ANNAMALAI UNIVERSITY

(Affiliated Colleges)

204 - B.Sc. Chemistry

Programme Structure and Scheme of Examination (under CBCS)

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

Part	Course Code	Study Components & Course Title	Credit	Hours/ week	Maximum Marks		
					CIA	ESE	Total
		SEMESTER – I					
I	23UTAML11/ 23UHINL11/ 23UFREL11	Language – I: பொதுதமிழ் – I: **தமிழிலக்கிய வரலாறு**-1/ Hindi – I/ French – I	3	6	25	75	100
II	23UENGL12	General English – I	3	6	25	75	100
III	23UCHEC13	Core – I: General Chemistry-I	5	5	25	75	100
	23UCHEP14	Core –II : Practical - I Quantitative Inorganic Estimation (Titrimetry) and Inorganic Preparations	5	4	25	75	100
	23UMATE15 23UBOTE15 23UZOOE15 23UBIOE15	Elective - I Mathematics-1 (or) Botany – I (or) Zoology – I (or) Biochemistry – I	3/2	5/3	25	75	100
	23UBOTEP1 23UZOOEP1 23UBIOEP1	Botany Practical – I (or) Zoology Practical – I (or) Biochemistry Practical–I	1	2	25	75	100
IV	23UTAMB16 23UTAMA16	Skill Enhancement Course – 1* NME-I/ Basic Tamil – I / Advanced Tamil - I	2	2	25	75	100
	23UCHEF17	Foundation Course : Introductory Chemistry	2	2	25	75	100
		Total	**23**	**30**			**700/800**
		SEMESTER – II					
I	23UTAML21/ 23UHINL21/ 23UFREL21	Language – II: பொது தமிழ் -II: **தமிழிலக்கிய வரலாறு**-2/ Hindi – II/ French –II	3	6	25	75	100
II	23UENGL22	General English – II	3	6	25	75	100
III	23UCHEC23	Core – III: General Chemistry-II	5	5	25	75	100
	23UCHEP24	Core –IV: Practical– II Qualitative Organic Analysis and Preparation of Organic Compounds	5	4	25	75	100
	23UMATE25	Elective - II Mathematics-II /	3	5	25	75	100
	23UBOTE25	Botany-II /	2	3	25	75	100
	23UZOOE25	Zoology-II /	2	3	25	75	100
	23UBIOE25	Biochemistry -II	2	3	25	75	100

III	23UBOTEP2	Botany Practical – II /	1	2	25	75	100
	23UZOOEP2	Zoology Practical – II/	1	2	25	75	100
	23UBIOEP2	Biochemistry Practical –II	1	2	25	75	100
IV	23UTAMB26 23UTAMA26	Skill Enhancement Course – 2* NME-II/ Basic Tamil – II / Advanced Tamil - II	2	2	25	75	100
	23USECG27	Skill Enhancement Course – 3: Internet and its Applications (Common Paper)	2	2	25	75	100
	23UNMSD01	Language Proficiency for employability: Overview of English Communication**	2	-	25	75	100
		Total	**25**	**30**			**700/800**
SEMESTER – III							
I	23UTAML31/ 23UHINL31/ 23UFREL31	Language – III: **பொது தமிழ்** -III: **தமிழக வரலாறும், பண்பாடும்/** Hindi-III/ French-III	3	6	25	75	100
	23UENGL32	English Course – III :	3	6	25	75	100
	23UCHEC33	Core Course – V :General Chemistry-III	5	5	25	75	100
	23UCHEP34	Core Course-VI-Core Practical – III- Inorganic Qualitative Analysis	5	4	25	75	100
III	23UPHYE35	Elective-III: Physics-I	2	3	25	75	100
	23UPHYEP3	Physics Practical-I	1	2	25	75	100
IV	23UCHES36.	Skill Enhancement Course SEC-4: Entrepreneurial Skills in Chemistry	1	1	25	75	100
	23UCHES37	Skill Enhancement Course-SEC-5: Pesticide Chemistry	2	2	25	75	100
		Environmental Studies	-	1	-	-	-
		Total	**22**	30			**800**
SEMESTER – IV							
I	23UTAML41/ 23UHINL41/ 23UFREL41	Language – IV: பொது தமிழ் -IV: தமிழும் அறிவியலும்/ Hindi-IV/ French-IV	3	6	25	75	100
	23UENGL42	English Course – IV	3	6	25	75	100
III	23UCHEC43	Core Course – VII : General Chemistry-IV	5	4	25	75	100
	23UCHEP44	Core Course-VIII-Core Practical – IV : Physical Chemistry Practical	5	4	25	75	100
IV	23UPHYE45	Elective-IV: Physics-II	2	3	25	75	100
	23UPHYEP4	Physics Practical-II	1	2	25	75	100
	23UCHES46	Skill Enhancement Course-SEC-6: Instrumental Methods of Chemical analysis	2	2	25	75	100
		Skill Enhancement Course-SEC-7:	2	**2**	25	75	100

	23UCHES47	Forensic Science					
	23UEVSG48	Environmental Studies	2	1	25	75	100
		Total	**25**	30			**900**
		SEMESTER – V					
III	23UCHEC51	Core Course – IX: organic Chemistry-I	4	5	25	75	100
	23UCHEC52	Core Course – X :Inorganic Chemistry-I	4	5	25	75	100
	23UCHEC53	Core Course – XI: Physical Chemistry-I	4	5	25	75	100
	23UCHED54	Core course-XII-Project with viva voce	4	5	25	75	100
	23UCHEE55-1 23UCHEE55-2 23UCHEE55-3	Elective-V: Bio Chemistry/ Green Chemistry/ Agriculture Chemistry	3	4	25	75	100
	23UCHEE56-1 23UCHEE56-2 23UCHEE56-3	Elective –VI: Industrial Chemistry/ C Language and Chemistry/ Applied Chemistry	3	4	25	75	100
IV	23UVALG57	Value Education	2	2	25	75	100
	23UCHEI58	Summer Internship^{++}	2	-	25	75	100
		Total	**26**	30			**800**
		SEMESTER VI					
III	23UCHEC61	Core Course –XIII: Organic Chemistry-II	4	6	25	75	100
	23UCHEC62	Core Course – XIV Inorganic Chemistry-II	4	6	25	75	100
	23UCHEC63	Core Course – XV: Physical Chemistry-II	4	6	25	75	100
	23UCHEE64-1/ 23UCHEE64-2/ 23UCHEE64-3	Elective Course VII – Fundamentals Of Spectroscopy/ Organic Synthesis / Health Chemistry	3	5	25	75	100
	23UCHEE65-1/ 23UCHEE65-2/ 23UCHEE65-3	Elective Course VIII-Nano Science/ Polymer Science/ Pharmaceutical Chemistry	3	5	25	75	100
IV	23UCHEF66	Professional Competency Skill: Cheminformatics	2	2	25	75	100
V	23UCHEX67	Extension Activity	1	-	100		100
		Total	**21**	**30**			**700**
		Grand total	**142**				**4600/4800**

Non-major (NME) Electives offered to other Departments

IV	23UCHEN16	Role of Chemistry in Daily Life	2	2	25	75	100
	23UCHEN26	Dairy Chemistry	2	2	25	75	100

* PART-IV: NME / Basic Tamil / Advanced Tamil (Any one)
Students who have not studied Tamil upto12th Standard and have taken any Language other than Tamil in Part-I, must choose Basic Tamil-I in First Semester & Basic Tamil-II in Second Semester.
Students who have studied Tamil upto10th& 12th Standard and have taken any Language other than Tamil in Part-I, must choose Advanced Tamil-I in First Semester and Advanced Tamil-II in Second Semester.

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

$^{++}$Students should complete two weeks of internship before the commencement of V semester.

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

First Year – Semester-I

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

Semester-II

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

Second Year – Semester-III

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

Semester-IV

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

Third Year

Semester-V

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

Semester-VI

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

Consolidated Semester wise and Component wise Credit distribution

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

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

CREDIT DISTRIBUTION FOR U.G. PROGRAMME

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

Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks

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

Programme Outcomes:	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. **PO3: Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. **PO4: Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society. **PO10 Information/digital literacy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.

	PO 12 Multicultural competence: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability toembrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstratingthe ability to identify ethical issues related to one"s work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.
Programme Specific Outcomes:	On successful completion of Bachelor of Physics with Computer Applications programme, the student should be able to: **PSO1: Disciplinary Knowledge:** Understand the fundamental principles, concepts, and theories related to physics and computer science. Also, exhibit proficiency in performing experiments in the laboratory. **PSO2: Critical Thinking:** Analyse complex problems, evaluate information, synthesize information, apply theoretical concepts to practical situations, identify assumptions and biases, make informed decisions and communicate effectively **PSO3: Problem Solving:** Employ theoretical concepts and critical reasoning ability with physical, mathematical and technical skills to solve problems, acquire data, analyze their physical significance and explore new design possibilities. **PSO4: Analytical & Scientific Reasoning:** Apply scientific methods, collect and analyse data, test hypotheses, evaluate evidence, apply statistical techniques and use computational models. **PSO5: Research related skills:** Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects. **PSO6: Self-directed & Lifelong Learning:** Set learning goals, manage their own learning, reflect on their learning, adapt to new contexts, seek out new knowledge, collaborate with others and to continuously improve their skills and knowledge, through ongoing learning and professional development, and contribute to the growth and development of their field.

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

SEMESTER: I **PART: III** **Core – I**	**23UCHEC13** **GENERAL CHEMISTRY-I**	**Credit: 5** **H/W: 5**

Objectives of the course	The course aims at giving an overall view of the • various atomic models and atomic structure • wave particle duality of matter • periodic table, periodicity in properties and its application in explaining the chemical behaviour • nature of chemical bonding, and • fundamental concepts of organic chemistry
Course Outline	UNIT I Atomic structure and Periodic trends History of atom (J.J.Thomson, Rutherford); Moseley's Experiment and Atomic number, Atomic Spectra; Black-Body Radiation and Planck's quantum theory Bohr's model of atom;The Franck-Hertz Experiment; Interpretation of Hspectrum; Photoelectric effect, Compton effect; Dual nature of Matter- DeBroglie wavelength-Davisson and Germer experiment Heisenberg's Uncertainty Principle; Electronic Configuration of Atoms and ions- Hund's rule, Pauli'exclusion principle and Aufbau principle; Numerical problems involving the core concepts.

	Unit II Introduction to Quantum mechanics Classical mechanics, Wave mechanical model of atom, distinction between a Bohr orbit and orbital; Postulates of quantum mechanics; probability interpretation of wavefunctions, Formulation of Schrodinger wave equation - Probability and electron density-visualizing the orbitals -Probability density and significance of Ψ and Ψ^2. Modern Periodic Table Cause of periodicity; Features of the periodic table; classification of elements Periodic trends for atomic size- Atomic radii, Ionic, crystal and Covalent radii; ionization energy, electron affinity, electronegativity-electronegativity scales, applications of electronegativity. Problems involving the core concepts

	UNIT-III: Structure and bonding - I Ionic bond Lewis dot structure of ionic compounds; properties of ionic compounds; Energy involved in ionic compounds; Born Haber cycle – lattice energies, Madelung constant; relative effect of lattice energy and solvation energy; Ion polarisation – polarising power and polarizability; Fajans' rules - effects of polarisation on properties of compounds; problems involving the core concepts. Covalent bond Shapes of orbitals, overlap of orbitals – σ and Π bonds; directed valency hybridization; VSEPR theory - shapes of molecules of the type AB_2, AB_3, AB_4, AB_5, AB_6 and AB_7 Partial ionic character of covalent bond-dipole moment, application to molecules of the type A_2, AB, AB_2, AB_3, AB_4; percentage ionic character-numerical problems based on calculation of percentage ionic character.

	UNIT-IV: Structure and bonding - II VB theory – application to hydrogen molecule; concept of resonance - resonance structures of some inorganic species – CO_2, NO_2, CO_3^{2-}, NO_3^- ; limitations of VBT; MO theory - bonding, antibonding and nonbonding orbitals, bond order; MO diagrams of H_2, C_2, O_2, O_2^+, O^{2-}, $O_2^{2-}N_2$, NO, HF, CO; magnetic characteristics, comparison of VB and MO theories. Coordinate bond: Definition, Formation of BF_3, NH_3, NH_4^+, H_3O^+ properties Metallic bond-electron sea model, VB model; Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor – types, applications of semiconductors Weak Chemical Forces - Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces; Hydrogen bonding – Types, special properties of water, ice, stability of DNA; Effects of chemical force, melting and boiling points.
	UNIT-V: Basic concepts in Organic Chemistry and Electronic effects Types of bond cleavage – heterolytic and homolytic; arrow pushing in organic reactions; reagents and substrates; types of reagents - electrophiles, nucleophiles, free radicals; reaction intermediates – carbanions, carbocations, carbenes, arynes and nitrynes. Inductive effect - reactivity of alkyl halides, acidity of halo acids, basicity of amines; inductomeric and electromeric effects. Resonance – resonance energy, conditions for resonance - acidity of phenols, basicity of aromatic amines, stability of carbonium ions, carbanions and free

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

Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC and others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Madan, R. D. and Sathya Prakash, Modern Inorganic Chemistry, 2nd ed.; S. Chand and Company: New Delhi, 2003. 2. Rao, C.N. R. University General Chemistry, Macmillan Publication: New Delhi, 2000. 3. Puri, B. R. and Sharma, L. R. Principles of Physical Chemistry, 38th ed.;Vishal Publishing Company: Jalandhar, 2002. 4. Bruce, P. Y. and PrasadK. J. R. Essential Organic Chemistry, Pearson Education: New Delhi, 2008. 5. Dash UN, Dharmarha OP, Soni P.L. Textbook of Physical Chemistry, Sultan Chand & Sons: New Delhi,2016
Reference Books	1. Maron, S. H. and Prutton C. P. Principles of Physical Chemistry,4th ed.; The Macmillan Company: Newyork,1972. 2. Lee, J. D. Concise Inorganic Chemistry, 4th ed.; ELBS William Heinemann: London,1991. 3. Gurudeep Raj, Advanced Inorganic Chemistry, 26th ed.; Goel Publishing House: Meerut, 2001. 4. Atkins, P.W. & Paula, J. Physical Chemistry, 10th ed.; Oxford University Press:New York, 2014. 5. Huheey, J. E. Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed .; Addison, Wesley Publishing Company: India,1993.
Website and e-learning source	1) https://onlinecourses.nptel.ac.in 2) http://www.mikeblaber.org/oldwine/chm1045/notes_m.htm 3) http://www.ias.ac.in/initiat/sci_ed/resources/chemistry/Inorganic.html 4) https://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding 5) https://www.chemtube3d.com/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain the atomic structure, wave particle duality of matter, periodic properties bonding, and properties of compounds.
CO2: classify the elements in the periodic table, types of bonds, reaction intermediates electronic effects in organic compounds, types of reagents.
CO3: apply the theories of atomic structure, bonding, to calculate energy of a spectral transition, Δx, Δp electronegativity, percentage ionic character and bond order.
CO4: evaluate the relationship existing between electronic configuration, bonding, geometry of molecules and reactions; structure reactivity and electronic effects
CO5: construct MO diagrams, predict trends in periodic properties, assess the properties of elements, and explain hybridization in molecules, nature of H – bonding and organic reaction mechanisms.

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

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

Level of Correlation between PSO's and CO'

SEMESTER: I **PART: III** **Core – II**	**23UCHEP14** **Quantitative Inorganic Estimation (titrimetry) and Inorganic Preparations**	**Credit: 5** **H/W: 4**

Objectives of the course	This course aims at providing knowledge on • laboratory safety • handling glasswares • Quantitative estimation • preparation of inorganic compounds • To develop the skill in finding out the end points of various types of indicators
Course Outline	Unit I Chemical Laboratory Safety in Academic Institutions Introduction - importance of safety education for students, common laboratory hazards, assessment and minimization of the risk of the hazards, prepare for emergencies from uncontrolled hazards; concept of MSDS; importance and care of PPE; proper use and operation of chemical hoods and ventilation system; fire extinguishers-types and uses of fire extinguishers, demonstration of operation; chemical waste and safe disposal. Common Apparatus Used in Quantitative Estimation (Volumetric) Description and use of burette, pipette, standard flask, measuring cylinder, conical flask, beaker, funnel, dropper, clamp, stand, wash bottle, watch glass, wire gauge and tripod stand. Principle of Quantitative Estimation (Volumetric) Equivalent weight of an acid, base, salt, reducing agent, oxidizing agent; concept of mole, molality, molarity, normality; primary and secondary standards, preparation of standard solutions; theories of acid-base, redox, complexometric, iodimetric and iodometric titrations; indicators – types, theory of acid–base, redox, metal ion and adsorption indicators, choice of indicators.
	Dichrometry Estimation of ferric alum using standard dichromate (external indicator) Estimation of ferric alum using standard dichromate (internal indicator)

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

Course Learning Outcomes (for Mapping with POs and PSOs)

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

CO1: explain the basic principles involved in titrimetric analysis and inorganic preparations.
CO2: compare the methodologies of different titrimetric analysis.
CO3: calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution.
CO4.Indetify the end point of various titrations
CO5 acquire knowledge on the systematic analysis of Mixture of salts., identify the cations and anions in the unknown substance.
CO5: handle the common apparatus used in volumetric estimation.

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

CO-PO Mapping (Course Articulation Matrix)

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

Note: Scheme for Practical Evaluation
Inorganic Preparation:15 marks
Record:10 marks
Procedure-10 marks
Volumetric Estimation – 40 marks
Results
< 2% - 40 marks
2-3% - 30 marks
3-4% - 20 marks
> 4% - 10 marks

SEMESTER: I PART: III	23UMATE15 MATHEMATICS – I	Credit: 3 H/W: 5

UNIT-I: SOLUTIONS OF TRANSCENDENTAL AND ALGEBRAIC EQUATIONS

Iteration method**,** Bisection method, Newton's method - Regula Falsi method, (without proof) (Simple problems only)

Unit-II: SOLUTIONS OF SIMULTANEOUS EQUATIONS

Gauss Elimination method- Gauss Jordan method-Gauss Seidel Iterative method-Gauss Jacobi method (Restricted to three variables only) (Simple problems only)

UNIT-III: MATRICES

Characteristic equation of a square matrix– Eigen values and eigen vectors – Cayley – Hamilton theorem [without proof] – Verification and computation of inverse matrix.

UNIT-IV: DIFFERENTIAL CALCULUS

n-th derivatives – Leibnitz theorem [without proof] and applications – Jacobians– Curvature and radius of curvature in Cartesian co-ordinates

UNIT-V: APPLICATION OF INTEGRATION

Evaluation of double – Simple applications to area,

TEXT BOOKS:

1. A.Singaravelu "Numerical Methods"Meenakshi Publications
   Unit-I: Chapter 2
   Unit-II: Chapter 2
2. P. Duraipandian and Dr. S. Udayabaskaran. 1997, "Allied Mathematics" , Vol I & II. Chennai: Muhil Publishers.
   Unit-III: Sec(4.5, 4.5.1 to 4.5.3)Vol I
   Unit-IV: Sec(1.1.1, 1.1.2, 1.2, 1.4.3)vol II
   Unit-V: Chap:3(3.2, 3.4, 3.4.1) vol II

REFERENCE BOOKS:

1. P. Balasubramanian and K. G. Subramanian. 1997, "Ancillary Mathematics", Vol I & II. New Delhi: Tata McGraw Hill.
2. S.P.Rajagopalan and R.Sattanathan(2005), "Allied Mathematics", Vol I & II. New Delhi: Vikas Publications.
3. P. R. Vittal (2003), "Allied Mathematics",Chennai: Marghan Publications.

Course Outcomes:

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

CO1: Attain knowledge on finding Approximate root for polynomial equations using Numerical methods.
CO2: Develop the skills of finding solutions of Simultaneous Linear equations.
CO3: Adopt techniques in solving problems involving Matrices
CO4: Provide skills on finding curvature and radius of curvature in Cartesian and polar co-ordinates.
CO5:Understand the applications of double and Triple integration in real life situation.

Outcome Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	2
CO2	3	2	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	2	3	3	3	2

1-Low 2-Moderate 3- High

SEMESTER: I **PART: III**	**23UBOTE15** **BOTANY- I**	**Credit: 2** **H/W: 3**

Learning Objective (LO):

LO1	To study morphological and anatomical adaptations of plants of various habitats.
LO2	To demonstrate techniques of plant tissue culture.
LP3	To familiarize with the structure of DNA, RNA.
LO4	To carryout experiments related with plant physiology.
LO5	To perform biochemistry experiments.

Unit – 1: Algae:

General characters of algae - Structure, reproduction and life cycle of the following genera - *Anabaena* and *Sargassum* and economic importance of algae.

Unit – 2 : Fungi, Bacteria and Virus:

General characters of fungi, structure, reproduction and life cycle of the following genera - *Penicillium* and *Agaricus* and economic importance of fungi.

Bacteria - general characters, structure and reproduction of *Escherichia coli* and economic importance of bacteria. Virus - general characters, structure of TMV, structure of bacteriophage.

Unit – 3 : Bryophytes, Pteridophytes and Gymnosperms:

General characters of Bryophytes, Structure and life cycle of *Funaria*.

General characters of Pteridophytes, Structure and life cycle of *Lycopodium*.

General characters of Gymnosperms, Structure and life cycle of *Cycas*.

Unit – 4: Cell Biology:

Prokaryotic and Eukaryotic cell- structure /organization. Cell organelles - ultra structure and function of chloroplast, mitochondria and nucleus. Cell division - mitosis and meiosis.

Unit – 5: Genetics and Plant Biotechnology:

Mendelism - Law of dominance, Law of segregation, Incomplete dominance. Law of independent assortment. Monohybrid and dihybrid cross - Test cross - Back cross. Plant tissue culture - *In vitro* culture methods. Plant tissue culture and its application in biotechnology.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Increase the awareness and appreciation of human friendly algae and their economic importance.
CO2	Develop an understanding of microbes and fungi and appreciate their adaptive strategies.
CO3	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.
CO4	Compare the structure and function of cells and explain the development of cells.
CO5	Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.

Recommended Texts

1. Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.
2. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.
3. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd. Delhi.
4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.
5. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany,S. Viswanathan Pvt. Ltd., Madras.

Reference books:

1. Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes - Surjeet Publications, Delhi.
2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.
3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand & Company Ltd, Delhi.
4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.
5. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand & Company Ltd, Delhi.
6. Parihar, N.S. 2013. An introduction to Embryophyta –Bryophytes -, Surjeet Publications, Delhi.
7. Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I &II, S.Chand and Co. New Delhi.

SEMESTER: I **PART: III**	**23UZOOE15** **Zoology – I**	**Credit: 2** **H/W: 3**

Course Objectives

The main objectives of this course are:

1	To acquire a basic knowledge of diversity and organization of Protozoa, Coelenterata, Helminthes and Annelida
2	To acquire a basic knowledge of diversity and organization of Arthropoda, Mollusca and Echinodermata
3	To comprehend the taxonomic position and diversity among Protochordata, Pisces and Amphibia
4	To comprehend the taxonomic position and diversity among Reptilia, Aves and Mammalia
5	To acquire detailed knowledge of selected invertebrate and chordate forms

Unit - I: Diversity of Invertebrates–I

Principles of taxonomy. Criteria for classification–Symmetry and Coelom –Binomial nomenclature. Classification of Protozoa, Coelenterata, Helminthes and Annelida upto classes with two examples.

Unit – II: Diversity of Invertebrates–II

Classification of Arthropoda, Mollusca and Echinodermata upto class level with examples.

Unit – III: Diversity of Chordates–I

Classification of Prochordata, Pisces and Amphibia upto orders giving two examples.

Unit – IV: Diversity of Chordates–II

Classification of Reptilia, Aves and Mammalia upto orders giving two examples.

Unit –V : Animal organization

Structure and organization of (i) Earthworm, (ii) Rabbit/Rat, (iii) Prawn/Fish

Expected Course Outcomes

On completion of this course, students will:

1	Recall the characteristic features invertebrates and chordates.
2	Classify invertebrates up to class level and chordates up to order level
3	Explain and discuss the structural and functional organisation of some invertebrates and chordates
4	Relate the adaptations and habits of animals to their habitat
5	Analyse the taxonomic position of animals.

Text Books (Latest Editions)

1. Ekambaranatha Iyer, - Outlines of Zoology, Viswanathan Publication.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1. Ekambaranatha Iyar and T.N.Ananthakrishnian - A Manual of Zoology Invertebrata–Vol. I: Viswanathan Publishers.
2. Ekambaranatha Iyar and T.N. Ananthakrishnan, - A Manual of Zoology -Invertebrata–Vol. II: Viswanathan Publishers.
3. Ekambaranatha Iyar and T.N.Ananthakrishnan, - A Manual of Zoology: Chordata Viswanathan Publishers.
4. Jordan E.L. and P.S. Verma-Invertebrate Zoology, S. Chand & Co.

Web Resources

1. www.sanctuaryasia.com
2. www.iaszoology.com

Outcome Maping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S-Strong **M-Medium** **L-Low**

SEMESTER: I PART: III	23UBIOE15 Biochemistry- I	Credit: 2 H/W: 3

Learning objectives

The objectives of this course are to

- Introduce the structure and classification of carbohydrates
- Comprehend the metabolism of carbohydrates
- Study the classification and properties of amino acids
- Elucidate the various levels of organization of Proteins
- Study functions and deficiency diseases of vitamins

Module I: Definition and classification of carbohydrates, linear and cyclic forms (Haworth projection) for glucose, fructose and mannose and disaccharides (maltose, lactose, sucrose).General properties of monosaccharides and disaccharides. Occurrence andsignificance of polysaccharides.12Hrs

Module II:Metabolism- Catabolism and Anabolism.Carbohydrate metabolism- Glycolysis, TCA cycle, HMP shunt and glycogen metabolism and energetics 12Hrs

Module III: Amino acids -Classifications, physical properties -amphoteric nature, isoelectric point and chemicalreactions of carboxyl ,amino and both groups. Amino acid metabolism- transamination, deamination and decarboxylation.12Hrs

Module IV : Proteins- classification - biological functions ,physical properties- ampholytes, iso electric point, salting in and salting out, denaturation, nature of peptide bond. Secondary structure, α-helix and β-pleated sheet, tertiary structure, various forces involved- quaternary structure. 12Hrs

Module V: Vitamins- Fat(A,D,E and K) and water soluble vitamins(B complex and C)- sources, RDA, biological functions and deficiency diseases12 Hrs

Course Outcome

CO	On completion of this course, students will be able to	Programme Outcome
CO1	Classify the structure of carbohydrates and its properties	PO1

CO2	Explain the metabolism of carbohydrates and its significance	PO1
CO3	Classify amino acids and its properties	PO1
CO4	Explain the classification and elucidate the different levels of structural organization of proteins	PO1
CO5	Identify the disease caused by the deficiency of vitamins	PO1

Text Books

1 Satyanarayan,U (2014) Biochemistry (4th ed), Arunabha Sen Books & Allied (P) Ltd, Kolkata.

2.Jain J.L.(2007) Fundamentals of Biochemistry,S.Chand publishers 311

Reference books

1. David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed) W.H. Freeman.

2. Voet.D&Voet. J.G (2010) Biochemistry , (4th ed), John Wiley & Sons, Inc.

3. Lubert Stryer (2010) Biochemistry,(7th ed), W.H.Freeman

4. Satyanarayan,U (2014) Biochemistry (4th ed), Arunabha Sen Books & Allied (P) Ltd, Kolkata.

5.Jain J.L.(2007) Fundamentals of Biochemistry,S.Chand publishers 31

Web sources

1.onlinecourses.swayam2.ac.in/cec20_bt12

2 onlinecourses.swayam2.ac.in/cec20_bt19

Mapping with Program Outcome

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3			3
CO 2	3						3			3
CO 3	3						3			3
CO 4	3						3			3
CO5	3						3	3		3

S - Strong (3) M - Medium (2) L -Low(1)

SEMESTER –I PART – III	Elective 23UBOTEP1: Botany Practical I	CREDITS: 1 H/W: 2

Course Objectives

1. To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, and fungi
2. To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.
3. To be familiar with the basic concepts and principles of cell biology.
4. Understanding of laws of inheritance, genetic basis of loci and alleles.
5. To learn about the principles and applications of Biotechnology

EXPERIMENTS

1. Make suitable micro preparation of the types prescribed in Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
2. Micro photographs of the cell organelles ultra structure.
3. Simple genetic problems.
4. Spotters - Algae, Fungi, Bryophytes, Pteridophytes, Gymnosperms Cell biology and Biotechnology.

Bonafide record of practical work done should be submitted for the practical examination

Course outcomes:

On completion of this course, the students will be able to:

1. To study the internal organization of algae .
2. To study the structure and organization of fungi, bacteria and viruses
3. Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.
4. To study the cell structure and function.
5. Understand the fundamental concepts of genetics and Biotechnology

Recommended texts

1. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd, New Delhi.
2. Sharma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.
3. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.
4. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.
5.Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.

Reference books

1. Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.
2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.
4. Aler Gingauz. 2001. Medicinal Chemistry. Oxford University Press & Wiley Publications.
5. Steward, F.C. 2012. Plant Physiology Academic Press, US

Web Resources

1. https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883
2. https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gy mnosperms&printsec=frontcover
3. https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4

OUTCOME MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	3	1	3	2
CO2	2	3	2	2	3
CO3	2	1	3	2	3
CO4	1	3	3	2	2
CO5	2	2	3	1	3

BOTANY PRACTICAL I

Time : 3 Hours Max. Marks : 75

PRACTICAL QUESTION PAPER

1. Make suitable micro preparations of the given specimens A, B and C.
Submit the slides for valuation. Identify the specimens, draw diagrams and give reasons.
(Identification – 1, diagram – 2, Reasons – 2, Slide -2) (7 X 3) (21)

2. Make suitable micro preparations of the given specimens D.
Submit the slides for valuation. Identify the specimens, draw diagrams and give reasons.
(Identification – 1, diagram – 2, Reasons – 2, Slide -2) (08)

3. Identify the given electron micrograph –E, describe and draw diagrams
(Identification – 2, Diagram – 3, description – 3) (08)

4. Spotters – F, G, H, I, J, K and L.
(Identification – 1, diagram – 1, Reasons – 2) (7 X 4) (28)

Total = 65
Record = 10
Grand Total = 75

BOTANY PRACTICAL I
KEY & SCHEME OF VALUATION

1. A – Algae / Fungi : *Sargassum/Agaricus*
   B – Bryophytes : *Funaria*
   C – Pteridophytes : *Lycopodium*
(Identification – 1, diagram – 2, Reasons – 2, Slide -2) (7 X 3) (21)

2. Gymnopserms - D : *Cycas* – rachis and leaflet
(Identification – 1, diagram – 2, Reasons – 2, Slide -3) (08)

3. Cell biology - E – Electron Micrograph of organelles- Chloroplast, Mitochondria, Nucleus, Mitosis, Giant Chromosomes
– (Identification – 2, Diagram – 3, description – 3) (08)

4. Spotters – F, G, H, I, J and L(any seven of the following)

(Algae, Fungi, Bacteria, Virus, Bryophytes, Pteridophytes and Gymnosperms –permanent slides, book diagrams or wet preserved jar specimens, mentioned in the syllabus)
Cytology – photographs of cell organelles
Genetics – simple genetics problems
Plant biotechnology – tissue culture techniques : explants, callus, hardening
(Identification – 1, diagram – 1, Reasons – 2) (7 X 4) (28)

Total = 65
Record = 10
Grand Total = 75

SEMESTER: I PART: III	23UZOOEP1 Zoology Practical– I	Credit: 1 H/W: 2

Course Objectives

1	To identify the different groups of invertebrate animals by observing their external characteristics.
2	To understand the organs, organ system and their functions in lower animals.
3	To get knowledge about the different modes of life and their adaptation based on the environment.
4	Able to dissect and display the internal organs and mount the mouthparts and scales of invertebrates.

UNIT – I : Major Dissection :

Cockroach: Circulatory system, Nervous system, Reproductive system. Leech : Nervous System, Reproductive system. Earthworm: Nervous System, Reproductive system. *Pila globosa*: Nervous system. Prawn: Nervous system (including Appendages).

UNIT – II: Minor Dissection:

Cockroach: Digestive system. Earthworm: Viscera, Lateral hearts.

Pila globosa: Digestive system (Including radula). Freshwater Mussel: Digestive system.

UNIT – III: Mounting:

Earthworm: Body setae; Pineal setae. *Pila globosa*: Radula. Freshwater muscle: Pedal ganglia.

UNIT - IV: Mounting :

Cockroach: Salivary apparatus, Mouth parts - Honey Bee, House fly and Mosquito mouth parts.

UNIT - V: Spotters :(i).

Protozoa: Amoeba, Paramoecium, Paramoecium Binary fission and Conjugation, Vorticella, Entamoeba histolytica, Plasmodium vivax **(ii). Porifera:** Sycon, Spongilla, Euspongia, Sycon - T.S & L.S, Spicules, Gemmule **(iii). Coelenterata:** Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatula **(iv). Platyhelminthes:** Planaria, Fasciola hepatica, Fasciola larval forms – Miracidium, Redia,

Cercaria, Echinococcus granulosus, Taenia solium, Schistosoma haematobium **(v). Nemathelminthes:** Ascaris(Male & Female), Drancunculus, Ancylostoma, Wuchereria **(vi). Annelida:** Nereis, Aphrodite, Chaetopteurs, Hirudinaria, Trochophore larva **(vii). Arthropoda:** Cancer, Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Peripatus, Larvae - Nauplius, Mysis, Zoea, Mouth parts of male & female Anopheles and Culex, Mouthparts of Housefly and Butterfly. **(viii). Mollusca:** Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva **(ix). Echinodermata:** Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon, Bipinnaria larva

Expected Course Outcomes

On completion of this course, students will;

1	Identify and label the external features of different groups of invertebrate animals.
2	Illustrate and examine the circulatory system, nervous system and reproductive system of invertebrate animals.
3	Differentiate and compare the structure, function and mode of life of various groups of animals.
4	To compare and distinguish the dissected internal organs of lower animals.
5	Prepare and develop the mounting procedure of economically important invertebrates.

Text Books

(Latest Editions)

1. Ekambaranatha Iyyar and T. N. Ananthakrishnan, 1995 A manual of Zoology Vol.I (Part 1, 2) S. Viswanathan, Chennai.
2. Ganguly, Sinha an d A dhikari , 2 0 11 . Biology of Animals: Volume I, New Central Book Agency; 3rd revised edition. 1008 pp.
3. Sinha, Chatterjee and Chattopadhyay, 2 0 1 4. Advanced Practical Zoology, Books & Allied Ltd; 3rd Revised edition, 1 07 0 pp.
4. Lal ,S. S, 2016 . Practical Zoology Invertebrate, Rastogi Publications.
5. Verma, P. S. 2010. A Manual of Practical Zoology: Invertebates, S Chand, 4 97pp.

References Books

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *The Invertebrates: A New Synthesis*, III Edition, Blackwell Science.

2. Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition. Holt Saunders International Edition.
3. Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson
4. Boradale, L.A. and Potts, E.A. (1961). *Invertebrates: A Manual for the use of Students*. Asia Publishing Home.
5. Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut

Web Resources

1. https://nbb.gov.in/
2. http://www.agshoney.com/training.htm
3. https://icar.org.in/
4. http://www.csrtimys.res.in/
5. http://csb.gov.in/
6. https://iinrg.icar.gov.in/
7. https://www.nationalgeographic.com/animals/invertebrates/

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S			S	S	S	M	
CO 2	M	S			M		L	
CO 3			M	S		S		
CO 4	S			S	S	M	S	
CO 5			S			S		S

S-Strong(3) **M-Medium (2)** **L-Low (1)**

SEMESTER: I PART: III	23UBIOEP1 **Biochemistry Practical - I**	**Credit: 1** **H/W: 2**

Learning objectives

- Identify carbohydrates by qualitative test
- Estimate biomolecules volumetrically
- Estimate protein quantitatively

I Qualitative analysis of carbohydrates- 25Hrs

a) Monosaccharides-Glucose, Fructose

b) Disaccharides- Lactose, Maltose, Sucrose

c) Polysaccharides-Starch

II Volumetric analysis 15 Hrs

a) Estimation of ascorbic acid using 2,6dichlorophenolindophenol as link solution

b) Estimation of Glucose by Benedicts method

c)Estimation of Glycine by Sorenson Formal titration

III Quantitative analysis(Demonstration Expt)5 hrs

a)Colorimetric estimation of protein by Biuret method

Course Outcome

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Qualitatively analyze and report the type of carbohydrate based on specific tests	PO1,PO2.PO3
CO2	Quantitatively estimate the carbohydrates, amino acids and ascorbic acid	PO1,PO2,PO3
CO3	Estimate protein by colorimetric method	PO1,PO2,PO3

Text books

1.Laboratory manual in Biochemistry, J. Jayaraman, 2nd edition, New Age International Publishers, 2011,

2. An Introduction to Practical Biochemistry, David T. Plummer, 3 rd edition, Tata McGraw- Hill Publishing Company Limited, 2001.

3. Biochemical Methods, Sadasivam S and Manickam A, 4h edition, New Age International Publishers, 2016

Mapping with Program Outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	2	3	3				3	3	3	3
CO 2	2	3	3				3	3	3	3
CO 3	2	3	3				3	3	3	3

S - Strong (3) M - Medi) L -Low(1)

SEMESTER: I PART: IV	23UCHEF17 INTRODUCTORY CHEMISTRY	Credit: 2 H/W: 2

Objectives of the Course	To give insights into chemistry experiments for a beginner in 1. Lab safety and Nature of chemicals. 2. Types of titrations and Concentration terms. 3. Semi micro analysis and precipitation techniques. 4. Organic analysis 5. Gravimetric Principles
Course Outline	UNIT-I: LAB SAFETY, CHEMICALS AND GLASSWARE 1.1 laboratory hygiene and safety – first–aid techniques – general work culture inside the chemistry lab. 1.2 Nature of chemicals – toxic, corrosive, explosive, inflammable, carcinogenic, other hazardous chemicals – safe storing and handling of chemicals – disposal of chemical wastes. 1.3. Handling of glass wares- Calibration of pipette, standard measuring flask and burette.
	UNIT-II: TITRIMETRIC METHODS OF ANALYSIS 2.1 Definitions of Molarity and Normality. Primary and secondary standards, Criteria for primary standards-Preparation of standard solutions. 2.2 Concepts of Acids & Bases - pH of strong and weak acid solutions. Indicators-Theory and their choice.. 2.3 Types of titrations- Acid-base Titrations, Redox Titrations, Precipitation Titrations and Complexometric Titrations- Principles and theory.
	UNIT-III: SEMIMICRO METHODS 3.1. Identification of interfering & non-interfering acid radicals - removal of interfering radicals (any one test for each). 3.2 Separation of cations into groups-Reagents involved and their principle 3.3 Spot test analysis for ammonium, Pb, Cu, Mg, Mn and Ni.
	UNIT-IV: BASICS OF ORGANIC ANALYSIS
	4.1 Preliminary and solubility tests for identifying organic compounds. Test for Aliphatic/Aromatic – Saturated/ Unsaturated compounds 4.2 Detection of Nitrogen, Sulphur and halogens 4.3– Test for functional groups: phenol, aldehyde, ketone, ester, carbohydrate, amine, amide & carboxylic acid (any one test for each).
	UNIT V: GRAVIMETRIC METHODS

	5.1 Gravimetric analysis- principle, theory and calculation. 5.2 Steps of a gravimetric analysis: precipitation, digestion, filtration, washing, drying and weighing. 5.2 Conditions for precipitation-choice of precipitants-advantages and disadvantages of using organic precipitants.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. U.N. Dash, 2005, Analytical Chemistry: Theory and Practice, Sultan Chand and sons. Educational Publishers, 2nd Edition, New Delhi, 2. J.Bassett, R.C.Denney, G.H.Jerrey and J.Mendham, 1994,Vogel's Text Book Of Inorganic Quantitative Analysis, ELBS, 5th Edition, London. 3. Gopalan R., Rangarajan K., Subramanian P.S. Elements of Analytical Chemistry, Sultan Chand & Sons, 2003 4. Svehla, 2012, Vogel's Qualitative Analysis, Pearson Education, 7thEdition,New Delhi. 5. Venkateswaran V, Veeraswamy R, Kulandaivelu A R,1997,Basic Principles Of Practical Chemistry, Sultan Chand and Sons, 2nd Edition, New Delhi. 6. D.A. Skoog, D.M. West and F. J.Holler, 1990, Analytical chemistry,Saunders college publishing, 5th Edition, Philadelphia.
Reference Books	1. Svehla, 2012, Vogel's Qualitative Analysis, Pearson Education, 7thEdition,New Delhi. 2. Venkateswaran V, Veeraswamy R, Kulandaivelu A R,1997,Basic Principles Of Practical Chemistry, Sultan Chand and Sons, 2nd Edition, New Delhi

	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Website and e-learning source	1. https://www.tees.ac.uk/parttime_courses/engineering_&_construction/certificate_of_credit_foundation_process_chemistry_(by_flexible_open_learning).cfm 2. https://le.ac.uk/courses/chemistry-with-foundation-year-bsc/2023 3. https://www.researchgate.net/publication/345381808_Foundations_for_Teaching_Chemistry_Chemical_Knowledge_for_Teaching 4. https://yuli-elearning.com/mod/resource/view.php?id=738 5. https://pubs.acs.org/doi/10.1021/acs.jchemed.1c00666
Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to CO1: to understand laboratory safety and hygiene. CO2: to understand principle of titrations. CO3: to understand semi micro analysis. CO4: to understand basics of organic compound analysis. CO5: to understand about gravimetric analysis	

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

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	2	2
CO2	2	2	2	2	2
CO3	2	2	2	2	2
CO4	2	2	2	2	2
CO5	2	2	2	2	2
Weightage	10	10	10	10	10
Weighted percentage of Course Contribution to Pos	2.0	2.0	2.0	2.0	2.0

Level of Correlation between PSO's and CO's

SEMESTER: II PART: III Core III	23UCHEC23 GENERAL CHEMISTRY-II	Credit: 5 H/W: 5

Objectives of the course	This course aims at providing an overall view of the • chemistry of acids, bases and ionic equilibrium • properties of s and p-block elements • chemistry of hydrocarbons • applications of acids and bases • compounds of main block elements and hydrocarbons
Course Outline	UNIT-I Acids, bases and Ionic equilibria Concepts of Acids and Bases - Arrhenius concept, Bronsted-Lowry concept, Lewis concept; Relative strengths of acids, bases and dissociation constant; dissociation of poly basic acids, ionic product of water, pH scale, pH of solutions; Degree of dissociation, common ion effect, factors affecting degree of dissociation; acid base indicators, theory of acid base indicators – action of phenolphthalein and methyl orange, titration curves - use of acid base indicators; Buffer solutions – types, mechanism of buffer action in acid and basic buffer, Henderson-Hasselbalch equation; Salt hydrolysis - salts of weak acids and strong bases, weak bases and strong acids, weak acids and weak bases - hydrolysis constant, degree of hydrolysis and relation between hydrolysis constant and degree of hydrolysis; Solubility product - determination and applications; numerical problems involving the core concepts.
	Unit-II Chemistry of s - Block Elements Hydrogen: Position of hydrogen in the periodic table. Alkali metals: Comparative study of the elements with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li with Mg. Preparation, properties and uses of NaOH, Na_2CO_3, KBr, $KClO_3$ alkaline earth metals. Anomalous behaviour of Be. Chemistry of p- Block Elements (Group 13 & 14) preparation and structure of diborane and borazine. Chemistry of borax. Extraction of Al and its uses. Alloys of Al. comparison of carbon with silicon. Carbon-di-sulphide – Preparation, properties, structure and uses. Percarbonates, per monocarbonates and per dicarbonates.
	UNIT-III Chemistry of p- Block Elements (Group 15-18) General characteristics of elementsof Group 15; chemistry of H_2N-NH_2,

	NH_2OH, HN_3 and HNO_3. Chemistry of PH_3, PCl_3, PCl_5, $POCl_3$, P_2O_5 and oxy acids of phosphorous (H_3PO_3 and H_3PO_4). General properties of elements of group16 - Structure and allotropy of elements - chemistry of ozone - Classification and properties of oxides - oxides of sulphur and selenium – Oxy acids of sulphur (Caro's and Marshall's acids). Chemistry of Halogens: General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI), oxides and oxy acids ($HClO_4$). Inter-halogen compounds (ICl, ClF_3, BrF_5 and IF_7), pseudo halogens [$(CN)_2$ and $(SCN)_2$] and basic nature of Iodine. Noble gases: Position in the periodic table. Preparation, properties and structure of XeF_2, XeF_4, XeF_6 and $XeOF_4$; uses of noble gases - clathrate compounds.
	UNIT-IV Hydrocarbon Chemistry-I Petroproducts: Fractional distillation of petroleum; cracking, isomerisation, alkylation, reforming and uses Alkenes-Nomenclature, general methods of preparation – Mechanism of □elimination reactions – E_1 and E_2 mechanism - factors influencing – stereochemistry – orientation – Hofmann and Saytzeff rules. Reactions of alkenes – addition reactions – mechanisms – Markownikoff's rule, Kharasch effect, oxidation reactions – hydroxylation, oxidative degradation, epoxidation, ozonolysis; polymerization. Alkadienes Nomenclature - classification – isolated, conjugated and cumulated dienes; stability of conjugated dienes; mechanism of electrophilic addition to conjugated dienes - 1, 2 and 1, 4 additions; free radical addition to conjugated dienes– Diels–Alder reactions – polymerisation – polybutadiene, polyisoprene (natural rubber), vulcanisation, polychloroprene. Alkynes Nomenclature; general methods of preparation, properties and reactions; acidic nature of terminal alkynes and acetylene, polymerisation and isomerisation. Cycloalkanes: Nomenclature, Relative stability of cycloalkanes, Bayer's strain theory and its limitations. Conformational analysis of cyclohexane, mono and di substituted cyclohexanes. Geometrical isomerism in cyclohexanes.

	UNIT-V Hydrocarbon Chemistry - II Benzene: Source, structure of benzene, stability of benzene ring, molecular orbital picture of benzene, aromaticity, Huckel's (4n+2) rule and its applications. Electrophilic substitution reactions - General mechanism of aromatic electrophilic substitution - nitration, sulphonation, halogenation, Friedel-Craft's alkylation and acylation. Mono substituted and disubstituted benzene - Effect of substituent – orientation and reactivity. Polynuclear Aromatic hydrocarbons: Naphthalene – nomenclature, Haworth synthesis; physical properties, reactions – electrophilic substitution reaction, nitration, sulphonation, halogenation, Friedel – Crafts acylation & alkylation, preferential substitution at □ - position – reduction, oxidation – uses. Anthracene – synthesis by Elbs reaction, Diels – Alder reaction and Haworth synthesis; physical properties; reactions - Diels-Alder reaction, preferential substitution at C-9 and C-10; uses.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed, S.Chand and Company, New Delhi. 2. Sathya Prakash, Tuli G D,Basu S K and Madan R D, (2003), Advanced Inorganic Chemistry, 17th ed., S.Chand and Company, New Delhi. 3. Bahl B S, Arul Bhal, (2003), Advanced Organic Chemistry, 3rd ed., S.Chand and Company, New Delhi. 4. Tewari K S, Mehrothra S N and Vishnoi N K, (1998), Text book of Organic Chemistry, 2nd ed., Vikas Publishing House, New Delhi. 5. Puri B R, Sharma L R, (2002), Principles of Physical Chemistry, 38th ed., Vishal Publishing Company, Jalandhar.
Reference Books	1. Maron S H and Prutton C P, (1972), Principles of Physical Chemistry, 4th ed., The Macmillan Company, Newyork. 2. Barrow G M, (1992), Physical Chemistry, 5th ed., Tata McGraw Hill, New Delhi. 3. Lee J D, (1991), Concise Inorganic Chemistry, 4thed., ELBS William Heinemann, London. 4. Huheey J E, (1993), Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed., Addison Wesley Publishing Company, India. 5. Gurudeep Raj, (2001), Advanced Inorganic Chemistry Vol – I, 26th ed.,

	Goel Publishing House, Meerut. 6. Agarwal O P, (1995), Reactions and Reagents in Organic Chemistry, 8th ed., Goel Publishing House,Meerut.
Website and e-learning source	https://onlinecourses.nptel.ac.inhttp://cactus.dixie.edu/smblack/chem1010/lecture_notes/4B.html http://www.auburn.edu/~deruija/pdareson.pdfhttps://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding MOOC components http://nptel.ac.in/courses/104101090/ Lecture 1: Classification of elements and periodic properties http://nptel.ac.in/courses/104101090/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain the concept of acids, bases and ionic equilibria; periodic properties of s and p-block elements, preparation and properties of aliphatic and aromatic hydrocarbons
CO2: discuss the periodic properties of sand p- block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids
CO3: classify hydrocarbons, types of reactions, acids and bases, examine the properties s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons CO4: explain theories of acids, bases and indicators, buffer action and important compounds of s-block elements
CO5: assess the application of hard and soft acids indicators, buffers, compounds of s and p-block elements and hydrocarbons

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

CO-PO Mapping (Course Articulation Matrix)

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

CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO&CO

SEMESTER: II **PART: II** **Core IV**	**23UCHEP24** **QUALITATIVE ORGANIC ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS**	**Credit: 5** **H/W: 4**

Objectives of the course	This course aims at providing knowledge on • laboratory safety • handling glass wares • analysis of organic compounds • preparation of organic compounds
Course Outline	UNIT I Safety rules, symbols and first-aid in chemistry laboratory Basic ideas about Bunsen burner, its operation and parts of the flame. Chemistry laboratory glassware –basis information and uses

	Unit II Qualitative Organic Analysis Preliminary examination, detection of special elements - nitrogen, sulphur and halogens Aromatic and aliphatic nature, Test for saturation and unsaturation, identification of functional groups using solubility tests Confirmation of functional groups • monocarboxylic acid, dicarboxylic acid • monohydric phenol, polyhydric phenol • aldehyde, ketone, ester • carbohydrate (reducing and non-reducing sugars) • primary, secondary, tertiary amine • monoamide, diamide, thioamide • anilide, nitro compound • Preparation of derivatives for functional groups
	UNIT III Preparation of Organic Compounds i. Nitration - picric acid from Phenol ii. Halogenation - p-bromo acetanilide from acetanilide iii. Oxidation - benzoic acid from Benzaldehyde iv. Microwave assisted reactions in water: v. Methyl benzoate to Benzoic acid vi. Salicylic acid from Methyl Salicylate vii. Rearrangement - Benzil to Benzilic Acid viii. Hydrolysis of benzamide to Benzoic Acid
	Unit-IV Separation and Purification Techniques (Not for Examination) 1. Purificationof organic compounds by crystallization (from water / alcohol) and distillation 2. Determination of melting and boiling points of organic compounds. 3.Steam distillation - Extraction of essential oil from citrus fruits/eucalyptus leaves. 4. Chromatography (any one) (Group experiment) (i) Separation of amino acids by Paper Chromatography (ii)Thin Layer Chromatography - mixture of sugars / plant pigments /permanganate

	dichromate. (iii) Column Chromatography - extraction of carotene, chlorophyll and xanthophyll from leaves / separation of anthracene - anthracene picrate. 5. Electrophoresis – Separation of amino acids and proteins. (Demonstration) 6. Isolation of casein from milk/Determination of saponification value of oil or fat/Estimation of acetic acid from commercial vinegar. (Any one Group experiment) (4,5& 6–not for ESE)
Reference Books	1. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. Basic Principles of Practical Chemistry, 2nd ed.; Sultan Chand: New Delhi, 2012. 2. Manna, A.K. Practical Organic Chemistry, Books and Allied: India, 2018. 3. Gurtu, J. N; Kapoor, R. Advanced Experimental Chemistry (Organic), Sultan Chand: New Delhi, 1987. 4. Furniss,B. S.; Hannaford, A. J.; Smith, P. W. G.; Tatchell, A.R. Vogel's Textbook of Practical Organic Chemistry, 5th ed.; Pearson: India,1989.
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences

Scheme of Valuation	Max. marks(75)
Record	:10 Marks
Preparation	:15 Marks
Recrystallization	:05 Marks
Organic Qualitative Analysis	:45 Marks
Preliminary Test	:05 Marks
Detection of Elements	:05 Marks
Detection of Functional Group	:05 Marks
Identification of the compound	:05 Marks
Confirmatory Test	:15 Marks
Derivatives preparation and its m.pt determination	:10 Marks

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

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

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

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

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

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

CO-PO Mapping (Course Articulation Matrix)

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

Level of Correlation between PSO's and CO's

SEMESTER: II **PART: II** **Core IV**	**23UMATE25** **MATHEMATICS – II**	**Credit: 3** **H/W: 5**

UNIT-I:TRIGONOMETRY

Expansions of $\sin^n\theta$, $\cos^n\theta$, $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ – Expansions of $\sin\theta$, $\cos\theta$, $\tan\theta$ in terms of θ

Unit-I: Chap: 6 (6.1,6.1.1 to 6.1.3)

UNIT-II: PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations, elimentary partial differential equations-Lagranges equations.

Unit-II: Chap:6 (6.1,6.1.1, 6.4).

UNIT-III: VECTOR DIFFRENTIATION

Vector functions- Scalar and vector point functions- Directional derivatives –Unit vector normal to a surface – angle between the surfaces-divergence, Gradient of a scalar point function- Divergence and curl of a vector point function.

Unit-III Section 8.1,8.2,8.3, 8.4).

UNIT-IV: VECTOR INTEGRATION

Green's theorem in the plane-Gauss divergence theorem- [without proofs] ,Stoke's theorem

(Statement only)

Unit-IV:Section(8.6.1, to 8.6.3).

UNIT-V: FINITE DIFFERENCES

Operator E, Relation between Δ, ∇ and E – Interpolation – Newton – Gregory forward & backward formulae for interpolation-Lagrange's interpolation formula for unequal intervals(without proof) .

Unit-V:Sec(5.1,5.2).

TEXT BOOK:

1.P. Duraipandian and S. Udayabaskaran(1997), "Allied Mathematics", Vol I & II. Chennai:

Muhil Publishers.

Unit-I: Chap: 6 (6.1,6.1,1 to 6.1.3), Vol I,

Unit-II: Chap:6 (6.1,6.1.1,6.4), Vol II,
Unit-IIISec(8.1,8.2,8.3,8.4),Vol I,
Unit-IV:Sec(8.6.1, - 8.6.3), Vol I,
Unit-V:Sec(5.1,5.2), Vol II.

REFERENCE BOOKS:

1. P. Balasubramanian and K. G. Subramanian. 1997, "Ancillary Mathematics", Vol I & II. New Delhi: Tata McGraw Hill.
2. S.P.Rajagopalan and R.Sattanathan(2005), "Allied Mathematics", Vol I & II. New Delhi: Vikas Publications.
3. P. R. Vittal (2003), "Allied Mathematics",Chennai: Marghan Publications.
4. P.Kandhasamy, K. Thilagavathy (2003), "Allied Mathematics" Vol I & II, New Delhi: Tata McGraw Hill.

Course Outcomes:

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

CO1: Attain knowledge on finding the expansions of trigonometric functions and concept of hyperbolic and inverse hyperbolic functions.
CO2: Provide a basic knowledge of Partial Differential equations and develops knowledge on handle practical problems.
CO3: Adopt techniques in solving problems involving vector and scalar functions
CO4: Provide skills on finding derivatives and gradients on vector differentiation and Integration.
CO5: Understand the applications of differentiation and integration in real life situation.

Outcome Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	2
CO2	3	2	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	2	3	3	3	2

1-Low 2-Moderate 3- High

SEMESTER: II **PART: III**	**23UBOTE25** **BOTANY-II** **(Elective)**	**Credit: 2** **H/W: 3**

Learning Objective (LO):

LO1	To be familiar with the basic concepts and principles of plant systematics.
LO2	Learn the importance of plant anatomy in plant production systems.
LO3	Understand the mechanism underling the shift from vegetative to reproductive phase.
LO4	To learn about the physiological processes that underlie plant metabolism.
LO5	To know the energy production and its utilization in plants.

Unit – 1: MORPHOLOGY OF FLOWERING PLANTS

Plant and its parts. Structure and function of root and stem. Leaf and its parts. Leaf types- simple and compound. Phyllotaxy and types. Inflorescence - Racemose, Cymose and Special types. Terminology with reference to flower description.

Unit – 2 : TAXONOMY

Study of the range of characters and plants of economic importance in the following families: Rutaceae, Caesalpiniaceae, Asclepiadaceae, Euphorbiaceae and Cannaceae

Unit – 3: ANATOMY

Tissue and tissue systems: Simple and complex tissues. Anatomy of monocot and dicot roots - anatomy of monocot and dicot stems - anatomy of dicot and monocot leaves.

Unit – 4: EMBRYOLOGY

Structure of mature anther and ovule - Types of ovules, structure of embryo sac, pollination - double fertilization, structure of dicotyledonous and monocotyledonous seeds.

Unit – 5: PLANT PHYSIOLOGY

Absorption of water, photosynthesis - light reaction - Calvin cycle; respiration - Glycolysis - Krebs cycle - electron transport system. Growth hormones - auxins and cytokinins and their applications.

Course Outcomes (CO)

At the end of the course, the student will be able to

CO1	Understand the fundamental concepts of plant anatomy and embryology.
CO2	Analyze and recognize the different organs of plants and secondary growth.
CO3	Understand water relation of plants with respect to various physiological processes
CO4	Classify aerobic and anaerobic respiration.
CO5	Classify plant systematics and recognize the importance of herbarium and virtual herbarium.

Recommended Texts

1. Sharma, O.P. 2017. Plant Taxonomy. (II Edition).The McGraw Hill Companies.
2. Bhojwani, S.S. Bhatnagar, S.P and Dantu, P.K. 2015. The Embryology of Angiosperms (6th revised and enlarged edition). Vikas Publishing House, New Delhi.
3. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi.
4. Salisbury, F. B.C.W. Ross.1991. Plant Physiology. Wassworth Pub. Co. Belmont.
5. Ting, I.P. 1982. Plant Physiology. Addison Wesley Pb. Philippines.

Reference books

1. Lawrence.G.H.M. 1985. An Introduction to Plant Taxonomy, Central Book Depot, Allahabad.
2. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4th revised and enlarged edition). Vikas Publishing House, New Delhi.
3. Pandey, B.P. 2012. Plant Anatomy. S Chand Publishing.
4. Jain, VK. 2006. Fundamentals of Plant Physiology, S. Chand and Company Ltd.
5. Rajni Gupta. 2012. Plant Taxonomy: Past, Present and Future. Vedams (P) Ltd. New Delhi.
6. Jain, V.K. 2006. Fundamentals of Plant Physiology, S.Chand and Company Ltd., New Delhi.
7. Verma, S.K. 2006. A Textbook of Plant Physiology, S.K.Chand & Co., New Delhi.

Web Resources

1. https://books.google.co.in/books/about/Plant_Taxonomy.html?id=0bYs8F0Mb9gC&redir_esc=y
2. https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFnUC&redir_esc=y
3. https://archive.org/EXPERIMENTS/plantanatomy031773mbp
4. https://www.amazon.in/Embryology-Angiosperms-6th-S-P-Bhatnagar-ebook/dp/B00UN5KPQG
5. https://www.crcpress.com/Plant-Physiology/Stewart-Globig/p/book/9781926692692

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	S	S	S	S	S	S	S	S	S	S
CO 2	S	S	S	S	S	S	S	S	S	S
CO 3	M	S	S	S	S	L	S	S	S	S
CO 4	S	S	M	S	S	S	S	M	S	M
CO 5	S	M	M	M	M	M	M	L	M	M

S – Strong; M – Medium; L – Low

SEMESTER: II **PART: III**	**23UZOOE25** **Zoology – II**	**Credit: 2** **H/W: 3**

1	To enable students to learn basic concepts relating to aspects of respiratory, circulatory, excretory, nervous and sensory physiology.
2	To enable students to comprehend the processes involved during development
3	To enable students to learn basic concepts of immunity and the working of immune organs and familiarize them with the recommended vaccination schedule
4	To enable students to comprehend the basic concepts of human genetics and patterns of inheritance
5	To enable students to learn about aspects of animal behaviour such as foraging, courtship, nest construction, parental care and learning

Unit – I: Respiration- Respiratory pigments and transport of gases. Mechanism of blood clotting. Types of excretory products – Ornithine cycle. Structure of neuron –Conduction of nerve impulse, Mechanism of vision and hearing.

Unit – II: Fertilization, Cleavage, Gastrulation and Organogenesis of Frog; Placentation in mammals

Unit – III: Innate and Acquired - Active and Passive; Antigens and Antibodies; Immunological organs–responses in humans; Vaccination schedule
Unit – IV: Human Genetics: Human Chromosomes – Sex Determination in Humans; Patterns of Inheritance: Autosomal Dominant, Autosomal Recessive, X-linked , Y-linked, Mitochondrial, Multiple Allelic and Polygenic; Genetic Counseling
Unit - V: Animal Behaviour: Foraging, Courtship Behaviour, Shelter and Nest Construction, Parental Care, Learning Behaviour

Expected Course Outcomes

On completion of this course, students will be able to:

1	Recall the parts and working of body organs and developmental stages, name the patterns of inheritance and list different types of animal behaviour
2	Analyse the different developmental stages
3	Analyse the working of body and immune systems
4	Analyse the different patterns of inheritance
5	Relate the behaviour of animals to physiology. Analyse the different types of behaviour

Text Books (Latest Editions)

1. Verma P.S. & Agarwal - Developmental Biology, Chordata embryology S. Chand & Co.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1. Owen, J. A., Punt, J. & Stranford, S. A. Kuby Immunology. New York: W.H. Freeman & Company.
2. Klug, W. S., Cummings, M. R. & Spencer, C - Concepts of Genetics. (12th ed.). New Jersey: Pearson Education.
3. Mathur, R. Animal Behaviour. Meerut: Rastogi.
4. Verma P.S. & Agarwal Developmental Biology, Chordata embryology. S.Chand & Co.

Outcome Maping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**
CO 1	S		S		M		S	S
CO 2	M	S						
CO 3		S	M	S		S	M	
CO 4	S			S	S	M		
CO 5			S					S

S-Strong M-Medium L-Low

SEMESTER: II **PART: III**	**23UBIOE25** **Biochemistry- II**	**Credit: 2** **H/W: 3**

Learning objectives

The objectives of this course are to

- Impart knowledge on the classification, properties and characterization of lipids.
- Comprehend the metabolism of Lipids
- Acquaint with the structure, properties and functions of nucleic acids
- Learn about the enzyme kinetics and inhibition
- Study the importance of Hormones

Module I : Lipids–Bloor's classification of lipids- simple lipids, fatty acids (saturated and unsaturated), compound lipids, derived lipids.Properties of lipids- reduction, oxidation, halogenation,saponification and rancidity .Classification andfunctions of phospholipids, Cholesterol – structure and biological importance.12 Hrs

Module II :Lipid metabolism- Oxidation of fatty acids(Palmitic acid) – Beta oxidation-Role of carnitine,energetics , alpha oxidation and omega oxidation.Biosynthesis of saturated fatty acids.12 Hrs

Module III : Purine and pyrimidine bases, nucleosides, nucleotides, polynucleotides, DNA structure, various types, properties- absorbance, effect of temperature. Different types of RNA, structure and function, Genetic code. 12 Hrs

Module III : Enzymes - Nomenclature, IUB system of enzyme classification,active site, specificity, isoenzymes, units of enzyme activity factors affecting enzyme activity-substrate concentration, pH, temperature.Enzyme Kinetics- Michaelis and Menten equation.Lineweaver- Burk plot. Enzyme inhibition, competitive, uncompetitive and andnon competitive inhibition 12Hrs

Module V: Hormones -classification,Biological functions of Insulin, Thyroid and Reproductive hormones . 12Hr

Course Outcome

CO	On completion of this course, students will be able to	Program Outcomes
CO1	Elaborate on classification, structure, properties, functions and characterization of lipids	PO1
CO2	Discuss the metabolism of lipids and its importance	PO1
CO3	Explain about structure, properties and functions of nucleic acids	PO1
CO4	Derive Michaelis Menten equation and concepts of enzyme inhibition	PO1,PO3
CO5	Classify the Hormones and its biological functions	PO1,PO4

Text books

1.Satyanarayan,U (2014) Biochemistry (4th ed), Arunabha Sen Books & Allied (P) Ltd, Kolkata.

2.Jain J.L.(2007) Fundamentals of Biochemistry,S.Chand publishers

Reference books

1. David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed) W.H. Freeman.

2. Voet.D & Voet. J.G (2010) Biochemistry , (4th ed), John Wiley & Sons, Inc.

3. Lubert Stryer (2010) Biochemistry,(7th ed), W.H.Freeman

Web sources

1.onlinecourses.swayam2.ac.in/cec20_bt12

2 onlinecourses.swayam2.ac.in/cec20_bt19

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	3						3			3
CO 2	3						3			3
CO 3	3		3				3			3
CO 4	3			3			3			3
CO5	3						3	3		3

S - Strong (3) M - Medium (2) L -Low(1)

SEMESTER –II PART – III	Elective 23UBOTEP2: Botany Practical II	CREDIT: 1 H/W: : 2

Course Objectives

1. To enhance information on the identification of taxonomical plant
2. To be familiar with the basic concepts and principles of plant systematics.
3. Understanding of reproduction and development of angiosperms
4. To understand the internal organization of Angiopserms
5. To learn about the physiological processes that underlie plant metabolism.

EXPERIMENTS

1. To identify Angiosperm root, stem, leaf, flowers and fruits based on morphology
2. To describe in technical terms, plants belonging to any of the family prescribes and to identify the family.
3. To dissect a flower, construct floral diagram and write floral formula.
4. Demonstration experiments
    a. Ganong's Light screen
    b. Ganong's respiroscope
5. To make suitable micro preparations of anatomy materials prescribed in the syllabus.
6. Spotters - Angiosperm morphology, anatomy, Embryology and Physiology

Bonafide record of practical work done should be submitted for the practical examination

Course outcomes:

On completion of this course, the students will be able to:

1. Understand external structure of angiosperms
2. To study the classical taxonomy with reference to different parameters.
3. Understand the fundamental concepts of plant anatomy and embryology
4. To study the effect of various physical factors on photosynthesis.
5. Understand simple experiments in plant Physiology

Recommended texts

1. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd, New Delhi.
2. Sharma, O.P. 2012. Pteridophyta, Tata McGraw-Hills Ltd, New Delhi.
3. Subramaniam, N.S. 1996. Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd., New Delhi.
4. Benjamin, A. Pierce. 2012. Genetics- A conceptual Approach. W.H. Freeman and Company, New York, England.
5.Noggle G.R and G.J. Fritz. 2002. Introductory Plant Physiology. Prentice Hall of India, New Delhi.

Reference books

1. Strickberger, M.W. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India.

2. Nancy Serediak and M. Huynh. 2011. Algae identification lab Guide. Accompanying manual to algae identification field guide, Ottawa Agriculture and Agri food Canada publisher.
3. Mohammed Gufran Khan, Shite Gatew and Bedilu Bekele. 2012. Practical manual for Bryophytes and Pteridophytes. Lambert Academic Publishing.
4. Aler Gingauz. 2001. Medicinal Chemistry. Oxford University Press & Wiley Publications.
5. Steward, F.C. 2012. Plant Physiology Academic Press, US

Web Resources

4. https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/8126106883
5. https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gy mnosperms&printsec=frontcover
6. https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4

OUTCOME MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	3	1	3	2
CO2	2	3	2	2	3
CO3	2	1	3	2	3
CO4	1	3	3	2	2
CO5	2	2	3	1	3

BOTANY PRACTICAL II

Time : 3 Hours Max. Marks : 75

PRACTICAL QUESTION PAPER

1. Identify the given specimens –A to its respective family, draw MLS of the flower and describe it in technical terms.
(Identification of family – 2, MLS diagram – 3, technical description – 4) (09)

2. Identify the given specimen –B, to its respective family, construct the floral diagram and write the floral formula.
(Identification of family – 2, floral diagram – 3, floral formula – 2) (07)

3. Make suitable micro preparations of the given specimens C.
Submit the slides for valuation. Identify the specimens, draw diagrams and give reasons. (Identification – 1, diagram – 2, Reasons – 2, Slide -2) (07)

4. Comment on the Physiology setup – D Write the aim, materials required , Procedure, Results and Inference
(Aim-1, Materials required -1, Procedure -2 , Results and Inference -3) (07)

4. Spotters – E, F, G, H, I, J, K and L.
(Identification – 1, diagram – 2, Reasons – 2) (7 X 5) (35)

Total = 65
Record = 10

Grand Total = 75

BOTANY PRACTICAL II
KEY & SCHEME OF VALUATION

1. Taxonomy - A – MLS of the flower (from any one family mentioned in the syllabus) (Identification of family – 2, MLS diagram – 3, technical description – 4) (09)

2. Taxonomy - B – Floral diagram and floral formula (from any one family mentioned in the syllabus) (Identification of family – 2, floral diagram – 3, floral formula – 2) (07)

3.. Anatomy - C : Dicot and monocot – stem, root and leaf.
(Identification – 1, diagram – 2, Reasons – 2, Slide -2) (07)

4. Physiology Set up D - Osmosis – thistle funnel experiment, Photosynthesis – Beaker and Funnel experiment, Ganong's light screen and Ganong's respire scope
(Aim-1, Materials required -1, Procedure -2 , Results and Inference -3) (07)

5. Spotters –E, F, G, H, I, J , and K (any seven of the following) (08)

Morphology – vegetative and reproductive morphological parts
Anatomy – simple and complex tissues, dicot, monocot root and leaf
Embryology – ovules, anther T.S.
Physiology - Osmosis – thistle funnel experiment, Photosynthesis – Beaker and Funnel experiment, Ganong's light screen and Ganong's respire scope experimental setup.
(Identification – 1, diagram – 2, Reasons – 2) (7 X 5) (35)

Total =	65
Record =	10
Grand Total =	75

SEMESTER: II PART: III	23UBIOEP2 **Biochemistry Practical - II**	**Credit: 1** **H/W: 2**

Learning objectives

The objectives of this course are to

- Identify amino acids by qualitative test
- Prepare biomolecules from its sources
- Estimate phosphorus quantitatively

I.**Qualitative analysis of amino acids**

a) Arginine b)Cysteine c) Tryptophan d)Tyrosine e) Histidine

II. **Biochemical preparations**

a) Preparation of casein from milk.

b)Preparation of starch from potato.

c)Preparation of albumin from egg.

IIIGroup Experiment

Determination of Iodine/ Saponification number of an edible oil(Demonstration) .

Course Outcome

CO	On completion of this course, students will be able to	Programme Outcome
CO1	Qualitatively analyze the amino acids and report the type of amino acids based on specific tests	PO1,PO2,PO3
CO2	Prepare the macronutrients from the rich sources.	PO1,PO2,PO3
CO3	Check the quality of edible oil	PO1,PO2,PO3

Text books

1.Laboratory manual in Biochemistry, J. Jayaraman, 2nd edition, NewAge International Publishers, 2011,

2. An Introduction to Practical Biochemistry, David T. Plummer, 3 rd edition, Tata McGraw-Hill Publishing Company Limited, 2001.

Reference books

1. Biochemical Methods, Sadasivam S and Manickam A, 4h edition, NewAge International Publishers, 2016

2. Essentials of Food and Nutrition, Vol. I & II, M.S. Swaminathan.

Mapping with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PSO1	PSO2	PSO3	PSO4
CO 1	2	3	3				3	3	3	3
CO 2	2	3	3				3	3	3	3
CO 3	2	3	3				3	3	3	3

S - Strong (3) M - Medium (2) L -Low

SEMESTER: II PART: III	23UZOOEP2 Zoology Practical – II	Credit: 1 H/W: 2

Course Objectives:

1	To learn basic concepts relating to various physiological aspects of animals.
2	To comprehend the processes involved during development
3	To learn basic concepts of immunity and familiarize on immune organs.
4	To know the basic concepts of human genetics and patterns of inheritance
5	To learn about aspects of animal behaviour.

Practicals:

1. Qualitative detection of excretory products (Ammonia, Urea, Uric acid).
2. Frog Egg, Blastula and Gastrula.
3. Demonstration of lymphoid organs.
4. Identification of ABO blood groups
5. Identification of human syndroms from karyotyping
5. Vital staining of chick blastoderm
7. Study of behavioural adaptations of animals

Expected Course Outcomes

On completion of this course, students will be able to:

1	Recall the parts and working of body organs
2	Analyse the different developmental stages
3	Analyse the functioning of body and immune systems
4	Analyse the different patterns of inheritance
5	Understand the different types of behaviour

Text Book(s)

1 Arumugam N. (2013). Developmental Zoology, Saras Publication, Nagercoil, Tamilnadu, India.
2 Das S. (2020).Microbiology Practical Manual, CBS Publication, Delhi.
3 Jayasurya, Arumugam N, Dulsy Fatima. (2013). Practical Zoology Vol 3, Saras Publication, Nagercoil, Tamilnadu, India.
4 Singh HR and Neerajkumar. (2014). Animal Physiology and Biochemistry, Vishal Publishing Co. Jalandhar, Delhi.

Outcome Maping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S	M		M	M	S		S
CO 2	M	S	M		S		M	
CO 3	S	M		S		S		M
CO 4	S	S		S	S	M		
CO 5	S	S	S				S	S

S-Strong M-Medium L-Low

Non-major (NME) Electives offered to other Department

SEMESTER: I **PART: III**	**23UCHEN16** **ROLE OF CHEMISTRY IN DAILY LIFE**	**Credit: 2** **H/W: 2**

Objectives of the course	This course aims at providing an overall view of the • importance of Chemistry in everyday life • chemistry of building materials and food • chemistry of Drugs and pharmaceuticals
Course Outline	UNIT-I General survey of chemicals used in everyday life. Air - components and their importance; photosynthetic reaction, air pollution, green - house effect and the impact on our life style. Water - Sources of water, qualities of potable water, soft and hard water, methods of removal of hardness-water pollution
	Unit-II Building materials - cement, ceramics, glass and refractories - definition, composition and application only. Plastics - polythene, PVC, bakelite, polyesters, melamine-formaldehyde resins -preparation and uses only.
	UNIT-III Food and Nutrition - Carbohydrates, Proteins, Fats - definition and their importance as food constituents – balanced diet – Calories minerals and vitamins (sources and their physiological importance). Cosmetics – tooth paste, face powder, soaps and detergents, shampoos, nail polish, perfumes - general formulation and preparations - possible hazards of cosmetic use.
	UNIT-IV Chemicals in food production – fertilizers - need, natural sources; urea, NPK fertilizers and super phosphate. Fuel – classification - solid, liquid and gaseous; nuclear fuel examples and uses.

	UNIT-V Pharmaceutical drugs - analgesics and antipyretics - paracetamol and aspirin. Colour chemicals - pigments and dyes - examples and applications. Explosives - classification and examples.
Recommended Text	1.Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010. 2. A textbook of pharmaceutical chemistry by Jayashree Ghosh, S Chand publishing, 2012. 3. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. 4. B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.Introduction to forensic chemistry, Kelly M. Elkins, CRC Press Taylor & Francis Group, 2019. 5. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand &Co.Publishers, second edition, 2006.
Reference Books	1. Randolph. Norris Shreve, Chemical Process Industries, McGraw-Hill, Texas, fourthedition, 1977. 2. W.A.Poucher,JosephA.Brink,Jr.Perfumes,Cosmetics and Soaps,Springer, 2000. 3. A.K.De,EnvironmentalChemistry,NewAge InternationalPublicCo.,1990.
Website and e-learning source	1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7044178/ 2. https://byjus.com/question-answer/name-the-element-which-is-important-component-of-ceramics-glass-and-cement-csialca-1/ 3. https://kids.britannica.com/students/article/food-and-nutrition/274373 4. https://study.com/academy/lesson/pharmaceutical-drugs-definition-types.html

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

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

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

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

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

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

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

CO-PO Mapping (Course Articulation Matrix)

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

Level of Correlation between PSO's and CO's

SEMESTER: II PART: III	23UCHEN26 DAIRY CHEMISTRY	Credit: 2 H/W: 2

Objectives of the course	This course aims at providing an overall view of the • chemistry of milk and milk products • processing of milk • preservation and formation of milk products.
Course Outline	UNIT I Composition of Milk Milk-definition-general composition of milk- constituents of milk - lipids, proteins, carbohydrates, vitamins and minerals - physical properties of milk - colour, odour, acidity, specific gravity, viscosity and conductivity -Factors affecting the composition of milk - adulterants, preservatives with neutralizer- examples and their detection- estimation of fat, acidity and total solids in milk.
	Unit II Processing of Milk Microbiology of milk - destruction of micro - organisms in milk, physico – chemical changes taking place in milk due to processing - boiling, pasteurization – types of pasteurization -Bottle, Batch and HTST (High Temperature Short Time) – Vacuum pasteurization – Ultra High Temperature Pasteurization.
	UNIT III Major Milk Products Cream - definition - composition - chemistry of creaming process - gravitational and centrifugal methods of separation of cream - estimation of fat in cream. Butter - definition -composition - theory of churning – desi butter - salted butter, estimation of acidity and moisture content in butter. Ghee - major constituents - common adulterants added to ghee and their detection - rancidity - definition - prevention - antioxidants and synergists - natural and synthetic.

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

SEMESTER: III PART: III Core – V	23UCHEC33 GENERAL CHEMISTRY-III	Credit: 5 H/W: 5

Prerequisites	General Chemistry – I and II
Objectives ofthe course	This course aims to provide a comprehensive knowledge on • the physical properties of gases, liquids, solids and X-ray diffraction of solids. • fundamentals of nuclear chemistry and nuclear waste management. • applications of nuclear energy • basic chemistry of halo-organic compounds, phenol and other aromatic alcohols. • preparation and properties of phenols and alcohols.
Course Outline	**UNIT I** **Gaseous state** Kinetic molecular model of a gas: postulates and derivation from the kinetic gas equation; The Maxwell –Boltzmann distribution of speed of molecules- average, root mean square and most probable velocity and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Collision frequency; collision diameter; mean free path and viscosity of gases. Real gases: Deviations from ideal gas behaviour, (Andrew's and Amagat's plots); compressibility factor, Z, and its variation with pressure for different gases. equations of states for real gases-van der Waal's equation; Virial equation; Boyle temperature; Numerical problems based on equations of statesfor real gases, isotherms of real gases – critical phenomena – isotherms of CO_2 - continuity of state–Van der waal's equation and the critical state; law of corresponding states-liquefaction of gases; numerical problems involving thecore concepts**.**
	Unit-II **Liquid and Solid State** Properties of Liquids- Surface tension, viscosity and their applications. Crystalline and amorphous – differences - geometry, isotropy and anisotropy, melting point; isomorphism, polymorphism. Crystals –size and shape; laws of crystallography; symmetry elements – plane,

	centre and axis; Miller indices, unit cells and space lattices; classification of crystal systems; Bravais lattices; X – ray diffraction – Bragg's equation Packing in atomic solids – simple cubic, body centered cubic, face centered and hexagonal close packing; Co-ordination number in typical structures - NaCl, CsCl, ZnS, TiO_2; comparison of structure and properties of diamond and graphite;.numerical problems involving core concepts Defects in solids - stoichiometric and nonstoichiometric defects. **Liquid crystals** – classification and applications.
	UNIT-III **Nuclear Chemistry** Natural radioactivity - α, β and γ rays; half-life period; Fajan–Soddy group displacement law; Geiger–Nattal rule; isotopes, isobars, isotones, mirror nuclei, iso diaphers; nuclear isomerism; radioactive decay series; magic numbers; units – Curie, Rutherford, Roentgen; nuclear stability - neutron- proton ratio; binding energy; packing fraction; mass defect. Simple calculations involving mass defect and B.E., decay constant and $t_{1/2}$ and radioactive series. Isotopes – uses – tracers – determination of age of rocks by radiocarbon dating. (Problems to be worked out) Nuclear energy; nuclear fission and fusion – major nuclear reactors in India; radiation hazards, disposal of radioactive waste and safety measures. .
	UNIT-IV **Halogen derivatives Aliphatic halogen derivatives** Nomenclature and classes of alkyl halides – isomerism, physical properties, Chemical reactions. Nucleophilic substitution reactions – S_N1, S_N2 and S_Ni mechanisms with stereochemical aspects and effect of solvent. **Di, Tri & Tetra Halogen derivatives:** Nomenclature, classification, preparation, properties and applications. **Aromatic halogen compounds** Nomenclature, preparation, properties and uses Mechanism of nucleophilic aromatic substitution – benzyne intermediate. **Aryl alkyl halides** Nomenclature, benzyl chloride – preparation – preparation properties and uses **Alcohols:** Nomenclature, classification, preparation, properties, use; conversions – ascent and descent of series; test for hydroxyl groups. Oxidation of diols by periodic acid and lead tetraacetate.

	UNIT-V **Phenols** Nomenclature; classification, Preparation from diazonium salts, cumene, Dow's process, Raching process; properties – acidic character and effect of substitution on acidity. Reactions – Fries, claisen rearrangement, Electrophilic substitution reactions, Reimer - Teimen, Kolbe, Schmidt, Gatermann synthesis, Libermann, nitro reaction, phthalein reaction. Resorcinol, quinol, picric acid – preparation, properties and uses. **Aromatic alcohols** Nomenclature, benzyl alcohol – methods of preparation – hydrolysis, reduction of benzaldehyde, Cannizzaro reaction, Grignard synthesis, physical properties, reactions – reaction with sodium, phosphorus pentachloride, thionyl chloride, acetic anhydride, hydrogen iodide, oxidation – substitution on the benzene nucleus, uses. Thiols: Nomenclature, structure, preparation and properties.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. B.R. Puri, L.R. Sharma, M.S. Pathania; *Principles of Physical Chemistry*, 46th edition, Vishal Publishing, 2020. 2. B.R. Puri, L.R. Sharma and K.C. Kalia, *Principles of Inorganic Chemistry*, Milestone Publishers and Distributors, New Delhi, thirtieth edition, 2009. 3. 4. P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, Sultan Chand & amp; Sons, twentieth edition, 2006. 4. M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003. 5. S.M. Mukherji, and S.P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.
ReferenceBooks	1. T. W. Graham Solomons, *Organic Chemistry*, John Wiley & Sons, fifth edition, 1992. 2. A. Carey Francis, *Organic Chemistry*, Tata McGraw-Hill Education Pvt., Ltd.,New Delhi, seventh edition, 2009. 3. I. L. Finar, *Organic Chemistry*, Wesley Longman Ltd, England, sixth edition, 1996.

	4. P. L. Soni, and H. M.Chawla - *Text Book of Organic Chemistry*, New Delhi, Sultan Chand & Sons, twenty ninth edition, 2007. 5. J.D. Lee, *Concise Inorganic Chemistry*, Blackwell Science, fifth edition, 2005.
Website and e-learning source	**MOOC components** https://nptel.ac.in/courses/104104101 Solid state chemistry https://nptel.ac.in/courses/103106071 Nuclear industries and safety https://nptel.ac.in/courses/104106119s Introduction to organic chemistry

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

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

CO2: describe the physical properties of liquid and solids; identify various types of crystals with respect to its packing and apply the XRD method for crystal structure determinations.

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

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

CO5: investigate the named organic reactions related to phenol; explain the preparation and properties of aromatic alcohol including thiol.

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

CO-PO Mapping (Course Articulation Matrix)

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

Level of Correlation between PSO's and CO's

SEMESTER: III PART: III Core – VI	23UCHEP34 INORGANIC QUALITATIVE ANALYSIS	Credit: 5 H/W: 4

Prerequisites	General chemistry
Objectives of the course	To develop the skill on systematic analysis of simple inorganic salts and mixture of salts.
Course Outline	**Semi - Micro Qualitative Analysis** 1. Analysis of simple acid radicals: Carbonate, sulphide, sulphate, thiosulphite, chloride, bromide, iodide, nitrate 2. Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate, arsenate, arsenite. 3. Elimination of interfering acid radicals and Identifying the group of basic radicals 4. Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, tin, antimony, iron, aluminium, arsenic, zinc,manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium 5. Analysis of a mixture - I to VIII containing two cations and two anions (of which one is interfering type)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	**Reference Books:** V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997.
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences
Course Learning Outcomes (for Mapping with POs and PSOs)	

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

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

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

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

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

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

CO-PO Mapping (Course Articulation Matrix)

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

Level of Correlation between PSO's and CO's

COURSE	**ELECTIVE: III**
COURSETITLE	**PHYSICS – I**
COURSE CODE	**23UPHYE35**
CREDITS	2
HOURS	3
COURSE OBJECTIVES	To impart basic principles of Physics that which would be helpful for students who have taken programmes other than Physics.

UNITS	**COURSE DETAILS**
UNIT-I	**WAVES, OSCILLATIONS AND ULTRASONICS:** simple harmonic motion (SHM) – composition of two SHMs at right angles (periods in the ratio 1:1) – Lissajous figures – uses – laws of transverse vibrations of strings – determination of AC frequency using sonometer (steel and brass wires) – ultrasound – production – piezoelectric method – application of ultrasonics: medical field – lithotripsy, ultrasonography – ultrasono imaging- ultrasonics in dentistry – physiotheraphy, 2phthalmology – advantages of noninvasive surgery – ultrasonics in green chemistry.
UNIT-II	**PROPERTIES OF MATTER:** *Elasticity*: elastic constants – bending of beam – theory of non- uniform bending – determination of Young's modulus by non-uniform bending – energy stored in a stretched wire – torsion of a wire – determination of rigidity modulus by torsional pendulum *Viscosity*: streamline and turbulent motion – critical velocity – coefficient of viscosity – Poiseuille's formula – comparison of viscosities – burette method, *Surface tension*: definition – molecular theory – droplets formation– shape, size and lifetime – COVID transmission through droplets, saliva – drop weight method – interfacial surface tension.
UNIT-III	**HEAT AND THERMODYNAMICS:** Joule-Kelvin effect – Joule-Thomson porous plug experiment – theory – temperature of inversion – liquefaction of Oxygen– Linde's process of liquefaction of air– liquid Oxygen for medical purpose– importance of cryocoolers – thermodynamic system – thermodynamic equilibrium – laws of thermodynamics – heat engine – Carnot's cycle – efficiency – entropy – change of entropy in reversible and irreversible process.
UNIT-IV	**ELECTRICITY AND MAGNETISM:** potentiometer – principle – measurement of thermo emf using potentiometer –magnetic field due to a current carrying conductor – Biot-Savart's law – field along the axis of the coil carrying current – peak, average and RMS values of ac current and voltage – power factor and current values in an AC circuit – types of switches in household and factories– Smart Wi-Fi switches-fuses and circuit breakers in houses

UNIT-V	**DIGITAL ELECTRONICS AND DIGITAL INDIA:** logic gates, OR, AND, NOT, NAND, NOR , EXOR logic gates – universal building blocks – Boolean algebra – De Morgan's theorem – verification – overview of Government initiatives: software technological parks under MeitY, NIELIT- semiconductor laboratories under Dept. of Space – an introduction to Digital India
TEXT BOOKS	1. R. Murugesan (2001), Allied Physics, S. Chand & Co, New Delhi. 2. Brijlal and N. Subramanyam (1994), Waves and Oscillations, Vikas Publishing House, New Delhi. 3. Brijlal and N. Subramaniam (1994), Properties of Matter, S. Chand & Co.,New Delhi. 4. J. B. Rajam and C. L. Arora (1976). Heat and Thermodynamics (8^{th} edition), S. Chand & Co.,New Delhi. 5. R. Murugesan(2005), Optics and Spectroscopy, S.Chand & Co, NewDelhi. 6. A. Subramaniyam, Applied Electronics 2^{nd} Edn., National Publishing Co., Chennai.
REFERENCE BOOKS	1. Resnick Halliday and Walker(2018). Fundamentals of Physics (11^{th}edition), John Willey and Sons, Asia Pvt .Ltd., Singapore. 2. V. R. Khanna and R. S. Bedi (1998), Textbook of Sound 1^{st}Edn. Kedharnaath Publish & Co, Meerut. 3. N. S. Khare and S. S. Srivastava (1983), Electricity and Magnetism 10^{th}Edn., Atma Ram & Sons, New Delhi. 4. D. R. Khanna and H.R. Gulati (1979). Optics, S. Chand &Co. Ltd., New Delhi. **5.** V. K. Metha (2004).Principles of electronics 6^{th} Edn. S. Chand and company.
WEBLINKS	1. https://youtu.be/M_5KYncYNyc 2. https://youtu.be/ljJLJgIvaHY 3. https://youtu.be/7mGqd9HQ_AU 4. https://youtu.be/h5jOAw57OXM 5. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/ 6. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.htmlhttps://www.youtube.com/watch?v=gT8Nth9NWPMhttps://www.youtube.com/watch?v=9mXOMzUruMQ&t=1shttps://www.youtube.com/watch?v=m4u-SuaSu1s&t=3shttps://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:
At the end of the course, the student will be able to:

COURSEOUTCOMES	**CO1**	Explain types of motion and extend their knowledge in the study of various dynamic motions analyze and demonstrate mathematically. Relate theory with practical applications in medical field.
	CO2	Explain their knowledge of understanding about materials and their behaviors and apply it to various situations in laboratory and real life. Connect droplet theory with Corona transmission.
	CO3	Comprehend basic concept of thermodynamics concept of entropy and associated theorems able to interpret the process of flow temperature physics in the background of growth of this technology.
	CO4	Articulate the knowledge about electric current resistance, capacitance in terms of potential electric field and electric correlatetheconnectionbetweenelectricfieldandmagneticfieldan danalyzethemmathematicallyverifycircuitsandapplytheconcepts to construct circuits and study them.
	CO5	Interpret the real life solutions using AND, OR, NOT basic logic gates and intend their ideas to universal building blocks. InferoperationsusingBooleanalgebraandacquireelementaryidea sofICcircuits.Acquire information about various Govt. programs/ institutions in this field.

MAPPING WITH PROGRAM OUT COMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the3-pointscale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

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

COURSETITLE	**PHYSICS PRACTICALS – I**
CREDITS	1
COURSE CODE	23UPHYEP3
HOURS	2
COURSE OBJECTIVES	Apply various physics concepts to understand Properties of Matter and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results

ANY Seven only

1. Young's modulus by non-uniform bending using pin and microscope
2. Young's modulus by non-uniform bending using optic lever, scale and telescope
3. Rigidity modulus by static torsion method.
4. Rigidity modulus by torsional oscillations without mass
2. Surface tension and interfacial Surface tension – drop weight method
3. Comparison of viscosities of two liquids – burette method
4. Specific heat capacity of a liquid – half time correction
5. Verification of laws of transverse vibrations using sonometer
6. Calibration of low range voltmeter using potentiometer
7. Determination of thermo emf using potentiometer
8. Verification of truth tables of basic logic gates using ICs
9. Verification of De Morgan's theorems using logic gate ICs.
10. Use of NAND as universal building block.

Note : Use of digital balance permitted

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

SEMESTER: III PART: III SEC IV	23UCHES36 ENTREPRENEURIAL SKILLS IN CHEMISTRY	Credit:1 H/W: 1

Prerequisites	General Chemistry
Objectives of the course	The course aims at providing training to • develop entrepreneur skills in students • to provide hands on experience to prepare and develop products • develop start ups
Course Outline	**UNIT -I** **Food Chemistry** Food adulteration-contamination of food items with clay stones, water andtoxicchemicals -Common adulterants. Food additives, Natural and synthetic anti-oxidants, glazing agents (hazardous effect),food colourants, Preservatives, leavening agents,Baking powder and baking soda, yeast,MSG,vinegar. **Dyes** Classification – Natural, synthetic dyes and their characteristics – basic methods and principles of dyeing
	UNIT II **Hands on Experience (Students can choose any four)** Detection of adulterants in food items like coffee, tea, pepper, chilli powder, turmeric powder, butter, ghee, milk, honey etc., by simple techniques. Preparation of Jam, squash and Jelly, Gulkand, cottage cheese. Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, tooth paste/powde rand disinfectants in small scale. Extraction of oils from spices and flowers. Testing of water samples using testing kit. Dyeing – cotton fabrics with natural and synthetic dyes Printing – tie and dye, batik.

Skills acquired from this course	**Entrepreneurial** skills.
Recommended Text	1. George S &Muralidharan V, (2007) Fibre to Finished Fabric – A Simple Approach, Publication Division, University of Madras, Chennai. 2. Appaswamy G P, A Handbook on Printing and Dyeing of Textiles.
Reference Books	Shyam Jha, Rapid detection of food adulterants and contaminants (Theory and Practice),Elsevier, e Book ISBN 9087128004289, 1st Edition,2015
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: identify adulterated food items by doing simple chemical tests.

CO 2: prepare cleaning products and become entrepreneurs

CO 3: educate others about adulteration and motivate them to become entrepreneurs.

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

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

SEMESTER: III **PART: III** **SEC V**	**3UCHES37** **PESTICIDE CHEMISTRY**	**Credit:2** **H/W: 2**

Title of the Course							
Paper No.	**Skill Enhancement Course V (Discipline specific)**						
Category	**Skill Enhancement Course**	**Year**	II	**Credits**	2	**Course Code**	
		Semester	III				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**			**Total**	
	2	-	-			2	
Prerequisites	Fundamentals in chemistry						
Objectives of the course	This course aims to providing the students • knowledge about the various types of pesticides and their toxicity. • to understand the accumulation of pesticides in in the form of residues and its analysis. • knowledge on choice of alternate and eco-friendly pesticides.						
Course Outline	**Unit I** **Introduction**: History of pesticides. Chemistry of Pesticides: Brief introduction to classes of pesticides (Chemical class, targets), structures, chemical names, physical and chemical properties. **Toxicity of pesticides**: Acute and chronic toxicity in mammals, birds, aquatic species etc. Methods of analysis of pesticides. **Insecticides:** Classification and study of following insecticides with respect to structure, chemical name, physical properties, chemical properties, synthesis, degradation, metabolism, formulations, Mode of action, uses, toxicity. Organophosphates and Phosphothionates: Acephate, Chlorpyriphos, Monocrotophos, and parathion-methyl. Organochlorine – Endosulfan, heptachlor; Carbamate: Cartap hydrochloride, Methomyl, Propoxur.						
	Unit II **Pesticides residues:** Introduction- application of agrochemicals, dissemination pathways of pesticides, causes of pesticide residues,remedies. Pesticides residues in atmosphere- entry into atmosphere, action of pesticides, effects on environments. Pesticides residues in water - entry into water systems, action and effect in aquatic environment. Pesticides residues in soil. entry into soil, absorption, retention and transport in soil, effects on microorganism, soil condition and fertility, decomposition and degradation by climatic factors and microorganism.						

	Pesticide Residues effect and analysis: Effects of pesticides residue on human life, birds and animals- routes for exposure to pesticides, action of pesticides on living system. Analysis of pesticides residues- sample preparation, extraction of pesticides residues (soil, water and vegetables/fruits) simple methods and schemes of analysis, multi-residue analysis.

	Unit III **Biopesticides:** Pheromones, attractants, repellents – Introduction, types and application (8- Dodecen-1-ol, 10-cis-12-hexadecadienoic, Trimedlure, Cue-lure, methyl eugenol, N,N- Diethyl-m-toluamide, Dimethyl phthalate, Icaridin). Baits- Metaldehyde, Iron (II) phosphate, Indoxacarb, Zinc Phosphide, Bromadiolone.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Handa SK. Principles of pesticide chemistry. Agrobios (India); 2012. 2. Matolcsy G, Nádasy M, Andriska V. Pesticide chemistry. Elsevier; 1989. 3. J. Miyamoto and P. C. Kearney Pesticide Chemistry Human Welfare and the Environment vol. IV Pesticide Residue and Formulation Chemistry, Pergamon press,1985. 4. R. Cremlyn: Pesticides, John Wiley.
Reference Books	1. Roy N. K., Chemistry of Pesticides. CBS Publisher & Distributors P Ltd; 1st Ed. (2010). 2. Nollet L.M., Rathore H.S., Handbook of pesticides: methods of pesticide residues analysis. CRC press; 2016. 3. Ellerbrock R.H., Pesticide Residues: Significance, Management and Analysis, 2005

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

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

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

Level of Correlation between PSO's and CO's

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

Level of Correlation between PO's and CO's

SEMESTER: IV **PART: III** **Core – VII**	**23UCHEC43** **GENERAL CHEMISTRY-IV**	**Credit: 5** **H/W: 4**

Prerequisites	General Chemistry III
Objectives ofthe course	This course aims to provide a comprehensive knowledge on • thermodynamic concepts on chemical processes and applied aspects. • thermo chemical calculations • transition elements with reference to periodic properties and group study of transition metals. • the organic chemistry of ethers, aldehydes and ketones • the organic chemistry of carboxylic acids
Course Outline	**UNIT I** **Thermodynamics I** Terminology – Intensive, extensive variables, state, path functions; isolated, closed and open systems; isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible processes; First law of thermodynamics – Concept and significance of heat (q), work (w), internal energy (E), enthalpy (H); calculations of q, w, E and H for reversible, irreversible

	expansion of ideal and real gases under isothermal and adiabatic conditions; relation between heat capacities (Cp & Cv); Joule Thomson effect- inversion temperature. Thermochemistry - heats of reactions, standard states; types of heats of reactions and their applications; effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions; Hess's law and its applications; determination of bond energy; Measurement of heat of reaction – determination of calorific value of food and fuels Zeroth law of thermodynamics-Absolute Temperature scale.
	Unit II **Thermodynamics II** Second Law of thermodynamics - Limitations of first law, spontaneity and randomness; Carnot's cycle; Concept of entropy, entropy change for reversible and irreversible processes, entropy of mixing, calculation of entropy changes of an ideal gas and a van der Waals gas with changes in temperature, volume and pressure, entropy and disorder. Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application. Third law of thermodynamics - Nernst heat theorem; Applications of third law - evaluation of absolute entropies from heat capacity measurements, exceptions to third law.
	UNIT III **General Characteristics of d-block elements** **Transition Elements**- Electronic configuration - General periodic trend variable valency, oxidation states, stability of oxidation states, colour, magnetic properties, catalytic properties and tendency to form complexes. Comparative study of transition elements and non transition elements – comparison of II and III transition series with I transition series. Group study of Titanium, Vanadium, Chromium, Manganese, Iron, Cobalt, Nickel and Zinc groups
	UNIT IV **Ethers, Thio ethers and Epoxides** Nomenclature, isomerism, general methods of preparations, reactions involving cleavage of C-O linkages, alkyl group and ethereal oxygen. Zeisel's method of estimation of methoxy group.

	Reactions of epoxides with alcohols, ammonia derivatives and $LiAH_4$ Thioethers - nomenclature, structure, preparation, properties and uses. **Aldehydes and Ketones** Nomenclatue, structure and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. Nucleophilic addition reactions, base catalysed reactions with mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes. Baeyer - Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf - Kishner reduction, Meerwein – Pondorf Verley reduction, reduction with $LiAlH_4$ and $NaBH_4$. Addition reactions of unsaturated carbonyl compounds: Michael addition.
	UNIT V **Carboxylic Acids**: Nomenclature, structure, preparation and reactions of aliphatic and aromatic monocarboxylic acids. Physical properties, acidic nature, effect of substituent on acidic strength. HVZ reaction, Claisen ester condensation, Bouveault Blanc reduction, decarboxylation, Hunsdieckerreaction.Formic acid-reducing property. Reactions of dicarboxylic acids, hydroxy acids and unsaturated acids. **Carboxylic acid Derivatives:** Preparations of aliphatic and aromatic acid chlorides, esters, amides and anhydrides. Nucleophilic substitution reaction at the acyl carbon of acyl halide, anhydride, ester, amide. Schottan-Baumann reaction. Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann bromamide degradation and Curtius rearrangement. **Active methylene compounds:** Keto – enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate **Halogen substituted acids** – nomenclature; preparation by direct halogenation, iodination from unsaturated acids, alkyl malonic acids **Hydroxy acids** – nomenclature; preparation from halo, amino, aldehydic and ketonic acids, ethylene glycol, aldol acetaldehyde; reactions – action of heat on α, β and γhydroxy acids.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)

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

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

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

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

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

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

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

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

CO-PO Mapping (Course Articulation Matrix)

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

Level of Correlation between PSO's and CO's

SEMESTER: IV PART: III Core – VIII	23UCHEP44 PHYSICAL CHEMISTRY PRACTICAL	Credit: 5 H/W: 4

Prerequisites	General Chemistry
Objectives of the course	The course aims at providing an understanding of • The laboratory experiments in order to understand the conceptsof physical changes in chemistry • The rates of chemical reactions • Colligative properties and adsorption isotherm
Course Outline	**UNIT-I** **Chemical kinetics** 1. Determination of rate constant of acid catalysed hydrolysis of an ester (methyl acetate). 2. Determination of order of reaction between iodide and persulphate (initial rate method). 3. Polarimetry: Determination of rate constant of acid catalysedinversion of cane sugar
	UNIT II **Phase diagrams** 1. Simple eutectic - determination of eutectic temperature and composition of naphthalene- diphenyl amine or naphthalene-diphenyl system 2. Determination of transition temperature of a salt hydrate. 3.Determination of concentration of sodium chloride using phenol-sodium chloride system
	UNIT III **Electrochemistry – Conductance measurements** 6. Determination of cell constant 7. Determination of molar conductance of strong electrolyte 8. Determination of dissociation constant of acetic acid **Colorimetry** 9. Determination of concentration of copper sulphate solution

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

Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: describe the principles and methodology for the practical work

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

CO3: apply the principles of electrochemistry, kinetics for carrying out the practical work.

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

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

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

Level of Correlation between PSO's and CO's

COURSE	**ELECTIVE: IV**
COURSE TITLE	**PHYSICS –II**
COURSE CODE	**23UPHYE45**
CREDITS	2
HOURS	3
COURSE OBJECTIVES	To understand the basic concepts of optics, modern Physics, concepts of relativity and quantum physics, semiconductor physics, and electronics.

UNITS	COURSE DETAILS
UNIT-I	**OPTICS: i**nterference – interference in thin films –colors of thin films – air wedge – determination of diameter of a thin wire by air wedge – diffraction – diffraction of light vs sound – normal incidence – experimental determination of wavelength using diffraction grating (no theory) – polarization – polarization by double reflection – Brewster's law – optical activity – application in sugar industries
UNIT-II	**ATOMIC PHYSICS:** atom models – Bohr atom model – mass number – atomic number – nucleons – vector atom model – various quantum numbers – Pauli's exclusion principle – electronic configuration – periodic classification of elements – Bohr magneton – Stark effect –Zeeman effect (elementary ideas only) – photo electric effect – Einstein's photoelectric equation – applications of photoelectric effect: solar cells, solar panels, optoelectric devices
UNIT-III	**NUCLEAR PHYSICS:** nuclear models – liquid drop model – magic numbers – shell model – nuclear energy – mass defect – binding energy – radioactivity – uses – half life – mean life - radio isotopes and uses –controlled and uncontrolled chain reaction – nuclear fission – energy released in fission – chain reaction – critical reaction – critical size- atom bomb – nuclear reactor – breeder reactor – importance of commissioning PFBR in our country – heavy water disposal, safety of reactors: seismic and floods – introduction to DAE, IAEA – nuclear fusion – thermonuclear reactions – differences between fission and fusion.
UNIT-IV	**INTRODUCTION TO RELATIVITY AND GRAVITATIONAL WAVES**: frame of reference – postulates of special theory of relativity – Galilean transformation equations – Lorentz transformation equations – derivation – length contraction – time dilation – twin paradox – mass-energy equivalence –introduction on gravitational waves, LIGO, ICTs opportunities at International Centre for Theoretical Sciences

UNIT-V	**SEMICONDUCTOR PHYSICS:** p-n junction diode – forward and reverse biasing – characteristic of diode – Zener diode – characteristic of Zener diode – voltage regulator – full wave bridge rectifier – construction and working – advantages (no mathematical treatment) – USB cell phone charger –introduction to e-vehicles and EV charging stations

TEXT BOOKS	1. R. Murugesan (2005), Allied Physics, S. Chand & Co, New Delhi. 2. K. Thangaraj and D. Jayaraman (2004), Allied Physics, Popular Book Depot, Chennai. 3. Brijlal and N. Subramanyam (2002), Textbook of Optics, S. Chand & Co, New Delhi. 4. R. Murugesan (2005), Modern Physics, S. Chand & Co, New Delhi. 5. A. Subramaniyam Applied Electronics, 2nd Edn., National Publishing Co., Chennai.
REFERENCE BOOKS	1. Resnick Halliday and Walker (2018), Fundamentals of Physics, 11th Edn., John Willey and Sons, Asia Pvt. Ltd., Singapore. 2. D. R. Khanna and H .R. Gulati (1979).Optics, S. Chand & Co. Ltd., New Delhi. 3. A. Beiser (1997), Concepts of Modern Physics, Tata McGraw Hill Publication, New Delhi. 4. Thomas L. Floyd (2017), Digital Fundamentals, 11th Edn., Universal Book Stall, New Delhi. 5. V. K. Metha (2004), Principles of electronics, 6th Edn. , S. Chand and Company, New Delhi.
WEBLINKS	1. https://www.berkshire.com/learning-center/delta-p-facemask/https://www.youtube.com/watch?v=QrhxU47gtj4https://www.youtube.com/watch?time_continue=318&v=D38BjgUdL5U&feature=emb_logo 2. https://www.youtube.com/watch?v=JrRrp5F-Qu4 3. https://www.validyne.com/blog/leak-test-using-pressure-transducers/ 4. https://www.atoptics.co.uk/atoptics/blsky.htm - 5. https://www.metoffice.gov.uk/weather/learn-about/weather/optical-effects

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

COURSE OUTCOMES:
At the end of the course the student will be able to:

COURSEOUTCOMES	**CO1**	Explain the concepts of interference diffraction using principles of superposition of waves and rephrase the concept of polarization based on wave patterns
	CO2	Outline the basic foundation of different atom models and various experiments establishing quantum concepts. Relate the importance ofinterpretingimprovingtheoreticalmodelsbasedonobservation. Appreciateinterdisciplinarynatureofscience and in solar energy related applications.
	CO3	Summarize the properties of nuclei, nuclear forces structure of atomic nucleus and nuclear models. Solve problems on delay rate half-life and mean-life. Interpret nuclear processes like fission and fusion. Understand the importance of nuclear energy, safety measures carried and get our Govt. agencies like DAE guiding the country in the nuclear field.
	CO4	To describe the basic concepts of relativity like equivalence principle, inertial frames and Lorentz transformation. Extend their knowledge on concepts of relativity and vice-versa. Relate this with current research in this field and get an overview of research projects of National and International importance, like LIGO, ICTS, and opportunities available.
	CO5	Summarize the working of semiconductor devices like junction diode, Zener diode, transistors and practical devices we daily use like USB chargers and EV charging stations.

MAPPING WITH PROGRAM OUT COMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3-point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

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

COURSE TITLE	**PHYSICS PRACTICALS – IV**
COURSE CODE	**23UPHYEP4**
CREDITS	1
HOURS	2
COURSE OBJECTIVES	Apply various Physics concepts to understand concepts of Light, electricity and magnetism and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results

Any Seven only

1. Radius of curvature of lens by forming Newton's rings
2. Thickness of a wire using air wedge
3. Wavelength of mercury lines using spectrometer and grating
4. Refractive index of material of the lens by minimum deviation
5. Refractive index of liquid using liquid prism
6. Determination of AC frequency using sonometer
7. Specific resistance of a wire using PO box
8. Thermal conductivity of poor conductor using Lee's disc
9. Determination of figure of merit table galvanometer
10. Determination of Earth's magnetic field using field along the axis of a coil
11. Characteristics of Zener diode
12. Construction of Zener / IC regulated power supply
13. Construction of AND, OR, NOT gates using diodes and transistor
14. NOR gate as a universal building block

METHOD OF EVALUATION:

Continuous Internal Assessment	End Semester Examination	Total	Grade
25	**75**	**100**	

SEMESTER: IV PART: IV SEC – VI	23UCHES46 INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS	Credit: 2 H/W: 2

Prerequisites	General Chemistry
Objectives of the course	The course aims at providing an overall view of the • operation and troubleshooting of chemical instruments • fundamentals of analytical techniques and its application in the characterization of compounds • theory of chromatographic separation and theory of thermo / electro analytical techniques • stoichiometry and the related concentration terms
Course Outline	**UNIT-I** **Qualitative and Quantitative Aspects of Analysis** S.I Units, Distinction between Mass and Weight. Moles, Millimoles, Milli equivalence, Molality, Molarity, Normality, Percentage by Weight and Volume, ppm, ppb. Density and Specific Gravity of Liquids. Stoichiometry Calculations Sampling, evaluation of analytical data, Errors – Types of Errors, Accuracy, Precision, Minimization of Errors. Significant Figures. Methods of Expressing Precision: Mean, Median, Average Deviation, Standard Deviation, Coefficient of Variation, Confidence Limits, Q- test, F-test, T-test. The Least Square Method for Deriving Calibration plots.
	UNIT II **Atomic Absorption Spectroscopy**: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.
	UNIT III **UV-Visible and IR Spectroscopy** Origin of spectra, interaction of radiation with matter, fundamental lawsof spetroscopy and selection rules, validity of Beer-Lambert's law. **UV-Visible Spectrometry:** Basic principles, instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. **Infrared Spectroscopy:** Basic principles of instrumentation (choice of source, monochromator& detector) for single and double beam instrument; sampling techniques.

	UNIT IV **Thermal and Electro-analytical Methods of Analysis** TGA and DTA- Principle, Instrumentation, methods of obtaining Thermograms, factors affecting TGA/DTA, Thermal analysis of silver nitrate, calcium oxalate and calcium acetate DSC- Principle, Instrumentation and applications. Electroanalytical methods: polarography - principle, instrumentation and applications. Derivative polarography- Cyclic Voltammetry - principle.
	UNIT V **Separation and purification techniques** Classification, principle, Factors affecting - Solvent Extraction – Liquid - Liquid Extraction, Chromatography: Column, TLC, Paper, Gas, HPLC and Electrophoresis, Principle, Classification, Choice of Adsorbents, Solvents, Preparation of Column, Elution Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms and Rf value.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

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

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

completion of the course the students should be able to

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

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

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

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

CO5: explain preparation of solutions, stoichiometric calculations

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

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

Level of Correlation between PSO's and CO's

SEMESTER: IV PART: IV SEC – VII	23UCHES47 FORENSIC SCIENCE	Credit: 2 H/W: 2

Prerequisites	General Chemistry
Objectives ofthe course	This course aims at giving an overall view of • crime detection through analytical instruments • forgery and its detection • medical aspects involved
Course Outline	**UNIT I** **Poisons** Poisons - types and classification - diagnosis of poisons in the living and the dead -clinical symptoms - postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of seafoods - use of neutron activation analysis in detecting arsenic in human hair. Treatment in cases of poisoning – use of antidotes for common poisons.
	Unit-II **Crime Detection** Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human bombs - possible explosives (gelatin sticks and RDX) - metal detector devices andother security measures for VVIP-composition of bullets and detecting powder burns.
	UNIT-III **Forgery and Counterfeiting** Documents - different types of forged signatures - simulated and traced forgeries -inherent signs of forgery methods - writing deliberately modified - uses of ultraviolet rays -comparison of type written letters – checking silver line water mark in currency notes – alloy analysis using AAS to detect counterfeit coins – detection of gold purity in 22 carat ornaments – detecting gold plated jewels -authenticity of diamond.
	UNIT-IV **Tracks and Traces** Tracks and traces - small tracks and police dogs - foot prints - costing of

	foot prints -residue prints, walking pattern or tyre marks – miscellaneous traces and tracks – glass fracture - tool marks - paints - fibres - Analysis of biological substances - blood, semen, saliva, urine and hair - Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and racehorses.
	UNIT-V **Medical Aspects** Aids - causes and prevention - misuse of scheduled drugs - burns and their treatment by plastic surgery. Metabolite analysis using mass spectrum - Gas chromatography-Arson -natural fires and arson - burning characteristics and chemistry of combustible materials -nature of combustion. Ballistics - classification - internal and terminal ballistics - small arms -laboratory examination of barrel washing and detection of powder residue by chemical tests.
Recommended Text	1. SA Iqbal, M Liviu, Textbook of forensic chemistry, Discovery publishing house private limited, 2011. 2. Kelly M. Elkins, Introduction to Forensic Chemistry, CRC Press, Taylor & Francis Group, 2019. 3. Javed I. Khan, Thomas J. Kennedy, Donnell R. Christian, Jr., Basic principles of Forensic chemistry, Humana Press, first edition, 2012. 4. Bapuly AK, (2006) Forensic Science – Its application in crime investigation, Paras Medical Publisher, Hyderabad. 5. Sharma B.R., (2006) Scientific Criminal Investigation, Universal Law Publishing Co. Pvt. Ltd, New Delhi.
ReferenceBooks	1. Richard Saferst in and Criminalistics-An Introduction to Forensic Science (College Version), Sopfestein, Printice hall, eighth edition,2003 2. Suzanne Bell, Forensic Chemistry, Pearson, second international edition, 2014. 3. Jay Siegel, Forensic chemistry: Fundamentals and applications, Wiley-Blackwell, first edition, 2015. 4. Max M. Houck & Jay A. Segal, (2006) Fundamentals of Forensic Science, Elsevier Academic press. 5. Henry C. Lee, Timothy Palmbach, Marilyn T. Miller, (2006) Henry Lee's Crime Scene Book Elsevier Academic press.
Website and e-learning source	1. http://www.library.ucsb.edu/ist/03-spring/internet.html 2. http://www.wonder howto.com/topic/forensic-science/

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

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

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

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

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

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

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

CO-PO Mapping (Course Articulation Matrix)

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

Level of Correlation between PSO's and CO's

SEMESTER: V PART: III Core IX	23UCHEC51 ORGANIC CHEMISTRY – I	Credit: 4 H/W: 5

Prerequisites	General Chemistry I,II, III and IV
Objectives of the course	This course aims to provide an understanding of • stereoisomerism in chirals and geometric isomerism in olefins, conformations of ethane and butane • preparation and properties of aromatic and aliphatic nitro compounds and amines • preparation of different dyes, food colour and additives • preparation and properties of five membered heterocycles like pyrrole, furan and thiophene • preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline.
Course Outline	**UNIT I** **Stereochemistry** Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism:cis–trans, syn-anti isomerism, E/Z notations. **Optical Isomerism:** Optical activity, specific rotation, asymmetry, enantiomers, distereoisomers, meso structures - molecules with one and two chiral centres, racemisation- methods of racemisation; resolution-methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereogenic) centres. Molecules with no asymmetric carbon atoms – allenes and biphenyls. Conformational analysis of ethane and butane.
	UNIT II **Chemistry of Nitrogen Compounds – I** **Nitroalkanes** Nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes; physical properties; reactions – reduction, halogenations, Grignard reagent, Pseudo acid character. Nitro - aci nitro tautomerism. **Aromatic nitro compounds** Nomenclature, preparation – nitration, from diazonium salts, physical properties; reactions - reduction of nitrobenzene in different medium, Electrophilic substitution reactions, TNT.

	Amines: Aliphatic amines Nomenclature, isomerism, preparation – Hofmanns' degradation reaction, Gabriel's phthalimide synthesis, Curtius Schmidt rearrangement. Physical properties, reactions – alkylation, acylation, carbylaminereaction, Mannich reaction, oxidation, basicity of amines.
	UNIT III **Chemistry of Nitrogen Compounds – II** **Aromatic amines** – Nomenclature, preparation – from nitro compounds, Hofmann's method; Schmidt reaction, properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid - zwitter ion formation. Distinction between primary, secondary and tertiary amines - aliphaticand aromatic Diazonium compounds Diazomethane, Benzene diazonium chloride - preparations and synthetic applications. **Dyes** Theory of colour and constitution; classification based onstructure and application; preparation –Martius yellow, aniline yellow, methyl orange, alizarin, indigo, malachite green. Industry oriented content Dyes Industry, Food colour and additives
	UNIT IV **Heterocyclic compounds** Nomenclature and classification. General characteristics - aromaticcharacter and reactivity. Five-membered heterocyclic compounds Pyrrole – preparation - from succinimide, Paal Knorr synthesis; reactions – reduction, basic character, acidic character, electrophilic substitution reactions, ring opening. Furan – preparation from mucic acid and pentosan; reactions – hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction. Thiophene synthesis - from acetylene; reactions –reduction; oxidation;

	electrophilic substitution reactions.
	UNIT V **Six-membered heterocyclic compounds** Pyridine – synthesis - from acetylene, Physical properties; reactions - basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution- uses Condensed ring systems Quinoline – preparation - Skraup synthesis and Friedlander's synthesis; reactions – basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions – Chichibabin reaction Isoquinoline – preparation by the Bischler – Napieralski reaction, reduction, oxidation; electrophilic substitution.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1.M.K. Jain, S.C.Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2009. 2.S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 2009. 3. ArunBahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand& Company Pvt. Ltd., Multicolour edition, 2012. 4.P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007. 5.C.N.Pillai, Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009.
Reference Books	1.R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia, sixth edition, 2012. 2. T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons, eleventh edition, 2012.

	3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, seventh edition,2009. 4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, sixth edition, 2006. 5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, Fifth Edition, 2010.
Website and e-learning sources	1.www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http:/swayam.gov.in 4. Virtual Textbook of Organic Chemistry

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: assign RS notations to chirals and EZ notations to olefins and explain conformations of ethane and butane.

CO2: explain preparation and properties of aromatic and aliphatic nitro compounds and amines

CO3: explain colour and constitution of dyes and food additives

CO4: discuss preparation and properties of five membered heterocycles like pyrrole, furan and thiophene

CO5: discuss preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline

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

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

Level of Correlation between PSO's and CO's

SEMESTER: V PART: III Core X	23UCHEC52 INORGANIC CHEMISTRY -I	Credit: 4 H/W: 5

Prerequisites	General Chemistry I , II, III and IV
Objectives of the course	The course aims to provide knowledge on • nomenclature, isomerism and theory of coordination compounds, and chelate complexes • crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect • preparation and properties of metal carbonyls • Lanthanoids and actinoids • preparation and properties of inorganic polymers
Course Outline	**UNIT I** **Co-ordination Chemistry - I** IUPAC Nomenclature of coordination compounds, Isomerism in coordination compounds. Werner's coordination theory – effective atomic number –interpretation of geometry and magnetic properties by Pauling's theory – geometry of co-ordination compounds with co-ordination number 4 &6. Chelates – types of ligands forming chelates – stability of chelates, applications of chelates in qualitative and quantitative analysis–application of DMG and oxine in gravimetric analysis –estimation ofhardness of water using EDTA, metal ion indicators. Role of metal chelates in living systems – haemoglobin and chlorophyll
	Unit II **Co-ordination Chemistry - II** Crystal field theory –Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy (CFSE), spectrochemical series - calculation of CFSE in octahedral and tetrahedral complexes - factors influencing the magnitude of crystal field splitting, crystal field effect on ionic radii, lattice energies, heats of ligation with water as a ligand (heat of hydration), interpretation of magnetic properties, spectra of $[Ti(H_2O)_6]^{3+}$ - Jahn – Teller effect. Stability of complexes in aqueous solution, stability constants- factors affecting the stability of a complex ion, thermodynamic and kinetic stability (elementary idea). Comparison of VBT and CFT.

	UNIT III **Organometallic compounds** **Metal Carbonyls** Mono and polynuclear carbonyls, General methods of preparation of carbonyls – general properties of binary carbonyls – bonding in carbonyls – structure and bonding in carbonyls of Ni, Fe, Cr, Co, Mn, Ru and Os. EAN rule as applied to metal carbonyls. Ferrocene-Methods of preparation, physical and chemical properties
	UNIT IV **Inner transition elements (Lanthanoids and Actinoids)** General characteristics of f-block elements - Comparative account of lanthanoids and actinoids - Occurrence, Oxidation states, Magnetic properties, Colour and spectra - Lanthanoids and Actinoids, Separation by ion-Exchange and Solvent extraction methods - Lanthanoids contraction-Chemistry of thorium and Uranium-Occurrence, Ores, Extraction, properties and uses - Preparation, Properties and uses of ceric ammonium sulphate, thorium dioxide and uranyl acetate.
	UNIT V **Inorganic polymers** General properties – classification of inorganic polymers based on element in the backbone (Si, S, B and P) - preparation and properties of silicones (polydimethylsiloxane and polymethylhydrosiloxane) phosphorous based polymer (polyphosphazines and polyphophonitrilic chloride), sulphur based polymer (polysulfide and polymeric sulphur nitride), boron based polymers (borazine polymers) – industrial applications of inorganic polymers.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31thEdition, Milestone Publishers & Distributors, Delhi. 2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009),

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

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain isomerism, Werner's Theory and stability of chelate complexes

CO2: discuss crystal field theory, magnetic properties and spectral properties of complexes.

CO3: explain preparation and properties of metal carbonyls

CO4: give a comparative account of the characteristics of lanthanoids and actinoids

CO5:explain properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorous

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

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

Level of Correlation between PSO's and CO's

SEMESTER: V PART: III Core XI	23UCHEC53 PHYSICAL CHEMISTRY -I	Credit: 4 H/W: 5

Prerequisites	General Chemistry I,II,III and IV
Objectives of the course	The course aims at providing an overall view of • Gibbs free energy, Helmholtz free energy, Ellingham's diagram and partial molar properties • chemical kinetics and different types of chemical reactions • adsorption, homogeneous and heterogeneous catalysis • colloids and macromolecules • photochemistry, fluorescence and phosphorescence
Course Outline	**UNIT I** **Thermodynamics - III** Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application. Partial molar properties – chemical potential, Gibbs Duhem equation, variation of chemical potential with temperature and pressure, chemical potential of a system of ideal gases, Gibbs- Duhem-Margules equation.

UNIT II
Chemical Kinetics

Rate of reaction - Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction - rate equation - order of reaction. order and molecularity of simple and complex reactions, Rate laws - Rate constants – derivation of rate constants and characteristics for zero, first order, second and third order (equal initial concentration) – Derivation of time for half change with examples. Methods of determination of order of Volumetry, manometry and polarimetry.

Effect of temperature on reaction rate – temperature coefficient - concept of activation energy - Arrhenius equation. Theories of reaction rates – Collision theory – derivation of rate constant of bimolecular gaseous reaction – Failure of collision theory. Lindemann's theory of unimolecular reaction. Theory of absolute reaction rates – Derivation of rate constant for a bimolecular reaction – significance of entropy and free energy of activation. Comparison of collision theory and ARRT.

Complex reactions – reversible and parallel reactions (no derivation and only examples) – kinetics of consecutive reactions – steady state approximation.

UNIT III
Adsorption – Chemical and physical adsorption and their general characteristics- distinction between them Different types of isotherms – Freundlich and Langmuir. Adsorption isotherms and their limitations – BET theory, kinetics of enzyme catalysed reaction –Michaelis- Menten and Briggs- Haldene equation – Lineweaver- Burk plot – inhibition – reversible – competitive, noncompetitive and uncompetitive (no derivation of rate equations)

Catalysis – general characteristics of catalytic reactions, auto catalysis, promoters, negative catalysis, poisoning of a catalyst – theories of homogenous and heterogeneous catalysis – Kinetics of Acid – base and enzyme catalysis. Heterogenous catalysis

UNIT IV
Colloids and Surface Chemistry

Colloids: Types of Colloids, Characteristics Colloids (Lyophilic and Lyophobic sols),
Preparation of Sols- Dispersion methods, aggregation methods, Properties of Sols- Optical properties, Electrical properties - Electrical double layer, Electro Kinetic properties- Electro-osmosis, Electrophoresis,

Coagulation or precipitation, Stability of sols, associated colloids, Emulsions, Gels-preparation of Gels, Applications of colloids

	Macromolecules: Molecular weight of Macromolecules-Number average molecular weight- average molecular weight, Determination of Molecular weight of molecules
	UNIT V **Photochemistry** Laws of photo chemistry – Lambert – Beer, Grotthus – Draper and Stark – Einstein. Quantum efficiency. Photochemical reactions – rate law – Kinetics of H_2-Cl_2, H_2-Br_2 and H_2-I_2 reactions, comparison between thermal and photochemical reactions. Fluorescence – applications including fluorimetry – sensitised fluorescence, phosphorescence – applications - chemiluminescence and photosensitisation – examples Chemistry of Vision – 11 cis retinal – vitamin A as a precursor - colour perception of vision
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., forty eighth edition, 2021. 2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018. 3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co. 4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996. 5. J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNagin Chand and CO., 1986.
Reference Books	1. J. Rajaram and J.C. Kuriacose, Chemical Thermodynamics, Pearson, 1st edition, 2013. 2. Keith J. Laidler, Chemical kinetics, third edition, Pearson, 2003. 3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002. 4. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan

	India Ltd, third edition, 2009. 5. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001
Website and e-learning source	1. https://nptel.ac.in 2. https://swayam.gov.in 3. www.epgpathshala.nic.in

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

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

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

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

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

CO5: utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision.

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

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

Level of Correlation between PSO's and CO's

SEMESTER: V PART: III Core XII	23UCHED54 PROJECT WITH VIVA VOCE	Credit: 4 H/W: 5

(Refer to the Regulations)

SEMESTER: V PART: III EC V	23UCHEE55-1 BIO CHEMISTRY	Credit: 3 H/W: 4

Prerequisites	Organic Chemistry – I
Objectives of the	The course aims at providing knowledge on
course	• relationship between biochemistry and medicine, composition of blood • structure and properties of amino acids, peptides, enzyme, vitamins and proteins • biological functions of proteins, enzymes, vitamins and hormones • biochemistry of nucleic acids and lipids metabolism of lipids
Course Outline	**UNIT I** **Logic of Living Organisms** Relationship of Biochemistry and Medicine Blood - Composition of Blood, Blood Coagulation – Mechanism. Hemophilia and Sickle Cell Anaemia • Maintenance of pH of Blood – Bicarbonate Buffer, Acidosis, Alkalosis.
	UNIT II **Peptides and Proteins** **Amino acids** – nomenclature, classification – essential and Non-essential; Synthesis - Gabriel Phthalimide, Strecker; properties – zwitter ion and isoelectric point, electrophoresis and reactions. **Peptides** – peptide bond – nomenclature – synthesis of simple peptides – solution and solid phase. Determination of structure of peptides, N-terminal analysis – Sanger's & Edmann method; C terminal analysis - Enzymic method. **Proteins** – classification based on composition, functions and structure; properties and reactions – colloidal nature, coagulation, hydrolysis, oxidation, denaturation, renaturation; colour tests for proteins; structure of proteins – primary, secondary, tertiary and quaternary. Metabolism of Amino acids – general aspects of metabolism (a brief outline); urea cycle.

	UNIT III **Enzymes and Vitamins** Nomenclature and classification, characteristics, factors influencing enzyme activity – mechanism of enzyme action – Lock and key hypothesis, Koshland's induced fit model. Proenzymes, antienzymes, coenzymes and isoenzymes; allosteric enzyme regulation. Vitamins as coenzymes – functions of TPP, lipoic acid, NAD, NADP, FMN, FAD, pyridoxal phosphate, CoA, folic acid, biotin, cyanocobalamin.
	UNIT IV **Amino acids** Components of nucleic acids - nitrogenous bases and pentose sugars, structure of nucleosides and nucleotides, DNA- structure & functions; RNA –types– structure - functions; biosynthesis of proteins **Hormones** Adrenalin and thyroxine — chemistry, structure and functions (No structure elucidation).
	UNIT V **Lipids** Occurrence, biological significance of fats, classification of lipids. **Simple lipids** – Oils and fats, chemical composition, properties, reactions – hydrolysis, hydrogenation, trans-esterification, saponification, rancidity; analysis of oils and fats – saponification number, iodine number, acid value, R.M. value. Distinction between animal and vegetable fats. **Compound lipids** – Lipoproteins - VLDL, LDL, HDL, chylomicrons – biological significance. Cholesterol – occurrence, structure, test, physiological activity. Metabolism of lipids: β-oxidation of fatty acids.

Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Bahl, B. S.; Bhal, A. *Advanced Organic Chemistry*, 3rd ed.; S. Chand: New Delhi, 2003. 2. Jain, M.K.; Sharma, S.C. *Modern Organic Chemistry*, Vishal Publications: New Delhi, 2017. 3. Shanmugam, A. *Fundamentals of Biochemistry for Medical Students*, 6th ed.; Published by the author, 1999. 4. Veerakumari, L. *Biochemistry*, 1st ed.; MJP Publications: Chennai, 2004. 5. Jain, J. L.; *Fundamentals of Biochemistry*, 2nd ed.; S.Chand: New Delhi, 1983.
Reference Books	1. Conn, E. E.; Stumpf, P. K. *Outline of Biochemistry*, 5th ed.; Wiley Eastern: New Delhi, 2002. 2. West, E. S.; Todd, W. R.; Mason, H. S.; Van Bruggen, J. T. *Text Book of Biochemistry*, 4th ed.; Macmillan: New York, 1970. 3. Lehninger, A. L. *Principles of Biochemistry*, 2nd ed.; CBS Publisher: Delhi, 1993. 4. Rastogi, S. C. *Biochemistry*, 2nd ed.; Tata McGraw-Hill: New Delhi, 2003 5. Chatterjea, M. N.; Shinde, R. *Textbook of Medical Biochemistry*, 5thed.; Jaypee Brothers: New Delhi, 2002.

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

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

CO1: explain molecular logic of living organisms, composition of blood and blood coagulation

CO2: explain synthesis and properties of amino acids, determination of structure of peptides and proteins

CO3: explain factors influencing enzyme activity and vitamins as coenzymes

CO4: explain RNA and DNA structure and functions

CO5: explain biological significance of simple and compound lipids

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

Level of Correlation between PSO's and CO's

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

Level of Correlation between PO's and CO's

SEMESTER: V PART: III EC V	23UCHEE55-2 GREEN CHEMISTRY	Credit: 3 H/W: 4

Prerequisites	Organic Chemistry-I
Objectives of the	The course aims at providing knowledge on
Course	**1.** To know the basics of Green Chemistry and its developments. **2.** To know the principles of green chemistry. **3.** To know the goals of Green Chemistry. **4.** To understand Limitations of green chemistry. **5.** To study the obstacles in the pursuit of the goals of Green Chemistry.
Course Outline	**UNIT-I: GREEN CHEMISTRY – INTRODUCTION** **HOURS: 9** Need for green chemistry – principles of green chemistry – atom economy – definition with example (ibuprofen synthesis) – green oxidant – hydrogen peroxide. Microwave assisted organic synthesis – apparatus required – examples of MAOS (synthesis of fused anthroquinones, Leukart reductive amination of ketones) – advantages and disadvantages of MAOS. Organic reactions by sonication method – apparatus required – examples of sonochemical reactions (Heck, Hundsdiecker and Wittig reactions).
	UNIT-II: PRINCIPLES OF GREEN CHEMISTRY **HOURS: 9** Twelve principles of Green Chemistry with their explanations and special emphasis on the following with examples: Designing a Green Synthesis using these principles; Prevention of Waste/ byproducts, maximum incorporation of the materials used in the process into the final products, Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions.
	UNIT-III: GREEN REACTIONS **HOURS: 9** Acetylation of primary amine, base catalyzed aldol condensation (synthesis of dibenzalpropanone), halogen addition to C=C bond (bromination of trans-stilbene), [4+2] cycloaddition reaction (Diels-Alder reaction between furan and maleic acid).

	Electrophilic aromatic substitution reactions (nitration of phenol, bromination of acetanilide) – green oxidation reactions (synthesis of adipic acid, preparation of manganese (III) acetylacetonate) – zeolite catalyzed Friedel-Crafts acylation.
	UNIT-IV: GREEN SOLVENTS **HOURS: 9** Ionic liquids: simple preparation – types – properties and application – ionic liquids in organic reactions (Heck reaction, Suzuki reactions, epoxidation), industrial (battery) and analytical chemistry (matrices for MALDI-TOF MS, gas chromatography stationary phases – advantages and disadvantages. Super critical CO_2 – preparation, properties, applications and environmental impact.
	UNIT-V: FUTURE TRENDS IN GREEN CHEMISTRY **HOURS: 9** Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; co crystal controlled solid state synthesis (C^2S^3); Green chemistry in sustainable development.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination Question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/JAM/TNPSCotherstobesolved (To be discussed during the Tutorial hours)
Skills acquired From this course	Knowledge, Problem solving, Analyticalability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	R. Sanghi and M.M.Srinivastava, Green Chemistry: Environmental alternatives, Narosa Publishing House, New Delhi. 2. V.K. Ahluwalia, M.Kidwai, 2007,New Trends in Green Chemistry, Anamaya Publishers, 2nd Edition, New Delhi.

Reference Books	1. P. Tundo, A. Perosa, F. Zechini, 2007, Methods and Reagents for Green Chemistry, John Wiley & Sons Inc., New Jersey. 2. Ahluwalia, Kidwai, 2005, New Trends in Green Chemistry, Anamalaya Publishers, Puducherry. 3. Anastas P.T. Warner J.K. 1998, Green Chemistry -Theory and Practical, University 4. Press, London. 5. Cann M.C., Connely M.E., 2000, World Cases in Green Chemistry, AmericanChemical Society, Washington.
Website and e-learning source	1. https://www.epa.gov/greenchemistry/basics-green-chemistry 2. https://www.sciencedoze.com/2021/01/green-solvents-definition-examples-types-of-green-solvents.html 3. https://www.organic-chemistry.org/topics/green-chemistry.shtm

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

CO1: Able to understand the need of green chemistry.

CO2: Able to explain the principles of green chemistry.

CO3: Able to explain green synthesis and reactions.

CO4: Able to understand about green solvents.

CO5: Able to explain the future trends in green chemistry.

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

Level of Correlation between PSO's and CO's

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

Level of Correlation between PO's and CO's

SEMESTER: V PART: III EC V	23UCHEE55-3 AGRICULTURAL CHEMISTRY	Credit: 3 H/W: 4

Prerequisites	General Chemistry
Objectives of the Course	The course aims at providing knowledge on • importance of agricultural chemistry • role of fertilizers • effect of fertilizers and manures • pesticides • fungicides and herbicides
Course Outline	**UNIT I:** **Soil science** Soil-Definition of soil, Properties of soil – Physical Property Components – Soil Structure and texture. Soil water, Soil air and Soil temperature.Chemical properties – Soil mineral matter – Soil colloid, ion- Exchange reactions – Soil fertility and its evaluations, Soil organic matter and their transformation into soil. Soil reactions – Soil pH – soil acidity and buffer action .
	UNIT II: **Fertilizers** Fertilizers-Primary nutrients -Nitrogen fertilizers: Effect of Nitrogen on plant growth and development. deficiency of nitrogeneous fertilizers classification – of nitrogenous fertilizers – Nitrates, urea and cynamide. Commercial method of preparing urea. Phosphate fertilizers: Effect of phosphorus on plant growth and development – kinds of phosphate fertilizers – Super phosphate – Bone meal – basic slag – rock phosphate – dicalcium phosphate – tricalcium phosphate and other phosphates – Manufacture of super phosphate.
	UNITIII **Fertilizers And Manures** Potassium fertilizers: function of potassium on plant growth and developement – classification into chloride and nonchloride forms manufacturing processes and properties of potassium fertilizers. Complex fertilizers and mixed fertilizers: their manufacture and composition. Secondary nutrients – micronutrients – their function in plants – materials containing micronutrients. Manures: bulky organic manures – Farm yard manure handling and storage – method of composting green manuring, concentrated organic manures and their chemical composition – oil cakes Blood meal – fish manures.
	UNITIV **Pesticides And Insecticides** Pesticides: Classification of Pesticides – mode of action – general methods of application and toxicity, safety measures when using pesticides. Insecticides: plant products – Nicotine, pyrethrum, rotenone, and petroleum oils, Inorganic pesticides – arsenical fluorides, borates. Organic pesticides – organochlorine compounds – D.D.T. B.H.C., methoxychlor, chlordane, and endosulfon

	UNITV **Fungicides And Herbicides:** Fungicides Inorganic – Sulphur compounds – Copper compounds – Mercuric compounds Organic – dithiocarbamates – Dithane, Bordeaux mixture. Herbicides: Inorganic herbicides – Arsenical compounds Boron compounds – Cyanamide – Cyanides and thiocyanates chlorates and sulphamates. Organic herbicides and Nitro – compounds – chlorinated compounds – 2 ,4D compounds –Propionic and acid derivatives – urea herbicides.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination Question paper)	Questions related to the above topics ,from various competitive examinations UPSC/JAM/TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired From this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Nelson S.L., Beaton, W.L. Tisdale J. D, 1990, Soil Fertility and Fertilizers, Macmillian Publishing Company, New York. 2. Buchel K.H., 2008, Chemistry of Pesticides, John Wiley & Sons, New York.
Reference Books	1. N.C. Brady, 1984, The Nature and properties of soils, Eurasia publishing House (P) Ltd., 9th Edition 2. U.S. Jones, 1987, Fertilizers and soil Fertility Prentice, Hall of India, 2nd Edition, New Delhi. 3. A.K. De, Environmental Chemistry, New Age International Pvt Ltd., 2nd Edition, New Delhi.
Website and e-learning source	1. https://en.wikipedia.org/wiki/Soil_science 2. https://www.britannica.com/topic/fertilizer 3. https://opjsrgh.in/Content/Worksheet/PRACTICE-WS/2021-2022/day32/12-AGRICULTURE.pdf 4. https://byjus.com/chemistry/pesticides/ 5. https://extension.psu.edu/fungicides-herbicides-and-insecticides
CourseLearningOutcomes(forMappingwithPOsandPSOs)Oncompletionofthecoursethestudentsshouldbeableto **CO1:**Understand the basics of soil. **CO2:**Classify and explain plant nutrients and fertilizers **CO3:**Differentiate fertilizers and manures. **CO4:**Explain the classification of pesticides **CO5:**Describe the Fungicides and herbicides	

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

Level of Correlation between PSO's and CO's

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

Level of Correlation between PSO's and CO's

SEMESTER: V PART: III EC VI	23UCHEE56-1 INDUSTRIAL CHEMISTRY	Credit: 3 H/W: 4

Prerequisites	General Chemistry I,II, III and IV
Objectives of the course	This course is designed to provide knowledge on • classifications and characteristics of fuels • preparation of cosmetics • manufacture of sugar, paper, cement and leather and food processing • applications of abrasives, lubricants and other industrial products • intellectual property rights
Course Outline	**UNIT 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, carbonisation of coal. Liquid fuels: Petroleum - characteristics; Gasoline aviation petrol-knocking in internal combustion engines, antiknock agents; unleaded petrol-octane number, cetane number. Gaseous fuel: advantages over solid and liquid fuels; water gas, producer gas, carburetted water gas - preparations - uses. Natural gas: LPG-composition, advantages, application; gobar gas-production, composition, advantages, application. Propellants – rocket fuels (basic idea)
	UNIT II **Cosmetics** Skin care: powders, ingredients; creams and lotion-cleansing, moisturising, all purpose shaving cream, sunscreen; make up preparations. Dental care: tooth pastes – ingredients. Hair care: shampoos-types, ingredients; conditioners-types, ingredients. Perfumes: natural-plant origin-parts of the plant used, chief constituents;

	animal origin-amber gries, civetone and musk; synthetic-classification-esters-amylsalicylate alcohols-citronellol; terpeneols-gereniol and nerol; ketones-muskone, coumarin; aldehydes-vanilin. **Soaps and Detergents** Soaps-properties, manufacture of soap-batch process; types-transparent soap, toilet soap, powder soap and liquid soap – ingredients. Detergents-definition, properties-cleansing action; soapless detergents-anionic, cationic and non-ionic (general idea only); uses of detergents as surfactants. Biodegradability of soaps and detergents.
	UNIT III **Sugar Industry** Manufacture from sugar cane; recovery of sugar from molasses; testing and estimation of sugar. **Food Preservation and processing** Food spoilage – causes; Food preservation - methods – high temperature, low temperature, drying, radiation; Food additives – preservatives, flavours, colours, anti-oxidants, sweetening agents; hazards of using food additives; Food standards – Agmark and Codex alimentarius.
	UNIT IV **Abrasives** Definition, characteristics, types-natural and synthetic; natural abrasives – diamond, corundum, emery, garnet, quartz – composition, uses; synthetic abrasives – carborundum, aluminium carbide, boron carbide, boron nitride, synthetic graphite – composition and uses. **Leather Industry** Structure and composition of skin, hide; Manufacture of leather – pre-tanning process – curing, liming, beating, pickling; methods of tanning-vegetable, chrome – one bath, two bath process; finishing. **Paper Industry** Manufacture of pulp - mechanical, chemical processes; sulphate pulp, rag pulp; manufacture of paper- beating, refining, filling, sizing, colouring, calendaring; cardboard.
	UNIT V **Lubricants** Definition, classification-liquid, semi-solid, solid and synthetic; properties-viscosity index, flash point, cloud point, pour point, aniline point and drop point; greases-properties, types; cutting fluids,

	selection of lubricants. **Cement Industry** Cement – types, raw materials; manufacture-wet process, constituent of cement, setting of cement; properties of cement-quality, setting time, soundness, strength; mortar, concrete, RCC; curing and decay of concrete. **Intellectual Property Rights** Introduction to Intellectual Property Rights – Patents - Factors for patentability - Novelty, Non obviousness, Industrial applications - Patent offices in India: Trademark - Types of trademarks- Certification marks, logos, brand names, signatures, symbols and service marks
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Sharma, B.K. *Industrial Chemistry*, 9th ed.; Goel Publishing House: Meerut, 1998. 2. Wilkinson, J.B.E. Moore, R.J. *Harry's Cosmeticology*, 7th ed.; Chemical Publishers : New York, 1982. 3. Alex V. Ramani, *Food Chemistry*, MJP publishers: Chennai, 2009. 4. Jayashree Ghosh, *Applied Chemsitry*, S. Chand : New Delhi, 2006. 5. Srilakshmi, B. *Food Science*, 4th ed.; New Age International Publication, 2005.
Reference Books	1. Jain, P.C.; Jain, M. *Engineering Chemistry*, 16th ed.; Dhanapet Rai: Delhi, 1992 2. George Howard, *Principles and Practice of Perfumes and Cosmetics*, Stanley Therones, Cheltenham: UK, 1987. 3. Thankamma Jacob, *Foods, Drugs and Cosmetics - A Consumer Guide*, Macmillan : London, 1997. 4. ShankuntalaManay, N.; Shadaksharaswamy, M. *Food Facts and Principles*, 3rd ed.; New Age Publication, 2008. 5. Neeraj Pandey, KhushdeepDharni, *Intellectual Property Rights*, PHI Learning, 2014.

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

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

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

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

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

Level of Correlation between PSO's and CO's

SEMESTER: V PART: III EC VI	23UCHEE56-2 "C " LANGUAGE AND CHEMISTRY	Credit: 3 H/W: 4

Prerequisites	Computer Literacy Programme&Basic Knowledge In Computers
Objectives of the	The course aims at providing knowledge on
Course	1. To acquire knowledge about the basic components of a computer and the operating system. 2. To understand Hardware and Software. 3. To understand Algorithm and Flowchart. 4. To familiarize the students in C language. 5. To understand the applications of computer software in Chemistry.
Course Outline	**UNIT – I: BASIC COMPUTER ORGANISATION HOURS: 9** **1.1** BasicComputerOrganisation-Types Of Data-Simple model Of A Computer-Data Processing Using A Computer,Desktop Computer. **1.2** Input Unit,OutputUnit,DataStorage:Random Access Memory, Read Only memory,Secondary Storage, Central Processing Unit. **1.3** Computer Software-programming Languages-Classification Of Programming languages based on Applications-Planning The Computer Program-algorithm and Flowcharts.
	UNIT – II: INTRODUCTION TO C PROGRAMMING HOURS:9 **2.**1Introduction to C Language –Introduction-CCompiler-PreprocessorDirectives. **2.3**Variables,Constants,Operators,InputandOutputFunctions.
	UNIT – III: CONTROL STRUCTURES **HOURS: 9** **3.1** Control Structures –Conditional, Looping, Goto, Break,Switchand Continue Statements, **3 . 2** Functions, Arrays and Pointers.

	UNIT – IV: APPLICATIONS IN CHEMISTRY-I **4.1** CalculationoftheRadiusofthefirstBohrorbitforan Electron. **4.2** CalculationofHalf-lifeTimeforanintegralorderreaction-CalculationofMolarity, Molality and Normality of a solution. **4.3** CalculationofPressureofIdealGasesandVanderWaal'sgases-CalculationofElectronegativity of an Element using Pauling's relation.
	UNIT – V: APPLICATIONS IN CHEMISTRY-II **5.1** ApplicationsinChemistry-CalculationofEmpiricalFormulaeofHydrocarbons-Calculation of Reduced Mass of a few Diatomic Molecules. **5.2** Determination of the Wave Numbers of Spectral lines of Hydrogen atom - Calculation of Work of Expansion in Adiabatic Process. **5.3**CalculationofpH,SolubilityProductandBondEnergyusingBorn-Landeequation-Calculation of Standard Deviation and Correlation Coefficient.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination Question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/JAM/TNPSCotherstobesolved (TobediscussedduringtheTutorialhours)
Skills acquired From this course	Knowledge,Problemsolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferableskills.
Recommended Text	1. K.V.Raman, 2005, Computers In Chemistry,TataMcGrawHillPublishers, 8th edition, New Delhi. 2. VenugopalandPrasad,1971,Programmimng with C, TataMcGrawHillPublishers 11thEdition, New Delhi. 3. E.Balaguruswamy,2017, Programming in C, TataMcGrawHillPublishers,2ndEdition, New Delhi.

Reference Books	1. YashavanKanetkar, Authentic guide to C programming, BPB Publications, 18th Edition, New Delhi. 2. Byron Gottfried, Programming with C, McGraw Hill Education, 4th Edition, New Delhi.
Website and e-learning source	1. https://unacademy.com/content/question-answer/gk/what-are-the-basic-organization-of-a-computer-system/ 2. https://www.geeksforgeeks.org/c-language-introduction/ 3. https://study.com/academy/lesson/molality-definition-formula.html

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

CO1: The students will be able to understand the basic computer architecture.
CO2: The students will be able to understand about the operating system.
CO3: The students will be able to understand the algorithm and programme.
CO4: The students will be able to describe the basic terminologies used in C language and explain the basic concepts of programming.
CO5: The students will be able to understand the applications of computer software in various areas in Chemistry.

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
WeightedpercentageofCourse Contributionto PSOs	3.0	3.0	3.0	3.0	3.0

LevelofCorrelationbetweenPSO'sandCO's

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weightedpercentageof CourseContributiontoPOs	3.0	3.0	3.0	3.0	3.0

LevelofCorrelationbetweenPO'sandCO's

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

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

Level of Correlation between PSO's and CO's

SEMESTER: V PART: III EC VI	23UCHEE56-3 APPLIED CHEMISTRY	Credit: 3 H/W: 4

Prerequisites	General Chemistry
Objectives of the Course	The course aims at providing knowledge eon 1. To impart Knowledge about Petrochemicals. 2. To learn about the process involved in paper and pulp technology. 3. To instill an interest about the process of sugar industry. 4. To enhance the knowledge about explosives. 5. To create an interest in leather chemistry.
CourseOutline	**UNIT – I: PETROLEUM HOURS:6** Introduction – Petroleum-Origin-Composition of Petroleum-Inorganic, Engler and Modern Theories-Classification-Refining-Cracking-Thermal and Catalytic-Knocking-Octane Rating-Antiknock Compounds - Cetane Rating-Synthetic Petrol-LPG - Gobargas-Production-Feasibility and Importance of Biogas. 1.1 Petrochemicals-Definition-Chemicals from Natural Gas, Petroleum-Light Naphtha and Kerosene-Origin-Composition-Synthetic Gasoline.
	UNIT – II: PULP AND PAPER TECHNOLOGY **2.1** Pulp and Paper technology-Introduction-Manufacture of Pulp-Mechanical Process-Chemical Process - Sulphate Pulp, Sulphite Pulp and Rag Pulp. **2.2** Various Processes-Beating, Refining, Filling, Sizing and Colouring - Manufacture of Paper- Calendering - Uses essential;Synthesis-GabrielPhthalimide,Strecker;properties–zwitter ionandisoelectricpoint,electrophoresisandreactions.
	UNIT – III: SUGARHOURS:6 **3.1** Sugar-Introduction-Manufacture of Cane Sugar-Extraction of Juice-Purification of Juice-Concentration – Crystallization - Separation of Crystals-Refining of crystals. **3.2** Recovery of Sugar Molasses – Bagasse - Preparation of alcohol from Molasses.

	UNIT – IV: EXPLOSIVESHOURS:6 **4.1** Explosives-Introduction-Classification-Detonating or High Explosives-Deflagrating or Low Explosives-Characteristics of Explosives-Nitrocellulose, TNB,TNT, Picric acid, Cordite, Nitroglycerine and Gun Powder, Lead Azide-Precautions during storage of Explosives.
	UNIT – V: LEATHER CHEMISTRY **HOURS:6** **5.1** Leather Chemistry-Main Process Used in leather Manufacture-Structure of Hide and Skin,Leather Processing-Process before tannage. . **5.2** Tanning Process-Vegetable tanning and Chrome tanning-Tannery Effluent and by product-treatment.
ExtendedProfessionalComponent(isapartofinternalcomponentonly,Nottobeincludedintheexternalexamination Questionpaper)	QuestionsrelatedtotheabovetopicsfromvariouscompetitiveexaminationsUPSC/JAM/TNPSCotherstobesolved (TobediscussedduringtheTutorialhours)
Skillsacquired Fromthiscourse	Knowledge,Problemsolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferableskills.
RecommendedText	1. B.K. Sharma, 2008, Industrial Chemistry including Chemical engineering, Goel Publishing house, 13th Edition, Meerut. 2. Jain and Jain, 2019 Chemistry of Engineering Materials, DhanpatRai Publishing Company (P) LTD, (K.K.Group), 17th Edition, New Delhi.
ReferenceBooks	1. Jayashree Ghosh, 2006, Fundamentals Concepts of Applied Chemistry,Sultan Chand and Sons, 1st Edition, New Delhi.

Websiteand e-learningsource	2. https://en.wikipedia.org/wiki/Petroleum 3. https://www.pulpandpaper-technology.com/articles/pulp-and-paper-manufacturing-process-in-the-paper-industry 4. https://www.haberwater.com/post/sugar-manufacturing-process 5. https://en.wikipedia.org/wiki/Explosive 6. https://www.chemistryislife.com/t-13

CourseLearningOutcomes(forMappingwithPosandPSOs)Oncompletionofthecoursethestudentsshouldbeableto

CO1: Able to understand the concept of Petrochemicals.
CO2: Prepare alcohol from Molasses.
CO3: Understand the processes involved in paper technology.
CO4: Extensive Knowledge about the Explosives and Leather Chemistry.
CO5: Able to understand the concepts involved in tanning process.

CO/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
WeightedpercentageofCourse Contributionto PSOs	3.0	3.0	3.0	3.0	3.0

LevelofCorrelationbetweenPSO'sandCO's

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weightedpercentageof CourseContributiontoPOs	3.0	3.0	3.0	3.0	3.0

LevelofCorrelationbetweenPO'sandCO's

SEMESTER: V **PART: IV**	**23UCHEI58** **SUMMER INTERNSHIP**	**Credit: 2** **H/W: -**

(Refer to the Regulations)

SEMESTER: VI PART: III Core XIII	23UCHEC61 ORGANIC CHEMISTRY – II	Credit: 4 H/W: 6

Prerequisites	Organic Chemistry – I
Objectives of the course	This course aims at providing knowledge on • classification, isolation and discussing the properties of alkaloids and terpenes • preparation and properties of saccharides • biomolecules • different molecular rearrangement • preparation and properties of organometallic compounds
Course Outline	**UNIT I** **Alkaloids** Classification, isolation, general properties- Hofmann Exhaustive Methylation; Structure elucidation – Coniine, piperine, nicotine. **Terpenes:** Classification, Isoprene rule, isolation and structural elucidation of Citral, alpha terpineol, Menthol, Geraniol and Camphor.
	UNIT II **Carbohydrates** Definition and Classification of Carbohydrates with examples.Relative configuration of sugars. Determination of configuration (Fischer'sProof). Definition of enantiomers, diastereomers, epimers and anomers with suitable examples. **Monosaccharides**– configuration – D and L hexoses – aldohexoses and ketohexoses. Glucose, Fructose – Occurrence, preparation, properties, reactions, structural elucidation, uses. Interconversions of sugar series – ascending, descending, aldose to ketose and ketose to aldose. **Disaccharides** – sucrose, lactose, maltose - preparation, properties and uses (no structural elucidation). **Polysaccharides** – Source, constituents and biological importance of homopolysaccharides- starch and cellulose, heteropolysaccharides – hyaluronic acid, heparin.

	UNIT III **Molecular rearrangements:** Molecular Rearrangement: Type of rearrangements, Mechanism for Benzidine, Favorskii, Clasien, Fries, Hofmann, Curtius, Schmidt and Beckmann, Pinacol-pinacolone rearrangement
	UNIT IV **Special reagents in organic synthesis** AIBN, 9BBN, BINAP/BINOL, BOC, DABCO, DCC, DIBAL, DMAP, NBS/NCS, NMP, PCC, TBHP, TEMPO **Organometallic compounds in Organic Synthesis** Preparation, Properties and applications: Grignard Reagents, Organo Lithium Compounds, Ziegler – Natta, Wilkinson, Metal Carbonyl, Zeiss's Salt
	UNIT V **Green Chemistry:** Principles, chemistry behind each principle and applications in chemical synthesis. Green reaction media – green solvents, green reagents and catalysts; tools used like microwave and ultra-sound in chemical synthesis.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. M.K.Jain, S. C.Sharma, Modern Organic Chemistry, Vishal Publishing, 4th reprint,2009. 2. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan IndiaLtd., 3rd edition,2009 3. Arun Bahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand& Company Pvt. Ltd., Multicolour edition,2012. 4. P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, 29th edition, 2007.

	5. C Bandyopadhya; An Insight into Green Chemistry; Published on 2020
Reference Books	1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia,6th edition, 2012. 2. T.W.Graham Solomons, Organic Chemistry, John Wiley & Sons,11th edition, 2012. 3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi,7th edition,2009. 4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, 6th edition, 2006. 5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, 5th Edition, 2010.
Website and e-learning source	1.www.epgpathshala.nic.in 2.www.nptel.ac.in 3.http:/swayam.gov.in 4.Virtual Textbook of Organic Chemistry 5.https://vlab.amrita.edu/

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

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

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

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

Level of Correlation between PSO's and CO's

SEMESTER: VI PART: III Core XIV	23UCHEC62 INORGANIC CHEMISTRY –II	Credit: 4 H/W: 6

Prerequisites	Inorganic Chemistry – I
Objectives of the course	The course aims to provide knowledge on • tracer elements and their role in the biological system. • iron transport and storage • metallo enzymes, oxygen transport. • silicates and their applications • industrial applications of refractories, alloys, paints and pigments
Course Outline	**UNIT I** **Bioinorganic Chemistry** Essential and trace elements: Role of Na^+, K^+, Mg^{2+}, Ca^{2+}, Fe^{3+}, Cu^{2+} and Zn^{2+} in biological systems. Effect of excess intake (Toxicity) of Metal ions – trace elements - As, Cd, Pb, Hg.
	UNIT II **Metal ion transport and storage** Iron – storage, transport - Transferrin and Ferretin; Iron-porphyrins – myoglobin, haemoglobin – oxygen transport - Bohr effect; Sodium/potassium pump, calcium pump; transport and storage - copper and zinc.

	UNIT III **Metallo enzymes** Isomerase and synthetases, structure of cyanocobalamin (Vitamin B12), nature of Co-C bond; Metalloenzymes - functions of carboxy peptidase A, zinc metalloenzyme – mechanism and uses, Zn-Cu enzyme - structure and function, carbonic anhydrase, Vitamin B-12 as transferase and isomerase - Iron-sulphur proteins - 2Fe-2S – rubredoxin, 4Fe-2S – ferridoxin, Iron sulphur cluster enzymes. Invivo and Invitro nitrogen fixation – biological functions of nitrogenase and molybdo enzymes.
	UNIT IV **Silicates** Introduction – general properties of silicates, structure – types of silicates – ortho silicates(zircon), pyrosilicates (thortveitite), chain silicates(pyroxenes), ring silicates(beryl), sheet silicates(talc, mica, asbestos), silicates having three dimensional structure (feldspars, zeolites, ultramarines)
	UNIT V **Industrial Applications of Inorganic Compounds** Refractories, pyrochemical, explosives. Alloys, Paints and pigments - requirements of a good paint; classification, constituents of paints – pigments, vehicles, thinners, driers, extenders, anti-knocking agents, anti-skinning agents, plasticizers, binders-application; varnishes- oils, spirit; enamels. Nanocomposite Hydrogels: synthesis, characterization and uses. Industrial visits and internship mandatory.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Puri B R, Sharma L R, Kalia K C (2011), Principles of Inorganic Chemistry, 31th ed., Milestone Publishers & Distributors, Delhi.

	2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advancd Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi 3. Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., ELBS William Heinemann, London. 4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, Schand 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, 2nded., S.Chand and Company, New Delhi. 2. Gopalan R, (2009) Inorganic Chemistry for Undergraduates, Ist Edition, University Press (India) Private Limited, Hyderabad 3. Sivasankar B, (2013) Inorganic Chemistry. Ist Edition, Pearson, Chennai 4. Alan G. Sharp (1992), Inorganic Chemistry, 3rd Edition, Addition-Wesley, England 5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.
Website and e-learning source	1. www.epgpathshala.nic.in 2. www.nptel.ac.in 3. http:/swayam.gov.in

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

CO1: ability to explain the importance of tracer elements on biological system.

CO2: explain the metal ion transport, Bohr effect, Na, K, Ca pump.

CO3: explain the function of Vitamin B_{12}, Zn-Cu enzyme, ferredoxin, cluster enzymes.

CO4: classification and structure of silicates.

CO5: explain the manufacture of refractories, explosives, paints and pigments

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

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

Level of Correlation between PSO's and CO's

SEMESTER: VI PART: III Core XV	23UCHEC63 PHYSICAL CHEMISTRY-II	Credit: 4 H/W: 6

Prerequisites	Physical Chemistry – I
Objectives of the course	The course aims at providing an overall view of the • phase diagram of one and two component systems • chemical equilibrium, • separation techniques for binary liquid mixtures. • electrical conductance and transport number. • galvanic cells, EMF and significance of electrochemical series.
Course Outline	**UNIT-I** **Phase rule** Definition of terms; derivation of phase rule ; application to one component systems – water and sulphur - super cooling, sublimation ; two component systems – solid liquid equilibria- simple eutectic (lead - silver and bismuth - cadmium), freezing mixtures (potassium iodide- water), compound formation with- congruent melting points (magnesium – zinc and ferric chloride – water system), peritectic change (sodium – potassium), solid solution (gold-silver); copper sulphate – water system.
	UNIT II **Chemical equilibrium** Law of mass action – thermodynamic derivation – relationship between $K_p$and K_c –application to the homogeneous equilibria – dissociation of PCl_5 gas,N_2O_4 gas –equilibrium constant and degree of dissociation - formation of HI, NH_3 ,and SO_3 –heterogeneous equilibrium – decomposition of solid calcium carbonate –Lechatelier principle – van't Hoff reaction isotherm – temperature dependence of equilibrium constant – van't Hoff reaction isochore – Clayperon equation – ClausiusClayperon equation and its applications.
	UNIT III **Binary liquid mixtures** Ideal liquid mixtures – non ideal solutions – azeotropic mixtures – fractional distillation – partially miscible mixtures – phenol-water, triethylamine-water, nicotine-water – effect of impurities on critical solution temperature; immiscible liquids- steam distillation; Nernst distribution law – applications.
	UNIT IV **Electrical Conductance and Transference** Arrhenius theory of electrolytic dissociation – Ostwald's dilution law, limitations of Arrhenius theory; behavior of strong electrolytes – interionic effects – Debye Huckel theory –Onsager equation (noderivation), significance of Onsager equation, Debye Falkenhageneffect, Wien effect. Ionic mobility – Discharge of ions on electrolysis (Hittorf's

	theoretical device), transport number –determination – Hittorf's method, moving boundary method – factors affecting transport number – determination of ionic mobility; Kohlrausch's law- applications; molar ionic conductance and viscosity (Walden's rule); applications of conductance measurements – determination of - degreeof dissociation of weak electrolyte, dissociation constant of weak acidand weak base, ionic product of water, solubility and solubility productof sparingly soluble salts - conductometric titrations – acid base titrations.
	UNIT V **Galvanic Cells and Applications** Galvanic cell, representation, reversible and irreversible cells, EMF and its measurement – standard cell; relationship between electrical energy and chemical energy; sign of EMF and spontaneity of a reaction, thermodynamics and EMF – calculation of ΔG, ΔH, and ΔS from EMF data; reversible electrodes, electrode potential, standard electrode potential, primary and secondary reference electrodes, Nernst equation for electrode potential and cell EMF; types of electrodes – metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode, redox electrode; electrochemical series – applications of electrochemical series.Chemical cells with and without transport, concentration cells with and without transport; **Applications of EMF measurements** applications of EMF measurements – determination of activity coefficient of electrolytes, transport number, valency of ions, solubility product, pH using hydrogen gas electrode, quinhydrone electrode and glass electrode, potentiometric titrations – acid base titrations, redox titrations, precipitation titrations, ionic product of water and degree of hydrolysis; redox indicators - use of diphenylamine indicator in the titration of ferrous iron against dichromate. **Industrial component** Galvanic cells- lead storage, Ni-Cd, Li and Zn-air, Al-air batteries Fuel cells – H_2-O_2 cell – efficiency of fuel cells. corrosion –mechanism, types and methods of prevention.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

Recommended Text	1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, ShobanLalNagin Chand and Co., forty eighth edition, 2021. 2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018. 3. ArunBahl, B.S. Bahl, G. D. Tuli Essentials of physical chemistry, 28th edition 2019, S, Chand & Co. 4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition, 1996. 5. J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNagin Chand and CO., 1986.
Reference Books	1. K. L. Kapoor, A Textbook of Physical Chemistry, Macmillan India Ltd, third edition,2009. 2. Gilbert. W. Castellen, Physical Chemistry, Narosa Publishing House, third edition, 1985. 3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002. 4. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001 5. D.N.Bajpai, Advanced Physical Chemistry, S.Chand&Co., 2001

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

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

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

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

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

CO4: Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equation and Kohlrausch's law in conductance.

CO5: Construct electrochemical cell with the help of electrochemical series and calculate cell EMF. Demonstrate the applications of EMF and significance of potentiometric titrations.

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

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

Level of Correlation between PSO's and CO's

SEMESTER: VI PART: III EC VII	23UCHEE64-1 FUNDAMENTALS OF SPECTROSCOPY	Credit: 3 H/W: 5

Prerequisites	General Chemistry I,II,III and IV
Objectives of the course	This course is designed to provide knowledge on • electrical and magnetic properties of organic and inorganic compounds • basic principles of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry • instrumentation of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry • applications of various spectral techniques in structural elucidation • solving combined spectral problems
Course Outline	**UNIT I** **Electrical and Magnetic properties of molecules** Dipole moment – polar and nonpolar molecules – polarisability of molecules. Application of dipole moments in the study of organic and inorganic molecules. Magnetic permeability, volume susceptibility, mass susceptibility and molar susceptibility; diamagnetism, paramagnetism – determination of magnetic susceptibility using Guoy balance, ferromagnetism, anti ferromagnetism **Microwave spectroscopy** Rotation spectra - diatomic molecules (rigid rotator approximation) selection rules – determination of bond length, effect of isotopic substitution – instrumentation and applications
	UNIT II **Ultraviolet and Visible spectroscopy** Electronic spectra of diatomic molecules (Born Oppenheimer approximation) - vibrational coarse structure – rotational fine structure of electronic vibration transitions – Frank Condon principle – dissociation in electronic transitions – BirgeSponer method of evaluation of dissociation energy – pre-dissociation transition - σ -σ *, π-π*, n-σ*, n-π* transitions. Applications of UV-Woodward – Fieser rules as applied to conjugated dienes and α, β - unsaturated ketones. Elementary Problems. Colorimetry - principle and applications (estimation of Fe^{3+})
	UNIT III

	Infrared spectroscopy Vibration spectra –diatomic molecules – harmonic oscillator and anharmonic oscillator; Vibration – rotation spectra – diatomic molecule as rigid rotator and anharmonic oscillator (Born-Oppenheimer approximation oscillator) - selection rules, vibrations of polyatomic molecules – stretching and bending vibrations – applications – determination of force constant, moment of inertia and internuclear distance – isotopic shift – application of IR spectra to simple organic and inorganic molecules – (group frequencies) **Raman Spectroscopy** Rayleigh scattering and Raman scattering of light – Raman shift – classical theory of Raman effect – quantum theory of Raman effect – Vibrational Raman spectrum – selection rules – mutual exclusion principle – instrumentation (block diagram) – applications.
	UNIT IV **Nuclear magnetic resonance spectroscopy:** PMR – theory of PMR – instrumentation - number of signals – chemical shift – peak areas and proton counting – spin-spin coupling – applications. Problems related to shielding and deshielding of protons, chemical shifts of protons in hydrocarbons, and in simple monofunctional organic compounds; spin-spin splitting of neighbouring protons in vinyl and allyl systems.
	UNIT V **Mass spectrometry** Principle – different kinds of ionisation – instrumentation – the mass spectrum – types of ions – determination of molecular formula-fragmentation and structural elucidation – McLafferty rearrangement; Retro Diels Alder reaction - illustrations with simple organic molecules. Solving structure elucidation problems using multiple spectroscopic data (NMR, MS, IR and UV-Vis).
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

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

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: explain electrical and magnetic properties of materials and microwave spectroscopy

CO2: explain theory, instrumentation and applications of Infrared and Raman spectroscopy

CO3: apply selection rules to understand spectral transitions, explain Woodward – Fieser's rule for the calculation of wavelength maximum of conjugated dienes

CO4: explain theory, instrumentation and applications of NMR spectroscopy

CO5: explain theory, instrumentation and applications of Mass spectrometry

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

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

Level of Correlation between PSO's and CO's

SEMESTER: VI PART: III EC VII	23UCHEE64-2 ORGANIC SYNTHESIS	Credit: 3 H/W: 5

Prerequisites	General Chemistry I,II,III and IV
Objectives of the course	The course aims to provide knowledge on ➢ To introduce the basics of disconnection approach. ➢ To learn about protecting groups. ➢ To introduce one group C-C disconnections. ➢ To introduce two group C-C disconnections. ➢ To learn about ring synthesis.
Course Outline	**UNIT I DISCONNECTION APPROACH** An introduction to synthons and synthetic equivalent. Disconnection approach, functional group interconversion, The importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections. Chemo selectivity, reversal of polarity.
	UNIT II PROTECTING GROUPS Principle of protection of alcohol group and amine group. Principle of protection of carbonyl group and carboxyl group. Activation of functional group.
	UNIT III ONE GROUP C-C DISCONNECTIONS Alcohols and carbonyl compounds. Regioselectivity and Alkene synthesis. Use of acetylenes and aliphatic nitrocompounds in organic synthesis.
	UNIT IV TWO GROUP C-C DISCONNECTIONS Diels-Alder reaction, 1, 3 - difunctionalised compounds. α,β unsaturated carbonyl compounds, Control in carbonyl condensations. 1, 5 - difunctionalised compounds, Michael addition and Robinson annulation.
	UNIT V RING SYNTHESIS Saturated heterocycles. Synthesis of 3-,4-,5- and 6- membered rings,aromatic heterocycles.in organic synthesis. Application of the above in the synthesis of camphor, longifolene, cortisone & reserpine.

Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	**Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)**
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Herbert O House, 1965, Modern synthetic reactions,W.A. Benjamin, 1st Edition,New York. 2. Warren Stuart, 2008, Organic Synthesis: The Disconnection Approach,Wiley, 2nd Edition, New Jersey, USA. 3. W. Carruthers, 1987, Some modern methods of Organic synthesis, Cambridge University Press, 3rd Edition, UK.
Reference Books	1. Michael B. Smith, 1994, Organic Synthesis, McGraw-Hill Inc., 1st Edition, US 2. C.K. Charles, 2012, Organic Synthesis, Alpha Science International Ltd, 1st Edition, Oxford, UK. 3. F.A.Carey and R.J. Sundberg, 1977, Advanced Organic Chemistry, Part-B, Plenium Press, 1st Edition, New York.
Website and e-learning source	1. https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004101314199439sangeeta_sriv_chem_Disconnection_Approach.pdf 2. https://profiles.uonbi.ac.ke/andakala/files/sch_504_protecting_groups_in_organic_synthesis.pdf 3. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000005CH/P000669/M026476/ET/1515666017CHE_P14_M3_etext.pdf 4. http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000005CH/P000669/M026477/ET/1515666038CHE_P14_M4_etext.pdf 5. https://en.wikipedia.org/wiki/Ring_forming_reaction

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

CO1: To describe methods for organic synthesis.
CO2:To understand transformation of the most common functional groups.
CO3:To understand the principles of disconnection approach.
CO4:To learn strategic approaches for organic Synthesis.

CO5:To provide theoretical understanding of heterocyclic chemistry which includes various methods for ring synthesis.

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

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

Level of Correlation between PSO's and CO's

SEMESTER: VI PART: III EC VII	23UCHEE64-3 HEALTH CHEMISTRY	Credit: 3 H/W: 5

Prerequisites	General Chemistry I,II,III and IV
Objectives of the course	The course aims to provide knowledge on ➢ To recognize the causes of common diseases, their control and treatment ➢ To understand the first aid for accidents ➢ To study the organic pharmaceutical aids ➢ To know about organic diagnostic agents To have an idea about diabetes and cancer.
Course Outline	**UNIT I** **CAUSES, CONTROL AND TREATMENT OF COMMON DISEASES** Insect borne diseases- Malaria, Filariasis, Plague. Air-borne diseases-Diphtheria, whooping cough, influenza, measles, mumps, tuberculosis (TB), and common cold, Water borne diseases-cholera, typhoid, dysentery.Some other common diseases-Jaundice, Asthma, Epilepsy, Piles, Leprosy.
	UNIT II FIRST AID FOR ACCIDENTS Important rules of First Aid – Cuts and Wounds, Abrasions, Bruises, Bleeding , Fractures, Burns, Fainting Poisonous bites. First Aid Box. Detection of Hallucinogens and poisons-Antidotes for Poisoning-Some common Poisons-Symptoms and their antidotes-Acid poisoning, Alkali poisoning, Disinfectant poisoning, Alcohol poisoning, Mercury poisoning and Salicylate poisoning.
	UNIT III ORGANIC PHARMACEUTICAL AIDS Preservatives, Antioxidants, Emulsifying agent, Sequestrants, Colouring, Flavouring and Sweetening agent, Ointment bases, Solvents, Stabilizing and Suspending agents.
	UNIT IV ORGANIC DIAGNOSTIC AGENTS Drug used as X-rays contrast media, Drugs used to test organ functions, Drugs used to determine blood volume, Hemopoietic

	functions, Drugs used for miscellaneous diagnostic tests.
	UNIT V DIABETES AND CANCER Diabetes and hypoglycemic drugs: Blood sugar level –Diabetes –causes, symptoms and control- Preliminary ideas about the structure and sources of insulin- oral hypoglycemic drugs- sulphonylureas and biguanides (synthesis not expected) Antineoplastic drugs**:** Causes of cancer- treatment methods- alkylating or cytotoxic agent- antimetabolite drugs.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	**Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)**
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Jayashree Ghosh, 2003, A Text Book of Pharmaceutical Chemistry, S.Chand& Company Ltd, 3rd revised Edition, New Delhi. 2. Lakshmi S, 1995, Pharmaceutical Chemistry, S.Chand& Company Ltd, 1st edition, New Delhi. 3. A. L. Leninger, 1998, Biochemistry,Kalyani Publishers, 2nd Edition, Ludhiana
Reference Books	1. Chatwal G.R, 1991, Pharmaceutical Chemistry-Organic-Volume II, Himalaya Publishing House, New Delhi. 2. Ashutoshkar and Mehta S.C, 2018, Essentials of Pharmacology, New Age International Publishers, New Delhi. 3. Gurdeep Chatwal, 2012 ,Medicinal Chemistry, Himalaya Publishing house private Ltd., Mumbai.

Website and e-learning source	https://my.clevelandclinic.org/health/diseases/17724-infectious-diseases https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/health_extension_trainees/ln_hew_first_aid_mgmt_final.pdf https://noteskarts.com/wp-content/uploads/2022/01/Pharmaceutics_Chapter_3_Pharmaceutical_aids_Organoleptic_Colouring.pdf https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/downloads/DIAGNOSTIC_AGENTS.pdf https://www.diabetes.org.uk/diabetes-the-basics/related-conditions/diabetes-and-cancer

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

CO1: Describe the causes, control and treatment of common diseases.
CO2: Understand the concepts of first aid for accidents.
CO3: Classify different organic pharmaceutical aids.
CO4: Explain organic diagnostic agents.
CO5: Describe diabetes, cancer and their control and treatment.

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

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

Level of Correlation between PSO's and CO's

SEMESTER: VI PART: III EC VIII	23UCHEE65-1 NANO SCIENCE	Credit: 3 H/W: 5

Prerequisites	Basics knowledge in physics and chemistry
Objectives of the course	This course aims at providing knowledge on • introduction to nanoparticles/clusters and nanocomposites • properties of nanomaterials • characterization of nanomaterials by different methods • synthesis of carbon nanotubes, graphene, quantum dots, self-assembled nanomaterials • applications of nanomaterials as sensors
Course Outline	**UNIT I** **Introduction to nanoscience** Definition of terms – nanoscience, nanoparticles, clusters, quantum dots, nanostructures and nanocomposites. Electron behaviour in free space, bulk material and nanomaterials. Synthesis and stabilization of nanomaterialsTop down approach (physical methods), mechanical dispersion – ball milling, methods based on evaporation of a precursor-inert gas condensation, ion sputtering, spray pyrolysis, aerosol synthesis-nanolithography. Bottom–up approach (chemical methods) - solvothermal synthesis, photochemical method, gamma radiolysis, sonochemical synthesis, electro deposition, sol-gel method, nanomaterials via chemical routes- solvents reducing agents, capping agents-stabilization of nanoparticles -electrostatic and steric stabilization, common stabilizers, nanoparticle growth in solution, templated growth, Langmuir – Blodgett (L-B) method, reverse micelles-emulsion method.
	Unit II **Properties of materials on a nanoscale** Optical properties of metal and semiconductor nanomaterials- surface Plasmon resonance (SPR), surface enhanced Raman spectra (SERS), quantum confinement effect, tuning of optical spectrum. Magnetic properties - Fe_3O_4 particle, supra magnetic properties, electronic properties, Chemical properties- chemical process on the surface of nanoparticles, catalysis, mechanical properties.
	UNIT III **Techniques employed for characterisation of nanomaterials** Spectrocopy – UV-visible, Photoelectron spectroscopy – Electron microscopy – Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning probe microscopy (SPM) – Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Optical microscopy – confocal microscopy, X-ray diffraction (XRD) [Principle and Block diagram only].

	UNIT IV **Special nanomaterials** Carbon Nano Structures Carbon nanotubes: Introduction - types - zigzag, armchair, helical, synthesis by CVD, Functionalization of Carbon Nanotubes, Reactivity of Carbon Nanotubes, Field emission, Fuel Cells, Display devices . Other Important Carbon based materials: Preparation and Characterization Fullerene, Graphene, properties, DLC and nanodiamonds and Applications Semiconductor nanoparticles: Quantum dots, synthesis – chemical synthesis using clusters, properties, porous silicon – electrochemical etching, aerogel – types – silica aerogel, resorcinol formaldehyde (RF) aerogels, zeolites – applications. Self Assembled Nanomaterials: Self Assembled Monolayers (SAMS) – inorganic, organic molecules.
	UNIT V **Application of nanomaterials** Biomedical Applications- drug, drug delivery, biolabelling, artificial implants, cancer treatment. Sensors – Natural nanoscale sensors, chemical sensors, biosensors, electronic noses. Optics & Electronics – Nanomaterials in the next generation computer technology, high definition TV, flat panel displays, quantum dot laser, single electron transistors [SET]. Nanotechnology in agriculture – Fertilizer and pesticides nanomaterials for water purification, nanomaterials in food and packaging materials, fabric industry. Impacts of Nanotechnology – human & environmental safety risks.
Extended Professional Component (is a part of internal component only, Not to be includedin the external examination question paper)	Questions related to the above topics, from various competitiveexaminations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
RecommendedText	1. Sulabha K. Kulkarni, *Nanotechnology: Principles and Practices*, Capital Publishing Co., New Delhi. 2. Pradeep. T, *Nano: The Essentials, Understanding Nanoscience and Nanotechnology*; Tata McGraw-Hill Publishing Company Limited, NewDelhi, 2007. 3. Shah. M.A.; Tokeer Ahmad, *Principles of Nanoscince and Nanotechnology*; Narosa Publishing House, New Delhi, 2010. 4. Murthy. B.S; Shankar. P, Baldev Raj.; Rath. B.B. JamesMurday, *Textbook of Nanoscience 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 Nanotechnology;* 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; Mu¨ller.A; Cheetham. A.K.*Nanomaterials*

	Chemistry Recent Developments and New Directions, WILEY-VCH Verlag GMBH & Co.,KGaA, Darmstad. 5. Jing Zhong Zhang, *Optical properties and spectroscopy of Nanomaterials*; World Scientific Publishing Pvt. Ltd., Singapore.
Website and e-learning source	1) http://www.nanotechnology.com/docs/wtd015798.pdf 2) http://nccr.iitm.ac.in/Nanomaterials.pdf

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

CO1: explain the general concepts and physical phenomena of relevance within thefield of nanoscience.

CO2: describe the properties, synthesis, characteristics of nanomaterials, specialnanomaterials and applications.

CO3: examine the structure, properties, applicability and characterization of nanomaterials.

CO4:analyze various synthesis procedures, characterizations and uses of carbon nanotubes,fullerene and graphene

CO5: discuss applications of nanomaterials of sensors and in optics and electronics

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

Level of Correlation between PSO's and CO's

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

Level of Correlation between PO's and CO's

SEMESTER: VI **PART: III** **EC VIII**	**23UCHEE65-2** **POLYMER SCIENCE**	**Credit: 3** **H/W: 5**

Prerequisites	Knowledge on functional groups and reaction mechanisms
Objectives of thecourse	The course aims at providing an overall view of • classification of polymers, preparation of polymers • kinetics of polymerization and characterization of polymers • analytical techniques used to characterize polymers • reactions of polymers • speciality polymers like PVC, PMMA
Course Outline	**UNIT I** **Introduction** Difference between polymer and macromolecule – classification – synthetic and natural, organic and inorganic, thermoplastic and thermosetting. Plastics, elastomers, fibres and liquid resins. **Techniques of polymerization** Bulk, solution, emulsion and suspension polymerization
	Unit – II **Kinetics of polymerization** Kinetics of condensation and addition polymerisation; ionic, freeradical, copolymerisation and coordination polymerisation – reactivity ratios – block and graft copolymers. **Characterisation of polymers** Appearance, feel and hardness, density, effect of heat, solubility,combustion, tensile strength, shear, stress, impact strength, mechanical, thermomechanical and rheological properties of polymers in viscoelastic state.
	UNIT III **Molecular Weight and Properties of Polymers** Molecular Weight of Polymers-Number Average and Weight Average, Molecular Weight Distribution, Determination of Molecular Weight polydispersity index – membrane and vapour phase osmometry, light scattering - Zimm plot, ultracentrifuge – sedimentation velocity and sedimentation equilibrium – viscometry – gel permeation chromatography Thermal properties of polymers – Glass Transition Temperature-State of Aggregation and State of Phase Transitions, Factors Influencing Glass Transition Temperature, Importance of Glass Transition Temperature, Heat Distortion Temperature, TGA / DTA,Crystallinity of Polymers: Crystalline Behaviour, Degree of Crystallinity.

	UNIT IV Reactions of Polymers-Hydrolysis, Acidolysis, Aminolysis, Additionand Substitution Reactions (One Example Each) Cyclisation, Cross-Linking and Reactions of Specific FunctionalGroups in the Polymer **Polymer technology** Processing of polymers – casting, thermoforming, moulding – extrusion, compression, blow moulding – foaming, lamination,reinforcing – processing of fibres – melt, wet and dry spinning.
	UNIT V **Speciality polymers** Polyelectrolytes, conducting polymers, polymeric supports for solid phase synthesis, biomedical polymers, liquid crystalline polymers, electroluminescent polymers – two examples of each of these polymers. Polyethylene, PVC, PMMA, polyester; rubber – synthetic and natural, vulcanisation of rubber. **Polymer Degradation** Types of Degradation - Thermal, Mechanical, Ultra Sound, Photo Radiation and Chemical Degradation Methods. Rubber-Natural and Synthetic-Structure, Mechanism of Vulcanisation Biodegradable and Non-Biodegradable Polymers.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
RecommendedText	1. Gowariker V.R, N.V. Viswanthan and Jayadev Sreedhar. Polymer Science. 2. New Delhi: New Age International, 2015 3. Misra G.S. Introductory Polymer Chemistry. New Delhi: Wiley Eastern, 2010. 4. Bahadur P and Sastry N V. Principles of Polymer Science. New Delhi: Narosa Publishing House, 2005 5. Ahluwalia, V.K. Anuradha Mishra, *Polymer Science A Text Book*, Ane Books India: New Delhi, 2008. 6. Morrison, R. R.; Boyd, R. N.; Bhattacharjee, S. K. *Organic Chemistry*, 7th ed.; Pearson: New Delhi, 2011.

Reference Books	1. Billmeyer, F.W. Polymer Science. India: Wiley-Interscience, 2007. 2. Seymour, R. B.; CarraherJr.C.E. *Polymer Chemistry: An Introduction*, Marcel Dckker Inc : New York, 1981. 3. Sinha, R. *Outlines of Polymer Technology*, Prentice Hall of India: New Delhi, 2000. 4. Joel R. Fried, *Polymer Science and Technology*, 3rd ed.; Prentice Hall of India: New Delhi, 2014.
Website and e-learning source	1. https://polymerdatabase.com http://amrita.vlab.co.in/?sub=2&brch=190&sim=603&cnt=1 3.http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/polymers. htm 4.http://nsdl.niscair.res.in/bitstream/123456789/406/2/Molecular+weigh ts+of+polymers.pdf

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

CO1: explain classification of polymers, elastomers, fibres and liquid resins

CO2: explain addition and condensation polymerization, mechanical properties of polymers

CO3: determine the molecular weight of polymers, and explain the thermal properties of polymers

CO4:explain reactions of polymers and polymer processing

CO5:discuss speciality polymers like PVC, PMMA, rubbers, biodegradable polymers

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

Level of Correlation between PSO's and CO's

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

Level of Correlation between PO's and CO's

SEMESTER: VI PART: III EC VIII	23UCHEE65-3 PHARMACEUTICAL CHEMISTRY	Credit: 3 H/W: 5

Prerequisites	Knowledge on active chemical compounds and biochemistry
Objectives of the course	The course aims at providing an overall view of • drugs design and drug metabolism • important Indian medicinal plants, common diseases andantibiotics drugs for major diseases like cancer, diabetes and AIDS • analgesics and antipyretic agents • significance of clinical tests
Course Outline	**UNIT I** **Introduction** Important terminologies – drug, pharmacognosy, pharmacy, pharmacology, pharmacodynamics, pharmacokinetics, clinical pharmacology, pharmacotherapeutics, chemotherapy, toxicology, pharmacophore, antimetabolites, mutation, bacteria, virus, fungi, actinomycetes, vaccines, pharmacopeia, posology and therapeutic index. Sources of drugs – dosage forms – bio availability – routes of administration – absorption, distribution and elimination of drugs – drug metabolism – prescription terms. **Structure and pharmacological activity** Effect of – unsaturation, chain length, isomerism; groups - halogens amino, nitro, nitrite, cyano, acidic, aldehydic, keto, hydroxyl and alkyl groups. **Development of Drugs** Development of a drug – classic steps- lead compounds- comparison of traditional and modern methods of development of drugs – drug design by method of variation – disjunction and conjunction methods.
	Unit II **Indian medicinal plants** Some important Indian medicinal plants – tulsi, neem, kizhanelli,mango, semparuthi, adadodai, turmeric and thoothuvalai – uses. **Common diseases and their treatment** Causes, prevention and treatment of the following diseases: Insect borne diseases– malaria, filariasis, plague;Air borne diseases– diphtheria, whooping cough, influenza, measles, mumps, common cold, tuberculosis; Water borne diseases – cholera, typhoid , dysentery. Digestive system – jaundice; Respiratory system – asthma; Nervous system – epilepsy. **Antibiotics** Definition – classification – structure and therapeutic uses of chloramphenicol, penicillins , structure activity relationship of chloramphenicol ; therapeutic uses of ampicillin, streptomycin, erythromycin, tetracycline, rifamycin.

	UNIT III **Drugs for major diseases** Cancer – common causes – chemotherapy – anti neoplastic agents - classification –adverse effects of cytotoxic agents ; alkylating agents – chlorambucil ; anti metabolites – methotrexate, fluouracil ; Vinca alkaloids – vincristine, vinblastine.Diabetes– types – management of diabetes – insulin ; oral hypoglycemic agents - sulphonyl ureas – chlorpropamide ; biguanides - metformin – thiazolidinediones .Cardiovascular drugs– cardio glycosides ; anti arrhythmic agents – quinidine, propranolol hydrochloride ; anti-hypertensive drugs - Aldomet, pentoliniumtartarate; vasodilator-tolazoline hydrochloride, sodium nitroprusside.AIDS – causes, symptoms and prevention – anti HIV drugs - AZT, DDC.
	UNIT IV **Analgesics and antipyretic agents** Classification – action of analgesics – narcotic analgesics –morphine; synthetic analgesics – pethidine, methadone; antipyretic analgesics – salicylic acid derivatives, indolyl derivatives, p-aminophenol derivatives. **Anaesthetics** Definition, characteristics, classification - general anaesthetics – volatile anaesthetics – nitrous oxide, ethers, cyclopropane, chloroform,halothane, trichloro ethylene– storage, advantages and disadvantages ; non volatileanaesthetics – thiopental sodium ; local anaesthetics – requisites – advantages- esters – cocaine, benzocaine ; amides – lignocaine, cinchocaine. **Blood and haemotological agents** Blood– composition, grouping – physiological functions of plasma proteins – mechanism of clotting; Coagulants – vitamin K, protamine sulphate, dry thrombin; Anti coagulants – coumarins, citric acid and heparin; antifibrinolytic agents – aminocaproic acid and tranexamic acid. Anaemia– causes, types and control – anti anaemic drugs.
	UNIT V **Clinical Chemistry** Blood tests – blood count – complete haemotogram – Hb, RBC, GTT, TC, DC, platelets, PCV, ESR; bleeding and clotting time –- glucose tolerance test. **Significance of Clinical Tests** Serum electrolytes - blood Glucose - orthotoluidine method**;** Renal functions tests - blood urea, creatinine; liver function tests - serum proteins, albumin globulin ratio, serum bilirubin, enzymes SGOT, SGPT; lipid profile – cholesterol, triglycerides, HDL, LDL, coronaryrisk index. Urine examination – pH, tests for glucose, albumin and bile pigment.

Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
RecommendedText	1. Jayashree Ghosh, (1999), A text book of pharmaceutical chemistry, 2nd ed., S.Chand& company, New Delhi. 2. Lakshmi S, (2004), Pharmaceutical chemistry, 3rd ed., Sultan chand& sons, Delhi. 3. Tripathi K D, (2018), Essentials of medical pharmacology, 8th ed., Jaypee brothers medical publishers (P) Limited, New Delhi. 4. Ashutosh Kar, (2018), Medicinal chemistry, 7th ed., New age international (P) Limited, Publishers, New Delhi.
Reference Books	**Reference Books:** 1. Chatwal G R, (2013), Pharmaceutical chemistry, inorganic (vol-I) 6thed ., Himalaya publishing house, Bombay. 2. Chatwal G R, (1991), Pharmaceutical chemistry, organic (vol-II)., Himalaya publishing house, Bombay. 3. Patrick G, (2002), Instant Notes Medicinal Chemistry, Viva Books Private Limited, New Delhi. Intellectual Property Rights, NeerajPandey, Khushdeep Dharni. Publisher: PHI Learning Pvt. Ltd., 2014 ISBN: 812034989X, 9788120349896.
Website and e-learning source	1.http://www.pharmacy.umaryland.edu/faculty/amackere/courses/phar531_delete/lectures/qsar_1.pdf 2. http://www.indianmedicinalplants.info/ https://www.wipo.int/about-ip/en/

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

CO1: Define the pharmaceutical terminologies; describe the principles in pharmacological activity, drug development, clinical chemistry, hematology, therapeutic drugs and treatment of diseases; list the types of IPR and trademarks.

CO2: Discuss the development of drugs, structural activity, disease types, physio-chemical properties of therapeutic agents, significance of medicinal plants,clinical tests and factors for patentability.

CO3: Apply the principles involved in structural activity and drug designing, functions ofhaematological agents; estimation of clinical parameters and therapeutic application of drugs for major diseases.

CO4: explain classification of analgesics and anasthetics, and physiological functions of plasma protiens

CO5: explain the significance of clinical tests like blood urea, serum proteins and coronary risk index

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

Level of Correlation between PSO's and CO's

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

Level of Correlation between PO's and CO's

SEMESTER: VI PART: V s	23UCHEF66 PROFESSIONAL COMPETENCY SKILL: CHEMINFORMATICS	Credit: 2 H/W: 2

Prerequisites	Basic Knowledge in Chemistry
Objectives of the	The course aims at providing knowledge to
Course	1.explain the primary and secondary structures of proteins with stereochemistry. 2.retrieve chemical information from structural and visualization tools. 3. make students familiar on existing databases and their application. 4.give a clear view on algorithms which is involved in bimolecular networks. 5.know about structure based drug design
Course Outline	**UNIT – I: Cheminformatics** Introduction-coordinates-Bonds-Bondlengths-Bond angle-electrostatic, vander Walls and nonbonded interactios-hydrogen bonding- Chemical structure-Conformation-representation of strutural information-Types of representation of structural information .
	UNIT – II: Introduction To Macromolcule Structure Determination &Classification Protein structure-organisation of protein structure-methods in protein structure determination- factors determining the stability of proteins-protein structure and conformational Properties. PDB format-classification using PDB format -SCOP-principal levels-family, super family, fold & fold class.
	UNIT – III: Chemical Information History of scientific information -communication-chemical literature-chemical information- chemical information search-chemical information sources-chemical name and formula searching-analytical chemistry-chemical history-biography-directories and industry sou**rces**
	UNIT – IV: Database Management Introduction to data and Database-storage of structural data in a data base-Important data storage organisations - Types of storage data base-data base searching-structure research, using structural keys & employing similarity search-canonical structure-Substructure search-types of binary screen-structural key & finger print-similarity search-

	UNIT – V: Structure-Based Drug Design Introduction to drugs, Chemical structural data files- Structure based drug design- Drug action & enzymes- Drug action & receptors- Drug Design- Ligand Based Design and De Novo Drug Design Virtual screening/docking of ligands.-Pharmacophore Design, Molecular similarity and molecular descriptors.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination Question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired From this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	3. Stereochemistry, by David G. Morris, Eddie Abel 4. Computer-Aided Drug Design: Methods and Applications, T.J. Perun C.L. Propst 5. Chemical Information Sources (Mcgraw-Hill Series in Advanced Chemistry), Gary Wiggins. 6. Trends in Bioinformatics. By Dr. P. Shanmughavel. 2006 Pointer publishers, Jaipur, India. 7. Principles Of Bioinformatics, Dr.P.Shanmugavel,2005,Pointer Publishers, Jaipur, India.
Reference Books	1. Thomas Engel (2006). "Basic Overview of Chemoinformatics". J. Chem. Inf. Model. 46 (6): 2267–77. doi:10.1021/ci600234z. PMID 17125169 2. Molecular Modeling: Basic Principles and Applications, 3rd Edition,Hans-Dieter Höltje, Wolfgang Sippl, Didier Rognan, Gerd Folkers 3. Martin, Yvonne Connolly (1978). Quantitative Drug Design: A Critical Introduction. Medicinal Research series. Vol. 8 (1st ed.). New York, NY: Marcel Dekker. ISBN 9780824765743. 4. Schaum's Outline of Probability and Statistics, Murray R Spiegel, John J. Schiller, R. Alu Srinivasan. 5. Gasteiger J.; Engel T., eds. (2004). Chemoinformatics: A Textbook. New York, NY: Wiley. ISBN 3527306811.

Website and e-learning source	7. https://www.sciencedirect.com/topics/chemistry/chemoinformatics 8. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7432360/ 9. https://chem.libretexts.org/Courses/Intercollegiate_Courses/Cheminformatics 10. https://github.com/PatWalters/resources/blob/main/cheminformatics_resources.md

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

CO1: Understand the mathematical implementation in molecular networks.
CO2: Evaluate the importance of protein structure in drug designing
CO3: Describe chemical data retrieval from the databases.
CO4: Know the various tools in proteomics, genomics and metabolomics.
CO5: Structure based designing of ligand with a help of QSAR.

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

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

Level of Correlation between PSO's and CO's

SEMESTER: V **PART: V**	**23UCHEX67** **EXTENSION ACTIVITY**	**Credit: 1** **H/W: -**

(Refer to the Regulations)