



JP COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

Run by DMI Sisters - Ayikudy, Tenkasi - 627852
Affiliated to Manonmaniam Sundaranar University - Tirunelveli



Regulations 2026-2027 for Undergraduate Programme

**Learning Outcomes Based Curriculum Framework–(LOCF) model with
Choice Based Credit System (CBCS)**

Programme: Bachelor of Chemistry

(Applicable for the Students admitted during the Academic Year 2026-2027 onwards)

CHEMISTRY

Bachelor of Science in Chemistry stands at the heart of today's technological breakthroughs. This program is designed to cultivate essential skills and deep knowledge across the chemical sciences, fueling progress for communities and industries alike. With a curriculum that bridges fundamental theory and real-world life sciences, students gain the expertise needed to solve modern problems. The emphasis on intensive laboratory experience empowers graduates to translate classroom concepts into practical applications, paving the way for excellence in professional assessments and personal growth.

VISION

To deliver quality education with values, blending academic learning with practical training and promoting innovative approaches for students and faster career growth in chemical science.

MISSION

- To motivate the students to explore the field of chemistry through innovative teaching, research opportunity, and hands on learning experience.
- To promote critical thinking and problems solving abilities, empowering students to apply chemistry concepts to address real- world challenges.
- To bridge the gap between theoretical knowledge and practical applications, equipping students to make meaningful contribution to the field of chemical science

Program Outcomes (POs)

The successful completion of the Chemistry programme shall enable the students to:

PO1	Subject Mastery: Develop an unbeatable command over your field. You won't just learn facts; you'll gain a sophisticated, comprehensive understanding of the entire discipline
PO2	Articulate Communication: Become a master of expression. Whether writing a report or speaking to a crowd, you'll convey complex ideas with absolute clarity, confidence, and punch.
PO3	Intellectual Sharpness: Don't just accept information—dissect it. Build the power to evaluate evidence, spot hidden assumptions, and craft airtight arguments based on hard facts.
PO4	Real-World Troubleshooting: Move beyond the textbook. We'll empower you to take what you've learned and apply it to unpredictable, real-life challenges with creative flair.
PO5	Analytical Edge: Become a human "logic-checker." You'll learn to synthesize data from everywhere, sniff out logical flaws, and reach rock-solid conclusions.
PO6	Discovery & Research: Ignite your curiosity. Master the art of asking the right questions, designing experiments, and interpreting data to unlock new insights.
PO7	Synergistic Collaboration: Excellence is a team sport. Learn to lead and support diverse groups, working respectfully and efficiently toward a massive common goal.
PO8	Scientific Precision: Sharpen your objective mind. Analyze quantitative and qualitative data with an open perspective to make reasoned, evidence-backed decisions.
PO9	Conscious Reflection: Develop deep self-awareness. Critically examine your own lived experiences and how they intersect with the world around you.
PO10	Digital Fluency: Future-proof your tech skills. Master the software, ICT tools, and information sources necessary to navigate a data-driven world..
PO11	Radical Autonomy: Take the wheel. Build the drive to work independently, manage high-stakes projects from start to finish, and source your own solutions.
PO12	Cultural Intelligence: Go global. Gain the sensitivity and knowledge to thrive in multicultural environments and interact respectfully with a world of diverse perspectives.
PO13	Ethical Integrity: Lead with a conscience. From protecting intellectual property to championing sustainability, you'll operate with a "truth-first" mindset and total professional honesty.
PO14	Visionary Leadership: Don't just manage—inspire. Learn to map out big-picture goals, build high-performance teams, and motivate others to turn a vision into reality.
PO15	Infinite Growth (Lifelong Learning): Stay ahead of the curve. Master the art of "learning how to learn" so you can pivot, upskill, and dominate in an ever-changing global job market.

Program Specific Outcomes (PSOs)

PSO1	The Physics-Tech Fusion: Master the ultimate dual-threat. You'll develop a rock-solid command of the fundamental laws of Physics integrated with high-level Computer Science, backed by elite laboratory precision.
PSO2	High-Octane Critical Thinking: Become a master of deconstruction. You will learn to slice through complex problems, neutralize biases, and synthesize information into sharp, actionable insights that you can communicate with total impact.
PSO3	The Solution Architect: Bridge the gap between theory and reality. Using a potent mix of mathematical muscle and technical grit, you'll capture data, decode its physical meaning, and engineer entirely new design possibilities.
PSO4	Computational & Scientific Precision: Move beyond guesswork. You will apply the scientific method with surgical accuracy—using statistical techniques and advanced computational models to stress-test hypotheses and turn raw data into proven evidence.
PSO5	The Research Powerhouse: Ignite discovery. From formulating high-stakes research questions to leading collaborative projects, you'll gain the skills to execute deep-dive studies and present your findings to the global scientific community.
PSO6	The Lifelong Innovator: Future-proof your career. We empower you to take total ownership of your growth—setting ambitious goals, adapting to new technologies on the fly, and continuously evolving to lead the next generation of scientific break throughs.

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

First Year – Semester-I

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	5
Part-2	English	3	5
Part-3	Core Courses & Elective Courses [in Total]	11	14
Part-4	Skill Enhancement Course SEC-1	2	2
	Foundation Course	2	2
	NME	2	2
		23	30

Semester-II

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	5
Part-2	English	3	5
Part-3	Core Courses & Elective Courses including laboratory [in Total]	11	14
Part-4	Skill Enhancement Course -SEC-2	2	2
	Skill Enhancement Course -SEC-3 (Discipline / Subject Specific)	2	2
	NME	2	2
		23	30

Second Year – Semester-III

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	5
Part-2	English	3	5
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	16
Part-4	Skill Enhancement Course -SEC-4 (Entrepreneurial Based)	2	2
	Environmental Studies	2	2
		23	30

Semester-IV

Part	List of Courses	Credit	No. of Hours
Part-1	Language – Tamil	3	5
Part-2	English	3	5
Part-3	Core Courses & Elective Courses including laboratory [in Total]	13	16
Part-4	Skill Enhancement Course -SEC-5 (Discipline / Subject Specific)	2	2
	Value Education	2	2
		23	30

**Third Year
Semester-V**

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project / Elective Based	22	28
	Internship / Industrial Visit / Field Visit	2	-
Part-4	Ability Enhancement Course	2	2
		26	30

Semester-VI

Part	List of Courses	Credit	No. of Hours
Part-3	Core Courses including Project / Elective Based & LAB	23	28
Part-4	Ability Enhancement Course	2	2
Part-5	Extension Activity	1	-
		26	30

Total Credits: 144

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	11	11	13	13	22	23	93
Part IV	6	6	4	4	4	2	26
Part V	-	-	-	-	-	1	01
Total	23	23	23	23	26	26	144

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

Part I – Tamil / Other Languages

Part II - English

Part III – Core Papers, Electives and Project

Part IV – Environmental Studies, Value Based Education, Skill Enhancement Courses, Foundation Course, NME and Internship

Part V – Extension Activity

Curriculum

Semester-1									
Course Code	Part	Course Category	Course Name	Hours/ Week	Examination				Credits
					Duration in Hours.	Max Marks			
						CIA	ESE	Total	
26U1TL11	I	Language- I	Tamil-I	5	3	50	50	100	3
26U1HD11	I		Hindi -I						
26U1MY11	I		Malayalam-I						
26U1FR11	I		French - I						
26U2EN11	II	Language- II	English-I	5	3	50	50	100	3
26UCCH11	III	Core- I	General Chemistry I	4	3	50	50	100	4
26UCCHP1	III	Core -II	Quantitative Inorganic Estimation	6	3	50	50	100	4
26UEMA11	III	EC - I	Algebra and Differential Equation	4	3	50	50	100	3
26USCH11	IV	SEC - I	Food Chemistry	2	3	50	50	100	2
26UFCH11	IV	FC - I	Foundation Course	2	3	50	50	100	2
26UNCA11	IV	NME - I	Water Management	2	3	50	50	100	2
Total				30				800	23

Semester-2									
Course Code	Part	Course Category	Course Name	Hours/ Week	Examination				Credits
					Duration in Hours	Max Marks			
						CIA	ESE	Total	
26U1TL21	I	Language-I	Tamil-II	5	3	50	50	100	3
26U1HD21	I		Hindi -II						
26U1MY21	I		Malayalam-II						
26U1FR21	I		French - II						
26U2EN21	II	Language-II	English-II	5	3	50	50	100	3
26UCCH21	III	Core-III	General Chemistry II	4	3	50	50	100	4
26UCCHP2	III	Core Lab-IV	Qualitative organic analysis	6	3	50	50	100	4
26UEMA21	III	EC - II	Vector Calculus and Fourier Series	4	3	50	50	100	3
26USCH21	IV	SEC - II	Dairy Chemistry	2	3	50	50	100	2
26USCH22	IV	SEC - III	Role of Chemistry in Daily Life	2	3	50	50	100	2
26UNCH21	IV	NME - II	Cosmetics and personal grooming	2	3	50	50	100	2
Total				30				800	23

Semester–3									
Course Code	Part	Course Category	Course Name	Hours/ Week	Examination				Credits
					Duration in Hours	Max Marks			
						CIA	ESE	Total	
26U1TL31	I	Language–I	Tamil–III	5	3	50	50	100	3
26U1HD31	I		Hindi –III						
26U1MY31	I		Malayalam– III						
26U1FR31	I		French – III						
26U2EN31	II	Language–II	English–III	5	3	50	50	100	3
26UCCH31	III	Core– V	General Chemistry III	4	3	50	50	100	4
26UCCHP3	III	Core –VI	Qualitative Inorganic analysis (<i>mixture</i>)	6	3	50	50	100	4
26UEPH31	III	EC - III	Allied Physics -I	4	3	50	50	100	3
26UEPHP1	IV	EC - IV	Allied Physics Lab -I	2	3	50	50	100	2
26USCHP1	IV	SEC – IV	Entrepreneurial skills in chemistry	2	3	50	50	100	2
26UEVS31	IV	Common	Environmental Studies	2	50	50	50	100	2
Total				30				800	23

Semester-4									
Course Code	Part	Course category	Course Name	Hours/ Week	Examination				Credits
					Duration in Hours	Max Marks			
						CIA	ESE	Total	
26U1TL41	I	Language- I	Tamil-IV	5	3	50	50	100	3
26U1HD41	I		Hindi -IV						
26U1MY41	I		Malayalam-IV						
26U1FR41	I		French - IV						
26U2EN41	II	Language- II	English-IV	5	3	50	50	100	3
26UCCH41	III	Core- VII	General Chemistry IV	4	3	50	50	100	4
26UCCHP4	III	Core -VIII	Preparation of organic and inorganic compounds and determination of physical constants	6	3	50	50	100	4
26UEPH41	III	EC -V	Allied Physics -II	4	3	50	50	100	3
26UEPHP2	III	EC -VI	Allied Physics Lab II	2	3	50	50	100	2
26USCH41	IV	SEC - VI	Instrumental methods of Chemical Analysis	2	3	50	50	100	2
26UVBE41	IV	Common	Value Based Education	2	3	50	50	100	2
Total				30				800	23

Semester-5									
Course Code	Part	Course Category	Course Name	Hours/ Week	Examination				Credits
					Duration in hrs.	Max Marks			
						CIA	ESE	Total	
26UCCH51	III	Core-IX	Organic Chemistry I	5	3	50	50	100	4
26UCCH52	III	Core -X	Inorganic Chemistry–I	5	3	50	50	100	4
26UCCH53	III	Core -XI	Physical Chemistry–I	5	3	50	50	100	4
26UCCH5P	III	Core -XII	Mini Project with Viva Voce	3	3	50	50	100	3
26UCCHP5	III	Core -XIII	Physical Chemistry practical	6	6	50	50	100	4
26UECH51	III	Elective- V	Industrial chemistry	4	3	50	50	100	3
26UECH52			Nano Science						
26UFIK51	IV		Internship/Industrial Visit/Field Visit/Knowledge Updation Activity	-	3	50	50	100	2
26UAEC51	IV	AEC I	Empowered Vocational English	2	3	50	50	100	2
Total				30				800	26

Semester–6									
Course Code	Part	Course Category	Course Name	Hours / Week	Examination				Credits
					Duration in hrs.	Max Marks			
						CIA	ESE	Total	
26UCCH61	III	Core– XIV	Organic Chemistry II	5	3	50	50	100	4
26UCCH62	III	Core -XV	Inorganic Chemistry–II	4	3	50	50	100	4
26UCCH63	III	Core -XVI	Physical Chemistry–II	4	3	50	50	100	4
26UCCH6P	III	Core -XVII	Major Project with Viva voce	7	3	50	50	100	5
26UECH61	III	Elective- VI	Forensic science	4	3	50	50	100	3
26UECH62			Chemistry in medicine						
26UECH63	III	Elective- V	Pesticide Chemistry	4	3	50	50	100	3
26UECH64			Agro Chemistry						
26UAEC61	IV	AEC II	Design Thinking	2	3	50	50	100	2
26U5EA61	V	Common	Extension Activity	-				100	1
Total				30				800	26
Grand Total				180				4800	144

Internship (minimum of 30 hours): The students should submit certificate of attendance from the industry stating the nature of work done, duration and role played along with report (minimum of 20 pages) at the end of V semester for external evaluation.

Industrial Visit/ Field Visit: A report based on the observation and learning outcome to be submitted (minimum of 10 pages) along with suitable evidences at the end of V semester for external evaluation.

Knowledge Updating Activity: A report to be submitted (minimum of 10 pages) based on the study made along with the completion certificate stating the work done (MOOC/NPTEL) at the end of V semester for external evaluation.

Internship/Industrial Visit/Field Visit/Knowledge Updating Activity: Internal –50 Marks, External – 50 Marks

Project: Group Project report should be submitted for external evaluation. Internal – 50 Marks, External – 50 Marks

Extension Activity (NSS/ NCC/ YRC/ RRC/ Games and Sports/ Youth Welfare Activities Outreach Programmes/Migration Awareness in the Tamil Nadu Education System): Individual report should be submitted at the end of VI semester for external evaluation.
Be External –100 Marks

Ability Enhancement Compulsory Course: an empowered Vocational English and Design Thinking subject is given to students.

Internal Marks – 50 Marks, External – 50 Marks

Semester-1

Semester–1									
Course Code	Part	Course Category	Course Name	Hours/ Week	Examination				Credits
					Duration in Hours.	Max Marks			
						CIA	ESE	Total	
26U1TL11	I	Language- I	Tamil–I	5	3	50	50	100	3
26U1HD11	I		Hindi –I						
26U1MY11	I		Malayalam–I						
26U1FR11	I		French - I						
26U2EN11	II	Language- II	English–I	5	3			100	3
						50	50		
26UCCH11	III	Core- I	General Chemistry I	4	3			100	4
						50	50		
26UCCHP1	III	Core -II	Quantitative Inorganic estimation	6	3	50	50	100	4
26UEMA11	III	EC - I	Algebra and Differential Equation	4	3			100	3
						50	50		
26USCH11	IV	SEC - I	Food Chemistry	2	3			100	2
						50	50		
26UFCH11	IV	FC – I	Foundation Course	2	3			100	2
						50	50		
26UNCA11	IV	NME – I	Water Management	2	3			100	2
						50	50		
Total				30				800	23

FIRST YEAR – SEMESTER – I
CORE – I: GENERAL CHEMISTRY I

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCCH11	4	0	0	I	4	4	50	50	100
Learning Objectives									
LO1	Various atomic models and atomic structure								
LO2	Wave particle duality of matter								
LO3	Periodic table, periodicity in properties and its application in explaining the chemical behaviour								
LO4	Nature of chemical bonding								
LO5	Fundamental concepts of organic chemistry								
Prerequisites:									
Unit	Contents								No. of Hours
I	Atomic structure and Periodic trends								12
	History of atom (J.J. Thomson, Rutherford); Moseley's Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck's quantum theory - Bohr's model of atom; The Franck-Hertz Experiment; Interpretation of H-spectrum; Photo electric effect, Compton effect; Dual nature of Matter- De-Broglie wavelength- Davisson and Germer experiment Heisenberg's Uncertainty Principle.								
II	Modern Periodic Table								12
	Cause of periodicity; Features of the periodic table; classification of elements- Periodic trends for atomic size-atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electronegativity - electro negativity scales applications of electro negativity. Problems involving the core concepts.								
III	Structure and bonding –I								12
	Ionic bond Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle–lattice energies, Madelung constant; relative effect of lattice energy and solvation energy; Ion polarization – polarizing power and polarizability; Fajans' rules - effects of polarization on properties of compounds; problems involving the core concepts. Covalent bond Shapes of orbitals, overlap of orbitals – σ and Π bonds; directed valency - hybridization; VSEPR theory-shapes of molecules of the type AB ₂ , AB ₃ , AB ₄ , AB ₅ , AB ₆ and AB ₇ Partial ionic character of covalent bond-dipole moment.								
IV	Structure and bonding–II								12
	VB theory–application to hydrogen molecule; concept of resonance- resonance structures of some inorganic species–CO ₂ , NO ₂ , CO ₃ ²⁻ , NO ₃ ⁻ limitations of VBT; MO theory - bonding, anti-bonding and nonbonding H ₂ , C ₂ , O ₂ , O ₂ ⁺ , O ₂ ⁻ , N ₂ , NO, HF, CO; CO ₂ . Magnetic characteristics, comparison of VB and MO theories.								

	Coordinate bond: Definition, Formation of BF ₃ , NH ₃ , NH ₄ ⁺ , H ₃ O ⁺ +properties Metallic bond –electron sea model, VB model; Band theory–mechanism of conduction in solids; conductors, insulator, semiconductor – types, applications of semiconductors	
V	Basic concepts in Organic Chemistry and Electronic effects Types of reagents–electrophiles, nucleophiles, free radicals; reaction intermediates–carbanions, carbocations, carbenes, arynes and nitrenes. Inductive effect–reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductomeric and electromeric effects. Resonance–resonance energy, conditions for resonance acidity of phenols, basicity of aromatic amines, stability of carbonium ions, carbanions and free radicals. Hyper conjugation–stability of alkenes, bond length, orienting effect of methyl group, dipole moment of aldehydes and nitro methane.	12
TOTAL		60
CO	Course Outcomes	
CO1	explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.	
CO2	CO2: classify the elements in the periodic table, types of bonds, reaction intermediates electronic effects inorganic compounds, types of reagents.	
CO3	CO3: apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, Δx, Δp electronegativity, percentage ionic character and bond order.	
CO4	CO4: evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects	
CO5	CO5: construct MO diagrams, predict trends in periodic properties, assess the properties of elements, and explain hybridization in molecules, nature of H – bonding and organic reaction mechanisms	
Textbooks		
➤	Madan. R.D, and SathyaPrakash, Modern Inorganic Chemistry, 2 nd ed.; S. Chand and Company: New Delhi, 2003.	
➤	Rao, C.N.R. University General Chemistry, Macmillan Publication: New Delhi, 2000.	
➤	Puri, B.R. and Sharma, L.R. Principles of Physical Chemistry, 38 th ed.; Vishal Publishing Company: Jalandhar, 2002.	
➤	Bruce, P.Y .and Prasad K.J.R. Essential Organic Chemistry, Pearson Education: New Delhi, 2008.	
➤	DashUN, Dharmarha OP, Soni P.L. Textbook of Physical Chemistry, Sultan Chand & Sons: New Delhi, 2016	
Reference Books		
1.	Maron, S.H. and Prutton C.P. Principles of Physical Chemistry, 4 th ed.; The Macmillan Company: New York, 1972.	
2.	Lee, J.D. <i>Concise Inorganic Chemistry</i> , 4 th ed.; ELBS William Heinemann: London, 1991.	
3.	Gurudeep Raj, <i>Advanced Inorganic Chemistry</i> , 26 th ed.; Goel Publishing House: Meerut, 2001.	
4.	Atkins, P.W. & Paula, J. <i>Physical Chemistry</i> , 10 th ed.; Oxford University Press: New York, 2014.	
5	Huheey, J.E. <i>Inorganic Chemistry: Principles of Structure and Reactivity</i> , 4 th ed.; Addison, Wesley Publishing Company: India, 1993.	

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

CORE – II: QUANTITATIVE INORGANIC ESTIMATION

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCCH11	0	0	6	I	4	6	50	50	100
Learning Objectives									
LO1	Laboratory safety practices								
LO2	Proper handling of glassware								
LO3	Study of the principle and equation related to the experiment								
LO4	Quantitative analysis / estimation								
LO5	Understand Chemical Stoichiometry:								
Prerequisites:									
Unit	Contents								No. of Hours
Unit I	Chemical Laboratory Safety in Academic Institutions Introduction - importance of safety education for students, common laboratory hazards, assessment and minimization of the risk of the hazards, prepare for emergencies from uncontrolled hazards; concept of MSDS; importance and care of PPE; proper use and operation of chemical hoods and ventilation system; fire extinguishers-types and uses of fire extinguishers, demonstration of operation; chemical waste and safe disposal. Common Apparatus Used in Quantitative Estimation (Volumetric) Description and use of burette, pipette, standard flask, measuring cylinder, conical flask, beaker, funnel, dropper, clamp, stand, wash bottle, watch glass, wire gauge and tripod stand. Principle of Quantitative Estimation (Volumetric) Equivalent weight of an acid, base, salt, reducing agent, oxidizing agent; concept of mole, molality, molarity, normality; primary and secondary standards, preparation of standard solutions; theories of acid-base, redox complex metric, iodimetric and iodometric titrations; indicators – types, theory of acid–base, redox, metal ion and adsorption indicators, choice of indicators								30
Unit II	Quantitative Estimation (Volumetric) Preparation of standard solution, dilution from stock solution. Permanganometry 1. Estimation of sodium oxalate using standard ferrous ammonium sulphate. 2. Estimation of ferrous sulphate using standard oxalic acid Dichrometry 3. Estimation of ferric alum using standard dichromate (external indicator) 4. Estimation of ferric alum using standard dichromate (internal indicator) Iodometry Estimation of copper in copper sulphate using standard dichromate								30
Unit III	Complexometry 5. Estimation of hardness of water using EDTA. 7. Estimation of Zinc 8. Estimation of Nickel Estimations 9. Estimation of iron in iron tablets.								30
	Total								90

CO	Course Outcomes
CO1	Explain the fundamental principles involved in titrimetric analysis.
CO2	Distinguish and compare the methods used in various types of titrimetric analysis.
CO3	Determine the concentrations of unknown solutions using different calculation methods.
CO4	Develop the ability to quantitatively estimate the amount of a substance present in a given solution.
CO5	Ability to prepare primary and secondary standard solutions and perform precise titrations to determine unknown concentrations.
Reference Books:	
1	Venkateswaran. V.; Veeraswamy. R.;Kulandivelu. A.R, Basic Principles of Practical Chemistry, 2nd ed.; Sultan Chand & Sons: New Delhi, 1997.
2	Nad, A.K.; Mahapatra, B.; Ghoshal ,A ;An advanced course in Practical Chemistry, 3 rd ed.; New Central Book Agency: Kolkata,2007

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

SKILL ENHANCEMENT COURSE (SEC-1) – FOOD CHEMISTRY

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USCH11	2	0	0	I	2	2	50	50	100
Learning Objectives									
LO1	Types of food								
LO2	Food adulteration and poisons								
LO3	Food additives and preservation								
LO4	Food Processing and Storage								
LO5	Food Flavors and Pigments								
Prerequisites:									
Unit	Contents								No. of Hours
UNIT I	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								06
UNIT II	Food Poison Food poisons – natural poisons (alkaloids –nephron toxin) – pesticides, (DDT, BHC,Malathion) – Chemical poisons – First aid for poison consumed victims								06
UNIT III	FoodAdditives Food additives -artificial sweeteners – Saccharin-Cyclomate and Aspartate Food flavours– esters, aldehydes and heterocyclic compounds – Food colours – Emulsifying agents–preservatives-leavening agents.Baking powder– yeast–taste makers–MSG-vinegar.								06
UNIT IV	Beverages Beverages -soft drinks – soda – fruit juices – alcoholic beverages-examples. Carbonation-addiction to alcohol– diseases of liver and social problems								06
UNIT V	Food processing and quality control Fruits and vegetables drying /dehydration – techniques – advantages of dehydration over sun drying. Freezing – of fruits and vegetables – methods of freezing – sharp freezing – Quick freezing – cryogenic freezing – dehydro – freezing –dehydro freezing- freeze drying. Quality control in Food processing Industry –F.P.O specification – storage life – permissible limits of preservatives – food toxins								06
	Total								30
CO	Course Outcomes								
CO1	Explain the types of food adulterants.								
CO2	Know about first aid and food poisons.								

CO3	Discuss about food colours, sweeteners and preservatives. CO4: know the types of beverages.
CO4	Discuss the sources of edible oils.
CO5	Designing a stabilization plan for a high-fat food product to prevent oxidative rancidity.
Text Books:	
1	Food chemistry, H.K.Chopra, P.S.Panesar, Narosa publishing house, 2010.
2	Jaya shree Ghosh, Fundamental Concepts of Applied Chemistry, S.Chand & Co. Publishers, second edition, 2006.
3	Food Chemistry, Dr.L.Rakesh Sharma, Evince pub publishing,2022.
4	Food processing and preservation, G.S ubbulakshmi, Shobha A Udipi, Padmini S Ghugre, New age international publishers, second edition, 2021
Reference Books:	
1	H.-D.Belitz, Werner Grosch, Food Chemistry Springer Science & Business Media, 4 th Edition, 2009.
2	M.Swaminathan, Food Science and Experimental Foods, Ganesh and Company, 1979.
3	Hasenhuettl, Gerard. L.; Hartel, Richard. W. Food Emulsifiers and their applications Springer New York 2nd ed. 2008.
4	Food Chemistry, H.-D.Belitz, W.Grosch, P.Schieberle Springer, fourth revised and extended edition, 2009.
5	Principles of food chemistry, John M. deMan, John W. Finley, W. Jefferey Hurst, Chang Yong Lee, Springer, Fourth edition, 2018.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

FOUNDATION COURSE (FC)

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UFCH11	2	0	0	I	2	2	50	50	100
Learning Objectives									
LO1	Explain the structure of atoms and electronic configuration of elements.								
LO2	Describe the different types of chemical bonds and their characteristics.								
LO3	Understand the various states of matter and their general properties.								
LO4	Learn the rules of nomenclature and isomerism in inorganic compounds.								
LO5	Understand the basic principles and applications of spectroscopy								
Unit	Contents							No. of Hours	
I	Structure of atom and periodic classification of Elements and properties. Atom structure- Fundamental particles-Atomic mass- Atomic number – Isotopes –Isobars –Isotones – Orbitals-Quantum number and their significance. Shapes of s,p and d orbitals Rules governing electronic configuration in various its atomic orbitals. Electronic configuration of elements up to atomic number 30. Periodic table-periodic laws. Classification of elements into s, p, d and f-blocks, Periodic properties and factors affecting various periodic properties.							6	
II	Chemical Bonding Definition- Types of chemical bond-Ionic bond- Ion polarization - Dipole moment and Percentage of ionic character-Covalent bond-Definition –Postulates of Valence bond theory And Concept of hybridization (sp, sp ² , sp ³ , sp ³ d, sp ³ d ² , dsp ² , d ² sp ³)–Magnetic properties– Paramagnetic – Diamagnetic- Ferromagnetic.							6	
III	Nomenclature and Isomerism in Organic compounds Carbon compounds- Uniqueness of carbons- Classification of hydrocarbons - IUPAC Nomenclature of Organic compound Definition – Oxidation and reduction reactions – Calculation of oxidation numbers – Equivalent weight. Isomerism: Structural and Stereo isomerism Structural Isomerism: Chain isomerism, Functional isomerism, Positional isomerism and Meta isomerism. Stereoisomerism: Geometrical and Optical isomerism							6	
IV	States of Matter Gaseous state: Kinetic theory of gases- Ideal and Non-ideal gases- Ideal gas equation-Deviation of ideal gas from ideal behavior -vander Waal's equation and Liquification of gases. Liquids: Inter molecular forces, Vapour pressure and Boiling point of liquid– Surface tension–Viscosity- Factors affecting surface tension and viscosity. Solids: Definition-Characteristics of solids-Amorphous and Crystalline solids							6	
V	Introduction to Spectroscopy Electromagnetic radiation- General characteristics of Wave – Wavelength – Frequency –Amplitude – Wave number - Electromagnetic spectrum- Absorption and Emission spectrum- Quantization of Energy level - Selection rule - Intensity of the Spectral lines –Width of Spectral lines. Types of spectroscopy: Microwave spectroscopy, Infrared spectroscopy, UV-Visible spectroscopy, Nuclear Magnetic Resonance spectroscopy, Electron spin resonance spectroscopy.							6	

TOTAL		30
CO	Course Outcomes	
CO1	Describe atomic structure and explain periodic properties of elements.	
CO2	Understand and classify the different types of chemical bonding.	
CO3	Explain the characteristics and behavior of various states of matter.	
CO4	Understand the principles of nomenclature and isomerism in organic compounds.	
CO5	Explain electromagnetic radiation and its interaction with matter.	
Textbooks		
➤	B.R. Puri, L.R. Sharma, K.C. Kalia, Principles of Inorganic chemistry, Milestone Publishers and Distributors, New Delhi, 2012.	
➤	B.R. Puri and L.R. Sharma, 38th edition, Vishal Publishing company, Jaipur, 2002.	
➤	K.S. Tewari, S.N. Mehrotra and N.K. Vishnoi, Textbook of Organic Chemistry, 2nd edition Vikas publishing House, New Delhi, 1998.	
➤		
Reference Books		
1.	R.D. Madan, Sathya Prakash, Modern Inorganic chemistry 2nd edition, S. Chand and company, New Delhi, 2003.	
2.	B.S. Bhal, Arun Bhal, Advanced Organic chemistry, 3rd edition, S. Chand and company, New Delhi, 2003.	
3.	U.N. Dash, O.P. Dharmarha, P.L. Soni, Text book of Physical Chemistry, Sultan Chand & sons, New Delhi, 2016.	
4.	Y.R. Sharma Organic spectroscopy Principles and Chemical applications, S.Chand & Company PVT Ltd, 2002.	
5.	C.N. Banwell, Fundamentals of spectroscopy Tata Mc Graw Hill, 1983.	

MAPPING TABLE						
CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	2	2
CO2	2	3	2	3	2	2
CO3	2	3	2	2	3	1
CO4	1	2	2	1	3	2
CO5	2	2	2	1	3	3
Weightage of course contributed to each PSO	10	12	10	10	13	10

NON -MAJOR ELECTIVE 1 (NME) - WATER MANAGEMENT

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UNCH11	2	0	0	I	2	2	50	50	100
Learning Objectives									
LO1	To understand the sources, types, and effects of water pollution including eutrophication.								
LO2	To study important physical, chemical, and biological parameters used to assess water quality.								
LO3	To understand methods used for purification of drinking and industrial water.								
LO4	To learn the various stages and methods involved in wastewater treatment.								
LO5	To understand water conservation, river restoration methods, and pollution control laws.								
Unit	Contents								No. of Hours
I	WATER POLLUTION								6
	Definition-sources of water pollution-types of water pollutants: sewage and domestic wastes, industrial effluents, agricultural discharges, detergents, disease causing agents and radioactive materials. Eutrophication and its effects								
II	WATER QUALITY PARAMETERS								6
	Physical, chemical and biological water quality parameters-water quality standards for drinking water – BIS and WHO. Determination of pH, Total hardness, DO, BOD and COD.								
III	WATER PURIFICATION.								6
	Purification of water for drinking purposes: Sedimentation, filtration and disinfection- Desalination: reverse osmosis-Purification of water for industrial purposes: water softening-permutit process and ion- exchange process								
IV	WASTE WATER TREATMENT								6
	Elementary ideas of waste water treatment: pre-treatment-primary treatment-secondary treatment: aerobic and anaerobic processes –tertiary treatment: evaporation adsorption –chemical precipitation.								
V	RESTORATION AND MANAGEMENT								6
	Importance of lakes and rivers-stresses on the Indian rivers and their effects –A restoration case study: Ganga Action Plan: objectives implementation and drawbacks. Rain water harvesting –water recycling- The water Prevention and control of Pollution Act 1974.								
TOTAL								30	
CO	Course Outcomes								
CO1	Students will be able to identify major water pollutants and explain their environmental effects.								
CO2	Students will be able to determine key water quality parameters such as pH, hardness, DO, BOD, and COD.								
CO3	Students will be able to explain different water purification and softening techniques.								

CO4	Students will be able to describe the stages of wastewater treatment and their functions.
CO5	Students will be able to explain water management practices and the importance of pollution control measures.
Reference Books	
1	A. K. De, Environmental Chemistry, Wiley Eastern Ltd., New Delhi
2	B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut.
3	R. K. Trivedy and P. K. Goel, Chemical and biological methods for water pollution studies, Environmental Publications, Karad, India.
4	BIS 1991, Specification for drinking water, Bureau of Indian Standards, New Delhi WHO 1992, International standards for drinking water, World Health Organisation, Geneva

MAPPING TABLE						
CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	2	2
CO2	2	3	2	3	2	2
CO3	2	3	2	2	3	1
CO4	1	2	2	1	3	2
CO5	2	2	2	1	3	3
Weightage of course contributed to each PSO	10	12	10	10	13	10

Semester-2

Semester-2									
Course Code	Part	Course Category	Course Name	Hours/ Week	Examination				Credits
					Duration in Hours	Max Marks			
						CIA	ESE	Total	
26U1TL21	I	Language-I	Tamil-II	5	3	50	50	100	3
26U1HD21	I		Hindi -II						
26U1MY21	I		Malayalam-II						
26U1FR21	I		French - II						
26U2EN21	II	Language-II	English-II	5	3	50	50	100	3
26UCCH21	III	Core-III	General Chemistry II	4	3	50	50	100	4
26UCCHP2	III	Core Lab-IV	Qualitative organic analysis	6	3	50	50	100	4
26UECH21	III	EC - II	Vector Calculus and Fourier Series	4	3	50	50	100	3
26USCH21	IV	SEC - II	Dairy Chemistry	2	3	50	50	100	2
26USCH22	IV	SEC - III	Role of Chemistry in Daily Life	2	3	50	50	100	2
26UNCH21	IV	NME - II	Cosmetics and personal grooming	2	3	50	50	100	2
Total				30				800	23

FIRST YEAR - SEMESTER – II
CORE COURSE (CC-3)–GENERALCHEMISTRY-II

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCCH21	4	0	0	II	4	4	50	50	100
Learning Objectives									
LO1	Chemistry of acids, bases and ionic equilibrium								
LO2	Properties of s and p-block elements								
LO3	Chemistry of hydrocarbons								
LO4	Applications of acids and bases								
LO5	Compounds of main block elements and hydrocarbons								
Prerequisites:									
Unit	Contents								No. of Hours
I	Acids, bases and Ionic equilibria Concepts of Acids and Bases-Arrhenius concept, Bronsted-Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant; dissociation of poly basic acids, ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degree of dissociation; acid base indicators, theory of acid base indicators – action of phenolphthalein and methyl orange, titration curves-use of acid base indicators; Buffer solutions – types, mechanism of buffer action in acid and basic buffer, Henderson-Hasselbalch equation;								12
II	Chemistry of s-Block Elements Hydrogen: Position of hydrogen in the periodic table. Alkali metals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Preparation, properties and uses of NaOH, Na ₂ CO ₃ , KBr, KClO ₃ alkaline earth metals. Anomalous behavior of Be. Chemistry of p-Block Elements (Group13&14) preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al. comparison of carbon with silicon. Carbon-di-sulphide– Preparation, properties, structure and uses. Percarbonates, per mono carbonates and per dicarbonates.								12
III	Chemistry of p-Block Elements (Group15-18) General characteristics of elements of Group15; chemistry of NH ₃ and HNO ₃ . Chemistry of PH ₃ , PCl ₃ , PCl ₅ , POCl ₃ . General properties of elements of group16-Structure and allotropy of elements - chemistry of ozone – Classification and properties of oxides-oxides of sulphur. Oxyacids of sulphur (Caro's and Marshall's acids). Chemistry of Halogens: Halogen acids (HF, HCl, HBr and HI), Inter-halogen compounds (ICl, ClF ₃ , BrF ₅ and IF ₇), pseudo halogens [(CN) ₂ and (SCN) ₂] Noble gases: Preparation and properties of XeF ₂ , XeF ₄ , uses of noble gas, clathrate compounds.								12
IV	Hydrocarbon Chemistry-I								12

	Alkenes-Nomenclature, general methods of preparation-Reactions of alkenes – addition reactions – mechanisms Elimination reactions– Markownikoff's rule, Kharasch effect, oxidation reactions – hydroxylation, oxidative degradation, epoxidation, ozonolysis; polymerization. Alkadienes Nomenclature-classification-isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2 and 1, 4 additions; free radical addition to conjugated dienes– Diels–Alder reactions Alkynes Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerization and isomerisation.	
V	Hydrocarbon Chemistry-II Benzene: Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's $(4n+2)\pi$e-rule and its applications. Electrophilic substitution reactions- General mechanism of aromatic electrophilic substitution-nitration, sulphonation, halogenations. Friedel-Craft's alkylation and acylation. Mono substituted and disubstituted benzene-Effect of substituent-orientation and reactivity. Polynuclear Aromatic hydrocarbons: Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions– electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, preferential substitution at o-, p- or m-position– reduction, oxidation–uses. Anthracene – synthesis by Elbs reaction, Diels – Alder reaction and Haworth synthesis; physical properties; reactions -Diels-Alder reaction, preferential substitution at C-9 and C-10; uses.	12
TOTAL		60
CO	Course Outcomes	
CO1	Explain the concept of acids, bases and ionic equilibria; periodic properties of s and p block elements, preparation and properties of aliphatic and aromatic hydrocarbons	
CO2	Discuss the periodic properties of s and p-block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids	
CO3	Classify hydrocarbons, types of reactions, acids and bases, examine the properties s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons	
CO4	Explain theories of acids, bases and indicators, buffer action and important compounds of s-block elements	
CO5	Assess the application of hard and soft acids indicators, buffers, compounds of s and p-block elements and hydrocarbons	
Textbooks		
1.	Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nded, S.Chand and Company, New Delhi.	
2	Sathya Prakash, Tuli G D, Basu S K and Madan R D, (2003), Advanced Inorganic Chemistry, 17th ed., S. Chand and Company, New Delhi.	
3	Bahl B S, Arul Bhal, (2003), Advanced Organic Chemistry, 3rded., S.Chand and Company, New Delhi	
4	Tewari K S, Mehrothra S N and Vishnoi N K, (1998), Text book of Organic Chemistry, 2nded., Vikas Publishing House, New Delhi.	
5	Puri B R, Sharma L R, (2002), Principles of Physical Chemistry, 38 th ed., Vishal Publishing Company, Jalandhar.	

Reference Books	
1	Maron SH and Prutton CP, (1972), Principles of Physical Chemistry, 4 th ed., The Macmillan Company, Newyork.
2	Barrow GM, (1992), Physical Chemistry, 5 th ed., Tata Mc Graw Hill, NewDelhi.
3	LeeJD,(1991),Concise Inorganic Chemistry,4thed.,ELBSWilliam Heinemann, London.
4	HuheeyJ E, (1993), Inorganic Chemistry: Principles of Structure and Reactivity, 4thed., Addison Wesley Publishing Company, India.
5	Gurudeep Raj,(2001),Advanced Inorganic Chemistry Vol–I, 26 th ed., Goel Publishing House, Meerut.
6	Agarwal OP, (1995), Reactions and Reagents in Organic Chemistry, 8 th ed., Goel Publishing House, Meerut.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	2	2
CO2	2	3	2	2	2	2
CO3	2	3	3	3	2	2
CO4	2	3	2	2	2	2
CO5	3	3	2	2	2	2
Weightage of course contributed to each PSO	12	14	11	11	10	10

CORE COURSE (CC-4)– QUALITATIVE ORGANIC ANALYSIS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCCHP2	0	0	6	II	4	6	50	50	100
Learning Objectives									
LO1	Laboratory safety								
LO2	Handling glass wares								
LO3	Analysis of organic compounds								
LO4	Preparation of derivatives.								
LO5	Study the principle of the experiment								
Prerequisites:									
Unit	Contents								No. of Hours
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.								45
Unit II	Qualitative Organic Analysis Preliminary examination, detection of special elements -nitrogen, sulphur and halogens Aromatic and aliphatic nature, Test for saturation and unsaturation, identification of functional groups using solubility tests Confirmation of functional groups ❖ Monocarboxylic acid, dicarboxylic acid ❖ Monohydric phenol, polyhydric phenol ❖ aldehyde, ketone, ester ❖ carbohydrate (reducing and non-reducing sugars) ❖ primary, secondary, tertiary amine ❖ monoamide, diamide, thioamide ❖ Preparation of derivatives for functional groups								45
	Total								90
CO	Course Outcomes								
CO1	Observe the physical state, odour, colour and solubility of the given organic compound.								
CO2	Identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.								
CO3	Compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non-reducing sugars and explain the reactions behind it.								
CO4	Exhibit a solid derivative with respect to the identified functional group.								
CO5	Proficiency in detecting the presence of nitrogen, sulfur, and halogens through sodium fusion extracts.								
Reference Books:									
1	Venkateswaran, V.;Veeraswamy, R.;Kulandaivelu, A.R. Basic Principles of Practical								

	Chemistry, 2nded.; Sultan Chand: New Delhi, 2012.
2	Manna, A.K. Practical Organic Chemistry, Books and Allied: India, 2018.
3	Gurtu, J.N; Kapoor, R.Advanced Experimental Chemistry (Organic),Sultan Chand: New Delhi, 1987.
4	Furniss, B.S. ; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R.Vogel's Textbook of Practical organic Chemistry, 5thed.; Pearson: India,1989.

MAPPING TABLE						
CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	3	2	3	3
CO2	3	3	2	2	3	3
CO3	3	2	2	3	3	2
CO4	3	2	3	3	2	2
CO5	3	3	3	3	3	2
Weightage of course contributed to each PSO	15	12	13	13	14	12

SKILL ENHANCEMENT COURSE (SEC-1)–DAIRY CHEMISTRY

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UECH21	2	0	0	II	2	2	50	50	100
Learning Objectives									
LO1	To understand the composition, physical properties of milk and factors affecting milk quality and colostrum's								
LO2	To gain knowledge of microbiology of milk and different milk processing methods such as pasteurization, sterilization, and homogenization								
LO3	To understand the manufacture, composition, and preservation of milk products such as cream, butter, and ghee.								
LO4	To learn about different types of processed milk, including toned, standardized, flavored, and condensed milk.								
LO5	To study the preparation and properties of indigenous milk products like khoa, channa, ice cream, and milk powder.								
Unit	Contents							No. of Hours	
I	Composition of Milk Milk-definition-general composition of milk-constituents of milk-lipids, proteins carbohydrates vitamins and minerals- physical properties of milk - colour, odour, acidity specific gravity, viscosity and conductivity-Factors affecting the composition of milk-adulterants, preservatives with neutralizer-examples and their detection-estimation of fat acidity and total solids in milk. Colostrum's - Definition, Composition, difference between normal milk and colostrum's.							6	
II	Processing of Milk Microbiology of milk – destruction of micro – organisms in milk, physico–chemical changes taking place in milk due to processing-boiling, pasteurization–types of pasteurization-Bottle, Batch and HTST(High Temperature Short Time)–Vacuum pasteurization–Ultra High Temperature Pasteurization. physico – chemical changes taking place in milk due to processing							6	
III	Major Milk Products Cream-definition-composition-chemistryofcreamingprocess-gravitational and centrifugal methods of separation of cream-estimation of fat in cream. Butter - definition -composition - theory of churning - desi butter -salted butter,Ghee – major constituents-common adulterants added to ghee and their detection–rancidity-definition- prevention-antioxidants and synergists-natural and synthetic.							6	
IV	Special Milk Standardised milk-definition-merits-reconstituted milk-definition-flow diagram of manufacture-Homogenised milk-flavoured milk–vitaminised milk-toned milk-Incitant milk-Vegetable toned milk- humanized milk-condensed milk-definition,composition and nutritive value.							6	
V	Indigenous Milk Products Khoa and channa – composition and preparation, ice cream – composition, classification, ingredients and manufacturing process, role of stabilizers and emulsifiers, Milk powder – need for making milk powder, manufacture of whole milk powder , Drying process - spray drying and foam drying.							6	

TOTAL		30
CO	Course Outcomes	
CO1	Describe the general composition of milk, its major constituents, and the important physical properties of milk.	
CO2	Gain understanding of milk pasteurization processes and distinguish between different methods such as Bottle, Batch, HTST, and Ultra High Temperature pasteurization.	
CO3	Understand the composition of cream and butter and learn methods used to estimate fat content in cream and ghee.	
CO4	Explain the characteristics and preparation of processed milk varieties including homogenized, flavored, vitaminized, and toned milk.	
CO5	Describe the preparation techniques of indigenous milk products such as khoa, channa, ice cream, and milk powder.	
Textbooks		
➤	K.Bagavathi Sundari, Applied Chemistry, MJP Publishers, first edition, 2006.	
➤	K.S. Rangappa and K.T.Acharya, Indian Dairy Products, Asia Publishing House New Delhi, 1974.	
➤	Text book of Dairy chemistry, M.P. Mathur, D. Datta Roy, P. Dinakar, Indian Council of Agricultural Research, 1 st edition, 2008.	
➤	A Text book of dairy chemistry, Saurav Singh, Daya Publishing house, 1 st edition, 2013.	
➤	Textbook of dairy chemistry, P.L.Choudhary, Bio-Green book publishers, 2021.	
Reference Books		
1.	Robert Jenness and S.P. Atam, Principles of Dairy Chemistry, S.Wiley, New York, 2005.	
2	F.P.Wond, Fundamentals of Dairy Chemistry, Springer, Singapore, 2006.	
3	Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi, 1980.	
4	P.F.Fox and P.L.H. Mcsweeney, Dairy Chemistry and Biochemistry, Springer, Second edition, 2016.	
5.	Dairy chemistry and biochemistry, P.F.Fox, T.Uniacke-Lowe, P.L.H. Mc Sweeney, J.A.O Mahony, Springer, Second edition, 2015.	

MAPPING TABLE						
CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	2	2
CO2	2	3	2	3	2	2
CO3	2	3	2	2	3	1
CO4	1	2	2	1	3	2
CO5	2	2	2	1	3	3
Weightage of course contributed to each PSO	10	12	10	10	13	10

SKILL ENHANCEMENT COURSE (SEC-2) - ROLE OF CHEMISTRY IN DAILY LIFE

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USCH22	2	0	0	II	2	2	50	50	100
Learning Objectives									
LO1	Significance of Chemistry in Daily Life								
LO2	Chemistry Related to Building Materials and Food								
LO3	Chemistry of Medicines and Pharmaceuticals								
LO4	To identify the difference between a "natural" and "synthetic" chemical and understand the specific purpose of additives								
LO5	To analyze how chemical compounds interact with biological systems to treat diseases and manage health.								
Unit	Contents							No. of Hours	
I	General survey of chemicals used in everyday life 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							6	
II	Building materials Building materials - cement, ceramics, glass and refractories - definition, composition and application only. Plastics - polythene, PVC, bakelite, polyesters, melamine-formaldehyde resins-preparation and uses only							6	
III	Food and Nutrition Food and Nutrition - Carbohydrates, Proteins, Fats - definition and their importance as food constituents – balanced diet – Calories minerals and vitamins(sources and their physiological importance)							6	
IV	Chemicals in food production Chemicals in food production – fertilizers - need, natural sources; urea, NPK fertilizers and super phosphate. Insecticides- inorganic insecticides- natural or plant insecticides- pesticides - disadvantages – bio-pesticide- blue green algae, vermi compost.							6	
V	Pharmaceutical drugs Pharmaceutical drugs - analgesics and antipyretics - paracetamol and aspirin. Colour chemicals-pigments and dyes-examples and applications.							6	
TOTAL							30		
CO	Course Outcomes								
CO1	Understand the chemicals used in daily life and gain awareness of air and water pollution.								
CO2	Gain knowledge of building materials such as cement, ceramics, glass, and plastics including polythene, PVC, bakelite, and polyesters.								
CO3	Acquire knowledge of food and nutrition, including carbohydrates, proteins, and fats								
CO4	Study fertilizers such as urea, NPK fertilizers, and superphosphate, along with Insecticides and their types								
CO5	Obtain an understanding of pharmaceutical drugs such as analgesics and antipyretics								

	(paracetamol and aspirin), as well as pigments, dyes, and their applications.
Textbooks	
➤	Food chemistry, H.K. Chopra, P.S. Panesar, Narosa publishing house, 2010. A textbook of pharmaceutical chemistry by Jaya shree Ghosh, S Chand publishing, 2012.
➤	S.Vaithyanathan, Textbook of Ancillary Chemistry; Priya Publications, Karur, 2006.
➤	B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
➤	Introduction to forensic chemistry, Kelly M. Elkins, CRC Press Taylor & Francis Group, 2019.
➤	Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand &Co. Publishers, second edition, 2006.
Reference Books	
1.	Randolph. Norris Shreve, Chemical Process Industries, McGraw-Hill, Texas, fourth edition, 1977.
2.	W.A. Poucher, Joseph. A. Brink, Jr. Perfumes, Cosmetics and Soaps, Springer, 2000.
3	A.K. De, Environmental Chemistry, New Age International Public Co., 1990.

MAPPING TABLE						
CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	2	2
CO2	2	3	2	3	2	2
CO3	2	3	2	2	3	1
CO4	1	2	2	1	3	2
CO5	2	2	2	1	3	3
Weightage of course contributed to each PSO	10	12	10	10	13	10

NON MAJOR ELECTIVE 2 (NME) –COSMETICS AND PERSONAL GROOMING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UNCH21	2	0	0	II	2	2	50	50	100
Learning Objectives									
LO1	Formulations of various types of cosmetics and their significance								
LO2	Hair, skin and dental care								
LO3	Makeup preparations and personal grooming								
LO4	Analyze the Formulation and Chemistry of Cosmetic Products								
LO5	Evaluate the Biological Impact of Grooming Products on Skin and Hair								
Unit	Contents								No. of Hours
I	Skin care Nutrition of the skin, skincare and cleansing of the skin;face powder– ingredients;creams and lotions – cleansing, moisturizing all purpose, shaving and sunscreen (formulation only); Gels – formulation and advantages; astringent and skin tonics – key ingredients, skin lightness, depilatories.								6
II	Haircare Shampoos–types–powder,cream,liquid,gel –ingredients; conditioner –types– ingredients Dental care Toothpastes–ingredients–mouthwash								6
III	Makeup Base–foundation–types–ingredients;lipstick,eyeliner,mascara,eyeshadow, concealers, rouge								6
IV	Perfumes Classification-Natural–plant origin–parts of the plant used,chief constituents;animal origin– ambergris from whale,civetone from civetcat,musk from muskdeer; synthetic –classification emphasizing- characteristics– esters – alcohols								6
V	Beauty treatments Facials - types – advantages – disadvantages; face masks – types; bleach -types– advantages– disadvantages; shaping the brows; eyelash tinting; perming– types; hair colouring and dyeing; permanent waving – hair straightening;								6
TOTAL								30	
CO	Course Outcomes								
CO1	Know about the composition of various cosmetic products								
CO2	Understand chemical aspects and applications of haircare and dental care and skincare products								
CO3	Understand chemical aspects and applications of perfumes and skincare products.								
CO4	To understand the methods of beauty treatments their advantages and disadvantage								
CO5	Understand the hazards of cosmetic products								

Textbooks	
➤	Thankamma Jacob, (1997) Foods, drugs and cosmetics–A consumer Ngude, Macmillan publication, London.
Reference Books	
1.	Wilkinson JBE and Moore RJ, (1997) Harry's cosmeticology, 7 th ed., Chemical Publishers, London.
2.	George Howard, (1987) Principles and practice of perfumes and cosmetics, Stanley Therones, Chettenham.

MAPPING TABLE						
CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	3	2	2
CO2	2	3	2	3	2	2
CO3	2	3	2	2	3	1
CO4	1	2	2	1	3	2
CO5	2	2	2	1	3	3
Weightage of course contributed to each PSO	10	12	10	10	13	10

Semester-3

Semester–3									
Course Code	Part	Course Category	Course Name	Hours/ Week	Examination				Credits
					Duration in Hours	Max Marks			
						CIA	ESE	Total	
26U1TL31	I	Language–I	Tamil–III	5	3	50	50	100	3
26U1HD31	I		Hindi –III						
26U1MY31	I		Malayalam– III						
26U1FR31	I		French – III						
26U2EN31	II	Language–II	English–III	5	3			100	3
						50	50		
26UCCH31	III	Core– V	General Chemistry III	4	3			100	4
						50	50		
26UCCHP3	III	Core –VI	Qualitative inorganic analysis (<i>mixture</i>)	6	3	50	50	100	4
26UEPH31	III	EC - III	Allied Physics -I	4	3			100	3
						50	50		
26UEPHP1	IV	EC - IV	Allied Physics Lab -I	2	3	50	50	100	2
26USCHP1	IV	SEC – IV	Entrepreneurial skills in chemistry	2	3			100	2
						50	50		
26UEVS31	IV	Common	Environmental Studies	2	3			100	2
						50	50		
Total				30				800	23

SECOND YEAR – SEMESTER – III
CORE – V: GENERAL CHEMISTRY III

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCCH31	4	0	0	III	4	4	50	50	100
Learning Objectives									
LO1	The physical properties of gases, liquids, and solids, including X-ray diffraction studies of solids.								
LO2	The basic principles of nuclear chemistry and methods of nuclear waste management.								
LO3	The practical applications of nuclear energy.								
LO4	The fundamental chemistry of halo-organic compounds, phenols, and other aromatic alcohols.								
LO5	The preparation methods and properties of phenols and alcohols.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Gaseous state Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; The Maxwell –Boltzmann distribution of speed of molecules-average, root mean square and most probable velocity and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Collision frequency; collision diameter; mean free path and viscosity of gases. Real gases: Deviations from ideal gas behaviour, (Andrew’s and Amagat’s plots); compressibility factor, Z, and its variation with pressure for different gases.								12
II	Liquid and Solid State Properties of Liquids-Surface tension, viscosity and their applications. Crystalline and amorphous– differences-geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism. Crystals–size and shape; laws of crystallography; symmetry elements –plane, Centre and axis; Miller indices, unit cells and space lattices; classification of crystal systems; Bravais lattices; X – ray diffraction – Bragg’s equation Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO2; comparison of structure and properties of diamond and graphite; Numerical problems involving core concepts Defects in solids- stoichiometric and non-stoichiometric defects. Liquid crystals –classification and applications.								12
III	Nuclear Chemistry Natural radioactivity - α , β and γ rays; half-life period; Fajan–Soddy group displacement law; Geiger–Nattal rule; isotopes, isobars, isotones, mirror nuclei, isodiapheres; nuclear isomerism; radioactive decay series; magic numbers; units – Curie, Rutherford, Roentgen; nuclear stability - neutron- proton ratio;								12

	binding energy; packing fraction; mass defect. Simple calculations involving mass defect and B.E., decay constant and $t_{1/2}$ and radioactive series. Isotopes – uses – tracers – determination of age of rocks by radiocarbon dating. (Problems to be worked out) Nuclear energy; nuclear fission and fusion–major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures	
IV	Halogen derivatives Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereo chemical aspects and effect of solvent. Di, Tri & Tetra Halogen derivatives: Nomenclature, classification, preparation, properties and applications Aromatic halogen compounds Nomenclature, preparation, properties and uses Mechanism of nucleophilic aromatic substitution–benzyne intermediate. Aryl alkyl halides Nomenclature, benzyl chloride – preparation – properties and uses	12
V	Phenols Nomenclature; classification, Preparation from diazonium salts, cumene, Dow's process, Raching process; properties – acidic character and effect of substitution on acidity. Reactions–Fries, claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimen, Kolbe, Schmidt, Gattermann synthesis, Libermann, nitro reaction, phthalein reaction Claisen rearrangements with mechanism Aromatic alcohols Nomenclature, benzyl alcohol – methods of preparation – hydrolysis, reduction of benzaldehyde, Cannizzaro reaction, Grignard synthesis, physical properties, reactions – reaction with sodium, phosphorus pentachloride, thionyl chloride, acetic anhydride, hydrogen iodide, oxidation–substitution on the benzene nucleus, uses Pinacol-Pinacolone rearrangement	12
TOTAL		60
CO	Course Outcomes	
CO1	Explain the kinetic behaviour of gases using mathematical principles.	
CO2	Describe the physical properties of liquids and solids, classify different types of crystals and apply X-ray diffraction techniques to determine crystal structures.	
CO3	Examine radioactivity, nuclear energy and its generation, along with nuclear waste management.	
CO4	Describe the nomenclature, physical and chemical properties, and basic reaction mechanisms of halo-organic compounds	
CO5	Analyse the important named organic reactions of phenols and explain the preparation and properties of aromatic alcohols	
Textbooks		
1	B.R. Puri, L.R. Sharma, M.S. Pathania; <i>Principles of Physical Chemistry</i> , 46 th edition, Vishal Publishing, 2020.	
2	B.R.Puri, L.R.Sharma and K.C.Kalia, <i>Principles of Inorganic Chemistry</i> , Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009.	
3	P.L.Soni and Mohan Katyal, <i>Textbook of Inorganic Chemistry</i> , Sultan Chand& amp; Sons, twentieth edition, 2006.	
4	M.K.Jain, S.C.Sharma, <i>Modern Organic Chemistry</i> , Vishal Publishing, fourth reprint, 2003.	

5	S.M.Mukherji, and S.P.Singh, <i>Reaction Mechanism in Organic Chemistry</i> , Macmillan India Ltd., third edition, 1994.
Reference Books	
1	T.W. Graham Solomons, <i>Organic Chemistry</i> , John Wiley & Sons, fifth edition, 1992.
2	A. Carey Francis, <i>Organic Chemistry</i> , Tata McGraw-Hill Education Pvt., Ltd., New Delhi, seventh edition, 2009.
3	I.L.Finar, <i>Organic Chemistry</i> , Wesley Longman Ltd, England, sixth edition, 1996.
4	P.L.Soni, and H.M. Chawla- <i>Text Book of Organic Chemistry</i> , New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007.
5	J.D.Lee, <i>Concise Inorganic Chemistry</i> , Blackwell Science, fifth edition, 2005.

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

CORE – VI QUALITATIVE INORGANIC ANALYSIS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCCHP3	0	0	6	III	4	6	50	50	100
Learning Objectives									
LO1	To develop skills in the systematic analysis of mixtures of inorganic salts and to study the principles and equations involved in the experiment								
LO2	To master the systematic "group separation" scheme to identify inorganic cations (basic radicals) and anions (acidic radicals) in a given sample.								
LO3	To identify probable ions based on physical characteristics and their behavior when subjected to heat, flame, or specific dry reagents.								
LO4	To classify anions into groups based on their reaction with dilute and concentrated acids and to perform specific confirmatory tests. S								
LO5	To explain the theoretical principles behind salt analysis, specifically the Common Ion Effect and Solubility Product (K_{sp}).								
Prerequisites:									
Unit	Contents								No. of Hours
I	Semi-MicroQualitativeAnalysis 1. Analysis of simple acid radicals: Carbonate, sulphate, chloride,nitrate Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate. 2. Elimination of interfering acid radicals and identifying the group of basic radicals 3. Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, zinc, manganese, nickel, cobalt, calcium, strontium, magnesium, ammonium. 4. Analysis of a mixture I to VIII containing two cations and two anions – of which one is interfering type								90
Total								90	
CO	Course Outcomes								
CO1	Acquire knowledge on the systematic analysis of simple salts.								
CO2	Identify the cations and anions in the unknown substance.								
CO3	Identifythecationsandanionsinthesoilandwaterandttestthequalityofwater.								
CO4	Assesstheroleofcommonioneffectandsolubilityproduct								
CO5	Demonstrate proficiency in handling small-scale laboratory equipment								
Reference Books:									
1	V.Venkateswaran, R. Veeraswamy and A.R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997								

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

ELECTIVE COURSE (EC-III)– CHEMISTRY FOR PHYSICAL SCIENCE I

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UECH31	4	0	0	III	3	4	50	50	100
Learning Objectives									
LO1	To provide fundamental understanding of chemical bonding, molecular orbital theory and nuclear chemistry.								
LO2	To develop knowledge of industrially important fuels, silicones, and fertilizers.								
LO3	To understand hybridization, reaction mechanisms, and electronic effects in organic chemistry.								
LO4	To explain principles of thermodynamics and relevant to chemical systems.								
LO5	To train students in qualitative and quantitative analysis techniques and separation methods used in chemistry laboratories.								
Prerequisites:									
Unit	Contents							No. of Hours	
I	Chemical Bonding - molecular orbital theory - bonding, antibonding and non-bonding orbitals, bond order, and molecular orbital diagram – H ₂ , N ₂ and He ₂ . Nuclear Chemistry - fundamental particles - isotopes, isobars, isotones and isomers, differences between chemical and nuclear reactions, group displacement law, nuclear binding energy, mass defect (calculations), differences between nuclear fission and nuclear fusion, stellar energy, applications of radioisotopes - carbon dating, rock dating and medicinal applications.							12	
II	Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.							12	
III	Hybridization - orbital overlap, hybridization and geometry of CH ₄ , C ₂ H ₄ , C ₂ H ₂ and C ₆ H ₆ , electronic effects - inductive effect and its consequences on K _a and K _b of organic acids and bases, - examples. Types of reactions – substitution, addition, elimination and polymerization reactions – illustration with examples, aromatic electrophilic substitution - nitration, halogenation, Friedel- Craft's alkylation and acylation.							12	
IV	Thermodynamics: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Carnot's cycle and efficiency of heat engine. Entropy and its significance. Free energy change and its importance (no derivation). Conditions for spontaneity in terms of entropy and Gibbs free energy Relationship between Gibbs free energy and entropy. Nernst heat theorem and its application.							12	
V	Principle of qualitative analysis and quantitative analysis volumetric analysis – acid base, permanganometry, iodimetry and iodometry titrations. Separation and purification techniques – extraction, distillation and crystallization, chromatography - principle and application of column, paper and thin layer chromatography							12	
TOTAL								60	
CO1	Students will acquire comprehensive knowledge of chemical bonding theories, nuclear reactions, and their practical applications.								

CO2	Students will be able to analyze and evaluate the efficiency and applications of various fuels, fertilizers, and important organic reactions.
CO3	Students will understand different types of hybridization, electronic effects, and reaction mechanisms in organic chemistry.
CO4	Students will apply thermodynamic principles, understand different systems, and interpret phase rule concepts in chemical processes.
CO5	Students will be able to select and explain appropriate methods for the separation and purification of chemical components.
Textbooks	
➤	V.Veeraiyan, Textbook of Ancillary Chemistry; Highmount publishing house, Chennai, first edition, 2009.
➤	S.Vaithyanathan, Textbook of Ancillary Chemistry, Priya Publications, Karur, 2006.
➤	Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012.
➤	P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.

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

ELECTIVE COURSE (EC-IV)– CHEMISTRY FOR PHYSICAL SCIENCES (INORGANIC VOLUMETRIC ANALYSIS)

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks			
							CIA	External	Total	
26UECHP1	0	0	2	III	2	2	50	50	100	
Learning Objectives										
LO1	To develop the practical experience of volumetric analysis.									
LO2	To accurately calculate and prepare primary and secondary standard solutions of specific molarity or normality.									
LO3	To differentiate between and perform various titrimetric methods, including Acid-Base, Redox, Complexometric, and Precipitation titrations.									
LO4	To select the appropriate internal, external, or self-indicators based on the pH range or the nature of the chemical reaction.									
LO5	To process titration data to calculate unknown concentrations and evaluate the reliability of results through statistical analysis.									
Prerequisites:										
Unit	Contents								No. of Hours	
I	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 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								30	
	TOTAL									30
	CO	Course Outcomes								
	CO1	Gain an understanding of the use of standard flask and volumetric pipettes, burette.								
	CO2	Design, carryout, record and interpret the results of volumetric titration.								
	CO3	Apply their skill in the analysis of water/hardness.								
CO4	Analyze the chemical constituents in allied chemical products									
CO5	To quantify inorganic chemical species by designing and executing titration protocols, applying stoichiometric calculations									
Reference Book:										
➤	V.Venkateswaran, R.Veerasingam, A.R. Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.									

SKILL CORE ELECTIVE (SCE-4)– ENTREPRENEURIAL SKILLS IN CHEMISTRY

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USCHP1	0	0	2	III	2	2	50	50	100
Learning Objectives									
LO1	Develop entrepreneurial skills in students								
LO2	To provide hands on experience to prepare and develop products								
LO3	Study the principle /equation of the experiment.								
LO4	Develop start ups								
LO5	To get knowledge about food chemistry								
Prerequisites:									
Unit	Contents								No. of Hours
I	Food Chemistry Food adulteration – contamination of food items with claystones, 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. Dyes Classification– Natural, synthetic dyes and their characteristics – basic methods and principles of dyeing.								10
II	Hands on Experience (Students can choose any four) Detection of adulterants in food items like coffee, tea, pepper, chili powder, turmeric powder, butter, ghee, milk, honey etc., by simple techniques. Preparation of Jam, squash and Jelly, Gulkand, cottage cheese. Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, toothpaste/ powder and disinfectants in small scale. Testing of water samples using testing kit. Dyeing –cotton fabrics with natural and synthetic dyes Printing–tie and dye, batik.								20
TOTAL								30	
CO	Course Outcomes								
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	Gain the knowledge of duplication and preservation of digital evidence.								
CO5	To become an entrepreneur								

Text books	
➤	George S & Muralidharan V, (2007) Fibre to Finished Fabric–A Simple Approach, Publication Division, University of Madras, Chennai.
➤	Appaswamy GP, A Hand book on Printing and Dyeing of Textiles
Reference Books	
1	ShyamJha, Rapid detection of food adulterants and contaminants (Theory and Practice), Elsevier, eBook ISBN 9087128004289, 1 st Edition, 2015

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weightedpercentageof CourseContributionto Pos	3.0	3.0	3.0	3.0	3.0

COMMON - ENVIRONMENTAL SCIENCE

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UEVS31	2	0	0	III	2	2	50	50	100
Learning Objectives									
LO1	To study the multidisciplinary nature of environmental studies, including the scope, importance, and sustainable management of natural resources such as forests, water, minerals, food, energy, and land.								
LO2	To understand different types of ecosystems, energy flow, ecological succession, food chains, food webs, and ecological pyramids.								
LO3	To examine the levels of biodiversity, its distribution in India and globally, threats to biodiversity, and conservation strategies including in-situ and ex-situ methods.								
LO4	To identify causes, effects, and control measures of various types of pollution, and to understand solid waste management and disaster management techniques.								
LO5	To analyze social and environmental issues such as climate change, global warming, and population growth, along with environmental protection laws and sustainable development practices.								
Prerequisites:									
Unit	Contents								No. of Hours
I	THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES Definition, scope and importance Natural resources and associated problems: a) Forest resources: Use and over-exploitation, deforestation, timber extraction, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, dams-benefits and problems, water conservation and watershed management. c) Mineral resources: Use and exploitation, environmental effects. d) Food resources: World food problems, changes, effects of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewables lion renewable energy sources, alternate energy sources. f) Land resources: Land as a resource, land degradation, man-induced landslides, soil erosion and desertification.								6
II	ECOSYSTEMS a) Forest Ecosystem b) Grassland Ecosystem c) Desert ecosystem d)Aquatic Ecosystem (Ponds, rivers, oceans, estuaries) Energy flow in the ecosystem Ecological succession Food Chains, Food Webs and Ecological Pyramids.								6

III	BIODIVERSITY AND ITS CONSERVATION Introduction Definition: Genetic, species and ecosystem diversity. Biogeographically classification of India ,Values of Biodiversity, Biodiversity at global, national and local levels India as a mega-diversity nation, Hot-Spots of biodiversity Threats to biodiversity Endangered and endemic species of India , Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity	6
IV	ENVIRONMENTAL POLLUTION Definition- Causes, effects and control measures of:- a) Air Pollution b) Water Pollution c) Soil Pollution d) Marine Pollution e) Noise Pollution f) Thermal Pollution Solid Waste Management, Disaster Management: Floods, earthquake, cyclone and landslides.	6
V	SOCIAL ISSUES AND THE ENVIRONMENT Climatic change, global warming, acid rain, ozone depletion. Wasteland reclamation Consumerism and Waste products, use and through plastics Environment Protection Act Air (Prevention and Control of Pollution) Act Water (Prevention and Control of Pollution) Act Wildlife Protection Act Forest Conservation Act Population Explosion - Family Welfare Programme Human Rights	6
TOTAL		30
CO	Course Outcomes	
CO1	Students will be able to explain the scope and importance of environmental studies and analyze the use, over-exploitation, and conservation of natural resources.	
CO2	Students will be able to describe ecosystem types, energy flow, ecological succession, and relationships such as food chains, food webs, and ecological pyramids.	
CO3	Students will be able to assess biodiversity at different levels, identify threats, and explain conservation methods including in-situ and ex-situ approaches.	
CO4	Students will be able to identify various types of pollution, analyze their causes and effects, and suggest control measures along with waste and disaster management practices.	
CO5	Students will be able to evaluate major environmental issues such as climate change and population growth, and understand environmental protection laws and sustainable practices.	
Reference Books		
1	G.S. Vijayalakshmi, A.G. Murugesan and N. Sukumaran. 2006. Basics of Environmental Science, Manonmaniam Sundaranar University Publications, Tirunelveli , pp.160.	
2	Agarwal. K.C. 2001. Environmental Biology, Nidi Publications Limited, Bikaner	
3	A.K.De. 1999. Environmental Chemistry, Wiley Eastern Limited, India.	

4	Jadhav,H. and Bhosale, V.M.1995. Environmental Protection and Laws, Himalaya Publishing House, Delhi. pp284
5	Odum, E.P.1971. Fundamentals of Ecology, W.B.Saunders Co., USA. pp.574.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	2	2
CO2	2	3	2	2	2	2
CO3	2	3	3	3	2	2
CO4	2	3	2	2	2	2
CO5	3	3	2	2	2	2
Weightage of course contributed to each PSO	12	14	11	11	10	10

Semester-4

Semester–4									
Course Code	Part	Course category	Course Name	Hours/ Week	Examination				Credits
					Duration in Hours	Max Marks			
						CIA	ESE	Total	
26U1TL41	I	Language– I	Tamil–IV	5	3	50	50	100	3
26U1HD41	I		Hindi –IV						
26U1MY41	I		Malayalam–IV						
26U1FR41	I		French - IV						
26U2EN41	II	Language– II	English–IV	5	3			100	3
						50	50		
26UCCH41	III	Core– VII	General Chemistry IV	4	3			100	4
						50	50		
26UCCHP4	III	Core –VIII	Preparation of organic and inorganic compounds and determination of physical constants	6	3			100	4
						50	50		
26UEPH41	III	EC – V	Allied Physics -II	4	3			100	3
						50	50		
26UEPHP2	III	EC –VI	Allied Physics Lab II	2	3	50	50	100	2
26USCH42	IV	SEC - VII	Forensic science	2	3			100	2
						50	50		
26UVBE41	IV	Common	Value Based Education	2	3			100	2
						50	50		
Total				30				800	23

SECOND YEAR – SEMESTER – IV
CORE COURSE (CC-7)– GENERAL CHEMISTRY IV

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCCH41	4	0	0	IV	4	4	50	50	100
Learning Objectives									
LO1	Fundamental thermodynamic principles related to chemical reactions and their practical applications.								
LO2	Calculations based on thermochemistry, including heat changes in chemical reactions.								
LO3	Transition metals with emphasis on periodic trends, properties, and group-wise study of transition elements.								
LO4	Organic chemistry of ethers, aldehydes, and ketones, focusing on their structure, properties, and reactions.								
LO5	Organic chemistry of carboxylic acids, including their preparation, properties, and chemical behavior.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Thermodynamics I Terminology – Intensive, extensive variables, state, path functions; isolated, closed and open systems; isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible processes; First law of thermodynamics– Concept and significance of heat(q), work(w), internal energy (E), enthalpy (H); calculations of q, w, E and H for reversible, irreversible. expansion of ideal and real gases under isothermal and adiabatic conditions; relation between heat capacities (Cp & Cv); Joule Thomson effect- inversion temperature. effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions								12
II	Thermodynamics II Second Law of thermodynamics- Limitations of first law, spontaneity and randomness; Carnot's cycle; Concept of entropy, entropy change for reversible and irreversible processes, entropy of mixing, calculation of entropy changes of an ideal gas and a van der Waals gas with changes in temperature, volume and pressure, entropy and disorder. Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation– derivations and applications; Maxwell relationships, Third law of thermodynamics– Nernst heat theorem; Applications of third law-evaluation of absolute entropies from heat capacity measurements, exceptions to third law.								12
III	General Characteristics of d-block elements Transition Elements- Electronic configuration - General periodic trend variable valency, oxidation states, stability of oxidation states, colour, magnetic properties, catalytic properties and tendency to form complexes. Comparative study of transition elements and non-transition elements– comparison of II and III transition series with I transition series. Group study of Titanium, Vanadium, Chromium, Iron, Nickel groups								12

IV	Ethers, Thioethers and Epoxides Nomenclature, isomerism, general methods of preparations, reactions involving cleavage of C-O linkages, alkyl group and ethereal oxygen. Zeisel's method of estimation of methoxy group. Reactions of epoxides with alcohols, ammonia derivatives and LiAlH ₄ , Thio ethers-nomenclature, structure, preparation, properties and uses.	12
	Aldehydes and Ketones Nomenclature, structure and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. Nucleophilic addition reactions, base catalyzed reactions with mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Addition reactions of unsaturated carbonyl compounds: Michael addition	
V	Carboxylic Acids: Nomenclature, structure, preparation and reactions of aliphatic and aromatic monocarboxylic acids. Physical properties, Acidic nature, effect of substituent on acidic strength. HVZ reaction, Claisen ester condensation, Bouveault Blanc reduction, decarboxylation, Hunsdiecker reaction. Formic acid-reducing property. Reactions of dicarboxylic acids, hydroxyl acids and unsaturated acids. Carboxylic acid Derivatives: Preparations of aliphatic and aromatic acid chlorides, esters, amides and anhydrides. Nucleophilic substitution reaction at the acyl carbon of acyl halide, anhydride, ester, amide. Schotten-Baumann reaction. Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann bromamide degradation and Curtius rearrangement. 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.	12
TOTAL		60
CO	Course Outcomes	
CO1	Study the concepts, processes, and laws of thermodynamics, including calculations based on thermochemical principles.	
CO2	Discuss the second law of thermodynamics and its application to heat engine; discuss third law and its application on heat capacity measurement.	
CO3	Discuss the principles of the second law of thermodynamics with reference to heat engines, and explain the third law along with its applications in measuring heat capacity.	
CO4	Analyze the chemical behavior of transition elements in relation to their periodic properties and group-wise discussion.	
CO5	Discuss the reactions and chemistry of carboxylic acids and their derivatives, including active methylene compounds, halogen-substituted acids, and hydroxyl acids.	
Textbooks		
1	B.R.Puri and L.R. Sharma, <i>Principles of Physical Chemistry</i> , Shoban Lal Nagin Chand and Co., thirty-three editions, 1992.	
2	K.L.Kapoor, <i>A Text book of Physical chemistry</i> , (volume-2 and 3), Macmillan, India Ltd, third edition, 2009.	
3	P.L. Soni and Mohan Katyal, <i>Text book of Inorganic Chemistry</i> , Sultan Chand & Sons, twentieth edition, 2006.	
4	M.K. Jain, S.C. Sharma, <i>Modern Organic Chemistry</i> , Vishal Publishing, fourth reprint, 2003.	
5	S.M. Mukherji, and S.P. Singh, <i>Reaction Mechanism in Organic chemistry</i> Macmillan India	

	Ltd., third edition, 1994.
Reference Books	
1	Maron, S.H. and Prutton C.P. <i>Principles of Physical Chemistry</i> , 4 th ed.; The Macmillan Company: Newyork, 1972.
2	Lee, J.D. <i>Concise Inorganic Chemistry</i> , 4 th ed.; ELBS William Heinemann: London, 1991.
3	Gurudeep Raj, <i>Advanced Inorganic Chemistry</i> , 26 th ed.; Goel Publishing House: Meerut, 2001.
4	Atkins, P.W. & Paula, J. <i>Physical Chemistry</i> , 10 th ed.; Oxford University Press: New York, 2014.
5	Huheey, J.E. <i>Inorganic Chemistry: Principles of Structure and Reactivity</i> , 4 th ed; Addison Wesley Publishing Company: India, 1993.

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

CORE (CC 8) – PREPARATION OF ORGANIC AND INORGANIC COMPOUNDS AND DETERMINATION OF PHYSICAL CONSTANTS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCCHP4	0	0	6	IV	4	6	50	50	100
Learning Objectives									
LO1	To develop the skill on systematic analysis of inorganic salts.								
LO2	To execute diverse chemical reactions								
LO3	To synthesize specific organic and inorganic compounds with high yield.								
LO4	To apply various purification methods—including recrystallization , filtration								
LO5	To accurately measure the melting point (for solids) and boiling point (for liquids)								
Prerequisites:									
Unit	Contents								No. of Hours
I	Preparation of Organic Compounds								40
	1.Nitration- picric acid from Phenol								
	2.Halogenation-p-bromoacetanilide from acetanilide								
	3.Oxidation- benzoic acid from Benzaldehyde								
	4.Benzoic acid from Benzamide								
	5.Methylbenzoate to Benzoic acid								
	6.Salicylicacid from Methyl Salicylate								
	7.Methylorange from sulphanilic acid								
II	Preparation of Inorganic compounds								30
	8.Potash alum								
	9.Tetraammine copper (II) sulphate								
	10.Hexammine cobalt (III) chloride								
	11.Hexathio urea lead (II) nitrate								
	12.Sodiumferrioxalate								
	13.Tristhio urea copper (I) chloride								
III	Determination of boiling point and melting point of organic substance / solvents								20
	Total								90
CO	Course Outcomes								
CO1	Acquire knowledge on the systematic analysis of simple salts.								
CO2	Identify the cations and anions in the unknown substance.								
CO3	Identify the cations and anions in the soil and water and to test the quality of water.								
CO4	Assess the role of common ion effect and solubility product								
CO5	Characterize Compounds Using Physical Constants								

Reference Books:	
1	Venkateswaran,V.; Veeraswamy, R.; Kulandaivelu, A.R. <i>Basic Principles of Practical Chemistry</i> , 2 nd ed.; Sultan Chand: New Delhi, 2012.
2	Gurtu, J.N; Kapoor, R. <i>Advanced Experimental Chemistry (Organic)</i> , Sultan Chand: New Delhi, 1987
3	Furniss, B.S; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. <i>Vogel's Textbook of Practical Organic Chemistry</i> , 5 th ed.; Pearson: India, 1989.
4	Manna,A.K. <i>Practical Organic Chemistry</i> , Books and Allied: India, 2018.

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

ELECTIVE COURSE – IV CHEMISTRY FOR PHYSICAL SCIENCE II

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UECH41	4	0	0	IV	3	4	50	50	100
Learning Objectives									
LO1	The Co-ordination Chemistry								
LO2	Carbohydrates and Amino acids								
LO3	Basics and applications of electro chemistry								
LO4	Applications of kinetics and catalysis								
LO5	Basics and applications of photochemistry								
Prerequisites:									
Unit	Contents								No. of Hours
I	Co-ordination Chemistry Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature Werner's theory EAN rule Pauling's theory- Postulates Applications to $[\text{Ni}(\text{CO})_4]$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Co}(\text{CN})_6]^{3-}$ Chelation Biological role of Haemoglobin and Chlorophyll (elementary idea) Applications in qualitative and quantitative analysis.								12
II	Carbohydrates and Amino acids Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose-fructoses inter conversion. Properties of starch and cellulose. Amino acids: Classification preparation and properties of alanine, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).								12
III	Electrochemistry Galvanic cells Standard hydrogen electrode calomel electrode –standard electrode potentials -electrochemical series. Strong and weak electrolytes ionic product of water pH, Conductometric titrations- buffer solutions and its biological applications electroplating Nickel and chrome plating-Types of cells-fuel cells-corrosion and its prevention								12
IV	Kinetics and Catalysis Order and molecularity. Integrated rate expression for I and II (2A Products) order reactions, Pseudo first order reaction, methods of determining order of a reaction Half-life period - Catalysis - homogeneous and heterogeneous, catalyst used in Contact and Haber's processes. Concept of energy of activation and Arrhenius equation.								12
V	Photochemistry Grothus Drapper's law and Stark-Einstein's law of photo chemical equivalence, Quantum yield Hydrogen -chloride reaction. Phosphorescence, fluorescence, chemiluminescence photosensitization and photosynthesis (definition with examples)								12
TOTAL								60	
CO	Course Outcomes								
CO1	Write the IUPAC name for complex, different theories to explain the bonding in coordination compounds.								
CO2	Explain the preparation and property of carbohydrate.								

CO3	Enlighten the biological role of transition metals, amino acids and nucleic acids
CO4	Apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.
CO5	Outline the various type of photochemical process
Textbooks	
➤	V.Veeraiyan, Text book of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009.
➤	S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
➤	Arun Bahl, B.S.Bahl, Advanced Organic Chemistry :S.Chand and Company, New Delhi, twenty third edition, 2012
Reference Books	
➤	P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007
➤	P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007.
➤	R.Puri, L.R. Sharma, M.S. Pathania, Textbook Physical Chemistry: Vishal Publishing Co., New Delhi, forty seventh edition, 2018.
➤	B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014

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

ELECTIVE COURSE – IV CHEMISTRY FOR PHYSICAL SCIENCES QUALITATIVE INORGANIC ANALYSIS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UECHP2	0	0	2	IV	2	2	50	50	100
Learning Objectives									
LO1	To develop the skill on systematic analysis of inorganic salts								
LO2	To master the classical "wet analysis" flowchart, using specific group reagents to selectively precipitate and identify cations (basic radicals) from Group 0 to Group V								
LO3	To utilize physical properties and thermal reactions—such as flame tests, borax bead tests, and charcoal cavity tests								
LO4	To classify and identify anions by observing gas evolution with dilute/concentrated acids and performing specific confirmatory tests like the Silver Nitrate or Barium Chloride tests.								
LO5	To explain and apply the Common Ion Effect and Solubility Product to ensure the accurate precipitation of specific groups without interference.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Semi-MicroQualitativeAnalysis 1. Analysis of simple acid radicals: Carbonate, sulphate, chloride, nitrate Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate. 2. Elimination of interfering acid radicals and identifying the group of basic radicals 3. Analysis of basic radicals (group wise): Lead, copper,cadmium, nickel, cobalt, barium, ammonium. 4. Analysis of a simple salt containing one cation and one anion.								30
TOTAL								30	
CO	Course Outcomes								
CO1	Acquire knowledge on the systematic analysis of simple salts.								
CO2	Identify the cations and anions in the unknown substance.								
CO3	Identify the cations and anions in the soil and water and to test the quality of water.								
CO4	Assess the role of common ion effect and solubility product								
CO5	Acquire knowledge on the systematic analysis of simple salts.								
Reference Books									
	V.Venkateswaran, R.Veeraswamy and A.R.Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand &Sons, New Delhi, second edition, 1997.								

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

SKILL ENHANCEMENT COURSE (SEC-6) – INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USCH41	2	0	2	IV	2	2	50	50	100
Learning Objectives									
LO1	To understand SI units, concentration terms, and methods of expressing analytical results.								
LO2	To develop skills in sampling, error analysis, and statistical evaluation of analytical data.								
LO3	To explain the principles and instrumentation of spectroscopic techniques such as AAS, UV-Visible, and IR spectroscopy.								
LO4	To familiarize students with thermal, electro-analytical, and instrumental methods of analysis.								
LO5	To provide knowledge of separation and purification techniques including solvent extraction and chromatography								
Prerequisites:									
Unit	Contents							No. of Hours	
I	Qualitative and Quantitative Aspects of Analysis S.I Units, Distinction between Mass and Weight. Moles, Millimoles, Milli equivalence, Molality, Molarity, Normality, Percentage by Weight and Volume, ppm, ppb. 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, Ttest. The Least Square Method for Deriving Calibration plots.							06	
II	Atomic Absorption Spectroscopy: Basic principles of instrumentationChoice 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.Applications of AAS							06	
III	UV-Visible and IR Spectroscopy Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert’s law. UV-Visible Spectrometry: Basic principles,instrumentation - choice of source, mono chromator 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.							06	
IV	Thermal and Electro-analytical Methods of Analysis TGA and DTA- Principle, Instrumentation, methods of obtaining Thermograms, factors affecting TGA/DTA, Thermal analysis of silver nitrate, calcium oxalate and calcium acetate DSC-Principle, Instrumentation and applications. Electro analytical methods: polarography - principle, instrumentation and							06	

	applications. Derivative polarography	
V	Separation and purification techniques Classification, principle, Factors affecting –Solvent Extraction–Liquid -Liquid Extraction, Chromatography: Column, TLC, Paper, Gas.Principle, Classification, Choice of Adsorbents, Solvents, Preparation ofColumn, Elution Mechanism of separation: adsorption, partition & ion exchange.Development of chromatograms and Rf value. Applications of Chromatography	06
	Total	30
CO	Course Outcomes	
CO1	Evaluate analytical data using statistical methods and assess accuracy, precision, and sources of error.	
CO2	Understand the principles, instrumentation, and applications of atomic absorption, UV-Visible, and infrared spectroscopy.	
CO3	Perform quantitative analysis using spectroscopic techniques and interpret spectral data	
CO4	Explain the principles and applications of thermal analysis techniques such as TGA, DTA, and DSC.	
CO5	Understand and apply separation and purification techniques such as solvent extraction and chromatography	
Text Books		
1	Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed., The English Language Book Society of Longman.	
2	R.Gopalan, P.S.Subramanian and K.Rengarajan,Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007	
3	Skoog,Holler and Crouch,Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint (2017).	
4	R.Speyer, Thermal Analysis of Materials, CRC Press, 1993.	
5	R.A. Day and A.L. Underwood, Quantitative Analysis, 6thedn., Prentice Hall of India Private Ltd., New Delhi, 1993	
Reference books		
1	D. A. Skoog, D. M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5thedn., Saunders college publishing, Philadelphia, 1998.	
2	Dash U.N, Analytical Chemistry;Theory and Practice,Sultan Chand and sons Educational Publishers, New Delhi, 2011.	
3	Christian,Gary D;Analytical Chemistry,6thEd.,JohnWiley& Sons, New York, 2004. Mikes,O. &Chalmes,	
4	R.A. Laboratory Hand book of Chromatographic & Allied Methods, Elles Harwood Ltd. London	
5	G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel’s Textbook of Quantitative Chemical Analysis, sixth edition Pearson Education, 2000	

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

SKILL ENHANCEMENT COURSE (SEC-7) – FORENSIC SCIENCE

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USCH42	2	0	0	IV	2	2	50	50	100
Learning Objectives									
LO1	Crime detection through analytical instruments								
LO2	Forgery and its detection medical aspects involved								
LO3	Master Crime Scene Documentation and Evidence Collection								
LO4	Analyze Biological and Trace Evidence								
LO5	Evaluate Physical and Pattern Evidence								
Prerequisites:									
Unit	Contents								No. of Hours
I	Poisons Poisons - types and classification - diagnosis of poisons in the living and the dead-clinical symptoms-postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of sea foods-use of neutron activation analysis in detecting arsenic in human hair. Treatment in cases of poisoning-use of antidotes for common poisons Principles of toxico kinetics and toxico dynamics of poisons.								6
II	Crime Detection Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human bombs-possible explosives (gelatin sticks and RDX)-metal detector devices and other security measures for VVIP-composition of bullets and detecting powder burns								6
III	Forgery and Counter feiting 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 counter feit coins–detection of gold purity in 22 carat ornaments–detecting gold plated jewels-authenticity of diamond.								6
IV	Tracks and Traces Tracks and traces–small tracks and police dogs –footprints–costing of footprints residue prints, walking pattern or tyre marks–tool marks-paints-fibers-Analysis of biological substances - blood, semen, saliva, urine and hair - Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and racehorses.								6
V	Medical Aspects Aids – causes and prevention-misuse of scheduled drugs-burns and their treatment by plastic surgery. Metabolite analysis using mass spectrum-Gas chromatography-Arson -natural fires and arson - burning characteristics and chemistry of combustible materials -nature of combustion. Ballistics- classification - internal and terminal ballistics - small arms - laboratory examination of barrel washing and detection of powder residue by chemical tests. Forensic toxicology of drugs of abuse (narcotics, stimulants and sedatives).								6
	Total								30
CO	Course Outcomes								
CO1	Learn about the Poisons-types and classification of poisons in the living and the dead organisms and also get information about Postmortem.								
CO2	Get awareness on Human bombs, possible explosives (gelatin sticks and RDX) and metal defector devices								

	and other security measures for VVIP – composition of bullets and detecting powder burns
CO3	Detect the forgery documents, different types of forged signatures
CO4	Have an idea about how to tracks and trace using police dogs, foot prints identification and gain the knowledge in analyzing biological substances - blood, semen, saliva, urine and hair-DNA Finger printing for tissue identification in dismembered bodies
CO5	Get the awareness on Aids-causes and prevention and also have an exposure on handling fire explodes.
Text Books:	
1	Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed., The English Language Book Society of Longman.
2	R. Gopalan, P.S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007
3	Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint (2017).
4	R. Speyer, Thermal Analysis of Materials, CRC Press, 1993.
5	R.A. Day and A.L. Underwood, Quantitative Analysis, 6 th ed., Prentice Hall of India Private Ltd., New Delhi, 1993
Reference Books:	
1	D. A. Skoog, D. M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5th edn., Saunders college publishing, Philadelphia, 1998.
2	Dash U.N, Analytical Chemistry; Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 2011.
3	Christian, Gary D; Analytical Chemistry, 6 th Ed., John Wiley & Sons, New York, 2004.
4	Mikes, O. & Chalmers, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elsevier Harwood Ltd. London
5	G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel's Text book of Quantitative Chemical Analysis, sixth edition Pearson Education, 2000

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

COMMON - VALUE BASED EDUCATION

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UVBE41	2	0	0	IV	2	2	50	50	100
Learning Objectives									
LO1	To provide basic knowledge of the Indian Constitution and its framework.								
LO2	To understand fundamental rights, duties, and directive principles.								
LO3	To create awareness about human rights and their protection mechanisms.								
LO4	To develop analytical skills regarding constitutional and human rights issues.								
LO5	To promote values of equality, justice, and democracy among students.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction to Indian Constitution Introduction: Meaning and importance of Constitution - Historical background of Indian Constitution - Making of the Constitution (Constituent Assembly) - Salient features of Indian Constitution - Preamble – Meaning, Objectives and Values.								6
II	Fundamental Rights and Duties Fundamental Rights – Types and significance - Right to Equality, Freedom, Religion, Cultural & Educational Rights - Right to Constitutional Remedies - Fundamental Duties – Meaning and importance.								6
III	Directive Principles of State Policy Meaning and objectives - Classification of Directive Principles - Relationship between Fundamental Rights and DPSP - Role in governance and welfare state.								6
IV	Human Rights – Concepts and Development Meaning and definition of Human Rights - Evolution of Human Rights - Universal Declaration of Human Rights (UDHR) - Types of Human Rights – Civil, Political, Economic, Social & Cultural								6
V	Human Rights in India Human Rights Protection Act, 1993 - National Human Rights Commission (NHRC) – Structure and functions - Role of NGOs in Human Rights protection - Issues: Women, Children, Minorities & Environment - Contemporary Human Rights challenges in India.								6
TOTAL								30	
CO	Course Outcomes								
CO1	Explain the structure and features of the Indian Constitution.								
CO2	Identify and interpret Fundamental Rights and Duties.								
CO3	Analyze the role of Directive Principles in governance.								
CO4	Understand the concept and importance of Human Rights.								
CO5	To create a congenial climate in the organization								

Textbooks	
➤	Durga Das Basu – <i>Introduction to the Constitution of India</i>
Reference Books	
1	V.N. Shukla – <i>Constitution of India</i>
2	M. Laxmikanth – <i>Indian Polity</i>
3	Upendra Baxi – <i>The Future of Human Rights</i>
4	H.O. Agarwal – <i>Human Rights</i>
5	P.M. Bakshi – <i>The Constitution of India</i>

Semester-5

Semester-5									
Course Code	Part	Course Category	Course Name	Hours/ Week	Examination				Credits
					Duration in hrs.	Max Marks			
						CIA	ESE	Total	
26UCCH51	III	Core-IX	Organic Chemistry I	5	3	50	50	100	4
26UCCH52	III	Core -X	Inorganic Chemistry–I	5	3	50	50	100	4
26UCCH53	III	Core -XI	Physical Chemistry–I	5	3	50	50	100	4
26UCCH5P	III	Core -XII	Mini Project with Viva Voce	3	3	50	50	100	3
26UCCHP5	III	Core -XIII	Physical Chemistry practical	6	6	50	50	100	4
26UECH51	III	Elective- V	Industrial chemistry	4	3	50	50	100	3
26UECH52			Nano Science						
26UFIK51	IV		Internship/Industrial Visit/Field Visit/Knowledge Updation Activity	-	3	50	50	100	2
26UAEC51	IV	AEC I	Empowered Vocational English	2	3	50	50	100	2
Total				30				800	26

THIRD YEAR – FIFTH SEMESTER
CORE COURSE (CC-9)–ORGANIC CHEMISTRY I

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCCH51	5	0	0	V	4	5	50	50	100
Learning Objectives									
LO1	Stereoisomerism in chiral and geometric isomerism in olefins, conformations of ethane and butane.								
LO2	Preparation and properties of aromatic and aliphatic nitro compounds and amines.								
LO3	The preparation, properties, reactions, and synthetic uses of diazonium salts and diazomethane.								
LO4	Preparation and properties of five membered hetero cycles and six membered heterocycles.								
LO5	Understand the aromaticity and explain electrophilic and nucleophilic substitution mechanisms.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Stereochemistry Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans, syn-anti isomerism, E/Z notations. Optical Isomerism: Optical activity, specific rotation, asymmetry, enantiomers, distereoisomers, meso structures – molecules with one and two chiral centres, racemization–methods of racemisation; resolution-methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereogenic) centres. Stereo selective and stereo specific reaction. Molecules with no asymmetric carbon atoms–allenes and biphenyls. Conformational analysis of ethane and butane.								15
II	Chemistry of Nitrogen Compounds–I Nitroalkanes Nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes;physical properties; reactions–reduction, halogenations,Grignard reagent, Pseudo acid character. Nitro-acinitro tautomerism. Aromatic nitro compounds Nomenclature, preparation–nitration, from diazonium salts, physical properties; reactions–reduction of nitrobenzene in different medium, Electrophilic substitution reactions TNT.								15
III	Chemistry of Nitrogen Compounds–II Aromatic amines – Nomenclature, preparation – from nitro compounds, Hofmann’s method; Schmidt reaction, properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid-zwitterion formation. Distinction between primary, secondary and tertiary amines - aliphatic and aromatic Diazonium compounds. Diazomethane, Benzene diazonium chloride - preparations and synthetic applications.								15
IV	Heterocyclic compounds Nomenclature–aromaticity of five and six membered heterocyclics–furan, pyrrole, thiophen, pyridine, piperidine–methods of synthesis- chemical reactions with special emphasis on mechanism of electrophilic and nucleophilic substitutions–comparison of basicity of pyridine, piperidine and pyrrole–condensed five and six membered heterocyclics- indole, quinoline, isoquinoline–synthesis with special reference to Fischer-indole, Skraup, Beisler-Napieralski synthesis-mechanism of electrophilic substitution reaction of the above.								15

V	AROMATICITY & AROMATIC SUBSTITUTION Aromaticity – definition – Huckel’s rule – consequence of aromaticity – stability, – examples. Non-benzenoid aromatic compounds Aromatic electrophilic substitution – general pattern of the mechanism, role of σ and π complexes, Mechanism of nitration, halogenation, sulphonation and Friedel-Crafts reaction. Activating and deactivating substituents, orientation in mono substituted benzenes, ortho/para ratio- Orientation- Korner’s absolute method, - Aromatic Nucleophilic substitutions- unimolecular, bimolecular and benzyne mechanisms	15
TOTAL		75
CO	Course Outcomes	
CO1	Analyze and differentiate optical activity, chirality, enantiomers, diastereomers, and meso compounds, and explain racemization, resolution methods, and stereoselective versus stereospecific reactions.	
CO2	Describe and predict the nomenclature, preparation, properties, tautomerism, and reactions of aliphatic and aromatic nitro compounds.	
CO3	Explain and apply the preparation, properties, reactions, and synthetic uses of diazonium salts and diazomethane, including diazotization and coupling reactions.	
CO4	Apply and analyze concepts of heterocyclic chemistry, including nomenclature, aromaticity, synthesis, reactivity, and substitution mechanisms in heterocyclic systems.	
CO5	Evaluate and analyze aromaticity using Hückel’s rule and explain electrophilic and nucleophilic substitution mechanisms, orientation effects, and substituent influence in aromatic systems.	
Textbooks		
1	M.K.Jain,S.C. Sharma,Modern Organic Chemistry,Vishal Publishing, fourth reprint, 2009.	
2	S.M.Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 2009.	
3	Arun Bahl and B.S.Bahl, Advanced organic chemistry, New Delhi, S.Chand& Company Pvt. Ltd., Multi colour edition,2012.	
4	P.L. Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007.	
5	C.N. Pillai, Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009.	
Reference Books		
1	R.T. Morrison and R.N. Boyd, Organic Chemistry, Pearson Education, Asia, sixth edition, 2012.	
2	T.W. Graham Solomons, Organic Chemistry, John Wiley & Sons, Eleventh edition, 2012.	
3	A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, seventh edition,2009.	
4	I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, sixth edition, 2006.	
5	J. A. Joule, and G.F.Smith, Heterocyclic Chemistry, Wiley, Fifth Edition,2010.	

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	3	3	2	2
CO2	3	3	3	3	2	2
CO3	3	3	3	2	2	3
CO4	3	3	3	3	3	2
CO5	3	3	2	3	2	2
Weightage of course contributed to each PSO	15	14	14	14	11	11

CORE – 10: INORGANIC CHEMISTRY-I

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCCH52	5	0	0	V	4	5	50	50	100
Learning Objectives									
LO1	Naming, structural variations (isomerism), and theoretical concepts of coordination compounds, including chelate complexes.								
LO2	Crystal field theory, magnetic behavior, stability of complexes, and the Jahn–Teller effect								
LO3	Synthesis and characteristics of metal carbonyl compounds								
LO4	Lanthanide and actinide elements								
LO5	Synthesis and properties of inorganic polymers								
Prerequisites:									
Unit	Contents								No. of Hours
I	Co-ordination Chemistry - I IUPAC Nomenclature of coordination compounds, Isomerism in Coordination compounds. Werner’s coordination theory – effective atomic number –interpretation of geometry and magnetic properties by Pauling’s theory–geometry of coordination compounds with co-ordination number 4&6. Chelates – types of ligands forming chelates – stability of chelates, applications of chelates in qualitative and quantitative analysis –application of DMG and oxine in gravimetric analysis – estimation of hardness of water using EDTA. Role of metal chelates in living systems – haemoglobin, Vitamin B12 and chlorophyll.								15
II	Co-ordination Chemistry - II Crystal field theory –Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy (CFSE), spectro chemical series – calculation of CFSE in octahedral and tetrahedral complexes - factors influencing the magnitude of crystal field splitting. spectra of [Ti(H2O)6] 3+ - Jahn – Teller effect. Stability of complexes in aqueous solution, stability constants - factors affecting the stability of a complex ion, thermodynamic and kinetic Stability (elementary idea). Comparison of VBT and CFT..								15
III	Organo metallic compounds Metal Carbonyls Mono and polynuclear carbonyls, General methods of preparation of carbonyls – general properties of binary carbonyls – bonding in carbonyls – structure and bonding in carbonyls of Ni, Fe, Cr, Co, Mn EAN rule as applied to metal carbonyls. Ferrocene – Methods of preparation, physical and chemical properties and applications.								15
IV	Inner transition elements (Lanthanoids and Actinoids) General characteristics of f-block elements - Comparative account of lanthanoids and actinoids - Occurrence, Oxidation states, Magnetic properties, Colour and spectra –Lanthanoids and Actinoids, Separation by ion-Exchange and Solvent extraction methods - Lanthanoids contraction .Chemistry of thorium and Uranium-Occurrence, Ores, Extraction, properties and uses - Preparation, Properties and uses of ceric ammonium sulphate, thorium dioxide								15

	and uranyl acetate.	
V	Inorganic polymers General properties – classification of inorganic polymers based on element in the backbone (Si, S, B and P) – preparation and properties of silicones (poly dimethyl siloxane and poly methyl hydro siloxane) phosphorous based polymer (poly phosphazines and poly hopho nitrilic chloride), sulphur based polymer (poly sulfide and polymeric sulphur nitride), boron based polymers (borazine polymers) – industrial applications of inorganic polymers.	15
TOTAL		75
CO	Course Outcomes	
CO1	Illustrate isomerism, Werner's coordination theory, and the factors affecting the stability of chelate complexes.	
CO2	Analyze crystal field theory and describe the magnetic and spectral characteristics of coordination compounds.	
CO3	Outline the preparation methods and explain the properties of metal carbonyl compounds.	
CO4	Compare and contrast the properties of lanthanoid and actinoid series elements	
CO5	Describe the properties and practical applications of inorganic polymers of silicon, sulphur, boron, and phosphorus.	
Textbooks		
1	Puri . B. R, Sharma. L. R, Kalia. K. C. (2011), Principles of Inorganic Chemistry, 31th Edition, Milestone Publishers & Distributors, Delhi.	
2	Satya Prakash, Tuli. G.D., Basu.S.K., Madan. R. D. (2009), Advanced Inorganic Chemistry, 18 th Edition, S. Chand & Co., New Delhi	
3	Lee. J. D,(1991), Concise Inorganic Chemistry, 4th Edition, ELBS William Heinemann, London	
4	W. V. Malik, G. D. Tuli, R. D. Madan, (2000), Selected Topics in Inorganic Chemistry, S.Chand and Company Ltd.	
5	A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992.	
Reference Books		
1	Madan R. D, Sathya Prakash,(2003), Modern Inorganic Chemistry, 2 nd ed ., S.Chand and Company, New Delhi.	
2	Gopalan. R, (2009) Inorganic Chemistry for Undergraduates, 1 st Edition, University Press (India) Private Limited, Hyderabad	
3	Sivasankar. B, (2013) Inorganic Chemistry. 1 st Edition, Pearson, Chennai	
4	Alan. G. Sharp. 1992), Inorganic Chemistry, 3 rd Edition, Addition - Wesley, England.	
5	Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014	

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCCH53	5	0	0	V	4	5	50	05	100
Learning Objectives									
LO1	Gibbs free energy, Helmholtz free energy, Ellingham's diagram and partial molar properties.								
LO2	Chemical kinetics and different types of chemical reactions.								
LO3	Adsorption, homogeneous and heterogeneous catalysis.								
LO4	Colloids and macromolecules.								
LO5	Photochemistry, fluorescence and phosphorescence.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Thermodynamics – III Free energy and work functions – Need for free energy functions, Gibbs free energy, Helmholtz free energy – their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application.								15
II	Chemical Kinetics Rate of reaction – Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction - rate equation - order of reaction. Order and molecularity of simple and complex reactions, Rate laws-Rate constants – derivation of rate constants and characteristics for zero, first order, second and third order (equal initial concentration) – Derivation of time for half change with examples. Effect of temperature on reaction rate – temperature coefficient – concept of activation energy –Arrhenius equation. Theories of reaction rates – Collision theory – derivation of rate constant of bimolecular gaseous reaction – Failure of collision theory. Lindemann's theory of unimolecular reaction.Theory of absolute reaction rates–Derivation of rate constant for a bimolecular reaction – significance of entropy and free energy of activation. Comparison of collision theory and ARRT.								15
III	Organo metallic compounds Metal Carbonyls Adsorption – Chemical and physical adsorption and their general characteristics – distinction between them. Different types of isotherms – Freundlich and Langmuir. Adsorption isotherms and their limitations – BET theory, kinetics of enzyme catalyzed reaction – Michaelis-Menten and – Line weaver- Burk plot – inhibition – reversible – competitive, noncompetitive and uncompetitive (no derivation of rate equations) Catalysis – general characteristics of catalytic reactions, autocatalysis, promoters, negative catalysis, poisoning of a catalyst – theories of homogenous and heterogeneous catalysis.								15
IV	Colloids and Surface Chemistry Colloids: Types of Colloids, Characteristics of Colloids (Lyophilic and Lyophobic sols), Preparation of Sols - Dispersion methods, aggregation methods, Properties of Sols - Optical properties, Electrical properties - Electrical double layer, Electro Kinetic properties- Electro-osmosis, Electrophoresis, Coagulation or precipitation, Stability of sols, associated colloids, Emulsions, Gels-preparation of Gels, Applications of colloids.								15
V	Photo chemistry Laws of photo chemistry – Lambert – Beer, Grotthus – Draper and Stark – Einstein. Quantum efficiency. Photochemical reactions – rate law – Kinetics of H ₂ -Cl ₂ , H ₂ -Br ₂ and , comparison between thermal and photo chemical reactions. Fluorescence – applications including fluorimetry – sensitised fluorescence, phosphorescence – applications – chemiluminescence and photosensitisation – examples Chemistry of Vision – 11 cis retinal – vitamin A as a precursor - colour perception of vision.								15
TOTAL								75	

CO	Course Outcomes
CO1	Explain Gibbs and Helmholtz free energy functions, partial molar quantities and Ellingham's .
CO2	Apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction, demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation
CO3	Compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogeneous and heterogeneous catalysis.
CO4	Demonstrate the types and characteristics of colloids, preparation of sols and emulsions, and determine the molecular weights of macromolecules.
CO5	Utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision.
Textbooks	
1	B.R. Puri and L.R.Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., forty eighth edition, 2021.
2	Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.
3	Arun Bahl, B.S. Bahl, G.D. Tuli Essentials of Physical chemistry, 28 edition, 2019, S.Chand & Co.
4	S.K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996.
5	J.Rajaram and J.C.Kuriacose, Thermodynamics, Shoban Lal. Nagin Chand and CO., 1986
Reference Books	
1	J.Rajaram and J.C. Kuriacose, Chemical Thermodynamics, Pearson, 1st edition, 2013..
2	Keith.J.Laidler, Chemical kinetics, third edition, Pearson, 2003.
3	P.W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002.
4	K.L. Kapoor, A text book of Physical Chemistry, Macmillan Oxford University Press, sixth edition, 2014 India Ltd, third edition, 2009.
5	B. R. Puri, L. R. Sharma and M. S.Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001

CORE – 11 PHYSICAL CHEMISTRY-I

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

ELECTIVE COURSE (5) – INDUSTRIAL CHEMISTRY

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UECH51	4	0	0	V	3	4	50	50	100
Learning Objectives									
LO1	Classifications and characteristics of fuels								
LO2	Properties of Nano materials.								
LO3	Manufacture of sugar, paper, cement, leather and food processing.								
LO4	Applications of abrasives, lubricants and other industrial products..								
LO5	Knowledge about cosmetics								
Prerequisites:									
Unit	Contents								No. of Hours
I	Survey of Indian Industries and mineral resources in India Fuels: Classification, characteristics of fuels. Solid fuels: coal - classification; analysis of coal-proximate analysis and ultimate analysis; calorific value - determination, carbonization of coal. Liquid fuels: Petroleum - characteristics; Gasoline aviation petrol- knocking in internal combustion engines, antiknock agents; unleaded petrol-octane number, cetane number. Gaseous fuel: advantages over solid and liquid fuels; water gas, producer gas, carbureted watergas - preparations-uses Natural gas: LPG-composition, advantages, application; gobar gas-production, composition, advantages, application. Propellants – rocket fuels (basic idea)								12
II	Cosmetics Skin care: powders, ingredients; creams and lotion-cleansing, moisturising, all purpose shaving cream, sunscreen; make up preparations. Dentalcare: toothpastes-ingredients Haircare: shampoos -types, ingredients; conditioners -types, ingredients Perfumes: natural – plant origin – parts of the plant used, chief constituents; animal origin - amber gries, civetone and musk; synthetic classification- esters – amyl salicylate alcohols - citronellol; terpeneols - geraniol and nerol; ketones - muskone, coumarin; aldehydes - vanilin. Soaps and Detergents Soaps-properties, manufacture of soap-batch process; types-transparent soap, toilet soap, powder soap and liquid soap – ingredients Detergents - definition, properties – cleansing action; soapless detergents - anionic, cationic and non-ionic (general idea only); uses of detergents as surfactants. Biodegradability of soaps and detergents								12
III	Sugar Industry Manufacture from sugar cane; recovery of sugar from molasses; testing and estimation of sugar. Food Preservation and processing Food spoilage – causes; Food preservation – methods – high temperature, low								12

	temperature, drying, radiation; Food additives – preservatives, flavours, colours, anti-oxidants, sweetening agents; hazards of using food additives; Food standards – Agmark and Codex alimentarius	
IV	Abrasives Definition, characteristics, types - natural and synthetic; natural abrasives – diamond, corundum, emery, garnet, quartz – composition, uses; synthetic abrasives – carborundum, aluminium carbide, boron carbide, boron nitride, synthetic graphite – composition and uses. Leather Industry Structure and composition of skin, hide; Manufacture of leather–pre- tanning process – curing, liming, beating, pickling; methods of tanning- vegetable, chrome–one bath, two bath process; finishing Paper Industry Manufacture of pulp - mechanical, chemical processes; sulphate pulp, rag pulp; manufacture of paper- beating, refining, filling, sizing, colouring, calendaring; cardboard.	12
V	Lubricants Definition, classification-liquid, semi-solid, solid and synthetic; properties – viscosity index, flash point, cloud point, pour point, aniline point and drop point; greases - properties, types; cutting fluids, Selection of lubricants. Cement Industry Cement – types, raw materials; manufacture –wetprocess, constituent of cement, setting of cement; properties of cement-quality, setting time, soundness, strength; mortar, concrete, RCC; curing and decay of concrete Intellectual Property Rights Introduction to Intellectual Property Rights – Patents - Factors for patentability - Novelty, Nonobviousness, Industrial applications - Patent offices in India: Trademark - Types of trademarks- Certification marks, logos, brand names, signatures, symbols and service marks.	12
TOTAL		60
CO	Course Outcomes	
CO1	Summarize the properties of fuels which include petroleum, water gas, natural gas and propellents.	
CO2	Evaluate cosmetic products, soaps, detergents.	
CO3	Explain manufacture of sugar, food spoilages and food additives.	
CO4	Explain properties of abrasives, manufacture of leather and paper.	
CO5	Explain properties and manufacture of lubricants and cement, and intellectual property rights	
Textbooks		
1	Sharma, B.K. Industrial Chemistry, 9 th ed.; Goel Publishing House: Meerut, 1998.	
2	Wilkinson. J. B. E, Moore. R. J,Harry’s Cosmeticology, 7 th ed. Chemical Publishers: NewYork, 1982.	
3	Alex. V. Ramani, Food Chemistry, MJP publishers: Chennai, 2009.	
4	Jayashree Ghosh, Applied Chemsitry, S.Chand: New Delhi, 2006.	
5	Srilakshmi, B.FoodScience,4 th ed.; New Age International Publication, 2005.	
Reference Books		
1.	Jain.P.C.; Jain.M, Engineering Chemistry,16 th ed.; Dhanapet Rai: Delhi, 1992.	

2	George Howard, Principles and Practice of Perfumes and Cosmetics, Stanley Therones, Cheltenham: UK, 1987.
3	Thankamma Jacob, Foods, Drugs and Cosmetics-A Consumer Guide, Macmillan : London, 1997.
4	Shankuntala Manay. N.; Shadak sharaswamy. M, Food Facts and Principles, 3 rd ed.; New Age Publication, 2008.
5	Neeraj Pandey, Khush deep Dharni, Intellectual Property Rights, PHI Learning, 2014.

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

ELECTIVE COURSE (5) – NANO SCIENCE

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UECH52	4	0	0	V	3	4	50	50	100
Learning Objectives									
LO1	Explain the general concepts and physical phenomena of relevance within the field of nanoscience.								
LO2	Describe the properties, synthesis, characteristics of nanomaterials, special nanomaterials and applications								
LO3	Examine the structure, properties, applicability and characterization of nanomaterials.								
LO4	Analyze various synthesis procedures, characterizations and uses of carbon nanotubes, fullerene and								
LO5	Discuss applications of nanomaterials of sensors and in optics and electronics.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction to nanoscience Definition of terms– nanoscience, nanoparticles, clusters, quantum dots, nanostructures and nanocomposites. Electron behavior in free space, bulk material and nanomaterials. Synthesis and stabilization of nanomaterials Top down approach (physical methods), mechanical dispersion–ball milling, methods based on evaporation of a precursor–inert gas condensation, ion sputtering, spray pyrolysis, aerosol synthesis–nanolithography. Bottom–up approach (chemical methods) - solvothermal synthesis, photochemical method, sol-gel method, nanomaterials via chemical routes- solvents reducing agents,								12
II	Properties of materials on a nanoscale Optical properties of metal and semiconductor nano materials–surface Plasmon resonance (SPR), surface enhanced Raman spectra (SERS), Quantum confinement effect, tuning of optical spectrum. Magnetic properties–Fe ₃ O ₄ particle, supermagnetic properties, electronic properties, Chemical properties–chemical process on the surface of nano particles, catalysis, mechanical properties								12
III	Techniques employed for characterization of nanomaterials Spectroscopy –UV-visible, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning probe microscopy (SPM)– Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Optical microscopy – confocal microscopy, X-ray diffraction (XRD) [Principle and Block diagram only].								12
IV	Special nanomaterials Carbon Nano Structures Carbon nanotubes: Introduction–types–zigzag, Armchair, helical, synthesis by CVD, Functionalization of Carbon Nanotubes, Reactivity of Carbon Nanotubes, Other Important Carbon-based materials: Preparation and Characterization Fullerene, Graphene, properties, DLC and Nanodiamonds and Applications Semiconductor nanoparticles: Quantum dots, synthesis–chemical Synthesis using clusters, properties. Self-Assembled Nanomaterials: Self Assembled Monolayers (SAMs)– inorganic, organic molecules.								12

V	Application of nanomaterials Biomedical Applications-drug, drug delivery, bio labelling, artificial implants, cancer treatment. Sensors– Natural nanoscale sensors, Chemical sensors, biosensors, electronic noses. Optics & Electronics–Nanomaterials in the next generation computer technology, high-definition TV, flat panel displays, quantum dot laser, Single electron transistors [SET]. Nanotechnology in agriculture–Fertilizer and pesticides nanomaterials for water purification, nanomaterials in food and packaging materials, fabric industry. Impacts of Nanotechnology–human&environmental safety risks.	12
TOTAL		60
CO	Course Outcomes	
CO1	Explain the general concepts and physical phenomena of relevance within the field of nanoscience.	
CO2	Describe the properties, synthesis, characteristics of nanomaterials, special nanomaterials and applications.	
CO3	Examine the structure, properties, applicability and characterization of nanomaterials.	
CO4	Analyze various synthesis procedures, characterizations and uses of carbon nanotubes, fullerene and grapheme	
CO5	Discuss applications of nanomaterials of sensors and in optics and electronics.	
Textbooks		
1	Sulabha K. Kulkarni, Nanotechnology: Principles and Practices, CapitalPublishing Co., New Delhi.	
2	Pradeep. T, Nano: The Essentials, Understanding Nanoscience andNanotechnology; Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007	
3	Shah. M.A.; Tokeer Ahmad, Principles of Nano science and Nano technology; Narosa Publishing House, NewDelhi,2010.	
4	Murthy. B.S; Shankar. P, Baldev Raj.; Rath. B.B. James Murday, Textbook ofNanoscience and Nanotechnology; Universities press, India Ltd, Hyderabad. 2012.	
Reference Books		
1.	Sharma. P.K., Understanding Nanotechnology; Vista International Publishing House, Delhi. 2008.	
2.	Charles P. Poole Jr.; Frank J. Owens. Introduction to Nano technology; A John Wiley & Sons, INC., Publication,2003.	
3	Viswanathan B., Nano Materials; Narosa Publishing House, New Delhi, 2009.	
4	Edited by C.N.R. Rao; Muller. A; Cheetham. A.K. Nanomaterials Chemistry Recent Developments and New Directions, WILEY-VCH Verlag GMBH & Co., KGa A, Darmstadt	
5	Jing Zhong Zhang, Optical properties and spectroscopy of Nanomaterials; WorldScientific Publishing Pvt. Ltd., Singapore.	

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

CORE (CC 9) – PHYSICAL CHEMISTRY EXPERIMENTS

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCCHP5	0	0	6	IV	4	6	50	50	100
Learning Objectives									
LO1	To provide hands-on training in thermometric methods for determining molecular weight, eutectic behavior, and critical solution temperature of organic systems.								
LO2	To develop an understanding of chemical kinetics through experimental determination of reaction rate constants and reaction orders.								
LO3	To familiarize students with electrochemical techniques such as conductometry and potentiometry for quantitative analysis.								
LO4	To study adsorption phenomena by constructing adsorption isotherms and interpreting experimental data.								
LO5									
Prerequisites:									
Unit	Contents								No. of Hours
I	Thermometric experiments 1.Determination of molecular weight of an organic compound by Rast method using naphthalene or diphenyl as solvent 2.Determination of molecular weight of organic compound by transition temperature method. 3.Simple eutectic-determination of eutectic temperature and composition of naphthalene- Diphenyl amine or naphthalene-diphenyl system. 4.Determination of upper critical solution temperature of phenol– water system; Study of the effect of impurity on CST and determination of the strength of unknown								30
II	Chemical kinetics 5. Determination of rate constant of acid catalyzed Hydrolysis of an ester- methylacetate. 6. Determination of order of reaction between iodide and persulphate (initial rate method).								10
III	Electrochemistry–Conductance measurements 7.Conductometric titration of hydrochloric acid against sodium hydroxide 8. Potentiometric titration of ferrous ion against potassium dichromate using quinhydrone electrode. 9.Construction of Freundlich isotherm for the adsorption of acetic acid on activated charcoal. 10.Estimation of MgSO4 by conductometric method using standard MgSO4 (to be prepared) and link BaCl2 11. Estimation of KMnO4 by potentiometric method using standard K2Cr2O7 (to be prepared) and link ferrous ammonium sulphate.								30
IV	Experiments for demonstration: Distribution law 1.Determination of the distribution co-efficient of iodine between carbon tetrachloride and water. 2.Determination of equilibrium constant of the reaction $I_2 + I^{-} \rightleftharpoons I_3^{-}$ 3. Determination of concentration of the given potassium iodide solution using the above equilibrium constant.								20

	Electrochemistry 4. Determination of cell constant and molar conductance of strong electrolyte. 5. Determination of dissociation constant of acetic acid Colorimetry 6. Determination of concentration of copper sulphate solution.	
	Total	90
CO	Course Outcomes	
CO1	Determine the molecular weight of organic compounds using thermometric methods such as the Rast method and transition temperature method.	
CO2	Analyze phase equilibria by determining eutectic temperature and composition and upper critical solution temperature, including the effect of impurities.	
CO3	Evaluate reaction kinetics by experimentally determining the rate constant of ester hydrolysis and the order of reaction using the initial rate method.	
CO4	Apply electrochemical methods (conductometric and potentiometric titrations) to estimate acids, bases, and redox systems accurately.	
CO5	Construct and interpret Freundlich adsorption isotherms for adsorption of solutes on activated charcoal	
Reference Books:		
1	Sindhu, P.S. Practicals in Physical Chemistry, Macmillan India: New Delhi, 2005.	
2	Khosla, B.D. Garg, V.C.; Gulati, A. Senior Practical Physical Chemistry, R. Chand : New Delhi, 2011.	
3	Gupta, Renu, Practical Physical Chemistry, 1 Ed.; New Age International: New Delhi, 2017.	

ABILITY ENHANCEMENT COURSE – EMPOWERED VOCATIONAL ENGLISH

IDENTITY ENHANCEMENT COURSE - EMPOWERED VOCATIONAL ENGLISH									
Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UAEC51	2	0	0	V	2	2	50	50	100
Learning Objectives									
LO1	To build self- assurance in students by mastering interpersonal, team- management, and leadership abilities.								
LO2	To equip aspiring learners with skills that transforms them into effective young managers.								
LO3	To sharpen communication proficiency for professional and workplace contexts.								
LO4	To foster strategic thinking and problem- solving through advanced writing & presentation techniques.								
LO5	To develop etiquette and corporate- ready competencies for modern business environments								
Prerequisites:									
Unit	Contents								No. of Hours
I	Communication Skills , Current English Usage , Aptitude and Attitude , Team Building and Leadership , Psychological Tests , Effective Resume Writing								6
II	Précis Writing, Essay Writing, Goal Setting ,Conflict Management, Appearing for an Interview , Myths regarding Group Discussion								6
III	Debates, Presentation for Small and Large Groups , Prioritization ,Time Management ,Stress Interview , Prerequisites of a Group Discussion								6
IV	Marketing and Business Presentations, Report Writing , Cross- Cultural Communication, Lateral Thinking, Qualities of a Candidate for an Interview, Generating Ideas for Discussion								6
V	Telephone Etiquette, Email Etiquette, Concepts of Leadership, Insights from Great Leaders, Mock Interview, Mock Group Discussion								6
TOTAL								30	
CO	Course Outcomes								
CO1	Students will demonstrate strong interpersonal and leadership skills in team settings.								
CO2	Learners will apply effective communication strategies in current English usage.								
CO3	Graduates will craft professional résumés and master interview- ready writing styles.								
CO4	Participants will manage conflicts, set goals, and deliver impactful presentations.								
CO5	Individuals will exhibit polished telephone & email etiquette alongside refined leadership insights								

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	2	2
CO2	2	3	2	2	2	2
CO3	2	3	3	3	2	2
CO4	2	3	2	2	2	2
CO5	3	3	2	2	2	2
Weightage of course contributed to each PSO	12	14	11	11	10	10

Semester-6

Semester–6									
Course Code	Part	Course Category	Course Name	Hours / Week	Examination				Credits
					Duration in hrs.	Max Marks			
						CIA	ESE	Total	
26UCCH61	III	Core– XIV	Organic Chemistry II	5	3	50	50	100	4
26UCCH62	III	Core -XV	Inorganic Chemistry–II	4	3	50	50	100	4
26UCCH63	III	Core -XVI	Physical Chemistry–II	4	3	50	50	100	4
26UCCH6P	III	Core -XVII	Major Project with Viva voce	7	3	50	50	100	5
26UECH61	III	Elective- VI	Forensic Science	4	3	50	50	100	3
26UECH62			Chemistry in medicine						
26UECH63	III	Elective- V	Pesticide Chemistry	4	3	50	50	100	3
26UECH64			Agro Chemistry						
26UAEC61	IV	AEC II	Design Thinking	2	3	50	50	100	2
26UEA61	V	Common	Extension Activity	-		50	50	100	1
Total				30				800	26
Grand Total				180				4800	144

THIRD YEAR – SIXTH SEMESTER
CORE COURSE (CC-14) – ORGANIC CHEMISTRY-II

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCCH61	5	0	0	VI	4	5	50	50	100

Learning Objectives

LO1	Understand the structure, types, isolation methods, and reactions of natural products such as alkaloids and terpenes.
LO2	learn about amino acids and carbohydrates, including their classification, preparation methods, stereochemistry, reactions, and importance in living systems
LO3	Study the mechanisms and uses of important rearrangement reactions in organic chemistry.
LO4	Gain basic knowledge of special reagents and organometallic compounds used in modern organic synthesis for selective chemical reactions.
LO5	Understand the principles and tools of green chemistry, with a focus on environment-friendly chemical processes and pollution control.

Prerequisites:

Unit	Contents	No. of Hours
I	Alkaloids Classification, isolation, general properties-Hofmann Exhaustive Methylation; Structure elucidation –Coniine, piperine, nicotine. Terpenes: Classification, Isoprenerule, isolation and structural elucidation of Citral, alpha terpineol, Menthol, Geraniol and Camphor.	15
II	Amino acids and Carbohydrates Amino acids - classification, general methods of preparation and reactions of amino acids, zwitter ion - isoelectric point, action of heat. Classification-Monosaccharides- constitution of glucose and fructose. Reactions of glucose and fructose – Osazone formation, Mutarotation, cyclic structure, pyranose and furanose forms. Epimerisation- Interconversions of aldoses and ketoses. Disaccharides- sucrose- reactions (elucidation of structure not necessary). Polysaccharides – starch and cellulose (elucidation of structure not necessary).	15
III	Molecular rearrangements Molecular Rearrangement: Type of rearrangements, Mechanism for Benzidine, Favorskii, Claisen, Fries, Hofmann, Curtius, Schmidt and Beckmann, Pinacol-pinacolone rearrangement.	15
IV	Special reagents in organic synthesis AIBN, 9BBN, BINAP/BINOL, BOC, DABCO, DCC, DIBAL, DMAP, NBS/NCS, Organo metallic compounds in Organic Synthesis Preparation, Properties and applications: Grignard Reagents, Organo Lithium Compounds, Ziegler-Natta, Wilkinson, Metal Carbonyl, Zeiss's Salt	15
V	Green Chemistry:	15

	Principles of green chemistry; basic chemistry behind each principle and their applications in chemical synthesis. Green reaction media including green solvents, green reagents, and green catalysts. Tools used in green chemical synthesis such as microwave-assisted and ultrasound-assisted techniques. Role of green chemistry in pollution prevention	
TOTAL		75
CO	Course Outcomes	
CO1	Understand the isolation and properties of alkaloids and terpenes.	
CO2	Explain preparation and reactions of amino acids and mono, disachharides	
CO3	Classify biomolecules and natural products based on their structure ,properties, reactions and uses	
CO4	Explain molecular rearrangements like benzidine, Hoffmann etc	
CO5	Preparation and properties of organo lithium compounds	
Textbooks		
1	M.K.Jain, S.C.Sharma, Modern Organic Chemistry,Vishal 10 th Publishing,4 th reprint,2009.	
2	S.M.Mukherji, and S.P.Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., 3 rd edition,2009	
3	ArunBahl and B.S.Bahl, Advanced organic chemistry, NewDelhi, S.Chand& Company Pvt. Ltd., Multi colour edition, 2012.	
4	.P.L.Soni and H.M.Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, NewDelhi, 29 edition, 2007	
5	C Bandyopadhyay; An Insight into Green Chemistry; Published on 2020	
Reference Books		
1	R.T. Morrison and R.N.Boyd, Organic Chemistry,Pearson Education, Asia, 6 th edition, 2012	
2	T.W. Graham Solomons ,Organic Chemistry, John Wiley & Sons,11 th edition, 2012.	
3	A. CareyFrancis,Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi,7 th edition,2009.	
4	I.L.Finar, Organic Chemistry, Vol.(1&2),England, Wesley LongmanLtd,6edition,2006.	
5	J.A.Joule, and G.F.Smith, Hetero cyclic Chemistry, Wiley,5 th Edition,2010.	

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

CORE COURSE (CC-15)– INORGANIC CHEMISTRY II

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCCH62	5	0	0	VI	4	5	50	50	100
Learning Objectives									
LO1	To understand the role of essential and trace metal ions in biological systems and their toxicological effects.								
LO2	To study the mechanisms of metal ion transport, storage, and biological functions in living organisms.								
LO3	To explain the structure, function, and mechanisms of metalloenzymes and biologically important metal complexes.								
LO4	To introduce the chemistry, classification, structure, and applications of silicates.								
LO5	To impart knowledge on industrial applications of inorganic compounds including refractories, alloys, Paints, corrosion prevention, eco-friendly materials, and nanocomposite hydrogels.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Bio inorganic Chemistry Essential and trace elements: Role of Na ⁺ , K ⁺ , Mg ²⁺ , Ca ²⁺ , Fe ³⁺ , Cu ²⁺ and Zn ²⁺ in biological systems. Effect of excess intake (Toxicity) of Metal ions – trace elements - As, Cd, Pb, Hg								15
II	Metal ion transport and storage Iron – storage, transport - Transferrin and Ferretin; Iron-porphyrins – myoglobin, haemoglobin – oxygen transport - Bohr effect; Sodium/potassium pump, calcium pump; transport and storage-copper and zinc.								15
III	Metallo enzymes Isomerase and synthetases, structure of cyanocobalamin (Vitamin B12), nature of Co-C bond; Metallo enzymes - functions of carboxy peptidase A, zinc metallo enzyme – mechanism and uses, Zn-Cu enzyme – structure and function, carbonic anhydrase, Vitamin B-12 as transferase and isomerase - Iron-sulphur proteins - 2Fe-2S – rubredoxin, 4Fe-2S – ferridoxin, Iron sulphur cluster enzymes.								15
IV	Silicates Introduction – general properties of silicates, structure – types of silicates – =ortho silicates(zircon), pyrosilicates (thortveitite), chain silicates(pyroxenes), ring silicates(beryl), sheet silicates(talc, mica, asbestos), silicates having three dimensional structure (feldspars, zeolites, ultramarines)								15
V	Industrial Applications of Inorganic Compounds Refractories, pyrochemical, explosives. Alloys, Paints and pigments - requirements of a good paint; classification, constituents of paints – pigments, vehicles, thinners, driers, extenders, anti-knocking agents, antiskinning agents, plasticizers, binders-application; varnishes- oils, spirit; enamels. Corrosion and its prevention, Eco-friendly inorganic materials Nanocomposite Hydrogels: synthesis, characterization and uses.								15
TOTAL								75	

CO	Course Outcomes
CO1	Illustrate isomerism, Werner's coordination theory, and the factors affecting the stability of chelate complexes.
CO2	Analyze crystal field theory and describe the magnetic and spectral characteristics of coordination compounds.
CO3	Outline the preparation methods and explain the properties of metal carbonyl compounds.
CO4	Compare and contrast the properties of lanthanoid and actinoid series elements.
CO5	Describe the properties and practical applications of inorganic polymers of silicon, sulphur, boron, and phosphorus

Textbooks

1	Puri . B. R, Sharma. L. R, Kalia. K. C. (2011), Principles of Inorganic Chemistry, 31th Edition, Milestone Publishers & Distributors, Delhi.
2	Satya Prakash, Tuli. G.D., Basu.S.K., Madan. R. D. (2009), Advanced Inorganic Chemistry, 18 th Edition, S. Chand & Co., New Delhi
3	Lee. J. D,(1991), Concise Inorganic Chemistry, 4th Edition, ELBS William Heinemann, London.
4	W. V. Malik, G. D. Tuli, R. D. Madan, (2000), Selected Topics in Inorganic Chemistry, S.Chand and Company Ltd.
5	A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992.

Reference Books

1.	Madan R. D, Sathya Prakash,(2003), Modern Inorganic Chemistry, 2 nd ed ., S.Chand and Company, New Delhi.
2.	Gopalan. R, (2009) Inorganic Chemistry for Undergraduates, 1 st Edition, University Press (India) Private Limited, Hyderabad
3	Sivasankar. B, (2013) InorganicChemistry. 1 st Edition, Pearson, Chennai.
4	Alan . G. Sharp. 1992), Inorganic Chemistry, 3 rd Edition, Addition - Wesley, England.
5	Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

CORE COURSE (CC-15)– PHYSICAL CHEMISTRY II

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UCCH63	5	0	0	VI	4	5	50	50	100
Learning Objectives									
LO1	Phase diagram of one and two component systems								
LO2	Chemical equilibrium,								
LO3	Separation techniques for binary liquid mixtures.								
LO4	Electrical conductance and transport number.								
LO5	Galvanic cells, EMF and significance of electrochemical series..								
Prerequisites:									
Unit	Contents								No. of Hours
I	Phaserule Definition of terms; derivation of phase rule; application to onecomponent systems–water and sulphur- super cooling, sublimation; two componentsystems–solidliquidequilibria–simpleeutectic(lead-silverand bismuth - cadmium), freezing mixtures (potassium iodide- water),compound formation with- congruent melting points(magnesium–zincandferricchloride–watersystem),peritecticchange(sodium–potassium).Solid solution(gold-silver);copper sulphate–watersystem .								15
II	Chemicalequilibrium Law of mass action–thermodynamic derivation–relationship between K _p and K _c –application to the homogeneous equilibria – dissociation of PCl ₅ gas, N ₂ O ₄ gas –equilibrium constant and degree of dissociation - formation of HI, NH ₃ ,– decomposition of solid calcium carbonate–Lechatelier principle – van’tHoff reaction isotherm– temperature dependence of equilibrium constant – van’t Hoff reaction isochore – Clayperon equation – Clausius Clayperon equation and its applications.								15
III	Binaryliquid mixtures Ideal liquid mixtures–non ideal solutions–azeotropic mixtures–Fractionaldistillation–partiallymisciblemixtures–phenol-water,–Triethylamine-water,–effectofimpuritiesoncriticalsolution temperature; immiscible liquids–steam distillation; Nernst Distributionlaw–applications.								15
IV	ElectricalConductanceandTransference Arrhenius theory of electrolytic dissociation – Ostwald’s dilution law, limitations of Arrhenius theory; behavior of strong electrolytes – interionic effects – Debye Huckel theory –Onsager equation (no derivation), significance of Onsager equation, Debye Falkenhagen effect, Wien effect. Kohlrausch’s law- applications; molar ionic conductance and viscosity (Walden’s rule); applications of conductancemeasurements–determinationof-degreeof dissociation of weak electrolyte, dissociation constant of weak acid and weak base, ionicproduct of water, solubility and solubility product of sparingly soluble salts–conductometric titrations–acid base titrations.								15
V	Galvanic Cells and Applications Galvanic cell, representation, reversible and irreversible cells, EMF and its								15

	measurement – standard cell; relationship between electrical energy and chemical energy; sign of EMF and spontaneity of are action, Thermodynamics and EMF–calculation of ΔG , ΔH , and ΔS from EMF data; reversible electrodes, electrode potential, standard electrode potential, primary and secondary reference electrodes, Nernst equation for electrode potential and cell EMF; types of electrodes–metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode, redox electrode; electrochemical series – applications of electro chemical series.	
TOTAL		75
CO	Course Outcomes	
CO1	Construct the phase diagram for one component and two component systems, explain the properties of freezing mixture, component with congruent melting points and solid solutions.	
CO2	Apply the concepts of chemical equilibrium in dissociation of PCl_5 , N_2O_4 and formation of HI , NH_3 , SO_3 and decomposition of calcium carbonate. Demonstrate important principles such as Le chatelier principle, van't Hoff reaction isotherm and Clausius-Clayperon equation.	
CO3	Identify an appropriate distillation method for these parathion of binary liquid mixtures such as azeotropic mixtures, partially miscible mixtures and immiscible liquids.	
CO4	Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equation and Kohlrausch's law in conductance	
CO5	Construct electrochemical cell with the help of electrochemical series and calculate cell EMF. Demonstrate the applications of EMF and significance of potentiometric titrations	
Textbooks		
1	B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., forty eighth editions, 2021.	
2	Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.	
3	ArunBahl,B.S.Bahl,G.D.Tuli Essentials of The physicalchemistry, 28edition 2019, S,Chand&Co.	
4	S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New AgeInternational,fourthedition,1996.	
5	J.RajaramandJ.C.Kuriacose,Thermodynamics, Shoban Lal Nagin Chandand CO., 1986	
Reference Books		
1.	K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition,2009.	
2.	Gilbert.W.Castellen, Physical Chemistry, Narosa Publishing House, third edition, 1985	
3	P.W.Atkins, and JuliodePaula, Physical Chemistry, Oxford University press, seventh edition, 2002.	
4	B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition,2001	
5	D.N. Bajpai, Advanced Physical Chemistry, S.Chand&Co., 2001..	

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course of PSO	15	12	5	11	10	15

SKILL ENHANCEMENT COURSE (SEC-5) – FORENSIC SCIENCE

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26USCH42	2	0	0	IV	2	2	50	50	100
Learning Objectives									
LO1	Crime detection through analytical instruments								
LO2	Forgery and its detection medical aspects involved								
LO3	Master Crime Scene Documentation and Evidence Collection								
LO4	Analyze Biological and Trace Evidence								
LO5	Evaluate Physical and Pattern Evidence								
Prerequisites:									
Unit	Contents								No. of Hours
I	Poisons Poisons - types and classification - diagnosis of poisons in the living and the dead-clinical symptoms-postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of sea foods-use of neutron activation analysis in detecting arsenic in human hair. Treatment in cases of poisoning–use of antidotes for common poisons Principles of toxico kinetics and toxico dynamics of poisons.								6
II	Crime Detection Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human bombs-possible explosives (gelatin sticks and RDX)-metal detector devices and other security measures for VVIP-composition of bullets and detecting powder burns								6
III	Forgery and Counter feiting 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 counter feit coins–detection of gold purity in 22 carat ornaments–detecting gold plated jewels-authenticity of diamond.								6
IV	Tracks and Traces Tracks and traces–small tracks and police dogs –footprints–costing of footprints residue prints, walking pattern or tyre marks–tool marks-paints-fibers-Analysis of biological substances - blood, semen, saliva, urine and hair - Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and racehorses.								6
V	Medical Aspects Aids – causes and prevention-misuse of scheduled drugs-burns and their treatment by plastic surgery. Metabolite analysis using mass spectrum-Gas chromatography-Arson -natural fires and arson - burning characteristics and chemistry of combustible materials -nature of combustion. Ballistics- classification - internal and terminal ballistics - small arms - laboratory examination of barrel washing and detection of powder residue by chemical tests. Forensic toxicology of drugs of abuse (narcotics, stimulants and sedatives).								6
	Total								30
CO	Course Outcomes								
CO1	Learn about the Poisons-types and classification of poisons in the living and the dead organisms and also get information about Postmortem.								
CO2	Get awareness on Human bombs, possible explosives (gelatin sticks and RDX) and metal defector devices								

	and other security measures for VVIP – composition of bullets and detecting powder burns
CO3	Detect the forgery documents, different types of forged signatures
CO4	Have an idea about how to tracks and trace using police dogs, foot prints identification and gain the knowledge in analyzing biological substances - blood, semen, saliva, urine and hair-DNA Finger printing for tissue identification in dismembered bodies
CO5	Get the awareness on Aids-causes and prevention and also have an exposure on handling fire explodes.
Text Books:	
1	Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed., The English Language Book Society of Longman.
2	R. Gopalan, P.S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007
3	Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint (2017).
4	R. Speyer, Thermal Analysis of Materials, CRC Press, 1993.
5	R.A. Day and A.L. Underwood, Quantitative Analysis, 6 th ed., Prentice Hall of India Private Ltd., New Delhi, 1993
Reference Books:	
1	D. A. Skoog, D. M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5th edn., Saunders college publishing, Philadelphia, 1998.
2	Dash U.N, Analytical Chemistry; Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 2011.
3	Christian, Gary D; Analytical Chemistry, 6 th Ed., John Wiley & Sons, New York, 2004.
4	Mikes, O. & Chalmers, R.A. Laboratory Handbook of Chromatographic & Allied Methods, Elsevier Harwood Ltd. London
5	G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel's Text book of Quantitative Chemical Analysis, sixth edition Pearson Education, 2000

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

ELECTIVE COURSE (6) – CHEMISTRY IN MEDICINE

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UECA61	5	0	0	VI	3	5	50	50	100
Learning Objectives									
LO1	To have knowledge of first aid and the important rules.								
LO2	To know the common chemicals in medicine.								
LO3	To have awareness of common diseases.								
LO4	To learn the diagnostic tests.								
LO5	To know about the composition of blood								
Prerequisites:									
Unit	Contents								No. of Hours
I	FIRSTAID First Aid for accidents-important rules-firstaid kit,Firstaid for cuts,bruises, bleeding, fractures, burns, fainting and poisonous bites.Common poisons Acid poisoning-antidote, Alkali poisoning-antidote, Poisoning by disinfectant-symptoms antidote, Alkaloid poisoning- symptoms-antidote,alcoholpoisoning-symptoms-antidote,Mercury poisoning-antidote and Salicylate poisoning-antidote.								15
II	CHEMICALS IN MEDICINE (Preparations and chemical equations not required) Alum - properties and uses-Aluminium hydroxide gel -uses-Dried Aluminium hydroxide gel - uses-Aluminium acetate-uses-Ferrous fumarate uses Ferric ammonium citrate uses. Ferrous gluconate uses, Ferrous sulphate. Biological importance of sodium, potassium, calcium, Iodine and copper.								15
III	CAUSES AND TREATMENT OF SOME COMMON DISEASES Insect borne diseases-malaria and filariasis-Prevention and treatment. Air borne diseases - diphtheria, whooping cough, influenza, measles, mumps, common cold, tuberculosis and leprosy - Prevention and treatment. Water borne diseases - cholera, typhoid and diarrhoeal diseases Prevention and treatment. Respiratory disorder - Prevention and treatment of asthma.Nervous disorder-epilepsy-Prevention and treatment-other diseases- Peptic ulcer - treatment.								15
IV	BLOOD ANALYSIS Blood – composition, grouping, Rh factor, physiological function of plasma protein, role of blood as oxygen carrier, blood pressure – hypertension and hypotension, coagulation – mechanism, coagulants and anti-coagulants with examples, anemia – causes and control. Urea determination – the urease method, estimation of bile pigment in serum, estimation of total protein in								15

	serum, estimation of total proteins and albumin based on biuret method and BCG method, dialysis.	
V	FORMULATION OF DRUG : Need for conversion of drugs into medicine - additives and their role- classification of formulations-route wise and form wise: tablets, capsules, syrups, suspensions, powders, ointment, creams, gels, lotions, sprays suppositories, injections.	15
TOTAL		75
CO	Course Outcomes	
CO1	Explain the first aid for accident and common poison.	
CO2	Explain the chemicals in medicine.	
CO3	Apply the knowledge for causes and treatment of common diseases.	
CO4	Explain the various clinical test	
CO5	Explain the formulation of drugs.	
Textbooks		
1	Gopalan, R.; Subramaniam, P. S.; Rengarajan, K. Elements of Analytical Chemistry; S Chand: New Delhi, 2003.	
2	Usharani, S. Analytical Chemistry, 1st ed.; Macmillan: India, 2002.	
3	Banwell, C.N.; McCash, E. M. Fundamentals of Molecular Spectroscopy, 4th ed.; Tata McGraw Hill, New Delhi, 2017.	
4	U.N. Dash, Analytical Chemistry Theory and Practice, Sultan Chand & Sons, 2nd ed., 2005	
5	B.K. Sharma, Spectroscopy, 22nd ed., Goel Publishing House, 2011.	
Reference Books		
1.	Srivastava, A.K.; Jain, P.C. Chemical Analysis an Instrumental Approach, 3rd ed.; S. Chand, New Delhi, 1997..	
2	Robert D Braun. Introduction to Instrumental Analysis; Mc.Graw Hill: New York, 1987.	
3	Skoog, D. A.; Crouch, S. R.; Holler, F.J.; West, D. M. Fundamentals of Analytical Chemistry, 9th ed.; Har court college Publishers: USA, 2013.	
4	Madan, R.L.; Tuli, G.D. Physical Chemistry, 2nd ed.; S. Chand: New Delhi, 2005.	
5	Puri, B.R.; Sharma, L.R.; Pathania, M.S. Principles of Physical Chemistry, 43rd ed.; Vishal Publishing: Delhi, 2008.	

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

SKILL ENHANCEMENT COURSE (SEC-7) – PESTICIDE CHEMISTRY

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UNCH31	2	0	0	III	2	2	50	50	100
Learning Objectives									
LO1	Knowledge about the various types of pesticides and their toxicity.								
LO2	To understand the accumulation of pesticides in the form of residues and its analysis.								
LO3	Knowledge on choice of alternate and eco-friendly pesticides.								
LO4	Classify Pesticides Based on Chemical Structure and Target								
LO5	Evaluate Environmental Fate and Persistence								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction: History of pesticides. Chemistry of Pesticides: Brief introduction to classes of pesticides (Chemical class, targets), structures, chemical names, physical and chemical properties. Toxicity of pesticides: Acute and chronic toxicity in mammals, birds, aquatic species etc. Methods of analysis of pesticides.								06
II	Insecticides: Classification and study of following insecticides with respect to structure, chemical name, physical properties, chemical properties, synthesis, degradation, metabolism, formulations, Mode of action, uses, toxicity. Organo phosphates and Phosphothionates: Acephate, Chlorpyrifos, Monocrotophos, and parathion-methyl. Organochlorine – Endosulfan, heptachlor; Carbamate: Cartop hydrochloride, Methomyl, Propoxur.								06
III	Pesticides residues: Introduction- application of agrochemicals, 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.								06
IV	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,								06

	water and vegetables/fruits) simple methods and schemes of analysis, multi-residue analysis.	
V	Biopesticides: Pheromones, attractants, repellents–Introduction, types and application 8-Dodecen-1-ol, 10-cis-12-hexadecadienoic, methyl eugenol, N, N- Diethyl-m-toluamide, Dimethyl phthalate, Icaridin. Baits- Metaldehyde, Iron (II) phosphate, Indoxacarb, Zinc Phosphide, Bromadiolone.	06
	Total	30
CO	Course Outcomes	
CO1	Teach about the pesticides and their toxicity with respect to structure and category.	
CO2	Explain the preparation and property of pesticides	
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	
Text Books:		
1	Handa. S.K, Principles of pesticide chemistry. Agro bios (India); 2012.	
2	Matolcsy. G, Nádasz. M, Andriska. V, Pesticide chemistry. Elsevier; 1989.	
3	J. Miyamoto and P. C. Kearney, Pesticide Chemistry, Human Welfare and the Environment vol. IV Pesticide Residue and Formulation Chemistry, Pergamon press,1985.	
Reference Books:		
1	Roy N.K., Chemistry of Pesticides. CBS Publisher & Distributors Pvt Ltd; 1st Ed. (2010).	
2	Nollet. L.M., Rathore. H.S., Hand book of pesticides: methods of pesticide residues analysis. CRC press; 2016.	
3	Ellerbrock. R.H., Pesticide Residues: Significance, Management and Analysis, 2005	

CO/PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of CourseContributionto PO's	3.0	3.0	3.0	3.0	3.0

ELECTIVE COURSE (8) – AGROCHEMISTRY

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UECH62	5	0	0	VI	3	5	50	50	100
Learning Objectives									
LO1	To learn about fertilizers and pesticides								
LO2	To study the origin, characterization and testing of soil								
LO3	To Understand the chemical makeup of soil, including minerals, organic matter, air, and water.								
LO4	To Identify the chemical signals and physical symptoms that occur when a plant lacks specific nutrients.								
LO5	Evaluate the impact of these chemicals on "non-target" species and the overall ecosystem.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Fertilizers Classification, macronutrients -role of nitrogen, potassium and phosphorus on plant growth -manufacture of urea, muriate potash and triple superphosphate. Complex fertilizers, mixed fertilizers & biofertilizers- their composition. Micronutrients - their role in plants. Manures: Bulky organic manures - Farm yard manure - oil cakes - bloodmeal - fish manures - Composting process - handling and storage Deficiency symptoms of micronutrients Aerobic and anaerobic composting methods.								15
II	Pesticides Definition - Classification of Pesticides based on the use and chemical composition - examples -general methods of application - Benefits of pesticides - Potential hazards. Safety measures -first aid Insecticides: Plant products - Nicotine, pyrethin- Inorganic pesticides - borates. Seed treatment as a pesticide application method Organic pesticide - D.D.T. and BHC. Fungicide: Sulphur compounds, Copper compounds, Bordeaux mixture. Herbicides: Acaricides - Rodenticides. Attractants - Repellants.								15
III	Soil Origin of soil - definition of soil - rock system - weathering of rocks and minerals-main components of soil - organic, inorganic constituents - soil formation - factors favouring soil formation.								15
IV	Characteristics of soil Physical aspects - soil texture - pore space - bulk density, particle density - soil colour- surface area - soil colloids - plasticity, shrinkage - flocculation and deflocculation, soil air, soil temperature and their importance in plant growth. Acid, alkaline and saline soils - diagnosis -Methods of reclamation and after care. Soil structure and its influence on crops After-care practices following soil reclamation.								15
V	Soil testing Concept and objectives - soil sampling, tools, collection, processing, and dispatch of soil sample. Estimation of total organic compound, available nitrogen and phosphorus in the soil sample. Determination of pH, EC, moisture content, bulk density and particle density of the soil sample Soil test-based fertilizer recommendations								15
TOTAL								75	

CO	Course Outcomes
CO1	Explain classification of fertilizers
CO2	Explain the classification of pesticides and insecticides.
CO3	Determine the factors favouring soil formation
CO4	Explain the characteristic of soil
CO5	Explain the methods of testing of soil
Textbooks	
1	A textbook of Soil Science-Daji.A,AsiaPublishingHouse,Madras 1970.
2	Textbook of soil Chemical Analysis-Hesse, P.R.AJohnMurray Newyork,1971
Reference Books	
1.	Textbook of SoilScience-Biswas,T.DandMukherjee,S.K.Second edition, Tata McGraw-Hill Education
2.	Chemistry for Agriculture and Ecology-Y.MidoM.Satake,Discovery Publishing
3	Soil Fertility &Fertilizers - Samuel L. Tisdale, Werner L. Nelson, James D.Beaton, John L. Havlin. Fifth edition, Macmillan
4	Nature and properties of soils-Harry, OBuckman NYleC.Brandy, Macmillan
5	Insecticides, Pesticides and Agro based Industries - R.C.Paliwal, K.Goel, R.K.Gupta, Small Business Publication

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	2	2	3
CO2	3	3	1	2	2	3
CO3	3	3	1	3	2	3
CO4	3	2	1	2	2	3
CO5	3	2	1	2	2	3
Weightage of course contributed to each PSO	15	12	5	11	10	15

ABILITY ENHANCEMENT COURSE – DESIGN THINKING

Subject Code	L	T	P	S	Credits	Inst. Hours	Marks		
							CIA	External	Total
26UAEC61	2	0	0	VI	2	2	50	50	100
Learning Objectives									
LO1	To recall and describe the key concepts, stages, and principles of Design Thinking.								
LO2	To explain the importance of empathy, ideation, and prototyping in solving user-entered problems.								
LO3	To apply Design Thinking methods such as brainstorming, empathy mapping, and SCAMPER to real-world problems.								
LO4	To analyze user needs and problem statements using observation and structured frameworks.								
LO5	To design innovative solutions and develop prototypes based on insights gained through the Design Thinking process.								
Prerequisites:									
Unit	Contents								No. of Hours
I	Introduction to Design Thinking Introduction to Design Thinking, Essential Design Thinking Skills, Core Principles of Design Thinking, Foundations of Design Thinking, Building an Effective Design Thinking Team, Discussion of Problems from IT sector.								6
II	Design Thinking Phases Stages of Design Thinking, Role of observation in understanding product and process challenges, Preparation of AEIOU and other canvases with defined problem statement, Exploring Design Thinking innovations, Understanding the Role of Design Thinking in Product and Process Innovation, Double Diamond model and its applications.								6
III	Design Thinking Techniques Understanding, listening and Empathizing Techniques, Exploring observation methods, Utilizing a structured, open-ended approach for effective communication, Ideation Labs, Brainstorming techniques for idea generation, Applying innovation to foster creativity, Application of SCAMPER technique to support Problem Statement								6
IV	Prototyping Methods Methods and Tools for Design Thinking Practice; Empathize: Ask five why questions, Empathy map, storytelling, critical items diagram, mind map, journey map; Ideate: Brainstorming, 2x2 matrix, Need-Approach-								6

	Benefit-Competition (NABC) Methods; Prototype: Exploration map, Minimum Viable Product (MVP), Feasibility Testing, Viability Testing, A/B Testing, Sustainability Verification, Collect Feedback, Iterate and Improve, PDC canvas versioning	
V	Case Studies Quick-Commerce Applications – Food and Grocery Delivery (eg.Swiggy, Instamart), Uber, OLA, Rapido, E-Commerce Applications – Online Shopping (eg. Amazon), Online Publishing (eg. Canva), Online Ticket Booking (eg.BookMyShow), Fintech apps (eg. Google Pay, Razorpay etc.)	6
TOTAL		30
CO	Course Outcomes	
CO1	Understand the fundamental principles and importance of Design Thinking in fostering innovation, ethics and its relevance.	
CO2	Apply systematic problem identification, problem framing, articulation, and problem-solving approaches in the context of Design Thinking	
CO3	Analyze and evaluate different tools and methodologies used in Design Thinking, such as observation, ethnographic research and mind mapping to gain insights into users’ needs	
CO4	Develop and refine product concepts by preparing product development canvases (PDC) that consider product experience, functions, features, and sustainable development of the components	
CO5	Create a final working prototype for projects with limitations, documenting the functionality and features, viability, sustainability, scalability, cost and resource utilization for the product	
Open-source software and websites		
➤	Google Workspace: Docs, Sheets and Slides	
➤	Google Jamboard	
➤	Mind-mapping tools: Wisemapping, Freeplane, Semantik	
Reference Books		
➤	Soni, Pavan. Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving. Penguin Random House India Private Limited, 2020	
➤	Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins e-books (2009)	
➤	Liedtka, Jeanne, Randy Salzman, and Daisy Azer. Design thinking for the greater good: Innovation in the social sector. Columbia University Press, 2019	

Suggested MOOC Courses

➤	B. K. Chakravarthy, Design Technology and Innovation, SWAYAM NPTEL (Online)
➤	B. K. Chakravarthy, Innovation by Design, SWAYAM NPTEL (Online)
➤	Nina Sabnani, Understanding Design, SWAYAM NPTEL (Online)
Note: Activities are to be performed in a team size of 3-4 students. Report is to be prepared based on these activities	
➤	Brainstorm and explore various problems in IT field. Select an appropriate problem, draft a Problem Statement and get it approved for performing further activities.
➤	Design AEIOU canvas
➤	Design Empathy map

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	2	2	3
CO2	3	2	2	2	3	2
CO3	3	3	3	3	2	2
CO4	3	2	2	2	2	3
CO5	3	3	2	2	3	2
Weightage of course contributed to each PSO	15	12	11	11	12	12