">UNIT I (6 hours)
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.</td></tr>
<tr><td colspan="7">Unit II (6 hours)
Building materials-cement, ceramics, glass and refractories-definition, composition and application only. Plastics-polythene, PVC, bakelite, polyesters, melamine-formaldehyde resins-preparation and uses only.</td></tr>
<tr><td colspan="7">UNIT III (6 hours)
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.</td></tr>
<tr><td colspan="7">UNIT IV (6 hours)
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.</td></tr>
<tr><td colspan="7">UNIT V (6 hours)
Pharmaceutical drugs-analgesics and antipyretics- paracetamol and aspirin. Colour chemicals-pigments and dyes-examples and applications. Explosives-classification and examples.</td></tr>
<tr><td>Recommended Text</td><td colspan="7">1. H. K. Chopra, P. S. Panesar, Food Chemistry, Narosa Publishing House, 2010.
2. Jayashree Ghosh, A textbook of Pharmaceutical Chemistry, S Chand Publishing, 2012.
3. S. Vaithyanathan, Text book of Ancillary Chemistry, Priya Publications, Karur, 2006.
4. B. K, Sharma, Industrial Chemistry, 16th Edition, GOEL Publishing House, Meerut, 2014.
5. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, 2nd Edition, S. Chand & Co. Publishers, 2006.</td></tr>
</table>

Reference Books	1. Randolph Norris Shreve, Chemical Process Industries, 4th Edition, McGraw-Hill,Texas, 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://chem.libretexts.org/Bookshelves/Introductory_Chemistry/Chemistry_for_Changing_Times_(Hill_and_McCreary)/20%3A_Chemistry_Down_on_the_Farm/20.01%3A_Farming_and_Chemicals-_Fertilizers#:~:text=A%20fertilizer%20is%20any%20material%20(of%20natural%20or%20synthetic%20origin,to%20the%20growth%20of%20plants 2) https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=13G8VouhmrFfuhs6rkiyTA==

Course Outcomes:

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

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

CO2: Explain about the building materials such as cement, ceramics, glass and plastics.

CO3: Recall the importance of balanced diet and explain the formulations of cosmetics and to assess their health hazards.

CO4: Discuss about the fertilizers and various types of fuels.

CO5: Analyze the uses and side effects of analgesics and antipyretics and to illustrate the applications of pigments and dyes.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">SKILL ENHANCEMENT COURSE: FOOD CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Skill Enhancement Course SEC IA</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">USCHB124</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per Week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at giving an overall view of the
• Types of food
• Food adulteration and poisons
• Food additives and preservation</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="7">UNIT I (6 hours)
Food Adulteration
Sources of food, types, advantages and disadvantages. Food adulteration-contamination of wheat, rice, milk, butter etc. with clay stones, water and toxic chemicals, common adulterants, ghee adulterants and their detection. Detection of adulterated foods by simple analytical techniques.</td></tr>
<tr><td colspan="7">Unit II (6 hours)
Food Poison
Food poisons-natural poisons (alkaloids-nephrotoxin)-pesticides, (DDT, BHC, Malathion)-Chemical Poisons-First aid for poison consumed victims.</td></tr>
<tr><td colspan="7">UNIT III (6 hours)
Food Additives
Food additives-artificial sweeteners-saccharin-cyclamate a n d aspartate. Food flavours-esters, aldehydes and heterocyclic compounds, Food colours, emulsifying agents, preservatives, leavening agents. Baking powder-yeast-tastemakers-MSG-vinegar.</td></tr>
<tr><td colspan="7">UNIT IV (6 hours)
Beverages
Beverages-soft drinks-soda-fruit juices-alcoholic beverages-examples. Carbonation-addiction to alcohol-diseases of liver and social problems.</td></tr>
<tr><td colspan="7">UNIT V (6 hours)
Edible Oils
Fats and oils-sources of oils-production of refined vegetable oils-preservation. Saturated and unsaturated fats-iodine value-role of MUFA and PUFA in preventing heart diseases-determination of iodine value, RM value, saponification values and their significance.</td></tr>
</table>

Recommended Text	1. H. K. Chopra, P. S. Panesar, Food Chemistry, Narosa Publishing House, 2010. 2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, 2nd Edition, S. Chand & Co., 2006. 3. Dr. L. Rakesh Sharma, Food Chemistry, Evince Publishing, 2022. 4. G. Subbulakshmi, Shobha A Udipi, Pdmini S Ghugre, Food Processing and Preservation, 2nd Edition, New Age International Publishers, 2021. 5. B. Srilakshmi, Food Science, 3rd Edition, New Age International Publishers, 2005.
Reference Books	1. H.-D. Belitz, Werner Grosch, Food Chemistry, 4th Edition, Springer Science &Business Media, 2009. 2. M. Swaminathan, Food Science and Experimental Foods, Ganesh and Company, 1979. 3. Hasenhuettl, L. Gerard, Hartel W. Richard, Food Emulsifiers and their Applications, 2nd Edition, Springer, New York, 2008. 4. John M. DeMan, John W. Finley, W. Jefferey Hurst, Chang Yong Lee, Principles of Food Chemistry, 4th Edition, Springer, 2018.
Website and e-learning Source	1) https://iamcheated.indianmoney.com/blogs/what-is-food-adulteration 2) https://www.youtube.com/watch?v=J_Pk1Z9YVsA 3) https://www.youtube.com/watch?v=ub-XdapCo18 4) https://www.youtube.com/watch?v=fju6l4nrhks

Course Outcomes:

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

CO 1: Apply the knowledge of food adulterants in everyday life.
CO 2: Describe the nature of food poisons and first aid for victims.
CO 3: Illustrate the nature of food additives.
CO 4: Comprehend the nature of beverages and their social impacts.
CO 5: Explain the chemistry of edible oils.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">FUNDAMENTALS OF CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Foundation Course FC</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">FC</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">UFCH24</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">2</td><td colspan="2">-</td><td colspan="2">-</td><td>2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the Course</td><td colspan="7">The course aims at providing knowledge on
States of matter, atom and chemical equation.
Quantum numbers and periodic table.
Bonds and fundamentals of thermodynamics, chemical equilibrium and electro chemistry.
Purification, introduction to carbon chemistry.
Covalent bond fission, intermediates, IUPAC nomenclature and fundamentals of practical chemistry.</td></tr>
<tr><td rowspan="4">Course Outline</td><td colspan="7">UNIT I (6 hours)
Matter and its nature; concept of atom, molecule, element and compound; atomic and molecular masses, mole concept (numerical problems); Dalton’s atomic theory, Introduction to atomic models; Empirical and molecular formula, chemical equations and stoichiometry; balancing chemical equation by oxidation number method.</td></tr>
<tr><td colspan="7">UNIT II (6 hours)
Laws of chemical combination; Quantum numbers, Modern periodic table, s, p, d and f classification; Periodic trends in properties of elements; Valency, oxidation, reduction, oxidation state, oxidation number calculation, redox reactions, oxidising agents and reducing agents.</td></tr>
<tr><td colspan="7">UNIT III (6 hours)
Ionic, covalent, coordinate bonds; Metallic bond, hydrogen bond, Vander Waals forces; Fundamentals of thermodynamics-system and surroundings, extensive and intensive properties; State functions and types of processes; Meaning of equilibrium, dynamic equilibrium; Electrolytic and metallic conduction.</td></tr>
<tr><td colspan="7">UNIT IV (6 hours)
Purification-crystallization, sublimation, distillation; Estimation of carbon and hydrogen (Basic principles only); Calculation of empirical and molecular formula; Tetravalency of carbon, shapes of simple molecules-ethane, ethene, ethyne; Classification of organic compounds based on functional groups; Homologous series, isomerism-structural and stereoisomerism.</td></tr>
</table>

	UNIT V (6 hours) Isomerism-structural and stereoisomerism-definition and examples. Aliphatic, aromatic and heterocyclic compounds-definition and examples; IUPAC nomenclature-rules, (simple alkanes, alkenes and alkynes); Quantitative and Qualitative analysis-types and significance; Common apparatus and their usage.

Extended Professional Component (is a part of internal component only, not to be includedin the external examination question paper)	Questions related to the above topics, from various competitiveexaminations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. B. S. Bahl, A. Bhal, Advanced Organic Chemistry, 5th Edition, S. Chand, New Delhi, 2014. 2. R. D. Madan, Modern Inorganic Chemistry, 3rd Edition, S. Chand & Co., Reprint 2016. 3. B. R. Puri, L. R Sharma and M.S. Pathania, Principles of Physical Chemistry, 47th Edition, Vishal Publishing Co., 2017.
Reference Books	1. P. L. Soni and Mohan Katyal, Textbook of Inorganic Chemistry, 20th Edition, Sultan Chand &Sons, Reprint 2015. 2. P. L. Soni and H. M. Chawla, Textbook of Organic Chemistry, 29th Revised Edition, Sultan Chand & Sons, 2012. 3. K. S. Tewari and M. K. Vishnoi, A Textbook of Organic Chemistry, 3rd Edition, Vikas Publishing House Private Ltd., 2015. 4. M.K. Jain and S.C. Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2019. 5. P. L. Soni, O. P. Dharmarha and U. N. Dash, Textbook of Physical Chemistry, 23rd Revised Edition, S. Chand & Co., Reprint, 2016. 6. O.P. Pandey, D. N. Bajpai and S. Giri, Practical Chemistry, 8th Edition, S. Chand & Co, 2016.
Website and e-learning source	1) https://epgp.inflibnet.ac.in 2) https://swayam.gov.in 3) https://onlinecourses.nptel.ac.in

Course Outcomes:

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

CO1: Explain atomic theory and balance chemical equation.

CO2: Explain the importance of periodic table and calculate oxidation number.

CO3: Explain bonding and fundamentals of thermodynamics, and chemical equilibrium.

CO4: Explain purification methods and fundamentals of carbon chemistry.

CO5: Explain IUPAC nomenclature and fundamentals of practical chemistry.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">GENERAL CHEMISTRY-II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>5</td><td>Course Code</td><td>UCCHC24</td></tr>
<tr><td>Semester</td><td>II</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry-I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide an overall view of the
● chemistry of acids, bases, and ionic equilibrium
● properties of s and p-block elements
● chemistry of hydrocarbons
● applications of acids and bases
● compounds of main block elements and hydrocarbons</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3, K4)
Acids, bases, and Ionic equilibria
1.1 Concepts of Acids and Bases-Arrhenius concept, Bronsted-Lowry concept, Lewis’s concept, relative strengths of acids, bases, and dissociation constant; dissociation of polybasic acids.
1.2 Ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degree of dissociation.
1.3 Acid-base indicators, theory of acid-base indicators-action of phenolphthalein and methyl orange, titration curves-use of acid-base indicators.
1.4 Buffer solutions-types, mechanism of buffer action in acid and basic buffer, Henderson-Hasselbalch equation.
1.5 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 the relation between hydrolysis constant and degree of hydrolysis.
1.6 Solubility product-determination and applications; numerical problems involving the core concepts.</td></tr>
<tr><td></td><td colspan="7">Unit II (15 hours) (K1, K2, K3, K4)
Chemistry of s-Block Elements
2.1 Hydrogen: Position of hydrogen in the periodic table. Alkali metals: Comparative study of the elements with respect to oxides.
2.2 Comparative study of the elements with respect to hydroxides, halides, carbonates, and bicarbonates. Diagonal relationship of Li with Mg.
2.3 Preparation, properties, and uses of NaOH, Na_2CO_3, KBr, and $KClO_3$ alkaline earth metals. Anomalous behavior of Be.
Chemistry of p- Block Elements (Group 13 & 14)
2.4 Preparation and structure of diborane and borazine. Chemistry of borax.
2.5 Extraction of Al and its Uses. Alloys of Al. Comparison of carbon with silicon.
2.6 Carbon-di-sulphide-Preparation, properties, structure, and uses. Percarbonates, per monocarbonates, and per dicarbonates.</td></tr>
</table>

	UNIT III (15 hours) (K1, K2, K3, K4) **Chemistry of p-Block Elements (Group 15-18)** 2.1 General characteristics of elements of Group 15; chemistry of H_2N-NH_2, NH_2OH, HN_3 and HNO_3. 2.2 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). 2.3 General properties of elements of group16-structure and allotropy of elements-chemistry of ozone-classification and properties of oxides-oxides of sulphur and selenium-oxy acids of sulphur (Caro's and Marshall's acids). 2.4 Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. 2.5 Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI), oxides and oxy acids ($HClO_4$). Inter-halogen compounds (ICl, ClF_3, BrF_5 and IF_7), pseudo halogens [$(CN)_2$ and $(SCN)_2$] and basic nature of Iodine. 2.6 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 (15 hours) (K1, K2, K3, K4) **Hydrocarbon Chemistry-I** 4.1 **Petroproducts:** Fractional distillation of petroleum; cracking, isomerization, alkylation, reforming and uses. 4.2 **Alkenes**-nomenclature, general methods of preparation-mechanism of β-elimination reactions-E1 and E2 mechanism-factors influencing-stereochemistry-orientation-Hofmann and Saytzeff rules. 4.3 Reactions of alkenes-addition reactions-mechanisms-Markownikoff's rule, Kharasch effect, oxidation reactions-hydroxylation, oxidative degradation, epoxidation, ozonolysis; polymerization. 4.4 **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-polymerization-polybutadiene, polyisoprene (natural rubber), vulcanization, polychloroprene. 4.5 **Alkynes**-nomenclature; general methods of preparation, properties, and reactions; acidic nature of terminal alkynes and acetylene, polymerization, and isomerization. 4.6 **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 (15 hours) (K1, K2, K3, K4) **Hydrocarbon Chemistry-II** 5.1 **Benzene:** Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's (4n+2) rule and its applications.

	5.2 Electrophilic substitution reactions-general mechanism of aromatic electrophilic substitution-nitration, sulphonation, halogenation, Friedel-Craft's alkylation, and acylation. 5.3 Mono substituted and disubstituted benzene-effect of substituent-orientation and reactivity. 5.4 **Polynuclear Aromatic hydrocarbons**: Naphthalene-nomenclature, Haworth synthesis; physical properties, reactions-electrophilic substitution reaction. 5.5 Nitration, sulphonation, halogenation, Friedel-Crafts acylation & alkylation, preferential substitution at o-position-reduction, oxidation-uses. 5.6 Anthracene-synthesis by Elbs reaction, Diels-Alder reaction, and Haworth synthesis; physical properties; 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)
Recommended Text	1. R D Madan, Sathya Prakash, Modern Inorganic Chemistry, 3rd Edition, S. Chand and Company, New Delhi, 2019. 2. Sathya Prakash, G D Tuli, S K Basu and R D Madan, Advanced Inorganic Chemistry, Latest Edition, S. Chand and Company, New Delhi, 2022. 3. B S Bahl, Arul Bhal, Advanced Organic Chemistry, 5th Edition, S. Chand and Company, New Delhi, 2012, 4. K S Tewari, S N Mehrothra and N K Vishnoi, Text book of Organic Chemistry, 4th Edition, Vikas Publishing House, New Delhi, 2017. 5. B R Puri, L R Sharma, Principles of Physical Chemistry, 47th Edition, Vishal Publishing Company, Jalandhar, 2020.
Reference Books	1. S H Maron and C P Prutton, Principles of Physical Chemistry, 4th Edition, The Macmillan Company, New York, 2017. 2. G M Barrow, Physical Chemistry, 5th Edition, Tata McGraw Hill, New Delhi, 1992. 3. J D Lee, Concise Inorganic Chemistry, 5th Edition, ELBS William Heinemann, London, 2012. 4. J E Huheey, Inorganic Chemistry: Principles of Structure and Reactivity, 4th Edition, Addison Wesley Publishing Company, India, 2006. 5. Gurdeep Raj, Advanced Inorganic Chemistry Vol-I, 31st Edition, Goel Publishing House, Meerut, 2008. 6. O. P. Agarwal, Reactions and Reagents in Organic Chemistry, 56th Revised Edition, Goel Publishing House, Meerut, 2023.

Website and e-learning source	1) https://onlinecourses.nptel.ac.in 2) http://cactus.dixie.edu/smblack/chem1010/lec ture_notes/4B.html 3) http://www.auburn.edu/~deruija/pdareson.pdfhttps://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding 4) https://ncert.nic.in/textbook/pdf/kech204.pdf 5) https://unacademy.com/content/nda/study-material/chemistry/s-block-elements-and-their-properties/ 6) https://nptel.ac.in/courses/104101006 **MOOC components** 7) http://nptel.ac.in/courses/104101090/ 8) http://nptel.ac.in/courses/104101090/ Lecture 1: Classification of elements and periodic properties

Course Outcomes:

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

CO1: Explain the concepts of acids, bases and ionic equilibria. (K1, K2, K3, K4)

CO2: Discuss the chemistry of s and group 13 & 14 p- block elements. (K1, K2, K3, K4)

CO3: Describe the chemistry of nitrogen, oxygen, halogen and noble gas group elements. (K1, K2, K3, K4)

CO4: Illustrate the nomenclature, preparation, reactions with mechanisms of alkenes, alkadienes, alkynes and cycloalkanes. (K1, K2, K3, K4)

CO5: Explain the structure, reactivity of benzene and polynuclear aromatic hydrocarbons. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="8">PRACTICAL-II: QUALITATIVE ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core Course IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">UCCHD24</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="4">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="2">3</td><td colspan="4">3</td></tr>
<tr><td>Prerequisites</td><td colspan="8">General Chemistry II</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims at providing knowledge on
• laboratory safety
• handling glass wares
• analysis of organic compounds
• preparation of organic compounds</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="8">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.</td></tr>
<tr><td colspan="8">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 sugars)
• primary amine
• monoamide, diamide
• anilide, nitro compound
Preparation of derivatives for functional groups</td></tr>
<tr><td colspan="8">UNIT III
Preparation of Organic Compounds
1. Halogenation - p-bromo acetanilide from acetanilide
2. Oxidation - benzoic acid from Benzaldehyde
3. Salicylic acid from Methyl Salicylate
4. Acetylation of salicylic acid (Preparation of Aspirin)
Separation and Purification Techniques (Not for Examination)
1. Purification of organic compounds by crystallization (from water / alcohol) and distillation.
2. Determination of melting and boiling points of organic compounds.
3. Separation of permanganate and dichromate by Paper Chromatography.
4. Determination of saponification value of oil.</td></tr>
</table>

Reference Books	1. V. Venkateswaran, R. Veeraswamy, A.R. Kulandaivelu, Basic Principles of Practical Chemistry, 2nd Edition, Sultan Chand, New Delhi, 2012. 2. A.K. Manna, Practical Organic Chemistry, Books and Allied, India, 2018. 3. J. N Gurtu, R. Kapoor, Advanced Experimental Chemistry (Organic), Sultan Chand, New Delhi, 1987. 4. B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A.R. Tatchell, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Pearson, India, 1989. 5. A.I. Vogel, A.R. Tatchell, B.S. Furnis, A.J. Hannaford and P.W.G. Smith, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Pearson, 2005. 6. Darshan V. Chaudhary, Organic Chemistry Practicals and Important Reagents, 1st Edition, Create Space Independent Pub., 2016.
Website and e-learning Source	1. https://www.vlab.co.in/broad-area-chemical-sciences 2. https://www.toppr.com/guides/chemistry/organic-chemistry/qualitative-analysis-of-organic-compounds/ **3.** https://vlab.amrita.edu/?sub=2&brch=191&sim=345&cnt=1
Method of Evaluation	**Continuous Assessment – 40 marks** I C.A. - 50 II C.A. - 50 Average - 25 Performance during regular practicals - 10 Regularity in submission of observation note-book and Record - 5 **Semester Practical examination – 60 marks** Viva-voce - 5 Record - 10 Preparation - 10 (Quantity-5, Quality-5) **Organic Analysis - 35** Preliminary Tests - 3 Special element - 6 Aliphatic/Aromatic - 4 Saturated/unsaturated - 4 Functional group - 8 Other tests - 6 Derivative - 4

Course Outcomes:

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 and explain the reactions behind it.

CO4: Compare mono and polyhydric phenols, aldehyde and ketone, reducing and non-reducing sugars and explain the reactions behind it.

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

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	M	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">SKILL ENHANCEMENT COURSE: DAIRY CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Skill Enhancement Course SEC II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">USCH224</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing an overall view of the
● chemistry of milk and milk products
● processing of milk
● preservation and formation of milk products.</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT I (6 hours)
Composition of Milk
Milk-definition-general composition of milk-constituents of milk-lipids, proteins, carbohydrates, vitamins and minerals-physical properties of milk-colour, odour, acidity, specific gravity, viscosity and conductivity-factors affecting the composition of milk- adulterants, preservatives with neutralizer-examples and their detection- estimation of fat, acidity and total solids in milk.</td></tr>
<tr><td colspan="7">Unit II (6 hours)
Processing of Milk
Microbiology of milk-destruction of micro-organisms in milk, physicochemical changes taking place in milk due to processing- boiling, pasteurization-types of pasteurization-Bottle, Batch and HTST (High Temperature Short Time)-Vacuum pasteurization-Ultra High Temperature Pasteurization.</td></tr>
<tr><td colspan="7">UNIT III (6 hours)
Major Milk Products
Cream-definition-composition-chemistry of creaming process-gravitational and centrifugal methods of separation of cream-estimation of fat in cream. Butter-definition-composition-theory of churning-desi butter-salted butter, estimation of acidity and moisture content in butter. Ghee-major constituents-common adulterants added to ghee and their detection-rancidity-definition-prevention-antioxidants and synergists-natural and synthetic.</td></tr>
<tr><td></td><td colspan="7">UNIT IV (6 hours)
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.</td></tr>
</table>

	UNIT V (6 hours) **Fermented and other Milk Products** Fermented milk products-fermentation of milk-definition, conditions, cultured milk-definition of culture-example, conditions-cultured cream, butter milk-bulgaricus milk-acidophilous milk-Yoheer Indigenous products-khoa and chhena definition-Ice cream-definition-percentage composition-types-ingredients-manufacture of ice-cream, stabilizers-emulsifiers and their role-milk powder-definition-need for making milk powder-drying process-types of drying.
Recommended Text	1. K. Bagavathi Sundari, Applied Chemistry, 1st Edition, MJP Publishers, 2006. 2. K. S. Rangappa and K.T. Acharya, Indian Dairy Products, Asia Publishing House, New Delhi, 1974. 3. M.P. Mathur, D. Datta Roy, P. Dinakar, Text book of Dairy Chemistry, 1st Edition, Indian Council of Agricultural Research, 2008. 4. Saurav Singh, A Text book of Dairy Chemistry, 1st Edition, Daya Publishing House, 2013. 5. P. L. Choudhary, Text book of Dairy Chemistry, Bio-Green Book Publishers, 2021. 6. N.P. Wong, R. Jenness, M. Keeney, E. H. Marth, Fundamentals of Dairy Chemistry, 3rd Edition, CBS Publishers & Distributors, 1998. 7. J. G. Davis, Milk Testing-A laboratory control of milk, Agrobios, India, 2010. 8. V. K. Chhazllani, Dairy Chemistry and Animal Nutrition, Mangala Publications, 2008. 9. Clarence Henry Eckles, Willes Barnes Combs, Harold Macy, Milk and Milk Products, 4th Edition, Tata McGraw-Hill Publishing Company Limited, 2002.
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, 2003. 4. P. F. Fox and P.L.H. Mcsweeney, Dairy Chemistry and Biochemistry, 2nd Edition, Springer, 2016. 5. P. F. Fox, T. Uniacke-Lowe, P.L.H. McSweeney, J.A.O Mahony, Dairy Chemistry and Biochemistry, 2nd Edition, Springer, 2015.
Website and e-learning source	1) https://www.youtube.com/watch?v=BdANJaYBXR0 2) https://www.youtube.com/watch?v=ebU8S6u2LWE 3) https://www.youtube.com/watch?v=QL0HFcsn4XQ

Course Outcomes:

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

CO1: Describe the composition and physical properties of milk.

CO2: Explain the methods of processing of milk.

CO3: Discuss the chemistry of milk products.

CO4: Explain about different types of special milk.

CO5: Make fermented milk, butter milk, ice cream and milk powder.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">SKILL ENHANCEMENT COURSE: COSMETICS AND PERSONAL GROOMING</td></tr>
<tr><td>Paper No.</td><td colspan="7">Skill Enhancement Course SEC III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">USCH324</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td>Instructional</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td>Total</td></tr>
<tr><td>hours per week</td><td>2</td><td>-</td><td colspan="3">-</td><td>2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at familiarizing the students with
formulations of various types of cosmetics and their significance
hair, skin and dental care
makeup preparations and personal grooming</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="7">Unit I (6 hours)
Skin care
Nutrition of the skin, skin care and cleansing of the skin; face powder-ingredients; creams and lotions-cleansing, moisturizing all purpose, shaving and sunscreen (formulation only); Gels-formulation and advantages; astringent and skin tonics-key ingredients, skin lightness, depilatories.</td></tr>
<tr><td colspan="7">Unit II (6 hours)
Hair care
Shampoos-types-powder, cream, liquid, gel-ingredients; conditioner-types-ingredients.
Dental care
Tooth pastes-ingredients-mouth wash.</td></tr>
<tr><td colspan="7">Unit III (6 hours)
Make up
Base-foundation-types-ingredients; lipstick, eyeliner, mascara, eye shadow, concealers, rouge.</td></tr>
<tr><td colspan="7">Unit IV (6 hours)
Perfumes
Classification-natural-plant origin-parts of the plant used, chief constituents; animal origin-ambergris from whale, civetone from civet cat, musk from musk deer; synthetic-classification emphasizing characteristics-esters-alcohols-aldehydes-ketones.</td></tr>
<tr><td colspan="7">Unit V (6 hours)
Beauty treatments
Facials-types-advantages-disadvantages; face masks-types; bleach- types-advantages-disadvantages; shaping the brows; eyelash tinting; perming-types; hair colouring and dyeing; permanent waving-hair straightening; wax
Types-waxing; pedicure, manicure-advantages-disadvantages.</td></tr>
<tr><td>Recommended Text</td><td colspan="7">1. Thankamma Jacob, Foods, drugs and cosmetics-A consumer guide, Macmillan Publication, London, 1997.</td></tr>
</table>

Reference Books	1. J B E Wilkinson and R J Moore, Harry's Cosmetology, 7th Edition, Chemical Publishers, London, 1997. 2. George Howard, Principles and Practice of Perfumes and Cosmetics, Stanley Therones, Chettenham, 1987. 3. Leslie S. Baumann, Cosmetic Dermatology: Principles and Practice, McGraw Hill Professional, 2009. 4. Draelos, Zoe Diana, Cosmetic Formulation of Skin Care Products, CRC Press, 2005. 5. André O. Barel, Marc Paye, and I. Howard Maibach, Handbook of Cosmetic Science and Technology, CRC Press, 2014. 6. Muller, M. Peter, and Dietmar Lamparski, Perfumes: Art, Science and Technology, Springer Science & Business Media, 2012. 7. D'Angelo, Janet M. Milady, Standard Aesthetics: Fundamentals, Milady Cengage Learning, 2012.
Website and e-learning source	1) http://www.khake.com/page75.html 2) Net.foxsm/list/284 3) https://scholarworks.umb.edu/bookshelf/37/ 4) https://chesterrep.openrepository.com/handle/10034/620356

Course Outcomes:
On completion of the course, the students should be able to
CO1: Illustrate the skin care methods.
CO2: Describe the hair care and dental care products.
CO3: Discuss the role of different make up products.
CO4: Comprehend the chemistry of perfumes.
CO5: Analyze the advantages and disadvantages of beauty treatments.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">GENERAL CHEMISTRY-III</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td>Credits</td><td>5</td><td>Course Code</td><td>UCCHE24</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="2">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry-I and II</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide a comprehensive knowledge on
● the physical properties of gases, liquids, solids and X-ray diffraction of solids
● fundamentals of nuclear chemistry and nuclear waste management
● applications of nuclear energy
● basic chemistry of halo-organic compounds, phenol and other aromatic alcohols
● preparation and properties of phenols and alcohols</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3, K4)
Gaseous state
1.1 Kinetic molecular model of a gas: postulates and derivation from the kinetic gas equation.
1.2 The Maxwell-Boltzmann distribution of speed of molecules-average, root mean square and most probable velocity and average kinetic energy.
1.3 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.
1.4 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.
1.5 Numerical problems based on equations of states for real gases, isotherms of real gases-critical phenomena-isotherms of CO_2-continuity of state.
1.6 Van der Waal’s equation and the critical state; law of corresponding states-liquefaction of gases; numerical problems involving the core concepts.</td></tr>
<tr><td></td><td colspan="7">Unit II (15 hours) (K1, K2, K3, K4)
Liquid and Solid State
2.1 Properties of Liquids-surface tension, viscosity and their applications.
2.2 Crystalline and amorphous-differences-geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism.
2.3 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.
2.4 Packing in atomic solids-simple cubic, body centered cubic, face centered and hexagonal close packing; Co-ordination number in typical structures-NaCl, CsCl, ZnS, TiO_2; comparison of structures and properties of diamond and graphite; numerical problems involving core concepts.
2.5 Defects in solids-stoichiometric and nonstoichiometric defects.</td></tr>
</table>

	2.6 Liquid crystals – classification and applications.
	UNIT III (15 hours) (K1, K2, K3, K4) **Nuclear Chemistry** 3.1 Natural radioactivity-α, β and γ rays; half-life period; Soddy-Fajan's group displacement law, Geiger-Nuttal rule. 3.2 Isotopes, isobars, isotones, mirror nuclei, isodiaphers; nuclear isomerism; radioactive decay series; magic numbers; units. 3.3 Curie, Rutherford, Roentgen; nuclear stability-neutron-proton ratio; binding energy; packing fraction; mass defect. 3.4 Simple calculations involving mass defect and B.E., decay constant and t1/2 and radioactive series. 3.5 Isotopes-uses-tracers-determination of age of rocks by radiocarbon dating. (Problems to be worked out). 3.6 Nuclear energy; nuclear fission and fusion-major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures.
	UNIT IV (15 hours) (K1, K2, K3. K4) **Halogen derivatives** 4.1 Aliphatic halogen derivatives-nomenclature and classes of alkyl halides-isomerism, physical properties, chemical reactions. 4.2 Nucleophilic substitution reactions-S_N1, S_N2 and S_Ni mechanisms with stereo chemical aspects and effect of solvent. 4.3 Di, Tri & Tetra Halogen derivatives: Nomenclature, classification; Methyl chloride, ethyl bromide, methylene dichloride, chloroform, iodoform, carbon tetrachloride-preparation, properties and applications. 4.4 Aromatic halogen compounds-nomenclature, preparation, properties and uses. 4.5 Aryl alkyl halides-nomenclature, benzyl chloride-preparation, properties and uses. 4.6 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 (15 hours) (K1, K2, K3, K4) **Phenols** 5.1 Nomenclature; classification, preparation from diazonium salts, cumene, Dow's process, properties-acidic character and effect of substitution on acidity. 5.2 Reactions-Reimer-Tiemann, Kolbe, Schmidt, Gattermann synthesis, Libermann's nitroso reaction, phthalein reaction. 5.3 Resorcinol, quinol, picric acid-preparation, properties and uses. **Aromatic alcohols** 5.4 Nomenclature, benzyl alcohol-methods of preparation-hydrolysis, reduction of benzaldehyde, Cannizzaro reaction, Grignard synthesis. 5.5 Reactions-reaction with sodium, phosphorus pentachloride, thionyl chloride, acetic anhydride, hydrogen iodide, oxidation-substitution on the benzene nucleus, uses. 5.6 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)

Recommended Text	1. M.S. Pathania, B.R. Puri, L.R. Sharma, Principles of Physical Chemistry, 46th Edition, Vishal Publishing, 2020. 2. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, 33rd Edition, Vishal Publishing Co., 2020. 3. P.L. Soni and Mohan Katyal, Textbook of Inorganic Chemistry, 20th Edition, Sultan Chand & Sons, 2006. 4. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, Golden Jubilee Year Edition, Vishal Publishing, 2020. 5. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, 3rd Edition, Laxmi Publications, 2007.
Reference Books	1. Craig B. Fryhle, Scott A. Snyder, T. W. Graham Solomons, Organic Chemistry, 13th Edition, John Wiley & Sons, 2023. 2. A. Carey Francis, Organic Chemistry, 7th Edition, McGraw-Hill Education, 2007. 3. I. L. Finar, Organic Chemistry, 6th Edition, Pearson Education India, 2002. 4. P. L. Soni, and H. M. Chawla, Text Book of Organic Chemistry, 29th Edition, Sultan Chand & Sons, 2012. 5. J. D. Lee, Concise Inorganic Chemistry, 5th Edition, Oxford University Press, 2008.
Website and e-learning source	**MOOC components** 1) https://nptel.ac.in/courses/104104101 Solid state chemistry 2) https://nptel.ac.in/courses/103106071 Nuclear industries and safety 3) https://nptel.ac.in/courses/104106119 Introduction to organic chemistry

Course Outcomes:

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

CO1: Explain the kinetic properties of gases by using mathematical concepts. (K1, K2, K3. K4)

CO2: Examine 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. (K1, K2, K3, K4)

CO3: Investigate the radioactivity, nuclear energy and its production, also the nuclear waste management. (K1, K2, K3, K4)

CO4: Write the nomenclature, analyze physical & chemical properties and basic mechanisms of halo organic compounds and alcohols. (K1, K2, K3, K4)

CO5: Investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including thiols. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">PRACTICAL-III: QUALITATIVE INORGANIC ANALYSIS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">UCCHF24</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per Week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">3</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">To develop the skill on systematic analysis of simple inorganic salts and mixture of salts.</td></tr>
<tr><td>Course Outline</td><td colspan="7">Semi-Micro Qualitative Analysis
1. Analysis of simple acid radicals: Carbonate, sulphate, chloride, nitrate.
2. Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate.
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, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium.
5. Analysis of a mixture - I to VIII containing two cations and two anions (of which one is interfering type).</td></tr>
<tr><td>Recommended Text</td><td colspan="7">Reference Books:
1. V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, 2nd Edition, Sultan Chand & Sons, New Delhi, 1997.
2. Dr. O. P. Pandey, D. N. Bajpai, Dr. S. Giri, Practical Chemistry, Revised Edition, S. Chand Ltd., 2013.
3. Vogel’s Text book of Qualitative Inorganic Analysis, 7th Edition, Pearson, 2012.</td></tr>
<tr><td>Website and e-learning source</td><td colspan="7">1. https://www.vlab.co.in/broad-area-chemical-sciences
2. https://amrita.olabs.edu.in/?sub=73&brch=7&sim=180&cnt=515(Analysisof anions)
3. http://amrita.olabs.edu.in/?sub=73&brch=7&sim=31&cnt=1 (Analysisof cations)
4. http://web.mst.edu/~gbert/qual/qual.html (Analysisof cations)
5. https://nroer.gov.in/55ab34ff81fccb4f1d806025/file/58664a1e472d4a6379bd98a5 (Analysis of anions)
6. https://nroer.gov.in/55ab34ff81fccb4f1d806025/file/58664a74472d4a6379bd98c7 (Analysis of cations)</td></tr>
<tr><td>Method of Evaluation</td><td colspan="7">Continuous Assessment - 40 marks
I CA - 50
II CA - 50
Average - 25
Performance during regular practicals - 10
Regularity in submission of observation note-book and record - 5</td></tr>
</table>

	Semester Practical Examination - 60 marks Viva-Voce - 5 Record - 10 Qualitative Analysis - 45 Simple Acid Radical - 8 Eliminating Radical - 10 Each Basic Radical - 9 (9 x 2 = 18) Other tests - 9 **Total** - **100** (Note: For each radical spotting - 2 marks)

Course Outcomes:

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

CO1: Recall the principles of inorganic qualitative analysis.

CO2: Apply the concepts of semimicro analysis in inorganic qualitative analysis.

CO3: Develop skill to analyse systematically the given inorganic mixture and identify the acid and basic radicals.

CO4: Describe the importance of eliminating the interfering radical.

CO5: Eliminate the interfering acid radical for group separation and identify the basic radicals.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	M	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	H	H
CO2	H	M	H	H	H	H
CO3	H	M	H	H	H	H
CO4	H	M	H	H	H	H
CO5	H	M	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">SKILL ENHANCEMENT COURSE: ENTREPRENEURIAL SKILLS IN CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Skill Enhancement Course SEC IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">1</td><td rowspan="2">Course Code</td><td rowspan="2">USCH424</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">1</td><td colspan="2">1</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at providing training to
• develop entrepreneur skills in students
• to provide hands on experience to prepare and develop products
• develop start ups</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="7">UNIT I (3 hours)
Food Chemistry
Food adulteration-contamination of food items with clay stones, water and toxic chemicals-common adulterants.
Food additives, natural and synthetic anti-oxidants, glazing agents (hazardous effect), food colourants, preservatives, leavening agents, baking powder and baking soda, yeast, MSG, vinegar.</td></tr>
<tr><td colspan="7">UNIT II (3 hours)
Dyes
Classification-natural, synthetic dyes and their characteristics-basic methods and principles of dyeing.</td></tr>
<tr><td colspan="7">UNIT III (3 hours)
Hands on Experience
Detection of adulterants in food items like coffee, tea, pepper, chilli powder, turmeric powder, butter, ghee, milk, honey etc., by simple techniques.
Preparation of Jam, squash and Jelly, gulkand, cottage cheese.</td></tr>
<tr><td colspan="7">UNIT IV (3 hours)
Hands on Experience (Students can choose any one)
1. Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, tooth paste/powder and disinfectants in small scale.
2. Extraction of oils from spices and flowers.</td></tr>
<tr><td colspan="7">UNIT V (3 hours)
Hands on Experience (Students can choose any one)
1. Testing of water samples using testing kit.
2. Dyeing-cotton fabrics with natural and synthetic dyes.
3. Printing-tie and dye, batik.</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="7">Entrepreneurial skills</td></tr>
<tr><td>Recommended Text</td><td colspan="7">1. S. George, V. Muralidharan, Fibre to Finished Fabric-A Simple Approach, Publication Division, University of Madras, Chennai, 2007.
2. G. P. Appaswamy, A Handbook on Printing and Dyeing of Textiles.</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Shyam Jha, Rapid detection of food adulterants and contaminants (Theory and Practice), 1st Edition, Elsevier, e Book ISBN 9087128004289, 2015.</td></tr>
</table>

Website and e-learning source	1. https://www.vlab.co.in/broad-area-chemical-sciences 2. https://agritech.tnau.ac.in/horticulture/extraction_methods_natural_essential_oil.pdf 3. https://tinyurl.com/5p5unwhn 4. https://youtu.be/Vz719gfUjOQ?si=W3YMxDvWx4EgtXEa

Course Outcomes:

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

CO1: Identify adulterated food items by doing simple chemical tests.

CO2: Prepare cleaning products and become entrepreneurs.

CO3: Educate others about adulteration and motivate them to become entrepreneurs.

CO4: Analyze the basic parameters of water samples.

CO5: Demonstrate the basic methods of dyeing.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">SKILL ENHANCEMENT COURSE : PESTICIDE CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Skill Enhancement Course SEC V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">USCH524</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Fundamentals in Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to providing the students
knowledge about the various types of pesticides and their toxicity.
to understand the accumulation of pesticides in the form of residues and its analysis.
knowledge on choice of alternate and eco-friendly pesticides.</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="7">Unit I (6 hours)
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.</td></tr>
<tr><td colspan="7">Unit II (6 hours)
Insecticides: Classification and study of following insecticides with respect to structure, chemical name, physical and chemical properties, synthesis, degradation, metabolism, formulations, mode of action, uses, toxicity.
Organophosphates and Phosphothionates: Acephate, Chlorpyriphos, Monocrotophos, and parathion-methyl. Organochlorine-Endosulfan, heptachlor; Carbamate: Cartap hydrochloride, Methomyl, Propoxur.</td></tr>
<tr><td colspan="7">Unit III (6 hours)
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.</td></tr>
<tr><td colspan="7">UNIT IV (6 hours)
Pesticide Residues effect and analysis: Effects of pesticides residue on human life, birds and animals-routes for exposure to pesticides, action of pesticides on living system. Analysis of pesticides residues-sample preparation, extraction of pesticides residues (soil, water and vegetables/fruits) simple methods and schemes of analysis, multi-residue analysis.</td></tr>
<tr><td colspan="7">Unit V (6 hours)
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,</td></tr>
</table>

	Bromadiolone.
Recommended Text	1. SK Handa, Principles of Pesticide Chemistry, Agrobios, India, 2022. 2. G Matolcsy, M Nádasy, V Andriska, Pesticide Chemistry, Revised Edition, Elsevier, 2021. 3. J. Miyamoto and P. C. Kearney, Pesticide Chemistry: Human Welfare and the Environment: Pesticide Residue and Formulation Chemistry, Volume IV, Elsevier Press, 2013. 4. R. Cremlyn, Pesticides, Preparation and mode of action, Chichester, New York, Wiley Publisher, 1978.
Reference Books	1. N. K. Roy, Chemistry of Pesticides, 1st Edition, CBS Publisher & Distributors Pvt. Ltd., 2010. 2. L. M. Nollet, H. S. Rathore, Handbook of Pesticides: Methods of Pesticide Residues Analysis, CRC Press, 2016. 3. R. H. Ellerbrock, Pesticide Residues: Significance, Management and Analysis, 2005. 4. A. Rakshit, H.B. Singh, A.K. Singh, P.C. Abhilash, B.K. Sarma, V.K. Tripathi and H.P. Parewa, Handbook of Agriculture, Environment and Biotechnology, Association of Agriculture, Environment and Biotechnology, New Delhi.
Website and e-learning source	1) https://youtu.be/QtC14bq42aw 2) https://youtu.be/-pdJ8xGnDpk 3) https://youtu.be/gJG2jg55Qe0 4) https://youtu.be/gloQQm33g2I?si=phQcYHF0U2EpcW4f

Course Outcomes:

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

CO1: Analyze about the pesticides and their toxicity with respect to structure and category.
CO2: Explain the chemistry of insecticides.
CO3: Investigate the pesticide residues, prevention and care.
CO4: Demonstrate the extraction and analytical methods of pesticide residues.
CO5: Make awareness to the public on bio-pesticides.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">GENERAL CHEMISTRY-IV</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course VII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td>Course Code</td><td>UCCHG24</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry-III</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide a comprehensive knowledge on
• thermodynamic concepts on chemical processes and applied aspects
• thermochemical calculations
• transition elements with reference to periodic properties and group study of transition metals
• the chemistry of ethers, aldehydes and ketones
• the chemistry of carboxylic acids</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3, K4)
Thermodynamics I
1.1 Thermodynamics-types of systems-isolated, closed, open, homogeneous and heterogeneous systems, phase, state of a system, state variables. Thermodynamic equilibrium-thermal, mechanical and chemical equilibria, extensive and intensive properties, processes and their types-isothermal, adiabatic and isobaric processes, reversible and irreversible processes, nature of work and heat.
1.2 The first law of thermodynamics-concept of internal energy, statements of I law, state and path functions, exact and inexact differentials, the Euler reciprocal relation, calculation of w, ΔU, q and ΔH for expansion and compression of ideal gases under reversible and irreversible isothermal conditions.
1.3 Adiabatic expansion-calculation of w, ΔU and ΔH, final temperatures in reversible and irreversible adiabatic expansions, comparison of isothermal and adiabatic expansions.
1.4 Enthalpy of a system, enthalpies of vaporization and fusion, heat capacity of a system-relationship between C_p and C_v in gaseous systems, Joule Thomson effect- inversion temperature.
1.5 Thermochemistry-heat of reaction, exothermic and endothermic reactions, relationship between q_p and q_v, standard enthalpy changes of reactions, standard enthalpies of combustion, neutralization and formation, determination of enthalpies of reactions, variation of enthalpy of reaction with temperature-Kirchhoff's equations.
1.6 Bond energies-definition, calculation and applications of bond energies. Zeroth law of thermodynamics-Absolute temperature scale.</td></tr>
<tr><td></td><td colspan="7">Unit II (15 hours) (K1, K2, K3, K4)
Thermodynamics II
2.1 The Second law of thermodynamics-need for the second law, statements of II law, spontaneous processes, Carnot's cycle-efficiency of a heat engine-Carnot's theorem.
2.2 Entropy-the concept of entropy, entropy changes in isothermal expansion</td></tr>
</table>

	of an ideal gas, in reversible and irreversible processes, entropy change accompanying change of phase. 2.3 Calculation of entropy changes with changes in T, V, and P, entropy changes in different processes, entropy of a mixture of ideal gases, entropy of mixing, physical significance of entropy. 2.4 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. 2.5 Gibbs-Helmholtz equation-derivations and applications; Maxwell relationships; Ellingham Diagram-application. 2.6 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 (15 hours) (K1, K2, K3, K4) **General Characteristics of d-block elements** 3.1 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. 3.2 Comparative study of transition elements and non-transition elements-comparison of II and III transition series with I transition series. 3.3 Group study of Titanium and Vanadium groups. 3.4 Group study of Chromium group. 3.5 Group study of Manganese and Iron groups. 3.6 Group study of Zinc group.
	UNIT IV (15 hours) (K1, K2, K3, K4) **Ethers, Thio ethers and Epoxides** 4.1 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. 4.2 Reactions of epoxides with alcohols, ammonia derivatives and $LiAlH_4$ Thioethers-nomenclature, structure, preparation, properties and uses. **Aldehydes and Ketones** 4.3 Nomenclature, structure and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. 4.4 Nucleophilic addition reactions, base catalysed reactions with mechanism-Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. 4.5 Oxidation of aldehydes. Baeyer-Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf-Kishner reduction, Meerwein-Pondorf Verley reduction, reduction with $LiAlH_4$ and $NaBH_4$. 4.6 Addition reactions of unsaturated carbonyl compounds: Michael addition.
	UNIT V (15 hours) (K1, K2, K3, K4) 5.1 **Carboxylic Acids**: Nomenclature, structure, preparation and reactions of aliphatic and aromatic monocarboxylic acids. Physical properties, acidic nature, effect of substituent on acidic strength. 5.2 HVZ reaction, Bouveault Blanc reduction, decarboxylation, Hunsdiecker reaction. Formic acid-reducing property. Reactions of dicarboxylic acids. 5.3 **Carboxylic acid Derivatives:** Preparations of aliphatic and aromatic acid

	chlorides, esters, amides and anhydrides. Nucleophilic substitution reaction at the acyl carbon of acyl halide, anhydride, ester, amide. Schottan-Baumann reaction. Claisen condensation, Dieckmann and Reformatsky reactions. 5.4 **Active methylene compounds:** Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate. 5.5 **Halogen substituted acids-**nomenclature; preparation by direct halogenation, iodination from unsaturated acids, alkyl malonic acids. 5.6 **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 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)

Recommended Text	1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, 33rd Edition, Shoban Lal Nagin Chand and Co., 1992. 2. R. D. Madan, Modern Inorganic Chemistry, 3rd Edition, S. Chand & Co., Reprint, 2016. 3. K. L. Kapoor, A Textbook of Physical Chemistry, (Volume 2 and 3), 3rd Edition, Macmillan India Ltd, 2009. 4. P. L. Soni and Mohan Katyal, Textbook of Inorganic Chemistry, 20th Edition, Sultan Chand & Sons, 2006. 5. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, 4th Reprint Edition, Vishal Publishing, 2003. 6. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, 3rd Edition, Macmillan India Ltd., 1994.
Reference Books	1. S. H. Maron, and C. P. Prutton, Principles of Physical Chemistry, 4th Edition, The Macmillan Company, New York, 1972. 2. J. D. Lee, Concise Inorganic Chemistry, 4th Edition, ELBS Heinemann, London, 1991. 3. Gurdeep Raj, Advanced Inorganic Chemistry, 26th Edition, Goel Publishing House, Meerut, 2001. 4. P.W. Atkins, & J. Paula, Physical Chemistry, 10th Edition, Oxford University Press, New York, 2014. 5. J. E. Huheey, Inorganic Chemistry: Principles of Structure and Reactivity, 4th Edition, Addison Wesley Publishing Company, India,1993. 6. K. S. Tewari and M. K. Vishnoi, A Textbook of Organic Chemistry, 3rd Edition, Vikas Publishing House Pvt. Ltd., 2015. 7. M. K. Jain and S. C. Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2019. 8. P.L. Soni. O. P. Dharmarha, and U.N. Dash, Textbook of Physical Chemistry, 23rd Revised Edition, S. Chand & Co., Reprint 2016. 9. J. Rajaram and J. C. Kuriakose, Thermodynamics, 3rd Edition, Vishal

	Publications, 2013. 10. J. N. Gurtu, Thermodynamics, 4th Edition, Pragati Prakashan, 2014.
Website and e-learning source	1) **MOOC components** https://nptel.ac.in/courses/112102255 Thermodynamics 2) https://nptel.ac.in/courses/104101136 Advanced transition metal chemistry https://nptel.ac.in/courses/104/106/104106107/ Thermodynamics

Course Outcomes:

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 thermochemical calculations. (K1, K2, K3, K4)

CO2: Discuss the second law of thermodynamics and its application to heat engine; discuss third law and its application on heat capacity measurement. (K1, K2, K3, K4)

CO3: Investigate the chemistry of transition elements with respect to various periodic properties and group wise discussions. (K1, K2, K3, K4)

CO4: Discuss the fundamental organic chemistry of ethers, epoxides and carbonyl compounds including named organic reactions. (K1, K2, K3, K4)

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. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">PRACTICAL-IV: PHYSICAL CHEMISTRY
PRACTICAL-I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course VIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">UCCHH24</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">3</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at providing an understanding of
• the laboratory experiments to understand the concepts of physical changes in chemistry
• the rates of chemical reactions
• colligative properties and adsorption isotherm</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I
Chemical kinetics
1. Determination of rate constant of acid catalysed hydrolysis of an ester (methyl acetate).
2. *Determination of rate constant of reaction between iodide and persulphate (initial rate method).
3. Determination of rate constant of reaction between iodine and acetone.
UNIT II
Electrochemistry-Conductance measurements
4. Determination of cell constant.
5. Determination of molar conductance of strong electrolyte.
6. *Determination of dissociation constant of acetic acid.
UNIT III
Colligative property
7. Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent.
Adsorption
8. *Construction of Freundlich isotherm for the adsorption of acetic acid on activated charcoal.
*Not to be given for examination</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. P. S. Sindhu, Practicals in Physical Chemistry, Macmillan India, New Delhi, 2005.
2. B. D. Khosla, V. C. Garg, A. Gulati, Senior Practical Physical Chemistry, R. Chand, New Delhi, 2011.
3. Gupta, Renu, Practical Physical Chemistry, 1st Edition, New Age International, New Delhi, 2017.
4. Departmental Lab Manual, 2018, Reprint 2020.
5. O. P. Pandey, D. N. Bajpai & S. Giri, Practical Chemistry, S. Chand & Company Ltd., 2001.
6. C. W. Garland, J.W. Nibler, & D.P. Shoemaker, Experiments in Physical Chemistry, 8th Edition, McGraw Hill, New York, 2003.
7. P. K. Mani and A. O. Thomas, A Textbook of Practical Chemistry, Scientific Publication, 1973.</td></tr>
</table>

Website and e-learning source	1) https://www.vlab.co.in/broad-area-chemical-sciences 2) https://www.sciencebysimulation.com/chemreax/AnalyzerAB.asp (Kinetics) 3) https://pages.uoregon.edu/tgreenbo/colligative.html (Rast Method)
Method of Evaluation	**Continuous Assessment - 40 marks** I C.A. - 50 II C.A. - 50 Average - 25 Performance during regular practicals - 10 Regularity in submission of observation note-book and Record - 5 **Semester Practical Examination – 60 marks** Principle writing - 5 marks Viva-voce - 5marks Record - 10 marks 1. **Kinetics** Graph - 5 marks Below a factor of 10 - 35 marks By a factor of 10 - 25 marks 2. **Conductivity** Error up to 10 % - 40 marks Error up to 15 % - 30 marks Error up to 20 % - 20 marks Error above 20 % - 10 marks More than the above - 10 marks 3. **Molecular weight** Error up to 10 % - 40 marks 10 - 20 % - 35 marks 20 - 30 % - 20 marks Above 30% - 10 marks (Proportionate marks are reduced for in between % of error)

Course Outcomes:

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: Construct a Freundlich adsorption isotherm.

CO5: Demonstrate laboratory skills for safe handling of the equipment and chemicals.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	M	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">SKILL ENHANCEMENT COURSE: INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Skill Enhancement Course SEC VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2">USCH624</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>2</td><td>-</td><td colspan="2">-</td><td colspan="3">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at providing an overall view of the
operation and troubleshooting of chemical instruments
fundamentals of analytical techniques and its application in the characterization of compounds
theory of chromatographic separation and
theory of thermo/electro analytical techniques
stoichiometry and the related concentration terms</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (6 hours)
Qualitative and Quantitative Aspects of Analysis
S.I. Units, Distinction between Mass and Weight. Moles, Millimoles, Milli equivalence, Molality, Molarity, Normality, Percentage by Weight and Volume, ppm, ppb. Density and Specific Gravity of Liquids. Stoichiometry Calculations.
Sampling, evaluation of analytical data, Errors-Types of Errors, Accuracy, Precision, Minimization of Errors. Significant Figures. Methods of Expressing Precision: Mean, Median, Average Deviation, Standard Deviation, Coefficient of Variation, Confidence Limits, Q-test, F-test, T-test. The Least Square Method for deriving calibration plots.</td></tr>
<tr><td></td><td colspan="7">UNIT II (6 hours)
Atomic Absorption Spectroscopy: Basic principles, instrumentation-choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.</td></tr>
<tr><td></td><td colspan="7">UNIT III (6 hours)
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.</td></tr>
</table>

	UNIT IV (6 hours) **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 (6 hours) **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 includedin the external examination question paper)	Questions related to the above topics, from various competitiveexaminations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Recommended Text	1. I. Vogel, A. Arthur, Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others), 5th Edition, 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, 6th Indian Reprint, Cengage Learning, 2017. 4. R. Speyer, Thermal Analysis of Materials, CRC Press, 1993. R.A. Day and A.L. Underwood, Quantitative Analysis, 6th Edition, 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 Edition, Saunders College Publishing, Philadelphia, 1998. 2. U N Dash, Analytical Chemistry: Theory and Practice, Sultan Chand and Sons Educational Publishers, New Delhi, 2011. 3. Christian, D Gary, Analytical Chemistry, 6th Edition, John Wiley & Sons, New York, 2004. 4. O. Mikes, & R. A. Chalmes, 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, 6th 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 Outcomes:

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

CO1: Prepare solutions, carry out stoichiometric calculations, and evaluate analytical data.

CO2: Estimate trace level of metal ions from water samples using Atomic Absorption Spectroscopy.

CO3: Estimate metal ions from aqueous solution using UV-Visible spectroscopy.

CO4: Apply the principle, instrumentation, and theory of thermal and electroanalytical techniques for various applications.

CO5: Apply the chromatographic techniques in the separation and identification of mixtures.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	H	H
CO2	H	H	H	L	H	H
CO3	H	H	H	L	H	H
CO4	H	H	H	L	H	H
CO5	H	H	H	L	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">SKILL ENHANCEMENT COURSE : FORENSIC SCIENCE</td></tr>
<tr><td>Paper No.</td><td colspan="7">Skill Enhancement Course SEC VII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td>Credits</td><td>1</td><td>Course Code</td><td>USCH724</td></tr>
<tr><td>Semester</td><td>IV</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>1</td><td>-</td><td colspan="3">-</td><td colspan="2">1</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at giving an overall view of
• crime detection through analytical instruments
• forgery and its detection
• medical aspects involved</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="7">UNIT I (3 hours)
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 sea foods-use of neutron activation analysis in detecting arsenic in human hair. Treatment in cases of poisoning-use of antidotes for common poisons.</td></tr>
<tr><td colspan="7">Unit II (3 hours)
Crime Detection
Human bombs-possible explosives (gelatin sticks and RDX)-metal detector devices and other security measures for VVIP-composition of bullets and detecting powder burns.</td></tr>
<tr><td colspan="7">UNIT III (3 hours)
Forgery and Counterfeiting
Documents-different types of forged signatures-simulated and traced forgeries-inherent signs of forgery methods-writing deliberately modified-uses of ultraviolet rays-comparison of type written letters-checking silver line water mark in currency notes-alloy analysis using AAS to detect counterfeit coins-detection of gold purity in 22 carat ornaments-detecting gold-plated jewels -authenticity of diamond.</td></tr>
<tr><td colspan="7">UNIT IV (3 hours)
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.</td></tr>
<tr><td colspan="7">UNIT V (3 hours)
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 race horses.</td></tr>
<tr><td>Recommended Text</td><td colspan="7">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, 1st Edition, Humana Press, 2012.
4. AK Bapuly, Forensic Science-Its application in Crime Investigation, Paras</td></tr>
</table>

	Medical Publisher, Hyderabad, 2006. 5. B. R. Sharma, Scientific Criminal Investigation, Universal Law Publishing Co. Pvt. Ltd, New Delhi, 2006. 6. S. H. James and J. J. Nordby, Forensic Science: An introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton, 2005. 7. A Lucas, Forensic Chemistry, Publisher: Forgotten Books, 2017, ISBN-13: 978-1330672037.
Reference Books	1. Richard Saferstein, Criminalistics-An Introduction to Forensic Science (College Version), 8th Edition, Printice Hall, 2003. 2. Suzanne Bell, Forensic Chemistry, Second International Edition, Pearson, 2014. 3. Jay Siegel, Forensic Chemistry: Fundamentals and Applications, 1st Edition, Wiley-Blackwell, 2015. 4. Max M. Houck & Jay A. Segal, Fundamentals of Forensic Science, Elsevier Academic Press, 2006. 5. Henry C. Lee, Timothy Palmbach, Marilyn T. Miller, Henry Lee's Crime Scene Book, Elsevier Academic Press, 2006.
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/ 3) https://www.compoundchem.com/2016/07/26/fingerprints/ 4) http://www.forensicsciencesimplified.org/drugs/principles.html.- principles of Forensic drug chemistry.

Course Outcomes:

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

CO1: Diagnose and treat different types of poisons.

CO2: Get awareness on Human bombs, possible explosives and metal defector devices and other security measures for VVIP.

CO3: Detect the forgery documents, and different types of forged signatures.

CO4: Learn to track and trace using police dogs, and to identify foot prints.

CO5: Analyze biological substances - blood, semen, saliva, urine and hair - DNA Finger printing for tissue identification in dismembered bodies.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	H	H
CO2	H	H	H	L	H	H
CO3	H	H	H	L	H	H
CO4	H	H	H	L	H	H
CO5	H	H	H	L	H	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ORGANIC CHEMISTRY-I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course IX</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>III</td><td>Credits</td><td>4</td><td>Course Code</td><td>UCCHI24</td></tr>
<tr><td></td><td></td><td>Semester</td><td>V</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td></td><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">-</td><td>5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry-I, II, III and IV</td></tr>
<tr><td>Objectives of the Course</td><td colspan="7">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</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3, K4)
Stereochemistry
1.1 Fischer Projection, Newmann and Sawhorse projection formulae and their interconversions.
1.2 Geometrical isomerism: cis–trans, syn-anti isomerism, E/Z notations.
1.3 Optical Isomerism-optical activity, specific rotation, asymmetry, enantiomers, diastereoisomers, meso structures-molecules with one and two chiral centres.
1.4 Racemisation-methods of racemization, resolution-methods of resolution.
1.5 C.I.P rules. R and S notations for one and two chirality (stereogenic) centres.
1.6 Molecules with no asymmetric carbon atoms-allenes and biphenyls. Conformational analysis of ethane and butane.</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3, K4)
Chemistry of Nitrogen Compounds-I
2.1 Nitroalkanes-nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes.
2.2 Physical properties; reactions-reduction, halogenations, Grignard reagent, pseudo acid character, nitro-aci nitro tautomerism.
2.3 Aromatic nitro compounds-nomenclature, preparation-nitration, from diazonium salts.
2.4 Physical properties; reactions-reduction of nitrobenzene in different medium, electrophilic substitution reactions, TNT.
2.5 Amines: Aliphatic amines-nomenclature, isomerism, preparation-Hofmann’s degradation reaction, Gabriel’s phthalimide synthesis, Curtius, Schmidt rearrangement.
2.6 Physical properties-basicity, reactions – alkylation, acylation, carbylamines reaction, Mannich reaction, oxidation.</td></tr>
</table>

	UNIT III (15 hours) (K1, K2, K3, K4) **Chemistry of Nitrogen Compounds-II** 3.1 Aromatic amines-nomenclature, preparation-from nitro compounds, Hofmann's method; Schmidt reaction. 3.2 Properties-basic nature, ortho effect; reactions-alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation. 3.3 Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid-zwitter ion formation. 3.4 Distinction between primary, secondary and tertiary amines. 3.5 Aliphatic diazonium compound-diazomethane-preparations and synthetic applications. 3.6 Aromatic diazonium compound-benzene diazonium chloride-preparations and synthetic applications.
	UNIT IV (15 hours) (K1, K2, K3, K4) 4.1 Heterocyclic compounds-nomenclature and classification. General characteristics-aromatic character and reactivity. 4.2 Five-membered heterocyclic compounds-pyrrole-preparation-from succinimide, Paal Knorr synthesis. 4.3 Reactions-reduction, basic character, acidic character, electrophilic substitution reactions, ring opening. 4.4 Furan-preparation from mucic acid and pentosan; reactions-hydrogenation, reaction with oxygen. 4.5 Furan-Diels Alder reactions, formation of thiophene and pyrrole; electrophilic substitution reactions. 4.6 Thiophene synthesis-from acetylene; reactions-reduction; oxidation; electrophilic substitution reactions.
	UNIT V (15 hours) (K1, K2, K3, K4) 5.1 Six-membered heterocyclic compounds-pyridine-synthesis-from acetylene, physical properties; reactions-basic character, oxidation, reduction. 5.2 Pyridine-electrophilic and nucleophilic substitution reactions; uses. 5.3 Quinoline-preparation-Skraup synthesis and Friedlander's synthesis; reactions-basic nature, reduction, oxidation. 5.4 Quinoline-electrophilic substitutions; nucleophilic substitutions-Chichibabin reaction. 5.5 Isoquinoline-preparation by the Bischler-Napieralski reaction, reduction, oxidation. 5.6 Isoquinoline-electrophilic substitution reactions.

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)

Recommended Text	1. B.S. Bahl and Arun Bahl, Advanced Organic Chemistry, 5th Edition, Sultan Chand & Co., 2014. 2. S. M. Mukherji and S. P. Singh, Organic Reaction Mechanism, Revised Edition, Trinity Press, 2017. 3. K. S. Tewari, S. N. Mehrotra, K. Vishnoi, A Text book of Organic Chemistry, Vikas Publishing House, Reprint, 2017. 4. P. L. Soni, Text book of Organic Chemistry, Sultan and Chand, Reprint, 2019. 5. M.K. Jain and S. C. Sharma, Modern Organic Chemistry, S. Chand & Co, Reprint, 2019. 6. C. N. Pillai, Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009. 7. O. P. Agarwal, Organic Chemistry, Reactions and Reagents, 55th Edition, GOEL Publishing House, 2017. 8. P. S. Kalsi, Stereo Chemistry, Conformations and Mechanisms, 10th Edition, New Age International Private Ltd., 2019. 9. D. Nasipuri, Stereochemistry of Organic Compounds-Principles and Applications, 3rd Edition, New Age International, 2011. 10. Gurdeep R. Chatwaal, Reaction Mechanism and Reagents in Organic Chemistry, 4th Edition, Himalaya Publishing House, 2005.
Reference Books	1. Jerry March, Reaction Mechanism and Structure, 4th Edition, John Wiley and Sons, 1992. 2. Peter Sykes, A Guidebook to Mechanism in Organic Chemistry, 6th Edition, 1988. 3. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Pearson Education, Asia, 2012. 4. T. W. Graham Solomons, Organic Chemistry, 11th Edition, John Wiley & Sons, 2012. 5. A. Carey Francis, Organic Chemistry, 7th Edition, Tata McGraw-Hill Education Private Ltd., New Delhi, 2009. 6. I. L. Finar, Organic Chemistry, Vol. (1&2), 6th Edition, England, Wesley Longman Ltd., 2006. 7. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, 5th Edition, Wiley, 2010.
Website and e-learning source	1) www.epgpathshala.nic.in 2) www.nptel.ac.in 3) http:/swayam.gov.in 4) https://www.youtube.com/watch?v=h0rUn2jzGjs 5) https://www.youtube.com/watch?v=w74NxOkvXg8 6) https://www.youtube.com/watch?v=A5ROLfgxFFw 7) https://www.youtube.com/watch?v=MDa-waAbJ30 8) https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=5PO9 9) https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=5PO1

Course Outcomes:

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. (K1, K2, K3, K4)

CO2: Explain preparation and properties of aromatic and aliphatic nitro compounds and aliphatic amines. (K1, K2, K3, K4)

CO3: Explain preparation and properties of aromatic amines and benzene diazonium chloride. (K1, K2, K3, K4)

CO4: Discuss preparation and properties of five membered heterocycles like pyrrole, furan and thiophene. (K1, K2, K3, K4)

CO5: Discuss preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	M	H
CO2	H	H	H	H	M	H
CO3	H	H	H	H	M	H
CO4	H	H	H	H	M	H
CO5	H	H	H	H	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	M	H
CO2	H	M	H	H	M	H
CO3	H	M	H	H	M	H
CO4	H	M	H	H	M	H
CO5	H	M	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">INORGANIC CHEMISTRY-I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course X</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td>Course Code</td><td rowspan="2">UCCHJ24</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry-I, II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims to provide knowledge on
nomenclature, isomerism and theory of coordination compounds, and chelate complexes
crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect
preparation and properties of metal carbonyls
Lanthanoids and actinoids
preparation and properties of inorganic polymers</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3, K4)
Co-ordination Chemistry-I
1.1 IUPAC Nomenclature of coordination compounds.
1.2 Isomerism in coordination compounds.
1.3 Werner’s coordination theory-postulates-experimental evidence-limitations.
1.4 Sidgwick theory-effective atomic number rule-failure.
1.5 Pauling’s theory-geometry of co-ordination compounds with co-ordination number 4 & 6-interpretation of geometry and magnetic properties.
1.6 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.</td></tr>
<tr><td colspan="7">Unit II (15 hours) (K1, K2, K3, K4)
Co-ordination Chemistry-II
2.1 Crystal field theory-crystal field splitting of energy levels in octahedral and tetrahedral complexes.
2.2 Crystal field stabilization energy (CFSE), spectrochemical series-calculation of CFSE in octahedral and tetrahedral complexes-factors influencing the magnitude of crystal field splitting.
2.3 Crystal field effect on ionic radii, lattice energies, heats of ligation with water as a ligand (heat of hydration), interpretation of magnetic properties, spectrum of $[Ti(H_2O)_6]^{3+}$.
2.4 Jahn-Teller effect-cause and consequences.
2.5 Stability of complexes in aqueous solution, stability constants-factors affecting the stability of a complex ion, thermodynamic and kinetic stability (elementary idea).
2.6 Comparison of VBT and CFT.</td></tr>
</table>

	UNIT III (15 hours) (K1, K2, K3, K4) **Organometallic compounds** **Metal Carbonyls** 3.1 Mono and polynuclear carbonyls, general methods of preparation of carbonyls. 3.2 General properties of mononuclear carbonyls. 3.3 General properties of binuclear carbonyls. 3.4 Bonding in carbonyls – structure and bonding in carbonyls of Ni, Fe, Cr. EAN rule as applied to metal carbonyls. 3.5 Bonding in carbonyls – structure and bonding in carbonyls of Co, Mn, Ru and Os. EAN rule as applied to metal carbonyls. 3.6 Ferrocene-Methods of preparation, physical and chemical properties.
	UNIT IV (15 hours) (K1, K2, K3, K4) **Inner transition elements (Lanthanoids and Actinoids)** 4.1 General characteristics of f-block elements-comparative account of lanthanoids and actinoids. 4.2 Lanthanoids and Actinoids-occurrence, oxidation states, magnetic properties, colour and spectra. 4.3 Separation by ion-exchange and solvent extraction methods-Lanthanoids contraction-causes and consequences. 4.4 Chemistry of thorium-occurrence, ores, extraction, properties and uses. 4.5 Chemistry of Uranium-occurrence, ores, extraction, properties and uses. 4.6 Preparation, properties and uses of ceric ammonium sulphate, thorium dioxide and uranyl acetate.
	UNIT V (15 hours) (K1, K2, K3, K4) **Inorganic polymers** 5.1 General properties-classification of inorganic polymers based on element in the backbone (Si, S, B and P). 5.2 Preparation and properties of silicones-polydimethylsiloxane and polymethylhydrosiloxane. 5.3 Preparation and properties of phosphorous based polymers-polyphosphazines and polyphophonitrilic chloride. 5.4 Preparation and properties of sulphur-based polymers-polysulfide and polymeric sulphur nitride. 5.5 Preparation and properties of boron-based polymers (borazine polymers). 5.6 Industrial applications of inorganic polymers.

Extended Professional Component (is a part of internal component only, not to be includedin the external examination question paper)	Questions related to the above topics, from various competitiveexaminations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, 31st Edition, Milestone Publishers & Distributors, Delhi, 2011. 2. Satya Prakash, G. D. Tuli, S. K. Basu, R. D. Madan, Advanced Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi, 2009. 3. J. D. Lee, Concise Inorganic Chemistry, 4th Edition, ELBS William Heinemann, London, 1991. 4. W V Malik, G D Tuli, R D Madan, Selected Topics in Inorganic Chemistry, S. Chand and Company Ltd., 2000. 5. A. K. De, Text book of Inorganic Chemistry, 7th Edition, Wiley East Ltd., 1992.
Reference Books	1. R. D. Madan, Sathya Prakash, Modern Inorganic Chemistry, 2nd Edition, S. Chand and Company, New Delhi, 2003. 2. R. Gopalan R, Inorganic Chemistry for Undergraduates, 1st Edition, University Press Private Limited, Hyderabad, 2009. 3. B. Sivasankar, Inorganic Chemistry, 1st Edition, Pearson, Chennai, 2013. 4. G. Alan Sharp, Inorganic Chemistry, 3rd Edition, Addition-Wesley, England, 1992. 5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, 6th Edition, Oxford University Press, 2014.
Website and e-learning source	1) www.epgpathshala.nic.in 2) www.nptel.ac.in 3) http:/swayam.gov.in

Course Outcomes:

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

CO1: Explain isomerism, Werner's theory and the importance of chelate complexes. (K1, K2, K3, K4)

CO2: Discuss crystal field theory, magnetic properties and spectral properties of complexes. (K1, K2, K3, K4)

CO3: Explain the preparation, properties and structures of metal carbonyls. (K1, K2, K3, K4)

CO4: Describe a comparative account of the characteristics of lanthanoids and actinoids. (K1, K2, K3, K4)

CO5: Explain the properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorous. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	M	H
CO2	H	M	H	H	M	H
CO3	H	M	H	H	M	H
CO4	H	M	H	H	M	H
CO5	H	M	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">PHYSICAL CHEMISTRY-I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course XI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td>Course Code</td><td>UCCHK24</td></tr>
<tr><td>Semester</td><td>V</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry-I, II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at providing an overall view of
• chemical kinetics and different types of chemical reactions
• adsorption, homogeneous and heterogeneous catalysis
• colloids and macromolecules
• photochemistry, fluorescence and phosphorescence</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3, K4)
Chemical Kinetics
1.1 Scope of chemical kinetics, rate, rate constant and rate law. Factors that affect the rate of the reaction. Measurements of reaction rates. Order and molecularity of chemical reactions- Differences between order and molecularity. Methods to determine the rate of the reactions.
1.2 Derivation of rate constants of first, second, third and zero order reactions and derivation for time for half change.
1.3 Examples of first, second, third and zero order reactions and study of kinetics of hydrolysis of ester, inversion of cane sugar, decomposition of H_2O_2, thermal decomposition of acetaldehyde and gaseous reactions involving NO.
1.4 Methods to determine the order of chemical reactions-Integration method, Graphical method, Vant Hoff differential method, Method using half-life period and Ostwald’s dilution method.
1.5 Experimental methods in the study of kinetics of reactions-Volumetry, Manometry and Polarimetry.
1.6 Effect of temperature on the rate of reactions-Arrhenius equation and concept of energy of activation.</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3, K4)
2.1 The Collision theory of bimolecular reactions and derivation of rate constant.
2.2 Theory of unimolecular reactions-Lindemann’s theory, draw backs of collision theory.
2.3 Theory of Absolute Reaction Rates based on thermodynamics. Derivation for the rate constant of a bimolecular reaction based on ARRT.
2.4 Comparison of Collision theory and ARRT.
2.5 Significance of entropy, enthalpy and free energy of activation and determination of ΔG^*, ΔH^* and ΔS^*.
2.6 Complex reactions: types-consecutive, parallel, reversible and chain reactions (no derivation, only examples).</td></tr>
<tr><td></td><td colspan="7">UNIT III (15 hours) (K1, K2, K3. K4)
3.1 Adsorption-chemical and physical adsorption and their general characteristics-distinction between them-different types of isotherms-Freundlich and Langmuir-adsorption isotherms and their limitations.</td></tr>
</table>

	3.2 BET theory, kinetics of enzyme catalysed reaction-Michaelis-Menten and Briggs-Haldane equation. 3.3 Lineweaver-Burk plot-inhibition-reversible-competitive, noncompetitive, and uncompetitive (no derivation of rate equations). 3.4 Catalysis-general characteristics of catalytic reactions, auto catalysis, promoters, negative catalysis, poisoning of a catalyst. 3.5 Theories of homogenous and heterogeneous catalysis-kinetics of acid-base and enzyme catalysis. 3.6 Heterogenous catalysis.
	UNIT IV (15 hours) (K1, K2, K3, K4) **Colloids and Surface Chemistr**y 4.1 Colloids: Types of colloids, characteristics colloids (lyophilic and lyophobic sols). 4.2 Preparation of sols-dispersion methods, aggregation methods. 4.3 Properties of sols-optical properties, electrical properties-electrical double layer. 4.4 Electro kinetic properties-electro-osmosis, electrophoresis. 4.5 Coagulation or precipitation, stability of sols, associated colloids, emulsions, gels-preparation of gels, applications of colloids. 4.6 Macromolecules: Molecular weight of macromolecules-number-average, weight-average molecular weights, determination of molecular weight of molecules.
	UNIT V (15 hours) (K1, K2, K3, K4) **Photochemistry** 5.1 Laws of photo chemistry-Lambert-Beer, Grotthus-Draper and Stark-Einstein, Quantum efficiency. 5.2 Photochemical reactions-rate law-kinetics of H_2-Cl_2 reactions, comparison between thermal and photochemical reactions. 5.3 Kinetics of H_2-Br_2 and H_2-I_2 reactions, comparison between thermal and photochemical reactions. 5.4 Fluorescence-applications including fluorimetry-sensitised fluorescence. 5.5 Phosphorescence-applications. 5.6 Chemiluminescence and photosensitization-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)

Recommended Text	1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, 48th Edition, Shoban Lal Nagin Chand and Co., 2021. 2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, 11th Edition, Oxford University Press, 2018. 3. Arun Bahl, B.S. Bahl, G. D. Tuli, Essentials of Physical Chemistry, 28th Edition, S, Chand & Co., 2019. 4. S. K. Dogra and S. Dogra, Physical Chemistry through Problem, 4th

	Edition, New Age International, 1996. 5. J. Rajaram and J.C. Kuriacose, Thermodynamics, Shoban Lal Nagin Chand and Co., 1986.
Reference Books	1. J. Rajaram and J. C. Kuriacose, Chemical Thermodynamics, 1st Edition, Pearson, 2013. 2. Keith J. Laidler, Chemical Kinetics, 3rd Edition, Pearson, 2003. 3. P. W. Atkins, and Julio de Paula, Physical Chemistry, 7th Edition, Oxford University Press, 2002. 4. K. L. Kapoor, A Textbook of Physical Chemistry, 3rd Edition, Macmillan India Ltd, 2009. 5. B. R. Puri, L. R. Sharma and M. S. Pathania, Principles of Physical Chemistry, 41st Edition, Shoban Lal Nagin Chand and Co., Jalandhar, 2001.
Website and e-learning source	1) https://nptel.ac.in 2) https://swayam.gov.in 3) www.epgpathshala.nic.in

Course Outcomes:

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

CO1: Apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction (K1, K2, K3, K4)

CO2: Demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation. (K1, K2, K3, K4)

CO3: Compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogenous and heterogeneous catalysis. (K1, K2, K3. K4)

CO4: Demonstrate the types and characteristics of colloids, preparation of sols and emulsions, and determine the molecular weights of macromolecules. (K1, K2, K3, K4)

CO5: Utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	M	H
CO2	H	M	H	H	M	H
CO3	H	M	H	H	M	H
CO4	H	M	H	H	M	H
CO5	H	M	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: BIOCHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective DSE I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">UECHA24</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">-</td><td>5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Organic Chemistry-I</td></tr>
<tr><td>Objectives of the Course</td><td colspan="7">This course aims to provide an understanding of
• relationship between biochemistry and medicine, composition of blood.
• structure and properties of amino acids, peptides, enzyme, vitamins and proteins.
• biological functions of proteins, enzymes, vitamins and hormones.
• biochemistry of nucleic acids and lipids.
• metabolism of lipids.</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3, K4)
Logic of Living Organisms
1.1 Relationship of Biochemistry and Medicine.
1.2 Blood-Composition of Blood.
1.3 Blood Coagulation-Mechanism.
1.4 Haemophilia and Sickle Cell Anaemia.
1.5 Maintenance of pH of Blood-Bicarbonate Buffer.
1.6 Acidosis, Alkalosis.</td></tr>
<tr><td colspan="7">UNIT II (15 hours) (K1, K2, K3, K4)
Peptides and Proteins
2.1 Amino acids-nomenclature, classification-essential and non-essential; Synthesis-Gabriel Phthalimide, Strecker.
2.2 Properties-zwitter ion and isoelectric point, electrophoresis and reactions.
2.3 Peptides-peptide bond-nomenclature-synthesis of simple peptides solution and solid phase.
2.4 Determination of structure of peptides, N-terminal analysis-Sanger’s & Edman method; C terminal analysis-Enzymic method.
2.5 Proteins-classification based on composition, functions and structure, properties and reactions-colloidal nature, coagulation, hydrolysis, oxidation, denaturation, renaturation; colour tests for proteins.
2.6 Structure of proteins-primary, secondary, tertiary and quaternary.
Metabolism of Amino acids-general aspects of metabolism (a brief outline); urea cycle.</td></tr>
<tr><td colspan="7">UNIT III (15 hours) (K1, K2, K3, K4)
Enzymes and Vitamins
3.1 Nomenclature and classification, characteristics.
3.2 Factors influencing enzyme activity.
3.3 Mechanism of enzyme action-Lock and key hypothesis, Koshland’s induced fit model.
3.4 Proenzymes, antienzymes, coenzymes and isoenzymes; allosteric enzyme regulation.
3.5 Vitamins as coenzymes-functions of TPP, lipoic acid, NAD, NADP.</td></tr>
</table>

	3.6 FMN, FAD, pyridoxal phosphate, CoA, folic acid, biotin, cyanocobalamin.
	UNIT IV (15 hours) (K1, K2, K3, K4) **Nucleic Acids** 4.1 Nucleic acids-components of nucleic acids-nitrogenous bases and pentose sugars. 4.2 Structure of nucleosides and nucleotides. 4.3 DNA-structure & functions. 4.4 RNA-types-structure-functions. 4.5 Hormones-Adrenalin chemistry, structure and functions (no structure elucidation). 4.6 Thyroxine-chemistry, structure and functions (no structure elucidation).
	UNIT V (15 hours) (K1, K2, K3, K4) **Lipids** 5.1 Lipids-occurrence, biological significance of fats, classification of lipids. 5.2 Simple lipids-oils and fats, chemical composition, properties. 5.3 Reactions-hydrolysis, hydrogenation, trans-esterification, saponification, rancidity. 5.4 Analysis of oils and fats-saponification number, iodine number, acid value, R.M. value, distinction between animal and vegetable fats. 5.5 Compound lipids-lipoproteins-VLDL, LDL, HDL, chylomicrons, biological significance. Trans fat-definition and health issues. 5.6 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)

Recommended Text	1. B. S. Bahl, A. Bhal, Advanced Organic Chemistry, 5th Edition, S. Chand, New Delhi, 2014. 2. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, Vishal Publications, New Delhi, 2017. 3. A. Shanmugam, Fundamentals of Biochemistry for Medical Students, 6th Edition, Published by the author, 1999. 4. L. Veerakumari, Biochemistry, 1st Edition, MJP Publications, Chennai, 2004. 5. J. L. Jain, Fundamentals of Biochemistry, 2nd Edition, S. Chand, New Delhi, 1983.
Reference Books	1. E. E. Conn, P. K. Stumpf, Outline of Biochemistry, 5th Edition, Wiley Eastern, New Delhi, 2002. 2. E. S. West, W. R. Todd, H. S. Mason, J. T. Van Bruggen, Text Book of Biochemistry, 4th Edition, Macmillan, New York, 1970. 3. A. L. Lehninger, Principles of Biochemistry, 2nd Edition, CBS Publisher, Delhi, 1993. 4. S. C. Rastogi, Biochemistry, 2nd Edition, Tata McGraw-Hill, New Delhi, 2003. 5. M. N. Chatterjea, R. Shinde, Textbook of Medical Biochemistry, 5th Edition, 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 Outcomes:

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

CO1: Explain molecular logic of living organisms, composition of blood and blood coagulation. (K1, K2, K3, K4)

CO2: Summarize the synthesis and properties of amino acids, determination of structure of peptides and proteins. (K1, K2, K3, K4)

CO3: Discuss factors influencing enzyme activity and vitamins as coenzymes. (K1, K2, K3, K4)

CO4: Describe RNA and DNA structure and functions. (K1, K2, K3, K4)

CO5: Explain biological significance of simple and compound lipids. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	M	H
CO2	H	H	H	H	M	H
CO3	H	H	H	H	M	H
CO4	H	H	H	H	M	H
CO5	H	H	H	H	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	H	H
CO2	H	M	H	H	H	H
CO3	H	M	H	H	H	H
CO4	H	M	H	H	H	H
CO5	H	M	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: GRAVIMETRIC ANALYSIS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective DSE IA</td></tr>
<tr><td>Category</td><td>DSE</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>UECHB24</td></tr>
<tr><td></td><td></td><td>Semester</td><td>V</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td></td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">5</td><td>5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry</td></tr>
<tr><td>Objectives of the Course</td><td colspan="7">This course aims at providing knowledge on
• the principles of gravimetric analysis
• the favorable conditions for precipitation and factors affecting the particle size of the precipitate</td></tr>
<tr><td>Course Outline</td><td colspan="7">GRAVIMETRIC ESTIMATIONS:
1 Estimation of sulphate as barium sulphate.
2 Estimation of barium as barium sulphate.
3 Estimation of barium as barium chromate.
4 Estimation of lead as lead chromate.
5 Estimation of lead as lead sulphate.
6 Estimation of nickel as DMG complex.</td></tr>
<tr><td>Recommended Text</td><td colspan="7">1. V. Venkateswaran, R. Veeraswamy, A.R. Kulandaivelu, Basic Principles of Practical Chemistry, 2nd Edition, Sultan Chand & Sons, New Delhi, 1997.
2. A. K. Nad, B. Mahapatra, A. Ghoshal, An Advanced Course in Practical Chemistry, 3rd Edition, New Central Book Agency, Kolkata, 2007.</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas, B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson Education Ltd., New Delhi, 2000.
2. Peter A C McPherson, Practical Volumetric Analysis, 4th Edition, Cambridge: The Royal Society of Chemistry, 2015.</td></tr>
<tr><td>Website and e-learning source</td><td colspan="7">1) https://www.khanacademy.org/science/chemistry/chemical-reactions-stoichiome/limiting-reagent-stoichiometry/a/gravimetric-analysis-and-precipitation-gravimetry.</td></tr>
<tr><td>Method of Evaluation</td><td colspan="7">Continuous Assessment - 40 marks
I C.A. - 50
II C.A. - 50
Average - 25
Performance during regular practicals -10
Regularity in submission of observation note-book and Record - 5
Semester Practical Examination - 60 marks
Viva-voce - 5
Record - 10
≤ 2% - 45 marks
> 2 up to 3% - 35 marks
> 3 up to 4% - 25 marks
>4 % - 15 marks</td></tr>
</table>

Course Outcomes:

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

CO1: Quantitatively estimate metal ions using gravimetric analysis.

CO2: Gain knowledge on the choice of precipitating methods, reagents, crucibles and filtration.

CO3: Identify common errors in gravimetric analysis.

CO4: Outline the favorable conditions for precipitation and factors affecting the particle size of the precipitate.

CO5: Relate particle size of the precipitates with choice of crucibles used in gravimetric estimations.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	M	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="8">ELECTIVE: INDUSTRIAL CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="8">Discipline Specific Elective DSE II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">UECHC24</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="3">-</td><td colspan="3">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">General Chemistry-I, II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course is designed to provide knowledge on
• classifications and characteristics of fuels
• manufacture of sugar, paper, cement and leather and food processing
• applications of abrasives, lubricants and other industrial products
• intellectual property rights</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I (12 hours) (K1, K2, K3, K4)
Fuels
1.1 Classification, characteristics of fuels. Solid fuels: coal-classification; analysis of coal-proximate analysis and ultimate analysis.
1.2 Calorific value-determination, carbonisation of coal.
1.3 Liquid fuels: Petroleum-characteristics; Gasoline aviation petrol-knocking in internal combustion engines
1.4 Antiknock agents; unleaded petrol-octane number, cetane number.
1.5 Gaseous fuel: advantages over solid and liquid fuels; water gas, producer gas, carburetted water gas-preparations-uses.
1.6 Natural gas: LPG-composition, advantages, application; gobar gas-production, composition, advantages, application. Propellants-rocket fuels (basic idea).</td></tr>
<tr><td></td><td colspan="8">UNIT II (12 hours) (K1, K2, K3. K4)
Leather Industry
2.1 Structure and composition of skin, and hide.
2.2 Manufacture of leather-pre-tanning process-curing, liming, beating, pickling.
2.3 Methods of tanning-vegetable, chrome-one bath, two bath process; finishing.
Adhesives
2.4 Introduction to adhesive, principles of gluing, natural glues, composition of adhesives.
2.5 Synthetic resins, preparation of resins.
2.6 Phenolic resins, latest developments.</td></tr>
<tr><td></td><td colspan="8">UNIT III (12 hours) (K1, K2, K3, K4)
Sugar Industry
3.1 Manufacture from sugar cane; recovery of sugar from molasses.
3.2 Testing and estimation of sugar.
Food Preservation and processing
3.3 Food spoilage-causes; Food preservation-methods-high temperature, low temperature, drying, radiation.
3.4 Food additives- preservatives, flavours, colours, anti-oxidants.</td></tr>
</table>

	3.5 Sweetening agents; hazards of using food additives. 3.6 Food standards-Agmark and Codex Alimentarius.
	UNIT IV (12 hours) (K1, K2, K3, K4) **Abrasives** 4.1 Definition, characteristics, types-natural and synthetic; natural abrasives-diamond, corundum, emery, garnet, quartz-composition, uses; 4.2 Synthetic abrasives-carborundum, aluminium carbide, boron carbide, boronnitride, synthetic graphite-composition and uses. **Ceramics** 4.3 Scope of sanitary wares and porcelains in India, their classification and uses, details of various types of raw materials including synthetic materials, processes involved-drying-types of water present, factors affecting drying (internal & external factors), convection, radiation, high frequency heating. 4.4 Glazing-purpose & advantages of glazing, raw glazes, fritted glazes, special glazes, fusibility of glazes, opacity & opacifiers, stains, colloidal colours, different colouring oxides, empirical formula of glazes, glaze defects, glazing techniques; Firing-factors determining firing schedule, effect of heat on white ware bodies, formation of different phases at different temperatures, final phases of porcelain bodies, brief description about various types of kiln. **Paper Industry** 4.5 Manufacture of pulp-mechanical, chemical processes; sulphate pulp, rag pulp. 4.6 Manufacture of paper-beating, refining, filling, sizing, colouring, calendaring; cardboard.
	UNIT V (12 hours) (K1, K2, K3, K4) **Lubricants** 5.1 Definition, classification-liquid, semi-solid, solid and synthetic. 5.2 Properties-viscosity index, flash point, cloud point, pour point,aniline point and drop point; greases-properties, types; cutting fluids, selection of lubricants. **Cement Industry** 5.3 Cement-types, raw materials; manufacture-wet process, constituent of cement. 5.4 Setting of cement; properties of cement-quality, setting time, soundness, strength; mortar, concrete, RCC; curing and decay of concrete. **Intellectual Property Rights** 5.5 Introduction to Intellectual Property Rights-Patents-Factors for patentability-novelty, non-obviousness, industrial applications-patent offices in India. 5.6 Trademark-types of trademarks-certification marks, logos, brand names, signatures, symbols and service marks.

Extended Professional Component (is a part of internal component only, not to be includedin the external examination question paper)	Questions related to the above topics, from various competitiveexaminations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. B.K. Sharma, Industrial Chemistry, 9th Edition, Goel Publishing House, Meerut, 1998. 2. J.B.E. Wilkinson, R. J. Moore, Harry's Cosmetology, 7th Edition, Chemical Publishers, New York, 1982. 3. Alex V. Ramani, Food Chemistry, MJP Publishers, Chennai, 2009. 4. Jayashree Ghosh, Applied Chemistry, S. Chand, New Delhi, 2006. 5. B. Srilakshmi, Food Science, 4th Edition, New Age International Publication, 2005.
Reference Books	1. P. C. Jain, M. Jain, Engineering Chemistry, 16th Edition, Dhanpat Rai, Delhi, 1992 2. George Howard, Principles and Practice of Perfumes and Cosmetics, Stanley Therones, Cheltenham, UK, 1987. 3. Thankamma Jacob, Foods, Drugs and Cosmetics-A Consumer Guide, Macmillan, London, 1997. 4. N. Shankuntala Manay, M. Shadaksharaswamy, Food Facts and Principles, 3rd Edition, New Age Publication, 2008. 5. Neeraj Pandey, Khushdeep Dharni, Intellectual Property Rights, PHI Learning, 2014.
Website and e-learning source	1) http://www.sciencecases.org/irradiation/irradiation_notes.asp 2) http://discovery.kcpc.usyd.edu.au//9.5.5/ 3) https://www.wipo.int/about-ip/en/ 4) www.nptel.ac.in 5) http:/swayam.gov.in 6) https://sitttrkerala.ac.in/syllabus/rev2015/6121.pdf

Course Outcomes:

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

CO1: Summarize the properties of fuels which include petroleum, water gas, natural gas and propellants. (K1, K2, K3, K4)

CO2: Discuss the manufacturing of leather and adhesives. (K1, K2, K3, K4)

CO3: Explain manufacture of sugar, food spoilage, and food additives. (K1, K2, K3, K4)

CO4: Explain the properties of abrasives, manufacture of ceramics and paper. (K1, K2, K3, K4)

CO5: Explain the properties and manufacture of lubricants and cement, and intellectual property rights. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	M	H
CO2	H	H	H	M	M	H
CO3	H	H	H	M	M	H
CO4	H	H	H	M	M	H
CO5	H	H	H	M	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: APPLIED CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective DSE IIA</td></tr>
<tr><td>Category</td><td>DSE</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>UECHD24</td></tr>
<tr><td></td><td></td><td>Semester</td><td>V</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td></td><td colspan="2">4</td><td colspan="2">-</td><td colspan="2">-</td><td>4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry</td></tr>
<tr><td>Objectives of the Course</td><td colspan="7">This course aims at providing knowledge on
• symmetry operations and point groups of molecules
• the advanced chromatographic techniques and their applications
• nano chemistry and water technology
• nutraceuticals and toxins</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3, K4)
Group theory
1.1 Introduction-symmetry elements and symmetry operations.
1.2 Group postulates and types of groups, sub groups, abelian and non-abelian groups.
1.3 Group multiplication table, similarity transformations and classes of symmetry operations.
1.4 Molecular point groups-point groups of molecules.
1.5 Point groups of tetrahedral and octahedral molecules.
1.6 Identification of symmetry operations and determination of point groups.</td></tr>
<tr><td></td><td colspan="7">UNIT II (12 hours) (K1, K2, K3, K4)
Advanced Chromatographic Techniques
2.1 Ion exchange Chromatography-principle, instrumentation, applications.
2.2 GC-MS Chromatography-principle, instrumentation, applications.
2.3 LC-NMR Chromatography-principle, instrumentation, applications.
2.4 Super critical fluid-definition, properties, uses.
2.5 Super critical fluid extraction and applications.
2.6 Super Critical Fluid Chromatography (SCFC)-principle, instrumentation, applications.</td></tr>
<tr><td></td><td colspan="7">UNIT III (12 hours) (K1, K2, K3, K4)
Nano Chemistry
3.1 Fundamental science behind nano chemistry-scientific revolutions-nanosized effects-surface to volume ratio.
3.2 Properties of Nanomaterials-optical, electrical, mechanical and magnetic properties.
3.3 Classification of nanomaterials-nanoparticles and nanoclusters.
3.4 Nanomaterials-nanowires and nanodots.
3.5 Nanotubes-Carbon nanotubes-types, properties and applications.
3.6 Synthesis of Nanomaterials-top down and bottom-up process.</td></tr>
<tr><td></td><td colspan="7">UNIT IV (12 hours) (K1, K2, K3, K4)
Water Technology
4.1 Water-characteristics, Hardness-types.
4.2 Softening methods-lime soda-hot and cold lime soda processes.</td></tr>
</table>

	4.3 Water quality standards-BOD, COD, TDS, TSS & TS. 4.4 Analysis of waste water and its treatment. 4.5 Zeolite process-ion exchange technique. 4.6 Sterilization and desalination.
	UNIT V (12 hours) (K1, K2, K3, K4) **Nutraceuticals and Toxins** 5.1 Nutraceuticals-introduction, types, plant sources. 5.2 Animal sources and microbial sources. 5.3 Nutraceuticals-market demand. 5.4 Toxins and their medicinal values-introduction, classification of toxins. 5.5 Toxins from plants, animals, microorganism, and reptiles. 5.6 Antioxidants-definition, examples, role of antioxidants.
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)
Recommended Text	1. K. V. Raman, Group Theory and Its Applications to Chemistry, Tata McGraw-Hill Publishing Company Ltd., Reprint 2004. 2. M. S. Gopinathan and V. Ramakrishnan, Group Theory in Chemistry, Vishal Publishing Co., Reprint 2005. 3. V. K. Ahluwalia, Madhu Chopra, Medicinal Chemistry, ANE Books India, 2008. 4. A. K. De, Environmental Chemistry, New Age International Publishers, New Delhi, 7th Edition, 2010. 5. B.S Murthy, P. Shankar, Baldev Raj, B.B. Rath, James Murday, Textbook of Nanoscience and Nanotechnology, University Press India Ltd., Hyderabad. 2012. 6. Jayashree Ghosh. Fundamental Concepts of Applied Chemistry. S. Chand Publishing Ltd., 2006.
Reference Books	1. F. A. Cotton, Group Theory and Its Applications to Chemistry, John Wiley & Sons (Asia) Pvt Ltd., Singapore, 2004. 2. A. Salahuddin Kunju and G. Krishnan, Group theory and its Applications in Chemistry, Asoke K. Ghosh, PHI Learning Pvt Ltd., New Delhi, 2010. 3. P. S. Kalsi and Sangeeta Jagtap, Pharmaceutical, Medicinal and Natural Product Chemistry, Narosa Publishing House, New Delhi, 2013. 4. Kirpal Singh. Chemistry in Daily life, 1st Edition, Prentice Hall of India Pvt. Ltd., 2008. 5. P.K. Sharma, Understanding Nanotechnology, Vista International Publishing House, Delhi. 2008.
Website and e-learning source	1) https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=5 (Applications of molecular symmetry and Group Theory) 2) http://epgp.inflibnet.ac.in/Home/ViewSubject?catid=5 (Water quality standards) 3) http://www.nanotechnology.com/docs/wtd015798.pdf 4) http://nccr.iitm.ac.in/Nanomaterials.pdf

Course Outcomes:

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

CO1: Illustrate the various symmetry elements and point groups. (K1, K2, K3, K4)

CO2: Explain the principle, instrumentation and applications of GC-MS, LC-NMR, SCFC techniques. (K1, K2, K3, K4)

CO3: Discuss the different types of nanomaterials and their uses. (K1, K2, K3, K4)

CO4: Analyze the quality of water and treat waste water. (K1, K2, K3, K4)

CO5: Summarize the importance of nutraceuticals and antioxidants. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	M	H
CO2	H	H	H	H	M	H
CO3	H	H	H	H	M	H
CO4	H	H	H	H	M	H
CO5	H	H	H	H	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	H	H
CO2	H	M	H	H	H	H
CO3	H	M	H	H	H	H
CO4	H	M	H	H	H	H
CO5	H	M	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ORGANIC CHEMISTRY-II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course XIII</td></tr>
<tr><td>Category</td><td>Core</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>UCCHM24</td></tr>
<tr><td></td><td></td><td>Semester</td><td>VI</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td></td><td colspan="2">4</td><td colspan="2">1</td><td colspan="2">-</td><td>5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Organic Chemistry-I</td></tr>
<tr><td>Objectives of the Course</td><td colspan="7">This course aims at providing knowledge on
• classification, isolation and the properties of alkaloids and terpenes
• preparation and properties of saccharides biomolecules
• different molecular rearrangement
• preparation and properties of organometallic compounds</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3, K4)
Alkaloids and Terpenoids
1.1 Alkaloids-classification and isolation.
1.2 General properties-Hofmann Exhaustive Methylation, structure elucidation-coniine.
1.3 Structure elucidation of piperine.
1.4 Terpenes: classification, isoprene rule, isolation and structural elucidation of citral.
1.5 Structure elucidation of alpha terpineol.
1.6 Structure elucidation of menthol and geraniol.</td></tr>
<tr><td colspan="7">UNIT II (15 hours) (K1, K2, K3, K4)
Carbohydrates
2.1 Carbohydrates-Definition and Classification of Carbohydrates with examples. Relative configuration of sugars. Determination of configuration (Fischer’s Proof). Definition of epimers and anomers with suitable examples.
2.2 Monosaccharides-configuration-D and L hexoses-aldohexoses and ketohexoses. Fructose-occurrence, preparation, properties, reactions, structural elucidation, uses.
2.3 Glucose-occurrence, preparation, properties, reactions, structural elucidation, uses.
2.4 Interconversions of sugar series-ascending, descending, aldose to ketose and ketose to aldose.
2.5 Disaccharides-sucrose, lactose, maltose-preparation, properties and uses (no structural elucidation).
2.6 Polysaccharides-source, constituents and biological importance of homopolysaccharides- starch and cellulose, heteropolysaccharides-hyaluronic acid, heparin.</td></tr>
</table>

	UNIT III (15 hours) (K1, K2, K3, K4) **Molecular rearrangements** 3.1 Molecular rearrangements-classification as anionotropic, cationotropic and inter molecular, intra molecular. 3.2 Mechanism, evidence for carbonium ion intermediate formation, migratory aptitude, inter/intra molecular rearrangement. Migration to electron deficient carbon atom-Pinacol-Pinacolone rearrangement. 3.3 Rearrangement involving electron deficient nitrogen atom-Beckmann rearrangement, migration to electron deficient oxygen-Baeyer Villiger oxidation. 3.4 Rearrangement of aromatic compounds-benzidine rearrangement. 3.5 Rearrangements involving sigmatropic shifts-Claisen and Para Claisen rearrangement. 3.6 Rearrangements to electron rich carbon atom-Favorskii rearrangements.
	UNIT IV (15 hours) (K1, K2, K3, K4) **Special Reagents** 4.1 Special reagents in organic synthesis-AIBN, 9BBN. 4.2 BOC, DABCO, DCC. 4.3 DIBAL, DMAP, NBS. 4.4 NMP, PCC. 4.5 Organometallic compounds in Organic Synthesis- preparation, properties and applications-Grignard reagent, Organolithium compounds. 4.6 Ziegler-Natta, Wilkinson, $HCo(CO)_4$, Zeiss's Salt.
	UNIT V (15 hours) (K1, K2, K3, K4) **Green Chemistry** 5.1 Green Chemistry-principles, chemistry behind each principle. 5.2 Applications in chemical synthesis. 5.3 Green reaction media-green solvents. 5.4 Green reagents and catalysts. 5.5 Tools-microwave in chemical synthesis. 5.6 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)

Recommended Text	1. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, 4th Reprint, Vishal Publishing, 2009. 2. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, 3rd Edition, Macmillan India Ltd., 2009. 3. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, Multicolour Edition, S. Chand & Company Private Ltd., New Delhi, 2012. 4. P. L. Soni and H. M. Chawla, Text Book of Organic Chemistry, 29th Edition, Sultan Chand & Sons, New Delhi, 2007. 5. C Bandyopadhya, An Insight into Green Chemistry, 2020. 6. SN Sanyal, Reactions, Rearrangements and Reagents, New Edition,

	Barathy Hawan (P&D), 2023.
Reference Books	1. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Pearson Education, Asia, 2012. 2. T. W. Graham Solomons, Organic Chemistry, 11th Edition, John Wiley & Sons, 2012. 3. A. Carey Francis, Organic Chemistry, 7th Edition, Tata McGraw-Hill Education Private Ltd., New Delhi, 2009. 4. I. L. Finar, Organic Chemistry, 6th Edition, Vol. (1& 2), England, Wesley Longman Ltd, 2006. 5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, 5th Edition, Wiley, 2010.
Website and e-learning source	1) www.epgpathshala.nic.in 2) www.nptel.ac.in 3) http:/swayam.gov.in 4) https://vlab.amrita.edu/

Course Outcomes:

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

CO1: Discuss the isolation and properties of alkaloids and terpenes. (K1, K2, K3, K4)

CO2: Explain preparation and properties of mono and disaccharides. (K1, K2, K3, K4)

CO3: Classify molecular rearrangements. (K1, K2, K3, K4)

CO4: Plan chemical reactions with special reagents. (K1, K2, K3, K4)

CO5: Explain the fundamentals of green chemistry. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	M	H
CO2	H	H	H	H	M	H
CO3	H	H	H	H	M	H
CO4	H	H	H	H	M	H
CO5	H	H	H	H	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	H	H	H
CO2	H	M	H	H	H	H
CO3	H	M	H	H	H	H
CO4	H	M	H	H	H	H
CO5	H	M	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="8">INORGANIC CHEMISTRY-II</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core Course XIV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td colspan="2">UCCHN24</td></tr>
<tr><td>Semester</td><td>VI</td><td colspan="5"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Inorganic Chemistry-I</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">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</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="8">UNIT I (15 hours) (K1, K2, K3, K4)
Bioinorganic Chemistry
1.1 Essential and trace elements: Role of sodium, and potassium ion.
1.2 Biological role of magnesium, and calcium ions.
1.3 Biological role of iron, and cobalt.
1.4 Role of Cu^{2+} and Zn^{2+} in biological systems.
1.5 Effect of excess intake (toxicity) of metal ions-trace elements-As, and Cd.
1.6 Toxicity of Pb, and Hg.</td></tr>
<tr><td colspan="8">UNIT II (15 hours) (K1, K2, K3, K4)
Metal ion transport and storage
2.1 Iron-storage, transport-Transferrin and Ferritin.
2.2 Iron-porphyrins-myoglobin, hemoglobin-oxygen transport-Bohr effect.
2.3 Sodium/potassium pump.
2.4 Calcium pump.
2.5 Transport and storage of copper.
2.6 Transport and storage of zinc.</td></tr>
<tr><td colspan="8">UNIT III (15 hours) (K1, K2, K3, K4)
Metallo enzymes
3.1 Isomerase and synthetases, structure of cyanocobalamin (Vitamin B12), nature of Co-C bond.
3.2 Metalloenzymes-functions of carboxy peptidase A.
3.3 Zinc metalloenzyme-mechanism and uses.
3.4 Zn-Cu enzyme-structure and function, carbonic anhydrase.
3.5 Vitamin B-12 as transferase and isomerase -iron-sulphur proteins-2Fe-2S-rubredoxin, 4Fe-2S-ferridoxin, iron sulphur cluster enzymes.
3.6 In vivo and Invitro nitrogen fixation-biological functions of nitrogenase and molybdo enzymes.</td></tr>
</table>

	UNIT IV (15 hours) (K1, K2, K3, K4) **Silicates** 1.1 Introduction-general properties of silicates. 1.2 Structure-types of silicates-ortho silicates (zircon). 1.3 Pyro silicates (thortveitite), chain silicates (pyroxenes). 1.4 Ring silicates (beryl). 1.5 Sheet silicates (talc, mica, asbestos). 1.6 Silicates having three-dimensional structure (feldspars, zeolites, ultramarines).
	UNIT V (15 hours) (K1, K2, K3, K4) **Industrial Applications of Inorganic Compounds** 5.1 Refractories, pyrochemical. 5.2 Explosives, alloys. 5.3 Paints and pigments-requirements of a good paint; classification, constituents of paints-pigments, vehicles, thinners, driers. 5.4 Constituents of paints-extenders, anti-knocking agents anti-skinning agents, plasticizers, binders-application. 5.5 Varnishes-oils, spirit; enamels. 5.6 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)

Recommended Text	1. B R Puri, L R Sharma, K C Kalia, Principles of Inorganic Chemistry, 31st Edition, Milestone Publishers & Distributors, Delhi, 2011. 2. Satya Prakash, G. D. Tuli, S. K. Basu, R. D. Madan, Advanced Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi, 2009. 3. J D Lee, Concise Inorganic Chemistry, 4th Edition, ELBS William Heinemann, London, 1991. 4. W V Malik, G D Tuli, R D Madan, Selected Topics in Inorganic Chemistry, S. Chand and Company Ltd, 2000. 5. A. K. De, Text book of Inorganic Chemistry, 7th Edition, Wiley East Ltd, 1992.
Reference Books	1. R D Madan, Sathya Prakash, Modern Inorganic Chemistry, 2nd Edition, S. Chand and Company, New Delhi, 2003. 2. R. Gopalan, Inorganic Chemistry for Undergraduates, 1st Edition, University Press (India) Private Limited, Hyderabad, 2009. 3. B. Sivasankar, Inorganic Chemistry, 1st Edition, Pearson, Chennai, 2013. 4. Alan G. Sharp, Inorganic Chemistry, 3rd Edition, Addition-Wesley, England, 1992. 5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, 6th Edition, Oxford University Press, 2014.

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

Course Outcomes:

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

CO1: Explain the importance of tracer elements on biological system. (K1, K2, K3, K4)

CO2: Explain the metal ion transport, Bohr effect, Na, K, Ca pumps. (K1, K2, K3, K4)

CO3: Explain the functions of Vitamin B_{12}, Zn-Cu enzyme, ferredoxin, and cluster enzymes. (K1, K2, K3, K4)

CO4: Describe the classification and structure of silicates. (K1, K2, K3, K4)

CO5: Explain the manufacture of refractories, explosives, paints and pigments. (K1, K2, K3. K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	L	H
CO2	H	H	H	M	L	H
CO3	H	H	H	M	L	H
CO4	H	H	H	M	L	H
CO5	H	H	H	M	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	H	H
CO2	H	L	H	H	H	H
CO3	H	L	H	H	H	H
CO4	H	L	H	H	H	H
CO5	H	L	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">PHYSICAL CHEMISTRY-II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Course XV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">UCCHO24</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Physical Chemistry-I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at providing an overall view of the
• phase diagram of one and two component systems
• chemical equilibrium,
• separation techniques for binary liquid mixtures.
• electrical conductance and transport number.
• galvanic cells, EMF and significance of electrochemical series.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3, K4)
Phase rule
1.1 Definition of terms; derivation of phase rule.
1.2 Application to one component systems-water and sulphur-super cooling, sublimation.
1.3 Two component systems-solid liquid equilibria-simple eutectic (lead-silver and bismuth-cadmium).
1.4 Freezing mixtures-potassium iodide-water system.
1.5 Compound formation with-congruent melting points (magnesium-zinc and ferric chloride-water system),
1.6 Peritectic change (sodium–potassium), solid solution (gold-silver); copper sulphate–water system.</td></tr>
<tr><td></td><td colspan="7">UNIT II (15 hours) (K1, K2, K3, K4)
Chemical equilibrium
2.1 Law of mass action-thermodynamic derivation-relationship between K_p and K_C.
2.2 Application to the homogeneous equilibria-dissociation of PCl_5 gas, N_2O_4 gas.
2.3 Equilibrium constant and degree of dissociation-formation of HI, NH_3 and SO_3.
2.4 Heterogeneous equilibrium-decomposition of solid calcium carbonate.
2.5 Le Chatelier principle-van’t Hoff reaction isotherm-temperature dependence of equilibrium constant-van’t Hoff reaction isochore.
2.6 Clapeyron equation-Clausius Clapeyron equation and its applications.</td></tr>
</table>

	UNIT III (15 hours) (K1, K2, K3, K4) **Binary liquid mixtures** 3.1 Ideal liquid mixtures-non ideal solutions. 3.2 Azeotropic mixtures-fractional distillation. 3.3 Partially miscible mixtures-phenol-water-effect of impurities on critical solution temperature. 3.4 Triethylamine-water, nicotine-water systems-effect of impurities on critical solution temperature 3.5 Immiscible liquids-steam distillation. 3.6 Nernst distribution law-applications.
	UNIT IV (15 hours) (K1, K2, K3, K4) **Electrical Conductance and Transference** 4.1 Arrhenius theory of electrolytic dissociation-Ostwald's dilution law, limitations of Arrhenius theory. 4.2 behavior of strong electrolytes-interionic effects-Debye Huckel theory-Onsager equation (no derivation), significance of Onsager equation, Debye Falkenhagen effect, Wien effect. 4.3 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. 4.4 Kohlrausch's law-applications; molar ionic conductance and viscosity (Walden's rule). 4.5 applications of conductance measurements-determination of-degree of dissociation of weak electrolyte, dissociation constant of weak acid and weak base. 4.6 Ionic product of water, solubility and solubility product of sparingly soluble salts-conductometric titrations-acid base titrations.
	UNIT V (15 hours) (K1, K2, K3, K4) **Galvanic Cells and Applications** 5.1 Galvanic cell, representation, reversible and irreversible cells, EMF and its measurement – standard cell; relationship between electrical energy and chemical energy. 5.2 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. 5.3 Types of electrodes-metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode, redox electrode; electrochemical series-applications of electrochemical series. 5.4 Chemical cells with and without transport, concentration cells with and without transport. 5.5 **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. 5.6 **Industrial component**-galvanic cells-lead storage, Ni-Cd, Li and Zn-air, Al-air batteries. 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)

Recommended Text	1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, 48th Edition, Shoban Lal Nagin Chand and Co., 2021. 2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, International 11th Edition, Oxford University Press, 2018. 3. Arun Bahl, B.S. Bahl, G. D. Tuli, Essentials of Physical Chemistry, 28th Edition, S. Chand & Co., 2019. 4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems, 4th Edition, New Age International, 1996. 5. J. Rajaram and J.C. Kuriakose, Thermodynamics, Shoban Lal Nagin Chand and Co., 1986.
Reference Books	1. K. L. Kapoor, A Textbook of Physical Chemistry, 3rd Edition, Macmillan India Ltd, 2009. 2. Gilbert. W. Castellan, Physical Chemistry, 3rd Edition, Narosa Publishing House, 1985. 3. P. W. Atkins, and Julio de Paula, Physical Chemistry, 7th Edition, Oxford University Press, 2002. 4. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, 41st Edition, Shoban Lal Nagin Chand and Co. Jalandhar, 2001. 5. D. N. Bajpai, Advanced Physical Chemistry, S. Chand & Co., 2001.
Website and e-learning source	1) https://nptel.ac.in 2) https://swayam.gov.in 3) https://archive.nptel.ac.in/content/storage2/courses/112108150/pdf/PPTs/MTS_07_m.pdf Thermodynamics – NPTEL 4) https://www.youtube.com/watch?v=f0udxGcoztE Introduction to chemical equilibrium-MIT open-course ware

Course Outcomes:

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

CO1: Construct the phase diagram for one and two component systems, explain the properties of freezing mixture and solid solutions. (K1, K2, K3, K4)

CO2: Apply the concepts of chemical equilibrium and demonstrate important principles. (K1, K2, K3, K4)

CO3: Identify an appropriate distillation method for the separation of binary liquid mixtures. (K1, K2, K3, K4)

CO4: Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equation and Kohlrausch's law. (K1, K2, K3, K4)

CO5: Construct electrochemical cell, calculate cell EMF, and demonstrate the applications of EMF and significance of potentiometric titrations. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

Title of the Course	**PRACTICAL-V: PHYSICAL CHEMISTRY PRACTICAL-II**						
Paper No.	**Core Course XVI**						
Category	**Core**	**Year**	III	**Credits**	2	**Course Code**	UCCHP24
		Semester	VI				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	-	-	3			3	
Prerequisites	Theoretical Knowledge on Physical Chemistry						
Objectives of the course	This course aims at providing • basic principles of physical chemistry experiments • hands on experience in carrying out the experiments						
Course Outline	**UNIT I** **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. ($Na_2S_2O_3.5\ H_2O$, $CH_3COONa.3H_2O$, $SrCl_2.6H_2O$, $MnCl_2.4H_2O$) 3. *Determination of upper critical solution temperature of phenol-water system. 4. Effect of an electrolyte on miscibility temperature of phenol-water system. 5. Determination of concentration of sodium chloride using phenol- sodium chloride system.						
	Unit II **Electrochemistry** 1. Conductometric titration of hydrochloric acid against sodium Hydroxide. 2. Potentiometric titration of ferrous ion against potassium dichromate using quinhydronde electrode. 3. *Determination of pH. *Not to be given for examination						

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)

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

Method of Evaluation	**Continuous Assessment - 40 marks** I C.A. - 50 II C.A. - 50 Average - 25 Performance during regular practicals -10 Regularity in submission of observation note-book and Record - 5 **Semester Practical examination - 60 marks** Principle writing - 5 marks Viva-voce - 5marks Record - 10 marks **1. Effect of electrolyte** Error up to 10 % - 40 marks 10 - 20 % - 35 marks 20 - 30 % - 20 marks Above 30% - 10 marks **1. Transition Temperature** Error up to 2^{o}C difference - 40 marks Error up to 7^{o}C difference - 25 marks Error above 7^{o}C difference - 10 marks **2. Conductivity / Potentiometric titrations /pH** Error up to 10 % - 40 marks Error up to 15 % - 30 marks Error up to 20 % - 20 marks Error above 20 % - 10 marks (Proportionate marks are reduced for in between % of error)

Course Outcomes:

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

CO1: Describe the principles and methodology for the practical work.

CO2: Explain the procedure, data and methodology for the practical work.

CO3: Apply the principles of phase rule and electrochemistry for carrying out the practicalwork

CO4: Demonstrate laboratory skills for safe handling of the equipment and chemicals.

CO5: Apply the principles of conductometric and potentiometric titrations.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	M	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ELECTIVE: FUNDAMENTALS OF SPECTROSCOPY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective DSE III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">UECHE24</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry-I, II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">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</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNIT I (15 hours) (K1, K2, K3, K4)
Electrical and Magnetic properties of molecules and Microwave spectroscopy
1.1 Dipole moment-polar and nonpolar molecules-polarisability of molecules.
1.2 Application of dipole moments in the study of organic and inorganic molecules.
1.3 Magnetic permeability, volume susceptibility, mass susceptibility and molar susceptibility; diamagnetism and paramagnetism.
1.4 Determination of magnetic susceptibility using Gouy balance, ferromagnetism and antiferromagnetism.
1.5 Rotation spectra-diatomic molecules (rigid rotator approximation) selection rules-determination of bond length, effect of isotopic substitution.
1.6 Instrumentation and applications of Microwave spectroscopy.</td></tr>
<tr><td colspan="7">UNIT II (15 hours) (K1, K2, K3, K4)
Ultraviolet and Visible spectroscopy
2.1 Electronic spectra of diatomic molecules (Born Oppenheimer approximation)-vibrational coarse structure-rotational fine structure of electronic vibration transitions.
2.2 Frank Condon principle-dissociation in electronic transitions-Birge Sponer method of evaluation of dissociation energy-pre-dissociation transition.
2.3 Types of transitions-σ –σ *, π-π*, n-σ*, n-π* transitions.
2.4 Woodward-Fieser’s rules as applied to conjugated dienes and α, β-unsaturated ketones. Elementary Problems.
2.5 Applications of UV-Visible spectroscopy.
2.6 Colorimetry-principle and applications (estimation of Fe^{3+}).</td></tr>
</table>

	Unit III (15 hours) (K1, K2, K3, K4) **Infrared spectroscopy** 3.1 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. 3.2 Molecular Vibrations-stretching and bending vibrations. Vibrations of polyatomic molecules. 3.3 Application of Infrared spectroscopy-determination of force constant, moment of inertia and internuclear distance-isotopic shift. 3.4 Application of IR spectra to simple organic and inorganic molecules-group frequencies. 3.5 Rayleigh scattering and Raman scattering of light-Raman shift; Classical theory of Raman effect-quantum theory of Raman effect. Vibrational Raman Spectrum-selection rules. 3.6 Mutual exclusion-principle-instrumentation (block diagram)-applications of Raman spectroscopy.
	Unit IV (15 hours) (K1, K2, K3, K4) **Nuclear magnetic resonance spectroscopy** 4.1 PMR-theory of PMR-instrumentation-number of signals. 4.2 Chemical shift-peak areas and proton counting-spin-spin coupling-applications. 4.3 Problems related to shielding and deshielding of protons. 4.4 Chemical shift of protons in hydrocarbons. 4.5 Chemical shift of protons in simple mono functional organic compounds. 4.6 Spin-spin splitting of neighbouring protons in vinyl and allyl systems.
	Unit V (15 hours) (K1, K2, K3, K4) **Mass spectrometry** 5.1 Principle-different kinds of ionization-instrumentation. 5.2 Mass spectrum-types of peaks-applications. 5.3 Determination of molecular formula-fragmentation and structural elucidation. 5.4 Nitrogen rule, McLafferty rearrangement-illustrations with simple organic molecules. 5.5 Retro Diels Alder reaction-illustrations with simple organic molecules. 5.6 Solving structure elucidation problems using multiple spectroscopic date (UV-Vis, IR, NMR and MS).

Extended Professional component (It is a part of internal component only, not to be included in the external 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)

Recommended Text	1. C. N. Banwell, E. M. Mc Cash, Fundamentals of Molecular Spectroscopy, 4th Edition, Tata McGraw Hill, New Delhi, 2017. 2. Shobha Ramakrishnan and Banani Mukhopadhyay. Essentials of

	Analytical Chemistry, 1st Edition, Pearson Education, 2019. 3. Y.R. Sharma, Elementary Organic Spectroscopy-Principles and Chemical Applications. Revised Edition, S. Chand, 2007. 4. R. Gopalan, P. S. Subramaniam, K. Rengarajan, Elements of Analytical Chemistry, S Chand, New Delhi, 2003. 5. S. Usharani, Analytical Chemistry, 1st Edition, Macmillan, India, 2002. 6. U. N. Dash, Analytical Chemistry Theory and Practice, 2nd Edition, Sultan Chand & Sons, 2005. 7. B. K. Sharma, Spectroscopy, 22nd Edition, Goel Publishing House, 2011.
Reference Books	1. D. A. Skoog, S. R. Crouch, F. J. Holler, D. M. West, Fundamentals of Analytical Chemistry, 10th Edition, Harcourt College Publishers, USA, 2021. 2. R. L. Madan, G. D. Tuli, Physical Chemistry, 2nd Edition, S. Chand, New Delhi, 2014. 3. A. K. Srivastava, P.C. Jain, Chemical Analysis an Instrumental Approach, 4th Edition, S. Chand, New Delhi, 2009. 4. B. R. Puri, L. R. Sharma, M. S. Pathania, Principles of Physical Chemistry, 43rd Edition, Vishal Publishing, Delhi, 2008. 5. Robert D Braun, Introduction to Instrumental Analysis, McGraw Hill, New York, 1987.
Website and e-learning source	1) www.epgpathshala.nic.in 2) www.nptel.ac.in 3) http:/swayam.gov.in 4) https://youtu.be/NyN9uPLxXJw?si=jVgK_rtOrRdLkZiX 5) https://youtu.be/7jOSbtR8mTs 6) https://youtu.be/4P8JZP-c-48?si=vVN_aIfmC27mcL7L 7) https://youtu.be/nnVGa8OjkFo?si=VfX7MEUwzoGXVeOS 8) https://youtu.be/myolF-h1kKI?si=mDklHxVE57FBBKFQ

Course Outcomes:

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

CO1: Explain electrical and magnetic properties of materials, and microwave spectroscopy. (K1, K2, K3, K4)

CO2: Explain theory, instrumentation and applications of Infrared and Raman spectroscopy. (K1, K2, K3, K4)

CO3: Apply selection rules to understand spectral transitions, explain Woodward-Fieser's rule for the calculation of wavelength maximum of conjugated dienes and α, β-unsaturated ketones. (K1, K2, K3, K4)

CO4: Explain theory, instrumentation and applications of NMR spectroscopy. (K1, K2, K3, K4)

CO5: Explain theory, instrumentation and applications of Mass spectrometry. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="8">ELECTIVE: NANOSCIENCE</td></tr>
<tr><td>Paper No.</td><td colspan="8">Discipline Specific Elective DSE IIIA</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">UECHF24</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Basic knowledge in Physics and Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">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</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="8">UNIT I (15 hours) (K1, K2, K3, K4)
Introduction to nanoscience
1.1 Definition of terms-nanoscience, nanoparticles, clusters, quantum dots, nanostructures and nanocomposites. Electron behaviour in free space, bulk material and nanomaterials.
1.2 Synthesis and stabilization of nanomaterials. Top-down approach (physical methods), mechanical dispersion-ball milling.
1.3 Methods based on evaporation of a precursor-inert gas condensation, ion sputtering, spray pyrolysis, aerosol synthesis-nanolithography.
1.4 Bottom–up approach (chemical methods)-solvothermal synthesis, photochemical method, gamma radiolysis, sono chemical synthesis, electro deposition, sol-gel method.
1.5 Nanomaterials via chemical routes-solvents-reducing agents, capping agents-stabilization of nanoparticles-electrostatic and steric stabilization, common stabilizers.
1.6 Nanoparticle growth in solution, templated growth, Langmuir-Blodgett (L-B) method, reverse micelles-emulsion method.</td></tr>
<tr><td colspan="8">Unit II (15 hours) (K1, K2, K3, K4)
Properties of materials on a nanoscale
2.1 Optical properties of metal and semiconductor nanomaterials-Surface Plasmon Resonance (SPR).
2.2 Surface Enhanced Raman Spectra (SERS).
2.3 Quantum confinement effect, tuning of optical spectrum.
2.4 Magnetic properties-Fe_3O_4 particle, supra magnetic properties.
2.5 Electronic properties, chemical properties-chemical process on the surface of nanoparticles.
2.6 Catalysis, mechanical properties.</td></tr>
</table>

	UNIT III (15 hours) (K1, K2, K3, K4) **Techniques employed for characterization of nanomaterial** 3.1 Spectroscopy-UV-visible, Photoelectron spectroscopy. 3.2 Electron microscopy-Scanning Electron Microscopy (SEM). 3.3 Transmission Electron Microscopy (TEM), Scanning Probe Microscopy (SPM). 3.4 Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM). 3.5 Optical microscopy-confocal microscopy. 3.6 X-ray Diffraction (XRD) (Principle and Block diagram only).
	UNIT IV (15 hours) (K1, K2, K3, K4) **Special nanomaterials** 4.1 Carbon Nano Structures-Carbon nanotubes: Introduction-types-zigzag, armchair, helical, synthesis by CVD, Functionalization of Carbon Nanotubes. 4.2 Reactivity of Carbon Nanotubes, Field emission, Fuel Cells, Display devices. 4.3 Other Important Carbon-based materials: Preparation and Characterization-Fullerene, Graphene; properties and applications-DLC and nanodiamonds. 4.4 Semiconductor nanoparticles: Quantum dots, synthesis-Chemical synthesis using clusters, properties, porous silicon 4.5 Electrochemical etching, aerogel-types-silica aerogel, resorcinol formaldehyde (RF) aerogels, zeolites – applications. 4.6 Self-Assembled Nanomaterials: Self Assembled Monolayers (SAMS)-inorganic, organic molecules.
	UNIT V (15 hours) (K1, K2, K3, K4) **Application of nanomaterials** 5.1 Biomedical Applications-drug, drug delivery, bio labelling, artificial implants, cancer treatment. 5.2 Sensors-Natural nanoscale sensors, chemical sensors, biosensors, electronic noses. 5.3 Optics & Electronics-Nanomaterials in the next generation computer technology, high-definition TV, flat panel displays, quantum dot laser, Single Electron Transistors (SET). 5.4 Nanotechnology in agriculture-Fertilizer and pesticides. 5.5 Nanomaterials for water purification, nanomaterials in food and packaging materials, fabric industry. 5.6 Impacts of Nanotechnology-human & environmental safety risks.

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)

Recommended Text	1. Sulabha K. Kulkarni, Nanotechnology: Principles and Practices, Capital Publishing Co., New Delhi. 2. T. Pradeep, Nano: The Essentials, Understanding Nanoscience and Nanotechnology, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007. 3. M. A. Shah, Tokeer Ahmad, Principles of Nanoscience and Nanotechnology, Narosa Publishing House, New Delhi, 2010. 4. B.S. Murthy, P. Shankar, Baldev Raj, Rath, B.B. James Murday, Textbook of Nanoscience and Nanotechnology, University Press, India Ltd., Hyderabad, 2012.
Reference Books	1. P. K. Sharma, Understanding Nanotechnology, Vista International Publishing House, Delhi. 2008. 2. Charles P. Poole Jr., Frank J. Owens, Introduction to Nanotechnology, A John Wiley & Sons, INC. Publication, 2003. 3. B. Viswanathan, Nano Materials, Narosa Publishing House, New Delhi, 2009. 4. Edited by C.N.R. Rao, A. Muller, A. K. Cheetham, Nanomaterials Chemistry Recent Developments and New Directions, WILEY-VCH Verlag GMBH & Co., Darmstadt. 5. Jing Zhong Zhang, Optical Properties and Spectroscopy of Nanomaterials; 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 Outcomes:

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. (K1, K2, K3, K4)

CO2: Describe the properties, synthesis, characteristics of nanomaterials, special nanomaterials and applications. (K1, K2, K3, K4)

CO3: Examine the structure, properties, applicability and characterization of nanomaterials. (K1, K2, K3, K4)

CO4: Analyze various synthesis procedures, characterizations and uses of carbon nanotubes, fullerene and grapheme. (K1, K2, K3, K4)

CO5: Discuss applications of nanomaterials of sensors and in optics and electronics. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="8">ELECTIVE: PHARMACEUTICAL CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="8">Discipline Specific Elective DSE IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td colspan="2">UECHG24</td></tr>
<tr><td>Semester</td><td>VI</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td colspan="2">-</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Knowledge on active chemical compounds and biochemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">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</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="8">UNIT I (12 hours) (K1, K2, K3, K4)
Introduction, structure, pharmacological activity of drugs
1.1 Important terminologies-drug, pharmacognosy, pharmacy, pharmacology, pharmacodynamics, pharmacokinetics, clinical pharmacology, pharmacotherapeutics, chemotherapy,
1.2 Toxicology, pharmacophore, antimetabolites, mutation, bacteria, virus, fungi, actinomycetes, vaccines, pharmacopeia, posology and therapeutic index.
1.3 Sources of drugs-dosage forms-bio availability-routes of administration-absorption, distribution and elimination of drugs-drug metabolism-prescription terms.
1.4 Effect of-unsaturation, chain length, isomerism; groups-halogens amino, nitro, nitrite, cyano, acidic, aldehydic, keto, hydroxyl and alkyl groups.
1.5 Development of a drug-classic steps-lead compounds- comparison of traditional and modern methods of development of drugs.
1.6 Drug design by method of variation=disjunction and conjunction methods.</td></tr>
<tr><td colspan="8">Unit II (12 hours) (K1, K2, K3, K4)
Indian medicinal plants, diseases and antibiotics
2.1 Some important Indian medicinal plants-tulsi, neem, kizhanelli, mango, semparuthi, adadodai, turmeric and thoothuvalai-uses.
2.2 Causes, prevention and treatment of the following diseases: Insect borne diseases-malaria, filariasis, plague.
2.3 Air borne diseases-diphtheria, whooping cough, influenza, measles, mumps, common cold, tuberculosis.
2.4 Water borne diseases-cholera, typhoid and dysentery. Digestive system – jaundice; Respiratory system-asthma; Nervous system-epilepsy.
2.5 Definition-classification-structure and therapeutic uses of chloramphenicol and penicillin.
2.6 Structure activity relationship of chloramphenicol, therapeutic uses of ampicillin, streptomycin, erythromycin, tetracycline, rifamycin.</td></tr>
</table>

	Unit III (12 hours) (K1, K2, K3, K4) **Drugs for major diseases** 3.1 Cancer-common causes-chemotherapy-anti neoplastic agents-classification-adverse effects of cytotoxic agents-alkylating agents-chlorambucil-anti metabolites-methotrexate and fluorouracil. Vinca alkaloids-vincristine and vinblastine. 3.2 Diabetes-types-management of diabetes-insulin. 3.3 Oral hypoglycemic agents-sulphonylureas-chlorpropamide; biguanides-metformin-thiazolidinediones. 3.4 Cardiovascular drugs-cardio glycosides; anti arrhythmic agents-quinidine, propranolol hydrochloride. 3.5 Anti-hypertensive drugs-aldomet, pentoliniumtartrate; vasodilator-tolazoline hydrochloride, sodium nitroprusside. 3.6 AIDS-causes, symptoms and prevention-anti HIV drugs-AZT, DDC.
	UNIT IV (12 hours) (K1, K2, K3, K4) **Analgesics, Anaesthetics and haematological agents** 4.1 Classification-action of analgesics-narcotic analgesics-morphine; synthetic analgesics-pethidine and methadone. 4.2 Non-narcotics analgesics-salicylic acid derivatives, indolyl derivatives, p-aminophenol derivatives. 4.3 Definition, characteristics, classification-general anaesthetics-volatile anaesthetics-nitrous oxide, ethers, cyclopropane, chloroform, halothane, trichloro ethylene-storage, advantages and disadvantages. 4.4 Non-volatile anaesthetics-thiopental sodium. Local anaesthetics-requisites-advantages-esters-cocaine, benzocaine-amides-lignocaine, cinchocaine. 4.5 Blood-composition, grouping-physiological functions of plasma proteins-mechanism of clotting; Coagulants-vitamin K, protamine sulphate, dry thrombin. 4.6 Anti-coagulants-coumarins, citric acid and heparin; antifibrinolytic agents-aminocaproic acid and tranexamic acid. Anaemia-causes, types and control-anti anaemic drugs.
	UNIT V (12 hours) (K1, K2, K3, K4) **Clinical Chemistry and Significance of clinical test** 5.1 Blood tests-blood count-complete haematogram-TC, DC and platelets. 5.2 Blood tests: RBC-Hb, PCV, ESR-GTT. 5.3 Serum electrolytes-blood Glucose-ortho toluidine method**;** Renal function tests-blood urea and creatinine. 5.4 Liver function tests-serum proteins, albumin globulin ratio, serum bilirubin, enzymes SGOT, SGPT. 5.5 Lipid profile-cholesterol, triglycerides, HDL, LDL, coronary risk index. 5.6 Urine examination-pH, tests for glucose, albumin and bile pigment.

Extended Professional component (It is a part of internal component only, not to be included in the external 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)

Recommended Text	1. Jayashree Ghosh, A text book of Pharmaceutical Chemistry, Kindle Edition, S. Chand & Company, 2012, New Delhi. 2. S. Lakshmi, Pharmaceutical Chemistry, 3rd Edition, Sultan Chand & Sons, 2004, New Delhi. 3. K. D. Tripathi, Essentials of Medical Pharmacology, 8th Edition, Jaypee brothers Medical Publishers (P) Limited, New Delhi, 2018. 4. Ashutosh Kar, Medicinal Chemistry, 7th Edition, New Age International (P) Limited, Publishers, New Delhi, 2018.
Reference Books:	1. G. R. Chatwal, Pharmaceutical Chemistry, Inorganic (Vol-I) 6th Edition, Himalaya Publishing House, Bombay, 2013. 2. G. R. Chatwal, Pharmaceutical Chemistry, Organic (Vol-II), Revised Edition. Himalaya Publishing House, Bombay, 2008. 3. G. Patrick, Instant Notes Medicinal Chemistry, Viva Books Private Limited, New Delhi, 2002.
Website and e-learning source	1) www.epgpathshala.nic.in 2) www.nptel.ac.in 3) http:/swayam.gov.in 4) http://www.pharmacy.umaryland.edu/faculty/amackere/courses/phar531_delete/lectures/qsar_1.pdf 5) http://www.indianmedicinalplants.info/ 6) https://www.wipo.int/about-ip/en/ 7) https://youtu.be/9wqaOpaOhOI

Course Outcomes:

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

CO1: Define the pharmaceutical terminologies and describe the principles in pharmacological activity. (K1, K2, K3, K4)

CO2: Discuss the significance of medicinal plants, disease types and antibiotics. (K1, K2, K3, K4)

CO3: Explain the therapeutic application of drugs for major diseases. (K1, K2, K3, K4)

CO4: Explain classification of analgesics and anaesthetics and physiological functions of plasma protiens. (K1, K2, K3, K4)

CO5: Explain the significance of clinical tests like blood urea, serum proteins and coronary risk index. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="8">ELECTIVE: POLYMER SCIENCE</td></tr>
<tr><td>Paper No.</td><td colspan="8">Discipline Specific Elective DSE IVA</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td colspan="2">UECHH24</td></tr>
<tr><td>Semester</td><td>VI</td><td colspan="5"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td></td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Knowledge on functional groups and reaction mechanisms</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">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</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I (12 hours) (K1, K2, K3, K4)
Introduction
1.1 Difference between polymer and macromolecule-classification-synthetic and natural.
1.2 Organic and inorganic polymers, thermoplastic and thermosetting polymers.
1.3 Plastics, elastomers,
1.4 Fibres and liquid resins.
Techniques of polymerization
1.5 Bulk polymerization and solution polymerization
1.6 Emulsion and suspension polymerization.</td></tr>
<tr><td></td><td colspan="8">Unit II (12 hours) (K1, K2, K3, K4)
Kinetics of polymerization
2.1 Kinetics of condensation and addition polymerization.
2.2 Ionic, free radical, copolymerization and coordination polymerization.
2.3 Reactivity ratios-block and graft copolymers.
Characterization of polymers
2.4 Appearance, feel and hardness, density, effect of heat, solubility, combustion.
2.5 Tensile strength, shear, stress, impact strength, mechanical.
2.6 Thermomechanical and rheological properties of polymers in viscoelastic state.</td></tr>
</table>

UNIT III (12 hours) (K1, K2, K3, K4)

Molecular Weight and Properties of Polymers

3.1 Molecular Weight of Polymers-Number Average and Weight Average, Molecular Weight Distribution.

3.2 Determination of Molecular Weight, polydispersity index-membrane and vapour phase osmometry, light scattering-Zimm plot.

3.3 Ultracentrifuge-sedimentation velocity and sedimentation equilibrium-viscometry-gel permeation chromatography.

3.4 Thermal properties of polymers-Glass Transition Temperature-State of Aggregation and State of Phase Transitions.

3.5 Factors Influencing Glass Transition Temperature, Importance of Glass Transition Temperature.

3.6 Heat Distortion Temperature, TGA / DTA, Crystallinity of Polymers: Crystalline Behaviour, Degree of Crystallinity.

UNIT IV (12 hours) (K1, K2, K3, K4)

4.1 Reactions of Polymers-Hydrolysis, Acidolysis, Aminolysis, Addition and Substitution Reactions (One Example Each).

4.2 Cyclisation, Cross-Linking and Reactions of Specific Functional Groups in the Polymer.

Polymer technology

4.3 Processing of polymers-casting, thermoforming, moulding.

4.4 Extrusion, compression, blow moulding.

4.5 Foaming, and lamination,

4.6 Reinforcing-processing of fibres-melt, wet and dry spinning.

UNIT V (12 hours) (K1, K2, K3, K4)

Special polymers

5.1 Polyelectrolytes, conducting polymers, polymeric supports for solid phase synthesis.

5.2 Biomedical polymers, liquid crystalline polymers, electroluminescent polymers-two examples of each of these polymers.

5.3 Polyethylene, PVC, PMMA, polyester.

5.4 Rubber-synthetic and natural, vulcanisation of rubber.

Polymer Degradation

5.5 Types of Degradation-Thermal, Mechanical, Ultra Sound, Photo Radiation and Chemical Degradation Methods.

5.6 Biodegradable and Non-Biodegradable Polymers.

Extended Professional Component (is a part of internal component only, not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)

Recommended Text	1. V. R. Gowariker, N.V. Viswanathan and Jayadev Sreedhar. Polymer Science, New Age International, New Delhi, 2015. 2. G. S. Misra, Introductory Polymer Chemistry. Wiley Eastern, New Delhi, 2010. 3. P. Bahadur, N. V. Sastry, Principles of Polymer Science, Narosa Publishing House, New Delhi, 2005 4. V. K. Ahluwalia, Anuradha Mishra, Polymer Science A Text Book, Ane Books India, New Delhi, 2008. 5. R. R. Morrison, R. N. Boyd, S.K. Bhattacharjee, Organic Chemistry, 7th Edition, Pearson, New Delhi, 2011.
Reference Books	1. F. W. Billmeyer, Polymer Science, Wiley-Inter Science, India, 2007. 2. R. B. Seymour, C. E. Carraher Jr., Polymer Chemistry: An Introduction, Marcel Dekker Inc., New York, 1981. 3. R. Sinha, Outlines of Polymer Technology, Prentice Hall of India, New Delhi, 2000. 4. Joel R. Fried, Polymer Science and Technology, 3r Edition, Prentice Hall of India, New Delhi, 2014.
Website and e-learning source	1) https://polymerdatabase.com 2) 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+weigh ts+of+polymers.pdf

Course Outcomes:

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

CO1: Explain classification of polymers, elastomers, fibres and liquid resins. (K1, K2, K3, K4)

CO2: Explain addition and condensation polymerization, mechanical properties of polymers. (K1, K2, K3, K4)

CO3: Determine the molecular weight of polymers, and explain the thermal properties of polymers. (K1, K2, K3, K4)

CO4: Explain reactions of polymers and polymer processing. (K1, K2, K3, K4)

CO5: Discuss special polymers like PVC, PMMA, rubbers, biodegradable polymers. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

Title of the Course	**CHEMISTRY FOR COMPETITIVE EXAMINATIONS**						
Paper No.	**Skill Enhancement Course SEC VIII**						
Category	**Professional Competency Skill**	**Year**	III	**Credits**	2	**Course Code**	UPCH24
		Semester	VI				
Instructional hours per Week	**Lecture**	**Tutorial**	**Lab Practice**		**Total**		
	2	-	-		2		
Prerequisites	Higher Secondary Course						
Objectives of the course	This course aims to • create an opportunity for passing the examination conducted by service commissions (UPSC, TNPSC etc.,)						
Course Outline	**UNIT I (6 hours)** Inorganic Chemistry-objective type questions-preparation for competitive examinations.						
	UNIT II (6 hours) Organic Chemistry-objective type questions-preparation for competitive examinations.						
	UNIT III (6 hours) Physical Chemistry-objective type questions-preparation for competitive examinations.						
	UNIT IV (6 hours) Indian politics, geography and economy-objective type questions-preparation for competitive examinations.						
	UNIT V (6 hours) History, environment and ecology-objective type questions-preparation for competitive examinations.						

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

Recommended Text	All the books connected with objective type questions in chemistry published by UPKAR, S. Chand etc.,
Reference Books	Text books in organic, inorganic, physical, Indian economy, Indian politics, History, Geography, Environment and Ecology.

Course Outcomes:
On completion of the course, the students should be able to
CO1: Investigate the methodology of competitive examinations.
CO2: Improve the reasoning and analytical ability and answer questions in objective type pattern.
CO3: Analyze the difficulty level of objective type questions in various subjects.
CO4: Solve the chemistry related problems.
CO5: Design the questions in objective type pattern.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	M	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	H	H
CO2	H	L	H	H	H	H
CO3	H	L	H	H	H	H
CO4	H	L	H	H	H	H
CO5	H	L	H	H	H	H

GENERIC ELECTIVES

<table>
<tr><td>Title of the Course</td><td colspan="7">ALLIED III: CHEMISTRY - I
CHEMISTRY FOR PHYSICAL SCIENCES-I
(FOR PHYSICS STUDENTS)</td></tr>
<tr><td>Paper No.</td><td colspan="7">Generic Elective III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">UACHA324</td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="2">-</td><td colspan="3">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on the
● basics of atomic orbitals, chemical bonds, hybridization
● concepts of thermodynamics and its applications.
● concepts of nuclear chemistry
● importance of chemical industries
● Qualitative and analytical methods.</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3, K4)
Chemical Bonding and Nuclear Chemistry
1.1 Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals.
1.2 Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.
1.3 Nuclear Chemistry: Fundamental particles-isotopes, isobars, isotones and isomers.
1.4 Differences between chemical reactions and nuclear reactions-group displacement law, nuclear binding energy-mass defect-calculations.
1.5 Nuclear fission and nuclear fusion-differences-Stellar energy.
1.6 Applications of radioisotopes-carbon dating, rock dating and medicinal applications.</td></tr>
<tr><td></td><td colspan="7">Unit II (12 hours) (K1, K2, K3, K4)
Industrial Chemistry
2.1 Fuels: Fuel gases: Natural gas, water gas (manufacturing details not required).
2.2 Semi water gas, carbureted water gas, (manufacturing details not required).
2.3 Producer gas, CNG, LPG and oil gas (manufacturing details not required).
2.4 Silicones: Synthesis, properties and uses of silicones.
2.5 Fertilizers: Urea, ammonium sulphate, potassium nitrate.
2.6 NPK fertilizer, superphosphate, triple superphosphate.</td></tr>
</table>

	UNIT III (12 hours) (K1, K2, K3, K4) **Fundamental Concepts in Organic Chemistry** 3.1 Hybridization: Orbital overlap, hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. 3.2 Electronic effects: Inductive effect and consequences on K_a and K_b of organic acids and bases. 3.3 Electromeric, mesomeric, hyper conjugation and steric effects-examples. 3.4 Reaction mechanisms: Types of reactions-aromaticity (Huckel's rule). 3.5 Aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation. 3.6 Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.
	UNIT IV (12 hours) (K1, K2, K3, K4) **Thermodynamics and Phase Equilibria** 4.1 Thermodynamics: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes, and spontaneous processes. 4.2 Statements of first law and second law of thermodynamics. Carnot's cycle and efficiency of heat engine. 4.3 Entropy and its significance. Free energy change and its importance (no derivation). 4.4 Conditions for spontaneity in terms of entropy and Gibbs free energy. Relationship between Gibbs free energy and entropy. 4.5 Phase Equilibria**:** Phase rule-definition of terms in it. Applications of phase rule to water system. 4.6 Two component system, Reduced phase rule, Pb-Ag system.
	UNIT V (12 hours) (K1, K2, K3, K4) **Analytical Chemistry** 5.1 Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. 5.2 Separation and purification techniques-extraction and crystallization. 5.3 Separation and purification techniques-distillation. 5.4 Chromatography: principle and application of column chromatography. 5.5 Principle and application of paper Chromatography. 5.6 Principle and application of thin layer chromatography.

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)

Recommended Text	1. V. Veeraiyan, Text book of Ancillary Chemistry, 1st Edition, High Mour Publishing House, Chennai, 2009. 2. S. Vaithyanathan, Text book of Ancillary Chemistry, Priya Publications, Karur, 2006. 3. S. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry, 23rd Edition, S. Chand and Company, New Delhi, 2012. 4. P. L. Soni, H. M. Chawla, Text Book of Organic Chemistry, 29th Edition, Sultan Chand & Sons, New Delhi, 2007. 5. Jain & Jain, Engineering Chemistry, 16th Edition, Dhanpati Raj Publishing Company, 2014. 6. R.D. Madan, Modern Inorganic Chemistry, 3rd Revised Edition, S. Chand and Company Ltd., 2011.
Reference Books	1. P. L. Soni, Mohan Katyal, Textbook of Inorganic Chemistry, 20th Edition, Sultan Chand and Company, New Delhi, 2007. 2. B. R. Puri, L. R. Sharma, M. S. Pathania, Textbook of Physical Chemistry, 47th Edition, Vishal Publishing Co., New Delhi, 2018. 3. B. K, Sharma, Industrial Chemistry, 16th Edition, GOEL Publishing House, Meerut, 2014.
Website and e-learning source	1) https://gascnagercoil.in/wp-content/uploads/2020/12/allied-chemistry-book.pdf

Course Outcomes:

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

CO1: Describe the theories of chemical bonding, nuclear reactions and its applications. (K1, K2, K3, K4)

CO2: Evaluate the efficiencies and uses of various fuels and fertilizers. (K1, K2, K3, K4)

CO3: Explain different types of hybridization, electronic effects and mechanism involved in the organic reactions. (K1, K2, K3, K4)

CO4: Describe thermodynamic principles, and phase rule. (K1, K2, K3, K4)

CO5: Explain various methods to identify an appropriate method for the separation of chemical components. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ALLIED IV: CHEMISTRY -II
CHEMISTRY FOR PHYSICAL SCIENCES-II
(FOR PHYSICS STUDENTS)</td></tr>
<tr><td>Paper No.</td><td colspan="7">Generic Elective IV</td></tr>
<tr><td>Category</td><td>Generic Elective</td><td>Year
Semester</td><td>II
IV</td><td>Credits</td><td>3</td><td>Course Code</td><td>UACHC424</td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>4</td><td>-</td><td colspan="2">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Chemistry for Physical Sciences I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on the
● co-ordination chemistry and water technology
● carbohydrates and amino acids
● basics and applications of electrochemistry
● basics and applications of kinetics and catalysis
● various photochemical phenomenon</td></tr>
<tr><td>Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3, K4)
Co-ordination Chemistry and Water Technology
1.1 Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature-Werner’s theory-postulates.
1.2 EAN rule-Pauling’s theory-postulates-applications to $[Ni(CO)_4]$, $[Ni(CN)_4]^{2-}$, $[Co(CN)_6]^{3-}$.
1.3 Chelation-biological role of Haemoglobin and Chlorophyll (elementary idea).
1.4 Applications in qualitative and quantitative analysis.
1.5 Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method.
1.6 Purification techniques-BOD & COD.</td></tr>
<tr><td></td><td colspan="7">Unit II (12 hours) (K1, K2, K3, K4)
Carbohydrates and Amino acids
2.1 Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose.
2.2 Discussion of open chain ring structures of glucose and fructose. Glucose-fructose interconversion.
2.3 Properties of starch and cellulose.
2.4 Amino acids: Classification-preparation and properties of Alanine.
2.5 Preparation of dipeptides using Bergmann method.
2.6 RNA and DNA (elementary idea only).</td></tr>
<tr><td></td><td colspan="7">UNIT III (12 hours) (K1, K2, K3, K4)
Electrochemistry
3.1 Galvanic cells-Standard hydrogen electrode-calomel electrode.
3.2 Standard electrode potentials-electrochemical series.
3.3 Strong and weak electrolytes-ionic product of water-pH, pKa, pKb.
3.4 Conductometric titrations-pH determination by colorimetric method-buffer solutions and its biological applications.
3.5 Electroplating-Nickel and chrome plating.
3.6 Types of cells-fuel cells-corrosion and its prevention.</td></tr>
</table>

	UNIT IV (12 hours) (K1, K2, K3, K4) **Kinetics and Catalysis** 4.1 Order and molecularity. Integrated rate expression for I and II (2A Products) order reactions. 4.2 Pseudo first order reaction, Half-life period. 4.3 Methods of determining order of a reaction. 4.4 Catalysis-homogeneous and heterogeneous 4.5 Catalyst used in Contact and Haber's processes. 4.6 Concept of energy of activation and Arrhenius equation.
	UNIT V (12 hours) (K1, K2, K3, K4) **Photochemistry** 5.1 Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence. 5.2 Quantum yield-Hydrogen-chloride reaction. 5.3 Phosphorescence, fluorescence (definition with examples). 5.4 Chemiluminescence (definition with examples). 5.5 Photosensitization (definition with examples). 5.6 Photosynthesis (definition with examples).

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)

Recommended Text	1. V. Veeraiyan, Text book of Ancillary Chemistry, 1st Edition, High Mour Publishing House, Chennai, 2009. 2. S. Vaithyanathan, Text book of Ancillary Chemistry, Priya Publications, Karur, 2006. 3. S. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry, 23rd Edition, S. Chand and Company, New Delhi, 2012. 4. P. L. Soni, H. M. Chawla, Text Book of Organic Chemistry, 29th Edition, Sultan Chand & Sons, New Delhi, 2007.

Reference Books	1. P. L. Soni, Mohan Katyal, Text book of Inorganic Chemistry, 20th Edition, Sultan Chand and Company, New Delhi, 2007. 2. R. Puri, L. R. Sharma, M. S. Pathania, Text book Physical Chemistry. 47th Edition, Vishal Publishing Co., New Delhi, 2018. 3. Jain & Jain, Engineering Chemistry, 16th Edition, Dhanpati Raj Publishing Company, 2014 4. R.D. Madan, Modern Inorganic Chemistry, 3rd Revised Edition, S. Chand and Company Ltd., 2011. 5. B. K, Sharma, Industrial Chemistry, 16th Edition, GOEL Publishing House, Meerut, 2014.
Website and e-learning source	1. https://gascnagercoil.in/wp-content/uploads/2020/12/allied-chemistry-book.pdf

Course Outcomes:

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

CO1: Write the IUPAC name for complexes, explain different theories of bonding in coordination compounds and water technology. (K1, K2, K3, K4)

CO2: Explain the preparation and property of carbohydrate, amino acids and nucleic acids. (K1, K2, K3, K4)

CO3: Apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells. (K1, K2, K3, K4)

CO4: Describe the kinetics of chemical reactions and explain the purpose of a catalyst. (K1, K2, K3, K4)

CO5: Outline the various types of photochemical processes. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	M	H
CO2	H	L	H	H	M	H
CO3	H	L	H	H	M	H
CO4	H	L	H	H	M	H
CO5	H	L	H	H	M	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ALLIED I: CHEMISTRY - I
CHEMISTRY FOR BIOLOGICAL SCIENCES-I
(FOR BIOCHEMISTRY AND ZOOLOGY STUDENTS)</td></tr>
<tr><td>Paper No.</td><td colspan="7">Generic Elective I</td></tr>
<tr><td>Category</td><td>Generic Elective</td><td>Year
Semester</td><td>I
I</td><td>Credits</td><td>3</td><td>Course Code</td><td>UACHA24</td></tr>
<tr><td>Instructional hours per week</td><td>Lecture
4</td><td>Tutorial
-</td><td colspan="2">Lab Practice
-</td><td colspan="2">Total
4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on
● basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry
● nuclear chemistry and industrial chemistry
● importance of specialty drugs and
● separation and purification techniques.</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3, K4)
Chemical Bonding and Nuclear Chemistry
1.1 Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals.
1.2 M. O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.
1.3 Nuclear Chemistry: Fundamental particles-isotopes, isobars, isotones and isomers.
1.4 Differences between chemical reactions and nuclear reactions, group displacement law.
1.5 Nuclear binding energy-mass defect-calculations. Nuclear fission and nuclear fusion-differences-Stellar energy.
1.6 Applications of radioisotopes-carbon dating, rock dating and medicinal applications.</td></tr>
<tr><td colspan="7">Unit II (12 hours) (K1, K2, K3, K4)
Industrial Chemistry
2.1 Fuels: Fuel gases: Natural gas, water gas (manufacturing details not required).
2.2 Semi water gas, carbureted water gas, (manufacturing details not required).
2.3 Producer gas, CNG, LPG and oil gas (manufacturing details not required).
2.4 Silicones: Synthesis, properties and uses of silicones.
2.5 Fertilizers: Urea, ammonium sulphate, potassium nitrate.
2.6 NPK fertilizer, superphosphate, triple superphosphate.</td></tr>
<tr><td colspan="7">UNIT III (12 hours) (K1, K2, K3, K4)
Fundamental Concepts in Organic Chemistry
3.1 Hybridization: Orbital overlap-hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6.
3.2 Polar effects: Inductive effect and consequences on Ka and K_b of</td></tr>
</table>

	organic acids and bases. 3.3 Electromeric, mesomeric, hyper conjugation and steric effects-examples and explanation. 3.4 Reaction mechanisms: Types of reactions-aromaticity. 3.5 Aromatic electrophilic substitution: nitration, halogenation, Friedel-Craft's alkylation and acylation. 3.6 Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.
	UNIT IV (12 hours) (K1, K2, K3, K4) **Drugs and Specialty Chemicals** 4.1 Antibiotics-definition, penicillin-structure and uses. 4.2 Chloramphenicol and streptomycin-structure and uses. 4.3 Anesthetics-chloroform and ether. 4.4 Antipyretics-aspirin, paracetamol and ibuprofen. 4.5 Artificial sweeteners-saccharin, aspartame and cyclamate. 4.6 Organic halogen compounds-Freon, Teflon.
	UNIT V (12 hours) (K1, K2, K3, K4) **Analytical Chemistry** 5.1 Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. 5.2 Separation and purification techniques: extraction and crystallization. 5.3 Separation and purification techniques: distillation 5.4 Chromatography: principle and application of column chromatography. 5.5 Principle and application of paper chromatography. 5.6 Principle and application of thin layer chromatography.

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)

Recommended Text	1. V. Veeraiyan, Textbook of Ancillary Chemistry, 1st Edition, High Mount Publishing House, Chennai, 2009. 2. S. Vaithyanathan, Text book of Ancillary Chemistry, Priya Publications, Karur, 2006. 3. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry, 23rd Edition, S. Chand and Company, New Delhi, 2012. 4. P. L. Soni, H. M. Chawla, Text Book of Inorganic Chemistry, 29th Edition, Sultan Chand & Sons, New Delhi, 2007.
Reference Books	1. P. L. Soni, Mohan Katyal, Text book of Inorganic Chemistry, 20th Edition, Sultan Chand and Company, New Delhi, 2007. 2. B. K, Sharma, Industrial Chemistry, 16th Edition, GOEL Publishing House, Meerut, 2014. 3. Jayashree Gosh, Fundamental Concepts of Applied Chemistry, Sultan & Chand, 2006. 4. Jain & Jain, Engineering Chemistry, 16th Edition, Dhanpati Raj Publishing Company, 2014

	5. R. D. Madan, Modern Inorganic Chemistry, 3rd Revised Edition, S. Chand and Company Ltd., 2011.
Website and e-learning source	https://gascnagercoil.in/wp-content/uploads/2020/12/allied-chemistry-book.pdf

Course Outcomes:

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

CO1: State the theories of chemical bonding, nuclear reactions and its applications. (K1, K2, K3, K4)

CO2: Evaluate the efficiencies and uses of various fuels and fertilizers. (K1, K2, K3, K4)

CO3: Explain different types of hybridization, electronic effects and mechanism involved in the organic reactions. (K1, K2, K3, K4)

CO4: Demonstrate the structure and uses of antibiotics, anesthetics, antipyretics and artificial sugars. (K1, K2, K3, K4)

CO5: Analyze various methods to identify an appropriate method for the separation of chemical components. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	L	H
CO2	H	H	H	M	L	H
CO3	H	H	H	M	L	H
CO4	H	H	H	M	L	H
CO5	H	H	H	M	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	H	H
CO2	H	L	H	H	H	H
CO3	H	L	H	H	H	H
CO4	H	L	H	H	H	H
CO5	H	L	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ALLIED II: CHEMISTRY - II
CHEMISTRY FOR BIOLOGICAL SCIENCES-II
(FOR BIOCHEMISTRY AND ZOOLOGY STUDENTS)</td></tr>
<tr><td>Paper No.</td><td colspan="7">Generic Elective II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective</td><td>Year</td><td>I</td><td>Credits</td><td>3</td><td>Course Code</td><td>UACHC24</td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td>-</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Chemistry for Biological Sciences I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on
● nomenclature of coordination compounds and carbohydrates
● Amino Acids and Essential elements of biosystem
● understand the concepts of kinetics and catalysis
● provide fundamentals of electrochemistry and photochemistry</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT I (12 hours) (K1, K2, K3, K4)
Co-ordination Chemistry and Water Technology
1.1 Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature-Werner’s theory-postulates.
1.2 EAN rule-Pauling’s theory-Postulates.
1.3 Applications to $[Ni(CO)_4]$, $[Ni(CN)_4]^{2-}$,$[Co(CN)_6]^{3-}$.
1.4 Chelation-Biological role of Hemoglobin and Chlorophyll (elementary idea)-Applications in qualitative and quantitative analysis.
1.5 Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method.
1.6 Purification techniques-BOD and COD.</td></tr>
<tr><td colspan="7">Unit II (12 hours) (K1, K2, K3, K4)
Carbohydrate
2.1 Classification of carbohydrates.
2.2 Preparation and properties of glucose and fructose.
2.3 Discussion of open chain ring structures of glucose and fructose.
2.4 Glucose-fructose interconversion.
2.5 Preparation and properties of sucrose.
2.6 Preparation and properties of starch and cellulose.</td></tr>
<tr><td colspan="7">UNIT III (12 hours) (K1, K2, K3, K4)
Amino Acids and Essential elements of biosystem
3.1 Classification-preparation and properties of alanine.
3.2 Preparation of dipeptides using Bergmann method.
3.3 Proteins-classification-structure-colour reactions.
3.4 Biological functions-nucleosides-nucleotides.
3.5 RNA and DNA-structure.
3.6 Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg.</td></tr>
</table>

	UNIT IV (12 hours) (K1, K2, K3, K4) **Electrochemistry** 4.1 Galvanic cells-standard hydrogen electrode-calomel electrode. 4.2 Standard electrode potentials-electrochemical series. 4.3 Strong and weak electrolytes-ionic product of water -pH, pKa, pKb. 4.4 Conductometric titrations-pH determination by colorimetric method-buffer solutions and its biological applications 4.5 Electroplating-Nickel and chrome plating. 4.6 Types of cells-fuel cells-corrosion and its prevention.
	UNIT V (12 hours) (K1, K2, K3, K4) **Photochemistry** 5.1 Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence. 5.2 Quantum yield-Hydrogen-chloride reaction. 5.3 Phosphorescence, fluorescence (definition with examples) 5.4 Chemiluminescence (definition with examples) 5.5 Photosensitization (definition with examples). 5.6 Photosynthesis (definition with examples).

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)

Recommended Text	1. V. Veeraiyan, Text book of Ancillary Chemistry, 1st Edition, High Mount Publishing House, Chennai, 2009. 2. S. Vaithyanathan, Text book of Ancillary Chemistry, Priya Publications, Karur, 2006. 3. S. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry, 23rd Edition, S. Chand and Company, New Delhi, 2012. 4. P. L. Soni, H. M. Chawla, Text Book of Organic Chemistry, 29th Edition, Sultan Chand & Sons, New Delhi, 2007.
Reference Books	1. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry, 23rd Edition, S. Chand and Company, New Delhi, 2012. 2. P. L. Soni, H. M. Chawla, Text Book of Organic Chemistry, 29th Edition, Sultan Chand & Sons, New Delhi, 2007. 3. P. L. Soni, Mohan Katyal, Text book of Inorganic Chemistry, 20th Edition, Sultan Chand & Sons Ltd., 2005. 4. Jain & Jain, Engineering Chemistry, 16th Edition, Dhanpati Raj Publishing Company, 2014. 5. R.D. Madan, Modern Inorganic Chemistry, 3rd Revised Edition, Sultan Chand and Company, New Delhi, 2007. 6. B. R. Puri, L. R. Sharma, M. S. Pathania, Text book Physical Chemistry, 47th Edition. Vishal Publishing Co., New Delhi, 2018. 7. B. K, Sharma, Industrial Chemistry, 16th Edition, GOEL Publishing House, Meerut, 2014.

Website and e-learning source	https://gascnagercoil.in/wp-content/uploads/2020/12/allied-chemistry-book.pdf

Course Outcomes:

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

CO1: Write the IUPAC name for complexes, explain different theories of bonding in coordination compounds and water technology. (K1, K2, K3, K4)

CO2: Explain the preparation and property of carbohydrates. (K1, K2, K3, K4)

CO3: Enlighten the biological role of transition metals, amino acids and nucleic acids. (K1, K2, K3, K4)

CO4: Apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells. (K1, K2, K3, K4)

CO5: Outline the various types of photochemical processes. (K1, K2, K3, K4)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	L	H
CO3	H	H	H	L	L	H
CO4	H	H	H	L	L	H
CO5	H	H	H	L	L	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	H	H	H
CO2	H	L	H	H	H	H
CO3	H	L	H	H	H	H
CO4	H	L	H	H	H	H
CO5	H	L	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ALLIED CHEMISTRY PRACTICAL-I
FOR PHYSICAL AND BIOLOGICAL SCIENCES
(for Physics-II Year/III Semester; for Biochemistry and Zoology-I Year/I Semester)</td></tr>
<tr><td>Paper No.</td><td colspan="7">Generic Elective I/III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective</td><td>Year</td><td>I/ II</td><td>Credits</td><td>2</td><td>Course Code</td><td>UACHB24/UACHB324</td></tr>
<tr><td>Semester</td><td>I/III</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">2</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher Secondary Course</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on the
● basics of preparation of solutions
● principles and practical experience of volumetric analysis</td></tr>
<tr><td>Course Outline</td><td colspan="7">VOLUMETRIC ANALYSIS
1. Estimation of sodium hydroxide using standard sodium carbonate.
2. Estimation of hydrochloric acid using standard oxalic acid.
3. Estimation of ferrous sulphate using standard Mohr's salt.
4. Estimation of oxalic acid using standard ferrous sulphate.
5. Estimation of potassium permanganate using standard sodium hydroxide.
6. Estimation of magnesium using EDTA.
7. Estimation of ferrous ion using diphenyl amine as indicator.</td></tr>
<tr><td>Reference Book</td><td colspan="7">1. V. Venkateswaran, R. Veerasamy, A. R. Kulandaivelu, Basic Principles of Practical Chemistry, 2nd Edition, Sultan Chand & Sons, 1997.</td></tr>
<tr><td>Method of Evaluation</td><td colspan="7">Continuous Assessment - 40 marks
I C.A. - 50
II C.A. - 50
Average - 25
Performance during regular practicals - 10
Regularity in submission of observation note-book and Record - 5
Semester Practical Examination - 60 marks
Short Procedure writing - 5
Viva-voce - 5
Record - 10
Volumetric Analysis:
≤ 2% - 40 marks
> 1 upto 2% - 35 marks
>2 upto 3% - 25 marks
>3 upto 4% - 15 marks
> 4% - 10 marks</td></tr>
<tr><td colspan="8">Course Outcomes:
On completion of the course, the students should be able to
CO1: Use of standard flask, volumetric pipette and burette.
CO2: Perform volumetric titration.
CO3: Design, carry out, record and interpret the results of volumetric titration.
CO4: Apply their skill in the analysis of water/hardness.
CO5: Explain the principles of volumetric estimations.</td></tr>
</table>

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	M	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

<table>
<tr><td>Title of the Course</td><td colspan="7">ALLIED CHEMISTRY PRACTICAL II
FOR PHYSICAL AND BIOLOGICAL SCIENCES
(For Physics-II year/IV semester; For Biochemistry and Zoology-I year/II semester)</td></tr>
<tr><td>Paper No.</td><td colspan="7">Generic Elective II/IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Generic Elective</td><td>Year</td><td>I/ II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td>Course Code</td><td>UACHD24/UACHD424</td></tr>
<tr><td>Semester</td><td>II/IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td>-</td><td colspan="3">2</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basic Knowledge in Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on
● identification of organic functional groups
● different types of organic compounds with respect to their properties.
● determination of elements in organic compounds.</td></tr>
<tr><td>Course Outline</td><td colspan="7">SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS
The analysis must be carried out as follows:
a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose].
b) Detection of elements (N, S, Halogens).
c) To distinguish between aliphatic and aromatic compounds.
d) To distinguish between saturated and unsaturated compounds.</td></tr>
<tr><td>Reference Book</td><td colspan="7">1. V. Venkateswaran, R. Veerasamy, A. R. Kulandaivelu, 2nd Edition, Basic Principles of Practical Chemistry. Sultan Chand & Sons, 1997.</td></tr>
<tr><td>Method of Evaluation</td><td colspan="7">Continuous Assessment - 40 marks
I C.A. - 50
II C.A. - 50
Average - 25
Performance during regular practicals - 10
Regularity in submission of observation note-book and Record - 5
Semester Practical examination - 60 marks
Viva-voce - 5
Record - 10
Organic Analysis - 45
Preliminary Tests - 7
Special element - 6
Aliphatic/Aromatic - 5
Saturated/unsaturated - 5
Functional group - 10
Other tests - 6
Derivative - 6</td></tr>
<tr><td colspan="8">Course Outcomes:
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, and explain the reactions behind it.</td></tr>
</table>

CO4: Compare mono and diamides, and explain the reactions behind it.
CO5: Exhibit a solid derivative with respect to the identified functional group.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	M	H
CO4	H	H	H	L	M	H
CO5	H	H	H	L	M	H

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H