THANTHAI PERIYAR GOVERNMENT ARTS AND SCIENCE COLLEGE
(Autonomous), TIRUCHIRAPPALLI-620 023.
B.Sc. CHEMISTRY– COURSE STRUCTURE (from the Academic year 2023-2024 onwards)

SL. NO.	PART	COURSE	Sub code	COURSE TITLE.	Hrs.	Credits	Internal Exam	External Exam	Total
				I SEMESTER					
1.	I	Tamil I		Tamil-I	6	3	25	75	100
2.	II	English I		English-I	6	3	25	75	100
3.	III	Core I		General Chemistry-I	6	5	25	75	100
		Core-II*-P		Quantitative Inorganic Estimation (Titrimetry) and Complex Preparations	2	-	-	-	-
4.		First Alli. I		Mathematics-I/Zoology-I	4	4	25	75	100
		First Alli. / First Alli.II*-P		Mathematics-II/Zoology Practical	2	-	-	-	-
5.	IV	SBE		Industrial chemistry	2	2	25	75	100
6.		VE		Value Education	2	2	25	75	100
				Total	**30**	**19**	**150**	**450**	**600**
				II SEMESTER					
7.	I	Tamil II		Tamil-II	6	3	25	75	100
8.	II	English II		English-II	4	3	25	75	100
9.	III	Core II*- P		Quantitative Inorganic Estimation (Titrimetry) and Complex Preparations	4	4	40	60	100
10.		Core III		General Chemistry-II	5	5	25	75	100
11.		First Alli. / First Alli.II*-P		Mathematics-II/Zoology Practical	3	3	40	60	100
12.		First Alli. III		Mathematics-III/Zoology II	4	4	25	75	100
13.	IV	EVS		Environmental Studies	2	2	25	75	100
14		NMSDC*1		NMSDC – I	2	2	25	75	100
				Total	**30**	**26**	**230**	**570**	**800**
				III SEMESTER					
15	I	Tamil III		Tamil-III	6	3	25	75	100
16	II	English III		English-III	6	3	25	75	100
17	III	Core IV		General Chemistry-III	4	4	25	75	100
		Core V*-P		Qualitative inorganic analysis	2	-	-	-	-
18		ME I		Polymer science / Pesticide chemistry	4	4	25	75	100
19		Sec. Alli. I		Physics – I	4	4	25	75	100
		Sec. Alli. II*P		Physics Practical	2	-	-	-	-
20	IV	NME I		Role of Chemistry in daily life / Dairy Chemistry	2	2	25	75	100
				Total	**30**	**20**	**150**	**450**	**600**
				IVSEMESTER					
21	I	Tamil IV		Tamil-IV	6	3	25	75	100
22	II	English IV		English-IV	6	3	25	75	100
23	III	Core V*-P		Qualitative inorganic analysis	4	4	40	60	100
24		Core VI		General Chemistry-IV	5	5	25	75	100
25		Sec. Alli. II*P		Physics Practical	3	3	40	60	100
26		Sec. allied III		Physics – II	4	4	25	75	100
27	IV	NMSDC* II		NMSDC – II	2	2	25	75	100
				Total	**30**	**23**	**205**	**495**	**700**
				V SEMESTER					
28	III	Core VII		Organic Chemistry-I	5	5	25	75	100
29		Core VIII		Inorganic Chemistry-I	5	5	25	75	100
30		Core IX		Physical Chemistry-I	6	5	25	75	100
31		Core X-P		Organic analysis & Gravimetry Practical	5	5	40	60	100
32		ME II		Fundamentals of spectroscopy / Instrumental methods of chemical analysis	5	3	25	75	100
33	IV	NME II		Food chemistry / Cosmetics and personal grooming	2	2	25	75	100
34		SSD		Soft Skill Development	2	2	25	75	100
35	V	EA		Extension Activities	-	1	25	75	100
				Total -	**30**	**28**	**215**	**585**	**800**
				VI SEMESTER					
36.	III	Core XI		Organic Chemistry-II	6	6	25	75	100
37.		Core XII		Inorganic Chemistry-II	6	5	25	75	100
38.		Core XIII		Physical Chemistry-II	5	5	25	75	100
39.		Core XIV-P		Physical Chemistry Practical	6	5	40	60	100
40.		ME III		Pharmaceutical Chemistry / Biochemistry	5	3	25	75	100
41.	IV	NMSDC* III		NMSDC – III	2	2	25	75	100
				Total	**30**	**26**	**190**	**435**	**600**
				GRAND TOTAL	**180**	**142**	**1115**	**2985**	**4200**

<table>
<tr><td>Title of the Course</td><td colspan="7">GENERAL CHEMISTRY-I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="3">Lecture</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="3">6</td><td colspan="2">-</td><td colspan="2">6</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher secondary chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">The course aims at giving an overall view of the
• various atomic models and atomic structure
• wave particle duality of matter
• periodic table, periodicity in properties and its application in explaining the chemical behaviour
• nature of chemical bonding, and
• fundamental concepts of organic chemistry</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">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; Interpretation of H-spectrum; photoelectric effect, Compton effect; dual nature of Matter-de Broglie relationship; Davisson and Germer experiment Heisenberg’s Uncertainty Principle; Electronic Configuration of Atoms and ions - Hund’s rule, Pauli’s exclusion principle and Aufbau principle. Numerical problems involving de-Broglie wavelength and Heisenberg’s uncertainty principle concepts.</td></tr>
<tr><td colspan="7">UNIT-II: Introduction to quantum mechanics
Classical mechanics, wave mechanical model of atom, distinction between a Bohr’s orbit and orbital, probability interpretation of wave functions, Schrodinger wave equation and its significance-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 electronegativity concepts.</td></tr>
<tr><td colspan="7">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.</td></tr>
</table>

	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, O_2, N_2, HF and CO, magnetic characteristics, comparison of VB and MO theories. Coordinate bond - definition, formation of BF_3, NH_3, NH_4^+ and H_3O^+ properties. Metallic bond-electron sea model, VB model; Band theory-mechanism of conduction in solids; conductors, insulator, semiconductor – types and applications. Weak chemical forces - van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions. Repulsive forces; Hydrogen bonding – Types, special properties of water, ice; 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 and carbenes (Definitions and examples). 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 (Elementary idea only).

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 Prasad K. J. R. *Essential Organic Chemistry*, Pearson Education: New Delhi, 2008. 5. Dash, U.N., Dharmarha, O.P., 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: New York, 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, deBroglie wavelength, 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.

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="7">QUANTITATIVE INORGANIC ESTIMATION (TITRIMETRY) AND COMPLEX PREPARATIONS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I & II*</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="3">Lecture</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="3">-</td><td colspan="2">6</td><td colspan="2">6</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher secondary chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on
• laboratory safety
• handling glasswares
• Quantitative estimation
• preparation of inorganic compounds</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">UNIT I: Chemical laboratory safety in academic institutions
Introduction - importance of safety education for students, common laboratory hazards, assessment and minimization of the risk of the hazards, prepare for emergencies from uncontrolled hazards; concept of MSDS; importance and care of PPE; proper use and operation of chemical hoods and ventilation system; fire extinguishers-types and uses of fire extinguishers, demonstration of operation; chemical waste and safe disposal.
Common apparatus used in quantitative estimation (Volumetric): Description and use of burette, pipette, standard flask, measuring cylinder, conical flask, beaker, funnel, dropper, clamp, stand, wash bottle, watch glass, wire gauge and tripod stand.
Principle of quantitative estimation (Volumetric): Equivalent weight of an acid, base, salt, reducing agent, oxidizing agent; concept of mole, molality, molarity, normality; primary and secondary standards, preparation of standard solutions; theories of acid-base, redox, complexometric, iodimetric and iodometric titrations; indicators – types, theory of acid–base, redox, metal ion and adsorption indicators, choice of indicators.</td></tr>
<tr><td colspan="7">UNIT II
Quantitative estimation(Volumetric)
Preparation of standard solution, dilution from stock solution
Acidimetry and alkalimetry
Estimation of sodium hydroxide using standard sodium carbonate
Estimation of sulphuric acid using standard oxalic acid
Permanganometry
Estimation of oxalic acid using standard ferrous ammonium sulphate
Estimation of ferrous sulphate using standard oxalic acid</td></tr>
</table>

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

***Practical examination will be carried out to the II – semester**

Course Learning Outcomes (for Mapping with POs and PSOs)

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

CO1: explain the basic principles involved in titrimetric analysis and inorganic preparations.

CO2: compare the methodologies of different titrimetric analysis.

CO3: calculate the concentrations of unknown solutions in different ways and develop the skill to estimate the amount of a substance present in a given solution.

CO4: assess the yield of different inorganic preparations and identify the end point of various titrations.

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="7">INDUSTRIAL CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Skill Based Elective I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SBE</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">2</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course 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</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT-I: Survey of Indian industries and mineral resources in India
Fuels: Classification, characteristics of fuels, solid fuels - coal -classification, calorific value - determination.
Liquid fuels: Petroleum - characteristics, knocking in internal combustion engines, antiknock agents, unleaded petrol - octane number and cetane number.
Gaseous fuel: Advantages over solid and liquid fuels, water gas, producer gas, carburetted water gas, gobar gas - preparations and uses.
Natural gas: LPG-composition, advantages, application</td></tr>
<tr><td colspan="7">UNIT-II: Cosmetics
Skin care: powders, ingredients, creams. lotion - cleansing, moisturising.
Dental care: tooth pastes – ingredients.
Hair care: shampoos - types, ingredients, conditioners - types, ingredients.
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).</td></tr>
<tr><td colspan="7">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.</td></tr>
</table>

	UNIT-IV: Abrasives Definition, characteristics, types-natural and synthetic; natural abrasives – diamond, corundum – composition, uses; synthetic abrasives – carborundum, aluminium carbide, boron carbide – composition and uses. **Leather industry:** Structure and composition of skin, hide; Manufacture of leather – pre- tanning process – curing, liming, beating, pickling. **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 Chemistry*, 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. Shankuntala Manay, N.; Shadaksharaswamy, M. *Food Facts and Principles*, 3rd ed.; New Age Publication, 2008. 5. Neeraj Pandey, Khushdeep Dharni, *Intellectual Property Rights*, PHI Learning, 2014.
Website and e-learning source	1. http://www.sciencecases.org/irradiation/irradiation_notes.asp 2. http://discovery.kcpc.usyd.edu.au//9.5.5/ 3. https://www.wipo.int/about-ip/en/ 4.www.nptel.ac.in 4. 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

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="7">GENERAL CHEMISTRY-II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">5</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing an overall view of the
• chemistry of acids, bases and ionic equilibrium
• properties of s and p-block elements
• chemistry of hydrocarbons
• applications of acids and bases
• compounds of main block elements and hydrocarbons</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="7">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.
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 pH concepts.</td></tr>
<tr><td colspan="7">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 and $KClO_3$. 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.</td></tr>
</table>

	UNIT-III: Chemistry of p-block elements (Group 15-18) General characteristics of elements of Group 15; chemistry of $H_2N\text{-}NH_2$, NH_2OH, HN_3 and HNO_3. Chemistry of PH_3, PCl_3, PCl_5, $POCl_3$, P_2O_5 and oxy acids of phosphorous (H_3PO_3 and H_3PO_4). **General properties of elements of group 16:** Structure and allotropy of elements - chemistry of ozone - Classification and properties of oxides - oxides of sulphur and selenium – Oxy acids of sulphur (Caro's and Marshall's acids). **Chemistry of halogens:** General characteristics of halogen with reference to electro-negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine. Halogen acids (HF, HCl, HBr and HI), oxides and oxy acids ($HClO_4$). Inter-halogen compounds (ICl, ClF_3, BrF_5 and IF_7), pseudo halogens [$(CN)_2$ 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.
	UNIT-IV: Hydrocarbon chemistry-I **Alkenes**-Nomenclature, general methods of preparation – Mechanism of β-elimination reactions – E_1 and E_2 mechanism - factors influencing – stereochemistry – orientation – Hofmann and Saytzeff rules. Reactions of alkenes – addition reactions – mechanisms – Markownikoff's rule, Kharasch effect, oxidation reactions – hydroxylation, oxidative degradation, epoxidation, ozonolysis and 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), polychloroprene, vulcanisation. **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. Geometrical isomerism in di substituted 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 □*o*-position – reduction, oxidation – uses. Anthracene – synthesis by Elbs reaction, 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, New York. 2. Barrow G M, (1992), Physical Chemistry, 5th ed., Tata McGraw Hill, New Delhi. 3. Lee J D, (1991), Concise Inorganic Chemistry, 4th ed., 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	1. https://onlinecourses.nptel.ac.inhttp://cactus.dixie.edu/smblack/chem1010/lecture_notes/4B.html 2. http://www.auburn.edu/~deruija/pdareson.pdfhttps://swayam.gov.in/course/64-atomic-structure-and-chemical-bonding **MOOC components** 3. http://nptel.ac.in/courses/104101090/ 4. 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 pblock elements, preparation and properties of aliphatic and aromatic hydrocarbons

CO2: discuss the periodic properties of sand p- block elements, reactions of aliphatic and aromatic hydrocarbons and strength of acids

CO3: classify hydrocarbons, types of reactions, acids and bases, examine the properties s and p-block elements, reaction mechanisms of aliphatic and aromatic hydrocarbons

CO4: explain theories of acids, bases and indicators, buffer action and important compoundsof s-block elements

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

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="8">GENERAL CHEMISTRY - III</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="3">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="3">4</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">General Chemistry – I and II</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims to provide a comprehensive knowledge on
• the physical properties of gases, liquids, solids and X-ray diffraction of solids.
• fundamentals of nuclear chemistry and nuclear waste management.
• applications of nuclear energy.
• basic chemistry of halo-organic compounds, phenol and other aromatic alcohols.
• preparation and properties of phenols and alcohols.</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="8">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 plot); compressibility factor, Z, and its variation with pressure for different gases. equations of states for real gases-van der Waal’s equation; Virial equation; Boyle temperature; Numerical problems based on equations of states for real gases, isotherms of real gases – critical phenomena – isotherms of CO_2 - continuity of state – Van der waal’s equation and the critical state; law of corresponding states - liquefaction of gases.</td></tr>
<tr><td colspan="8">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 - numerical problems involving core concepts.</td></tr>
</table>

	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. 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 binding energy, 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 – SN^1, SN^2 and SN^i 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. P.L. Soni and Mohan Katyal, *Textbook of Inorganic Chemistry*, Sultan Chand & amp; Sons, twentieth edition, 2006. 4. M. K. Jain, S. C. Sharma, *Modern Organic Chemistry*, Vishal Publishing, fourth reprint, 2003. 5. S.M. Mukherji, and S.P. Singh, *Reaction Mechanism in Organic Chemistry*, Macmillan India Ltd., third edition, 1994.
Reference Books	1. T. W. Graham Solomons, *Organic Chemistry*, John Wiley & amp; 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** 1. https://nptel.ac.in/courses/104104101 Solid state chemistry 2. https://nptel.ac.in/courses/103106071 Nuclear industries and safety 3. https://nptel.ac.in/courses/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.

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="7">QUALITATIVE INORGANIC ANALYSIS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III & IV*</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">-</td><td colspan="3">6</td><td colspan="2">6</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">To develop the skill on systematic analysis of simple inorganic salts and mixture of salts.</td></tr>
<tr><td>Course Outline</td><td colspan="7">Semi-Micro Qualitative Analysis
1. Analysis of simple acid radicals: Carbonate, sulphide, sulphate, thiosulphite, chloride, bromide, iodide, nitrate
2. Analysis of interfering acid radicals: Fluoride, oxalate, borate, phosphate, arsenate, arsenite.
3. Elimination of interfering acid radicals and identifying the group of basic radicals
4. Analysis of basic radicals (group wise): Lead, copper, bismuth, cadmium, tin, antimony, iron, aluminium, arsenic, zinc, manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium
5. Analysis of a mixture - I to VIII containing two cations and two anions (of which one is interfering type)</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="7">Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</td></tr>
<tr><td>Recommended Text</td><td colspan="7">Reference Books:
V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997.</td></tr>
<tr><td>Website and e-learning source</td><td colspan="7">https://www.vlab.co.in/broad-area-chemical-sciences</td></tr>
</table>

*Practical examinations will be carried out to the IV Semester

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.
CO 4: assess the role of common ion effect and solubility product.

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="8">POLYMER SCIENCE</td></tr>
<tr><td>Paper No.</td><td colspan="8">Major Elective-I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ME</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="3">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="3">4</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Knowledge on functional groups and reaction mechanisms</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at providing an overall view of
• classification of polymers, preparation of polymers
• kinetics of polymerization and characterization of polymers
• analytical techniques used to characterize polymers
• reactions of polymers
• specialty polymers like PVC, PMMA</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="8">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.</td></tr>
<tr><td colspan="8">UNIT–II: Kinetics of polymerization
Kinetics of condensation and addition polymerisation; ionic, free radical, 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.</td></tr>
<tr><td colspan="8">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.</td></tr>
</table>

	UNIT-IV Reactions of polymers-hydrolysis, acidolysis, aminolysis, addition and substitution reactions (one example each), cyclisation, cross-linking and reactions of specific functional groups in the polymer. **Polymer technology:** Processing of polymers – casting, thermoforming, moulding – extrusion, compression, blow moulding – foaming, lamination, reinforcing – processing of fibres – melt, wet and dry spinning.
	UNIT-V: Specialty 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.
Recommended Text	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.; Carraher Jr. 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 2. http://amrita.vlab.co.in/?sub=2&brch=190&sim=603&cnt=1 3. http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/polymers.htm 4. http://nsdl.niscair.res.in/bitstream/123456789/406/2/Molecular+ weights+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-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 PSOs	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="8">PESTICIDE CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="8">Major Elective-I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ME</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="3">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="3">2</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Fundamentals in chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims to providing the students
• knowledge about the various types of pesticides and their toxicity.
• to understand the accumulation of pesticides in in the form of residues and its analysis.
• knowledge on choice of alternate and eco-friendly pesticides.</td></tr>
<tr><td rowspan="4">Course Outline</td><td colspan="8">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.</td></tr>
<tr><td colspan="8">UNIT-II: Insecticides: Classification and study of following insecticides with respect to structure, chemical name, physical properties, chemical properties, synthesis, degradation, metabolism, formulations, Mode of action, uses, toxicity.
Organophosphates and Phosphothionates: Acephate, Chlorpyriphos, Monocrotophos, and parathion-methyl. Organochlorine – Endosulfan, heptachlor; Carbamate: Cartap hydrochloride, Methomyl, Propoxur.</td></tr>
<tr><td colspan="8">UNIT-III: Pesticides residues: Introduction - application of agrochemicals, dissemination pathways of pesticides, causes of pesticide residues, remedies. Pesticides residues in atmosphere - entry into atmosphere, action of pesticides, effects on environments. Pesticides residues in water - entry into water systems, action and effect in aquatic environment. Pesticides residues in soil. Entry into soil, absorption, retention and transport in soil, effects on microorganism, soil condition and fertility, decomposition and degradation by climatic factors and microorganism.</td></tr>
<tr><td colspan="8">UNIT-IV: Pesticide residues effect and analysis: Effects of pesticides residue on human life, birds and animals - routes for exposure to pesticides, action of pesticides on living system. Analysis of pesticides residues - sample preparation, extraction of pesticides residues (soil, water and vegetables / fruits) simple methods and schemes of analysis, multi-residue analysis.</td></tr>
</table>

	UNIT-V: 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-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 PSOs	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="8">ROLE OF CHEMISTRY IN DAILY LIFE</td></tr>
<tr><td>Paper No.</td><td colspan="8">Non-Major Elective-I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">NME</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="3">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="3">2</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher secondary chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims at providing an overall view of the
• importance of Chemistry in everyday life
• chemistry of building materials and food
• chemistry of Drugs and pharmaceuticals</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">UNIT-V
Pharmaceutical drugs - analgesics and antipyretics - paracetamol and aspirin. Colour chemicals - pigments and dyes - examples and applications. Explosives - classification and examples.</td></tr>
</table>

Recommended Text	1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa Publishing House, 2010. 2. S. Jayashree Gosh, A textbook of pharmaceutical chemistry, S. Chand publishing, 2012. 3. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. 4. B. K. Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014. Introduction to forensic chemistry, Kelly M. Elkins, CRC Press Taylor & Francis Group, 2019. 5. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co. Publishers, second edition, 2006.
Reference Books	1. Randolph. Norris Shreve, Chemical Process Industries, McGraw-Hill, Texas, fourth edition, 1977. 2. W.A. Poucher, Joseph A. Brink, Jr. Perfumes, Cosmetics and Soaps, Springer, 2000. 3. A.K. De, Environmental Chemistry, New Age International Public Co., 1990.
Website and e-learning source	

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.

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="8">DAIRY CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="8">Non Major Elective-I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">NME</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="3">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="3">2</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher secondary chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims at providing an overall view of the
• chemistry of milk and milk products
• processing of milk
• preservation and formation of milk products.</td></tr>
<tr><td rowspan="4">Course Outline</td><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
</table>

	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 – Yoheer indigeneous products - khoa and chhena definition - Ice cream - definition-percentage composition – types – ingredients – manufacture of ice–cream, stabilizers – emulsifiers and their role – milk powder – definition – need for making milk powder – drying process - types of drying.
Recommended Text	1. K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, first edition, 2006. 2. K. S. Rangappa and K.T. Acharya, Indian Dairy Products, Asia Publishing House New Delhi, 1974. 3. Text book of dairy chemistry, M.P. Mathur, D. Datta Roy, P. Dinakar, Indian Council of Agricultural Research, 1st edition, 2008. 4. A Text book of dairy chemistry, Saurav Singh, Daya Publishing house, 1st edition, 2013. 5. Text book of dairy chemistry, P. L. Choudhary, Bio-Green book publishers, 2021.
Reference Books	1. Robert Jenness and S. Patom, Principles of Dairy Chemistry, S.Wiley, New York, 2005. 2. F.P. Wond, Fundamentals of Dairy Chemistry, Springer, Singapore, 2006. 3. Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi, 1980. 4. P.F. Fox and P.L.H. Mcsweeney, Dairy Chemistry and Biochemistry, Springer, Second edition, 2016. 5. Dairy chemistry and biochemistry, P. F. Fox, T. Uniacke-Lowe, P.L.H. McSweeney, J.A. OMahony, Springer, Second edition, 2015.
Website and e-learning source	

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: understand about general composition of milk – constituents and its physical properties.

CO 2: acquire knowledge about pasteurization of Milk and various types of pasteurization - Bottle, Batch and HTST Ultra High Temperature Pasteurization.

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

CO 4: explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk.

CO 5: have an idea about how to make milk powder and its drying process - types of drying process.

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="8">GENERAL CHEMISTRY - IV</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="3">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="3">5</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">General Chemistry – I and II</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims to provide a comprehensive knowledge on
• Thermodynamic concepts on chemical processes and applied aspects.
• Thermo chemical calculations.
• Transition elements with reference to periodic properties and group study of transition metals.
• The organic chemistry of ethers, aldehydes and ketones.
• The organic chemistry of carboxylic acids.</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.
Third law of thermodynamics – Nernst heat theorem; Applications of third law – evaluation of absolute entropies from heat capacity measurements, exceptions to third law.</td></tr>
</table>

	UNIT-III: General characteristics of d-block elements **Transition elements** – Electronic configuration – General periodic trend variable valency, oxidation states, stability of oxidation states, colour, magnetic properties, catalytic properties and tendency to form complexes. Comparative study of transition elements and non transition elements – comparison of II and III transition series with I transition series. Group study of Titanium, Vanadium, Chromium, Manganese, Iron, Cobalt, Nickel and Zinc groups.
	UNIT-IV: Ethers, thio ethers and epoxides Nomenclature, isomerism, general methods of preparations, reactions involving cleavage of C-O linkages, alkyl group and ethereal oxygen. Zeisel's method of estimation of methoxy group. Reactions of epoxides with alcohols, ammonia derivatives and $LiAlH_4$ Thioethers – nomenclature, structure, preparation, properties and uses. **Aldehydes and ketones:** Nomenclature, structure and reactivity of aliphatic and aromatic aldehydes and ketones; general methods of preparation and physical properties. Nucleophilic addition reactions, base catalysed reactions with mechanism- Aldol, Cannizzaro's reaction, Perkin reaction, Benzoin condensation, Haloform reaction, Knoevenagel reaction. Oxidation of aldehydes. Baeyer – Villiger oxidation of ketones. Reduction: Clemmensen reduction, Wolf – Kishner reduction, Meerwein – 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, Hunsdiecker reaction. Formic acid-reducing property. Reactions of dicarboxylic acids, hydroxy acids and unsaturated acids. **Carboxylic acid derivatives:** Preparations of aliphatic and aromatic acid chlorides, esters, amides and anhydrides. Nucleophilic substitution reaction at the acyl carbon of acyl halide, anhydride, ester, amide. 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 γ hydroxy acids.

Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
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.
Reference Books	1. Maron, S. H. and Prutton C. P. *Principles of Physical Chemistry*, 4th ed.; The Macmillan Company: New York, 1972. 2. Lee, J. D. *Concise Inorganic Chemistry*, 4th ed.; ELBS William Heinemann: London, 1991. 3. Gurudeep Raj, *Advanced Inorganic Chemistry*, 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** 1. https://nptel.ac.in/courses/112102255 Thermodynamics 2. 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 hermos 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

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="8">ORGANIC CHEMISTRY – I</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core VIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="3">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="3">5</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">General Chemistry I, II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims to provide an understanding of
• stereoisomerism in chirals and geometric isomerism in olefins, conformations of ethane and butane.
• preparation and properties of aromatic and aliphatic nitro compounds and amines.
• preparation of different dyes, food colour and additives.
• preparation and properties of five membered heterocycles like pyrrole, furan and thiophene.
• preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline.</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="8">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, diastereoisomers, meso structures - molecules with one and two chiral centers, racemisation - methods of racemisation; resolution - methods of resolution. C.I.P rules, R and S notations for one and two chirality (stereogenic) centers.
Molecules with no asymmetric carbon atoms – allenes and biphenyls. Conformational analysis of ethane and butane.</td></tr>
<tr><td colspan="8">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 – Hofmann’s degradation reaction, Gabriel’s phthalimide synthesis, Curtius Schmidt rearrangement.
Physical properties, reactions – alkylation, acylation, carbylamine reaction, Mannich reaction, oxidation, basicity of amines.</td></tr>
</table>

	UNIT-III: Chemistry of nitrogen compounds – II **Aromatic amines:** Nomenclature, preparation – from nitro compounds, Hofmann's method; Schmidt reaction, properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid - zwitter ion formation. Distinction between primary, secondary and tertiary amines - aliphatic and aromatic Diazonium compounds, Diazomethane, Benzene diazonium chloride - preparations and synthetic applications. **Dyes:** Theory of colour and constitution; classification based on 'structure and application; preparation – Martius yellow, aniline yellow, methyl orange, alizarin, indigo, malachite green. Industrial applications of dyes, Food colour and additives.
	UNIT-IV: Heterocyclic compounds Nomenclature and classification. General characteristics - aromatic character and reactivity. **Five-membered heterocyclic compounds:** Pyrrole – preparation from succinimide, Paal Knorr synthesis; reactions – reduction, basic character, acidic character, electrophilic substitution reactions, ring opening. Furan – preparation from mucic acid and pentosan; reactions – hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction. Thiophene - synthesis from acetylene; reactions – reduction; oxidation; electrophilic substitution reactions.
	UNIT-V: Six-membered heterocyclic compounds Pyridine – synthesis - from acetylene, Physical properties; reactions - basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution - uses. **Condensed ring systems:** Quinoline – preparation - Skraup synthesis and Friedlander's synthesis; reactions – basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions – Chichibabin reaction. Isoquinoline – preparation by the Bischler – Napieralski reaction, reduction, oxidation; electrophilic substitution.

Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. M.K. Jain, S.C.Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2009. 2. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 2009. 3. 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, 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. 3. 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

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="8">INORGANIC CHEMISTRY -I</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core IX</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td colspan="2">5</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">General Chemistry I, II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims to provide knowledge on
• nomenclature, isomerism and theory of co-ordination compounds, and chelate complexes.
• crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect.
• preparation and properties of metal carbonyls.
• lanthanides and actinides.
• preparation and properties of inorganic polymers.</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="8">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 oxime in gravimetric analysis – estimation of hardness of water using EDTA, metal ion indicators.
Role of metal chelates in living systems – haemoglobin and chlorophyll.</td></tr>
<tr><td colspan="8">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.</td></tr>
</table>

	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 (Lanthanides and Actinides) General characteristics of f-block elements - comparative account of lanthanides and actinides - occurrence, oxidation states, magnetic properties, colour and spectra - Lanthanides and Actinides, separation by ion-exchange and solvent extraction methods - Lanthanide 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, 31st Edition, Milestone Publishers & Distributors, Delhi. 2. Satya Prakash, Tuli G. D., Basu S. K., Madan R. D. (2009), Advanced Inorganic Chemistry, 18th Edition, S. Chand & Co., New Delhi. 3. Lee J D, (1991), Concise Inorganic Chemistry, 4th Edition, ELBS William Heinemann, London. 4. W V Malik, G D Tuli, R D Madan, (2000), Selected Topics in Inorganic Chemistry, S. Chand and Company Ltd. 5. A. K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992.

Reference Books	1. Madan R D, Sathya Prakash, (2003), Modern Inorganic Chemistry, 2nd ed., S. Chand and Company, New Delhi. 2. Gopalan R, (2009) Inorganic Chemistry for Undergraduates, 1st Edition, University Press (India) Private Limited, Hyderabad. 3. Sivasankar B, (2013) Inorganic Chemistry. 1st 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 lanthanides and actinides

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

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="8">PHYSICAL CHEMISTRY -I</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core X</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2" colspan="2"></td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td colspan="2">6</td><td colspan="3">-</td><td colspan="3">6</td></tr>
<tr><td>Prerequisites</td><td colspan="8">General Chemistry I, II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">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</td></tr>
<tr><td rowspan="2">Course Outline</td><td colspan="8">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.
Partial molar properties – chemical potential, Gibbs Duhem equation, variation of chemical potential with temperature and pressure, chemical potential of a system of ideal gases, Gibbs- Duhem-Margules equation.</td></tr>
<tr><td colspan="8">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, parallel reactions and consecutive reactions (Definitions and examples).</td></tr>
</table>

	UNIT-III Adsorption – Chemical and physical adsorption and their general characteristics - distinction between them. Different types of isotherms – Freundlich and Langmuir. Adsorption isotherms and their limitations – BET theory, kinetics of enzyme catalysed reaction – Michaelis - Menten equation – Lineweaver - Burk plot – inhibition – reversible – competitive and non-competitive (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. Arun Bahl, 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, Shoban Lal Nagin Chand and CO., 1986.
Reference Books	1. J. Rajaram and J. C. Kuriacose, Chemical Thermodynamics, Pearson, 1st edition, 2013. 2. Keith J. Laidler, Chemical kinetics, third edition, Pearson, 2003. 3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002. 4. K. L. Kapoor, A 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, Shoban lal 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.

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="7">ORGANIC ANALYSIS AND GRAVIMETRY PRACTICALS</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core XI-P</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">-</td><td colspan="3">5</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on
• systematic analysis of organic compounds
• skills of handling of organic chemicals
• preparation of simple organic compounds
• learning the basic principles of gravimetric analysis of Ba, Ca, Mg, Pb and Ni.</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT-I: Qualitative organic analysis
Preliminary examination, detection of special elements - nitrogen, sulphur and halogens.
Aromatic and aliphatic nature, test for saturation and unsaturation, identification and confirmation of functional groups.
• monocarboxylic acid, dicarboxylic acid
• monohydric phenol, polyhydric phenol
• aldehyde, ketone, ester
• carbohydrate
• primary amine
• monoamide, diamide,
• anilide, nitro compound
Preparation of derivatives for functional groups</td></tr>
<tr><td colspan="7">UNIT-II: Preparation of organic compounds: Preparations involving oxidation, hydrolysis, nitration, sulphonation, and halogenation</td></tr>
<tr><td colspan="7">UNIT-III: Gravimetric analysis
1. Estimation of calcium as calcium oxalate monohydrate.
2. Estimation of barium as barium sulphate.
3. Estimation of barium as barium chromate.
4. Estimation of sulphate as barium sulphate
5. Estimation of lead as lead chromate.
6. Estimation of nickel as nickel dimethylglyoxime complex.
7. Estimation of magnesium as oxinate.</td></tr>
<tr><td></td><td colspan="7">UNIT-IV: Viva-voce on related practicals</td></tr>
</table>

Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Reference Books	1. N. S. Gnanapragasam and G. Ramamurthy, Organic Chemistry Lab manual, S. Viswanathan Co. Pvt. Ltd. (1998). 2. J. N. Gurtu and R. Kapoor, Advanced Experimental Chemistry (Organic), S. Chand and Co. (1987). 3. Vogel's Textbook of Practical Organic Chemistry, 401st edition, ELBS/Longman, England (1984). 4. Venkateswaran, V.; Veeraswamy, R.; Kulandaivelu, A.R. Basic Principles of Practical Chemistry, 2nd Ed.; Sultan Chand: New Delhi, 2012.
Website and e-learning source	https://www.vlab.co.in/broad-area-chemical-sciences

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

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

CO2: identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis and exhibit a solid derivative with respect to the identified functional group.

CO3: learnt the skills of handling of organic chemicals and knowing the methods of preparing organic compounds.

CO4: acquire the knowledge on basic principles of gravimetric analysis.

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="7">FUNDAMENTALS OF SPECTROSCOPY</td></tr>
<tr><td>Paper No.</td><td colspan="7">MAJOR ELECTIVE – II (Discipline Specific Elective-III)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ME</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">5</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">General Chemistry I, II, III and IV</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course is designed to provide knowledge on
• electrical and magnetic properties of organic and inorganic compounds
• basic principles of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry
• instrumentation of microwave, UV-Visible, infrared, Raman, NMR and Mass spectrometry
• applications of various spectral techniques in structural elucidation
• solving combined spectral problems.</td></tr>
<tr><td rowspan="2">Course Out Line</td><td colspan="7">UNIT-I: Electrical and magnetic properties of molecules
Dipole moment – polar and non-polar molecules – polarisability of molecules. Application of dipole moments in the study of organic and inorganic molecules.
Magnetic permeability, volume susceptibility, mass susceptibility and molar susceptibility; diamagnetism, paramagnetism – determination of magnetic susceptibility using Guoy balance, ferromagnetism, anti-ferromagnetism.
Microwave spectroscopy: Rotation spectra - diatomic molecules (rigid rotator approximation), selection rules – determination of bond length, effect of isotopic substitution – instrumentation and applications.</td></tr>
<tr><td colspan="7">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 – Birge - Sponer method of evaluation of dissociation energy – pre-dissociation transition - σ-σ*, π-π*, n-σ*, n-π* transitions.
Applications of UV-Woodward – Fieser rules as applied to conjugated dienes and α, β - unsaturated ketones. Elementary problems.
Colorimetry - principle and applications (estimation of Fe^{3+}).</td></tr>
</table>

	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/SymmetryGroup Theory.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.

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="8">INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS</td></tr>
<tr><td>Paper No.</td><td colspan="8">MAJOR ELECTIVE - II (Discipline Specific Elective-III)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ME</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="3">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="3">5</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">General Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">The course aims at providing an overall view of the
• operation and troubleshooting of chemical instruments
• fundamentals of analytical techniques and its application in the characterization of compounds
• theory of chromatographic separation and
• theory of thermo / electro analytical techniques
• stoichiometry and the related concentration terms</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="8">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, co-efficient of variation, confidence limits, Q-test, F-test, T-test, the least square method for deriving calibration plots.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">UNIT-III: UV-Visible and IR Spectroscopy
Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert’s law.
UV-Visible Spectrometry: Basic principles, instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers.
Infrared Spectroscopy: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques.</td></tr>
</table>

	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 R_f value.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed., The English Language Book Society of Longman. 2. R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand, New Delhi, 2007. 3. Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning, 6th Indian Reprint (2017). 4. R. Speyer, Thermal Analysis of Materials, CRC Press, 1993. 5. R. A. Day and A. L. Underwood, Quantitative Analysis, 6th edn., Prentice Hall of India Private Ltd., New Delhi, 1993.
Reference Books	1. D. A. Skoog, D. M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5th edn., Saunders college publishing, Philadelphia, 1998. 2. Dash U N, Analytical Chemistry; Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 2011. 3. Christian, Gary D; Analytical Chemistry, 6th Ed., John Wiley & Sons, New York, 2004.

	4. Mikes, O. & Chalmes, R. A. Laboratory Handbook of Chromatographic & Allied Methods, Elles Harwood Ltd. London. 5. G. H. Jeffery, J. Bassett, J. Mendham and R. C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, sixth edition Pearson Education, 2000.
Website and e-learning sources	1. http://www.epa.gov/rpdweb00/docs/marlap/402-b-04-001b-14-final.pdf 2. http://eric.ed.gov/?id=EJ386287 3. http://www.sjsu.edu/faculty/watkins/diamag.htm 4. http://www.britannica.com/EBchecked/topic/108875/separation-and-purification 5. http://www.chemistry.co.nz/stoichiometry.htm

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

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

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

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

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

CO5: explain preparation of solutions, stoichiometric calculations

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="8">FOOD CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="8">NON MAJOR ELECTIVE–II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">NME</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">2</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims at giving an overall view of the
• Types of food
• Food adulteration and poisons
• Food additives and preservation</td></tr>
<tr><td>Course Outline</td><td colspan="8">UNIT I: Food adulteration
Sources of food, types, advantages and disadvantages. Food adulteration - contamination of wheat, rice, milk, butter etc. with clay stones, water and toxic chemicals - common adulterants, ghee adulterants and their detection. Detection of adulterated foods by simple analytical techniques.</td></tr>
<tr><td rowspan="4"></td><td colspan="8">Unit-II: Food poison
Food poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion) - chemical poisons - first aid for poison consumed victims.</td></tr>
<tr><td colspan="8">UNIT-III: Food additives
Food additives - artificial sweeteners - saccharin - cyclomate and aspartate food flavours - esters, aldehydes and heterocyclic compounds – food colours – emulsifying agents – preservatives - leavening agents. Baking powder – yeast – tastemakers – MSG - vinegar.</td></tr>
<tr><td colspan="8">UNIT-IV: Beverages
Beverages - soft drinks-soda – fruit juices - alcoholic beverages examples. Carbonation - addiction to alcohol– diseases of liver and social problems.</td></tr>
<tr><td colspan="8">UNIT-V: Edible Oils
Fats and oils - sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventing heart diseases-determination of iodine value, RM value, saponification values and their significance.</td></tr>
<tr><td>Recommended Text</td><td colspan="8">1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co. Publishers, second edition, 2006.</td></tr>
</table>

	3. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010. 4. Food Chemistry, Dr. L. Rakesh Sharma, Evincepub publishing, 2022. 5. Food processing and preservation, G. Subbulakshmi, Shobha A Udipi, Pdmini S Ghugre, New age international publishers, second edition, 2021.
Reference Books	1. H.-D. Belitz, Werner Grosch, Food Chemistry Springer Science & Business Media, 4th Edition, 2009. 2. M. Swaminathan, Food Science and Experimental Foods, Ganesh and Company, 1979. 3. Hasenhuettl, Gerard. L.; Hartel, Richard. W. Food Emulsifiers and their applications Springer New York 2nd ed. 2008. 4. Food Chemistry, H. D. Belitz, W. Grosch, P. Schieberle, Springer, fourth revised and extended edition, 2009. 5. Principles of food chemistry, John M. deMan, John W. Finley, W. Jefferey Hurst, Chang Yong Lee, Springer, Fourth edition, 2018.
Website and e-learning Source	

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: learn about Food adulteration - contamination of Wheat, Rice, Milk, Butter.

CO 2: get an awareness about food poisons like natural poisons (alkaloids - nephrotoxin) pesticides, DDT, BHC, Malathion.

CO 3: get an exposure on food additives, artificial sweeteners, saccharin, cyclomate and aspartate in the food industries.

CO 4: acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages examples.

CO 5: study about fats and oils - Sources of oils - production of refined vegetable oils – preservation saturated and unsaturated fats – MUFA and PUFA.

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 - Low

<table>
<tr><td>Title of the Course</td><td colspan="8">COSMETICS AND PERSONAL GROOMING</td></tr>
<tr><td>Paper No.</td><td colspan="8">NON-MAJOR ELECTIVE – II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">NME</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="3">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="3">2</td><td colspan="3">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher secondary Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims at familiarizing the students with
• formulations of various types of cosmetics and their significance
• hair, skin and dental care
• makeup preparations and personal grooming.</td></tr>
<tr><td rowspan="5">Course Outline</td><td colspan="8">Unit I: Skin care
Nutrition of the skin, skin care and cleansing of the skin; face powder – ingredients; creams and lotions – cleansing, moisturizing all purpose, shaving and sunscreen (formulation only); Gels – formulation and advantages; astringent and skin tonics – key ingredients, skin lightness, depilatories.</td></tr>
<tr><td colspan="8">Unit II: Hair care
Shampoos – types – powder, cream, liquid, gel – ingredients; conditioner – types – ingredients
Dental care
Tooth pastes – ingredients – mouth wash.</td></tr>
<tr><td colspan="8">Unit III: Make up
Base – foundation – types – ingredients; lipstick, eyeliner, mascara, eye shadow, concealers, rouge.</td></tr>
<tr><td colspan="8">Unit IV : Perfumes
Classification – natural – plant origin – parts of the plant used, chief constituents; animal origin – amber gries from whale, civetone from civet cat, musk from musk deer; synthetic – classification emphasizing characteristics – esters – alcohols – aldehydes – ketones.</td></tr>
<tr><td colspan="8">Unit V: Beauty treatments
Facials – types, advantages – disadvantages; face masks – types; bleach - types – advantages – disadvantages; shaping the brows; eyelash tinting; perming types; hair colouring and dyeing; permanent waving – hair straightening; wax types – waxing; pedicure, manicure - advantages – disadvantages.</td></tr>
<tr><td>Recommended Text</td><td colspan="8">Thankamma Jacob, (1997) Foods, drugs and cosmetics – A consumer guide, Macmillan publication, London.</td></tr>
</table>

Reference Books	1. Wilkinson J B E and Moore R J, (1997) Harry's cosmeticology, 7th ed., Chemical Publishers, London. 2. George Howard, (1987) Principles and practice of perfumes and cosmetics, Stanley Therones, Chettenham
Website and e-learning source	1. http://www.khake.com/page75.html 2. Net.foxsm/list/284

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: know about the composition of various cosmetic products

CO2: understand chemical aspects and applications of hair care and dental care and skin care products.

CO3: understand chemical aspects and applications of perfumes and skin care products.

CO4: to understand the methods of beauty treatments their advantages and disadvantage

CO5: understand the hazards of cosmetic products.

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 – Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="8">ORGANIC CHEMISTRY-II</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core XII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">6</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td colspan="2">6</td><td colspan="3">-</td><td colspan="3">6</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Organic Chemistry – I</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">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</td></tr>
<tr><td rowspan="4">Course outline</td><td colspan="8">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.</td></tr>
<tr><td colspan="8">UNIT II: Carbohydrates: Definition and Classification of Carbohydrates with examples. Relative configuration of sugars. Determination of configuration (Fischer’s Proof). Definition of enantiomers, diastereomers, epimers and anomers with suitable examples.
Monosaccharides – configuration – D and L hexoses – aldohexoses and ketohexoses. Glucose, Fructose – Occurrence, preparation, properties, reactions, structural elucidation, uses. Interconversions of sugar series – ascending, descending, aldose to ketose and ketose to aldose.
Disaccharides – sucrose, lactose, maltose - preparation, properties and uses (no structural elucidation).
Polysaccharides – Source, constituents and biological importance of homopolysaccharides - starch and cellulose, heteropolysaccharides – hyaluronic acid and heparin.</td></tr>
<tr><td colspan="8">UNIT III: Molecular rearrangements: Molecular Rearrangement: Type of rearrangements, Mechanism for Pinacol - pinacolone, Wagner - Meerwein, Benzidine, Favorskii, Clasien, Fries, Hofmann, Curtius, Schmidt and Beckmann, Cope, Oxycope rearrangement.</td></tr>
<tr><td colspan="8">UNIT IV: Special reagents in organic synthesis: AIBN, 9BBN, BINAP/BINOL, BOC, DABCO, DCC, DIBAL, DMAP, NBS/NCS, NMP, PCC, TBHP, TEMPO.</td></tr>
</table>

	Organometallic compounds in organic synthesis: Preparation, Properties and applications: Grignard Reagents, Organo Lithium Compounds, Ziegler – Natta, Wilkinson, Metal Carbonyl, Zeise'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 India Ltd., 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. https://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

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 – Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="8">INORGANIC CHEMISTRY-II</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core XIII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td colspan="2">6</td><td colspan="3">-</td><td colspan="3">6</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Inorganic Chemistry – I</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims at providing knowledge on
• tracer elements and their role in the biological system.
• iron transport and storage
• metallo enzymes, oxygen transport.
• silicates and their applications
• industrial applications of refractories, alloys, paints and pigments</td></tr>
<tr><td rowspan="5">Course outline</td><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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).</td></tr>
<tr><td colspan="8">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.</td></tr>
</table>

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, 31st ed., 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 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, 2nd ed., S.Chand and Company, New Delhi. 2. Gopalan R, (2009), Inorganic Chemistry for Undergraduates, 1st Edition, University Press (India) Private Limited, Hyderabad 3. Sivasankar B, (2013) Inorganic Chemistry. 1st 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. https://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

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 – Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="7">PHYSICAL CHEMISTRY-II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core XIV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">5</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Physical Chemistry – I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on
• phase diagram of one and two component systems
• chemical equilibrium,
• separation techniques for binary liquid mixtures.
• electrical conductance and transport number.
• galvanic cells, EMF and significance of electrochemical series.</td></tr>
<tr><td rowspan="4">Course outline</td><td colspan="7">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.</td></tr>
<tr><td colspan="7">UNIT-II: Chemical equilibrium: Law of mass action – thermodynamic derivation – relationship between K_p and K_c – application to the homogeneous equilibria – dissociation of PCl_5 gas, N_2O_4 gas – equilibrium constant and degree of dissociation - formation of HI, NH_3, and SO_3 – heterogeneous equilibrium – decomposition of solid calcium carbonate – Lechatelier principle – van’t Hoff reaction isotherm – temperature dependence of equilibrium constant – van’t Hoff reaction isochore – Clayperon equation – Clausius Clayperon equation and its applications</td></tr>
<tr><td colspan="7">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.</td></tr>
<tr><td colspan="7">UNIT-IV: Arrhenius theory of electrolytic dissociation – Ostwald’s dilution law, limitations of Arrhenius theory; behavior of strong electrolytes – interionic effects – Debye Huckel theory – Onsager equation (no derivation), significance of Onsager equation, Debye Falkenhagen effect, Wien effect.</td></tr>
</table>

	Ionic mobility – Discharge of ions on electrolysis (Hittorf's theoretical device), transport number – determination – Hittorf's method, moving boundary method – factors affecting transport number – determination of ionic mobility; Kohlrausch's law- applications; molar ionic conductance and viscosity (Walden's rule); applications of conductance measurements – determination of degree of dissociation of weak electrolyte, dissociation constant of weak acid and weak base, ionic product of water, solubility and solubility product of sparingly soluble salts - conductometric titrations – acid base titrations.
	UNIT-V: Galvanic cells and applications: Galvanic cell, representation, reversible and irreversible cells, EMF and its measurement – standard cell; relationship between electrical energy and chemical energy; sign of EMF and spontaneity of a reaction, thermodynamics and EMF – calculation of ΔG, ΔH, and ΔS from EMF data; reversible electrodes, electrode potential, standard electrode potential, primary and secondary reference electrodes, Nernst equation for electrode potential and cell EMF; types of electrodes – metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode, redox electrode; electrochemical series – applications of electrochemical series. Chemical cells with and without transport, concentration cells with and without transport. **Applications of EMF measurements:** Applications of EMF measurements – determination of activity coefficient of electrolytes, transport number, valency of ions, solubility product, pH using hydrogen gas electrode, quinhydrone electrode and glass electrode, potentiometric titrations – acid base titrations, redox titrations, precipitation titrations. **Industrial component:** Galvanic cells - lead storage, Ni-Cd, Li-ion batteries, Fuel cells – H_2-O_2 cell – efficiency of fuel cells.
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, Shoban Lal Nagin 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	1. https://nptel.ac.in https://swayam.gov.in 2. https://archive.nptel.ac.in/content/storage2/courses/112108150/pdf/PPTs/MTS_07_m.pdf 3. Thermodynamics-NPTEL https://www.youtube.com/watch?v=f0udxGcoztE 4. 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.

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 – Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="8">PHARMACEUTICAL CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="8">MAJOR ELECTIVE-III (Discipline Specific Elective-IV)</td></tr>
<tr><td>Category</td><td rowspan="2">ME</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td colspan="2">5</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Knowledge on active chemical compounds and biochemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims at providing knowledge on
• drugs design and drug metabolism
• important Indian medicinal plants, common diseases and antibiotics
• drugs for major diseases like cancer, diabetes and AIDS
• analgesics and antipyretic agents
• significance of clinical tests</td></tr>
<tr><td>Course outline</td><td colspan="8">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 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.</td></tr>
<tr><td></td><td colspan="8">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.</td></tr>
</table>

	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; nonvolatile anaesthetics – thiopental sodium; local anaesthetics – requisites – advantages - esters – cocaine, benzocaine; amides – lignocaine, cinchocaine. **Blood and haemotological agents:** Blood – composition, grouping – physiological functions of plasma proteins. 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, coronary risk index. Urine examination – pH, tests for glucose, albumin and bile pigment.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)

Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. Jayashree Ghosh, (1999), A text book of pharmaceutical chemistry, 2nd ed., S. Chand & Company, New Delhi. 2. Lakshmi S, (2004), Pharmaceutical chemistry, 3rd ed., Sultan Chand & Sons, Delhi. 3. Tripathi K D, (2018), Essentials of medical pharmacology, 8th ed., Jaypee brothers medical publishers (P) Limited, New Delhi. 4. Ashutosh Kar, (2018), Medicinal chemistry, 7th ed., New age International (P) Limited, Publishers, New Delhi.
Reference Books	1. Chatwal G R, (2013), Pharmaceutical chemistry, inorganic (vol-I), 6th ed., Himalaya Publishing House, Bombay. 2. Chatwal G R, (1991), Pharmaceutical chemistry, organic (vol-II), Himalaya Publishing House, Bombay. 3. Patrick G, (2002), Instant Notes Medicinal Chemistry, Viva Books Private Limited, New Delhi. 4. Intellectual Property Rights, Neeraj Pandey, 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. https://www.indianmedicinalplants.info/ 3. https://www.wipo.int/about-ip/en/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

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

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

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

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

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

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 – Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="8">PHYSICAL CHEMISTRY PRACTICAL</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core XV-P</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">5</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td colspan="2">-</td><td colspan="3">6</td><td colspan="3">6</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Theoretical knowledge on physical chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims at providing knowledge on
• basic principles of physical chemistry experiments
• hands on experience in carrying out the experiments</td></tr>
<tr><td rowspan="3">Course outline</td><td colspan="8">UNIT I
1. Distribution law: Partition coefficient of iodine between carbon tetrachloride and water.
2. Kinetics: Acid-catalyzed hydrolysis of an ester (Methyl acetate or Ethyl acetate).
3. Rast macro method.
4. Simple eutectic system: Naphthalene-biphenyl</td></tr>
<tr><td colspan="8">UNIT II
5. Determination of physical constants.
6. Determination of R_f values of organic compounds by Paper/Thin Layer chromatography.
7. Heterogeneous equilibrium
a) Critical Solution Temperature of phenol-water system.
b) Effect of impurity on C.S.T. (2% NaCl or 2% succinic acid solutions).
c) Determination of transition temperature: Sodium acetate, sodium thiosulphate, $SrCl_2.6H_2O$ & $MnCl_2.4H_2O$.</td></tr>
<tr><td colspan="8">UNIT III
8. Electrochemistry
a. Conductometry:
a) Cell constant
b) Equivalent conductance
c) Conductometric titration
b. Potentiometry:
Redox titration: FAS Vs $KMnO_4$, FAS Vs $K_2Cr_2O_7$</td></tr>
</table>

	UNIT IV: Viva-voce on related practicals
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.
Reference Books	1. P. Shoemaker, C. W. Garland and J. W. Nibler, Experiments in Physical Chemistry, 5th edition, McGraw Hill (1989). 2. V. D. Athawala and P. Mathur, Experimental Physical Chemistry, New Age International Publishers (2001). 3. V. Venkateswaran, R. Veeraswamy and A.R. Kulandaivelu, Basic Principles of Practical Chemistry, 2nd edition, S. Chand & Sons, New Delhi (1997). 4. A. Findlay, Practical Physical Chemistry, 7th edition, Longman, London (1959). 5. V.K. Ahluwalia, S.Dingra and A.Gulati, College Practical Chemistry, Orient Longman Pvt. Ltd., Hyderabad (2005).
Website and e-learning source	1. https://www.youtube.com/watch?v=cklOIg4KVaQ 2. https://www.youtube.com/watch?v=5oVnpYhmMVU 3. https://www.youtube.com/watch?v=X1DdTOTRa28

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 kinetics, electrochemistry and chromatography for carrying out the practical work

CO4: Apply principles heterogeneous equilibrium and chromatography for carrying out the practical work.

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

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 – Low

Level of Correlation between PSO's and CO's

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

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="8">BIOCHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="8">MAJOR ELECTIVE-III (Discipline Specific Elective-III)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">ME</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td colspan="2">5</td><td colspan="3">-</td><td colspan="3">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Organic Chemistry – I</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims at providing knowledge on
• relationship between biochemistry and medicine, composition of blood
• structure and properties of amino acids, peptides, enzyme, vitamins and proteins
• biological functions of proteins, enzymes, vitamins and hormones
• biochemistry of nucleic acids and lipids
• metabolism of lipids</td></tr>
<tr><td rowspan="3">Course outline</td><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
<tr><td colspan="8">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.</td></tr>
</table>

	UNIT-IV **Amino acids:** Components of nucleic acids - nitrogenous bases and pentose sugars, structure of nucleosides and nucleotides, DNA- structure & functions; RNA – types – structure - functions; biosynthesis of proteins **Hormones:** Adrenalin and thyroxine – chemistry, structure and functions (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*, 5th ed.; Jaypee Brothers: New Delhi, 2002.
Website and e-learning source	1) http://library.med.utah.edu/NetBiochem/nucacids.html 2) http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/ EnzymeKinetics.html 3) https://swayam.gov.in/courses/4384-biochemistry Biochemistry 4) https://onlinecourses.nptel.ac.in/noc19_cy07/preview Experimental Biochemistry

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

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

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

CO3: explain factors influencing enzyme activity and vitamins as coenzymes

CO4: explain RNA and DNA structure and functions

CO5: explain biological significance of simple and compound lipids**.**

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 – Low

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

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="8">CHEMISTRY FOR PHYSICAL SCIENCES I (FOR MATHEMATICS & PHYSICS STUDENTS)</td></tr>
<tr><td>Paper No.</td><td colspan="8">GENERIC ELECTIVE-IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">GE</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="3">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="3">4</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Higher secondary chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims to provide knowledge on the
• basics of atomic orbitals, chemical bonds, hybridization
• concepts of thermodynamics and its applications.
• concepts of nuclear chemistry
• importance of chemical industries
• Qualitative and analytical methods.</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="8">UNIT-I: Chemical Bonding and Nuclear Chemistry
Chemical bonding: Molecular Orbital Theory - bonding, antibonding and non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.
Nuclear chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers. Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy and mass defect (calculations). Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes – carbon dating, rock dating and medicinal applications.</td></tr>
<tr><td colspan="8">UNIT-II: Industrial chemistry
Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones: Synthesis, properties and uses of silicones.
Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.</td></tr>
<tr><td colspan="8">UNIT-III: Fundamental concepts in organic chemistry
Hybridization: Orbital overlap, hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Electronic effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyper conjugation and steric - examples.
Reaction mechanisms: Types of reactions – aromaticity (Huckel’s rule) aromatic electrophilic substitution; nitration, halogenation, Friedel - Craft’s alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.</td></tr>
</table>

	UNIT-IV: Thermodynamics and phase equilibria **Thermodynamics**: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Carnot's cycle and efficiency of heat engine. Entropy and its significance. Free energy change and its importance (no derivation). Conditions for spontaneity in terms of entropy and Gibbs free energy. Relationship between Gibbs free energy and entropy. **Phase Equilibria:** Phase rule - definition of terms in it. Applications of phase rule to water system. Two component system - Reduced phase rule and its application to a simple eutectic system (Pb-Ag).
	UNIT-V: Analytical chemistry Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques – extraction, distillation and crystallization. **Chromatography:** Principle and application of column, paper and thin layer chromatography.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. V. Veeraiyan, Text book of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009. 2. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. 3. S. Arun Bahl, B.S. Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012. 4. P.L. Soni, H.M. Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
Reference Books	1. P.L. Soni, Mohan Katyal, Textbook of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. 2. B.R. Puri, L.R. Sharma, M.S. Pathania, Textbook Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018. 3. B.K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications.

CO 2: evaluate the efficiencies and uses of various fuels and fertilizers

CO 3: explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.

CO 4: apply various thermodynamic principles, systems and phase rule.

CO 5: explain various methods to identify an appropriate method for the separation of chemical components

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 – Low

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

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="8">CHEMISTRY FOR PHYSICAL SCIENCES II
(FOR MATHEMATICS & PHYSICS STUDENTS)</td></tr>
<tr><td>Paper No.</td><td colspan="8">Discipline Specific Elective-II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="3">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="3">4</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Chemistry for physical sciences -I</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">This course aims at providing knowledge on the
• Co-ordination Chemistry and Water Technology
• Carbohydrates and Amino acids
• basics and applications of electrochemistry
• basics and applications of kinetics and catalysis
• Various photochemical phenomenon</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="8">UNIT-I: Co-ordination Chemistry and Water Technology
Co-ordination Chemistry: Definition of terms - IUPAC Nomenclature - Werner’s theory - EAN rule - Pauling’s theory – Postulates - Applications to $[Ni(CO)_4]$, $[Ni(CN)_4]^{2-}$, $[Co(CN)_6]^{3-}$ Chelation - Biological role of Haemoglobin and Chlorophyll (elementary idea) – Applications in qualitative and quantitative analysis.
Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques - BOD, COD.</td></tr>
<tr><td colspan="8">UNIT-II: Carbohydrates and Amino acids
Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose – fructose interconversion. Properties of starch and cellulose.
Amino acids: Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).</td></tr>
<tr><td colspan="8">UNIT-III: Electrochemistry: Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials - electrochemical series. Strong and weak electrolytes - ionic product of water - pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome plating – Types of cells -fuel cells-corrosion and its prevention.</td></tr>
</table>

	UNIT IV: Kinetics and Catalysis: Order and Molecularity. Integrated rate expression for I and II (2A □ Products) order reactions. Pseudo first order reaction, methods of determining order of a reaction – Half-life period – Catalysis - homogeneous and heterogeneous, catalyst used in Contact and Haber's processes. Concept of energy of activation and Arrhenius equation.
	UNIT V: Photochemistry: Grothus - Draper's law and Stark - Einstein's law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. V. Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009. 2. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. 3. Arun Bahl, B.S. Bahl, Advanced Organic Chemistry; S. Chand and Company, New Delhi, twenty third edition, 2012. 4. P.L. Soni, H.M. Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
Reference Books	1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. 2. R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018. 3. 3. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
Website and e-learning source	

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology

CO 2: explain the preparation and property of carbohydrate, amino acids and nucleic acids.

CO 3: apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.

CO 4: identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst.

CO 5: outline the various type of photochemical process.

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 – Low

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

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY FOR BIOLOGICAL SCIENCES I (FOR BOTANY AND ZOOLOGY STUDENTS)</td></tr>
<tr><td>Paper No.</td><td colspan="7">Generic Elective-IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">GE</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">4</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Higher secondary chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims at providing knowledge on
• basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry
• nuclear chemistry and industrial chemistry
• importance of speciality drugs and
• separation and purification techniques.</td></tr>
<tr><td rowspan="3">Course Outline</td><td colspan="7">UNIT-I: Chemical Bonding and Nuclear Chemistry
Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. M. O diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.
Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers - Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes – carbon Dating, rock dating and medicinal applications.</td></tr>
<tr><td colspan="7">UNIT-II: Industrial Chemistry
Fuel gases: Natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required).
Silicones: Synthesis, properties and uses of silicones. Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.</td></tr>
<tr><td colspan="7">UNIT-III: Fundamental Concepts in Organic Chemistry
Hybridization: Orbital overlap hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Polar effects: Inductive effect and consequences on Ka and K_b of organic acids and bases. Electromeric, Mesomeric, Hyper conjugation and Steric effect (examples and explanation).
Reaction mechanisms: Types of reactions - aromaticity – aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft’s alkylation and acylation.
Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.</td></tr>
</table>

	UNIT-IV: Drugs and Speciality Chemicals: Definition, structure and uses: Antibiotics - Penicillin, Chloramphenicol and Streptomycin; Anaesthetics - Chloroform and ether. Antipyretics - aspirin, paracetamol and ibuprofen. Artificial Sweeteners - saccharin, Aspartame and cyclamate. Organic Halogen compounds - Freon, Teflon.
	UNIT-V: Analytical Chemistry: Introduction qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization. Chromatography: principle and application of column, paper and thin layer chromatography.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. V. Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009. 2. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. 3. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S. Chand and Company, New Delhi, twenty third edition, 2012. 4. P.L. Soni, H.M. Chawla, Text Book of Inorganic Chemistry; Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007.
Reference Books	1. P.L. Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. 2. B.K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014. 3. Jayashree Gosh, Fundamental Concepts of Applied Chemistry; Sultan & Chand, Edition 2006.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: state the theories of chemical bonding, nuclear reactions and its applications.

CO 2: evaluate the efficiencies and uses of various fuels and fertilizers.

CO 3: explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.

CO 4: demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.

CO 5: analyse various methods to identify an appropriate method for the separation of chemical components.

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 – Low

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

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY FOR BIOLOGICAL SCIENCES II
(FOR BOTANY AND ZOOLOGY STUDENTS)</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective-II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">4</td><td colspan="3">-</td><td colspan="2">4</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Chemistry for Biological Sciences I</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on
• nomenclature of coordination compounds and carbohydrates.
• Amino Acids and Essential elements of biosystem
• understand the concepts of kinetics and catalysis
• provide fundamentals of electrochemistry and photochemistry</td></tr>
<tr><td rowspan="4">Course Outline</td><td colspan="7">UNIT-I: Co-ordination Chemistry and Water Technology
Co-ordination Chemistry: Definition of terms - IUPAC Nomenclature - Werner's theory - EAN rule - Pauling's theory – Postulates - Applications to $[Ni(CO)_4]$, $[Ni(CN)_4]^{2-}$, $[Co(CN)_6]^{3-}$ Chelation - Biological role of Hemoglobin and Chlorophyll (elementary idea) - Applications in qualitative and quantitative analysis.
Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method - Purification techniques – BOD and COD.</td></tr>
<tr><td colspan="7">UNIT-II: Carbohydrates
Classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose. Glucose and fructose interconversion. Preparation and properties of sucrose, starch and cellulose.</td></tr>
<tr><td colspan="7">UNIT-III: Amino Acids and Essential elements of biosystem
Classification - preparation and properties of alanine. preparation of dipeptides using Bergmann method – Proteins - classification – structure - Colour reactions – Biological functions – nucleosides - nucleotides – RNA and DNA – structure. Essentials of trace metals in biological system - Na, Cu, K, Zn, Fe, Mg.</td></tr>
<tr><td colspan="7">UNIT-IV: Electrochemistry
Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials - electrochemical series. Strong and weak electrolytes - ionic product of water - pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome plating – Types of cells - fuel cells - corrosion and its prevention.</td></tr>
</table>

	UNIT-V: Photochemistry Grothus - Drapper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen - chloride reaction. Phosphorescence, fluorescence, chemiluminescence, photosensitization and photosynthesis (definition with examples). Applications of photochemistry.
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. V. Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition, 2009. 2. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006. 3. Arun Bahl, B.S. Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012. 4. P.L. Soni, H.M. Chawla, Text Book of Organic Chemistry; Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007.
Reference Books	1. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012. 2. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007. 3. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. 4. B.R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018. 5. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology.

CO 2: explain the preparation and property of carbohydrate.

CO 3: enlighten the biological role of transition metals, amino acids and nucleic acids.

CO 4: apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.

CO 5: outline the various type of photochemical process.

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 – Low

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

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY PRACTICAL FOR PHYSICAL AND BIOLOGICAL SCIENCES
(for Mathematics and Physics – II Year/III and IV Semester; for Botany and Zoology II Year/III & IV Semester)</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective-I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE-I</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>III & IV</td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td colspan="3">Lecture</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="3">-</td><td colspan="2">3</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7"></td></tr>
<tr><td>Objectives of the course</td><td colspan="7">This course aims to provide knowledge on the
• basics of preparation of solutions.
• principles and practical experience of volumetric analysis</td></tr>
<tr><td>Course Outline</td><td colspan="7">VOLUMETRIC ANALYSIS
1. Estimation of sodium hydroxide using standard sodium carbonate.
2. Estimation of hydrochloric acid using standard oxalic acid.
3. Estimation of ferrous sulphate using standard Mohr's salt.
4. Estimation of oxalic acid using standard ferrous sulphate.
5. Estimation of potassium permanganate using standard sodium hydroxide.
6. Estimation of magnesium using EDTA.
7. Estimation of ferrous ion using diphenyl amine as indicator.</td></tr>
<tr><td>Reference Books</td><td colspan="7">V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.</td></tr>
</table>

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette.

CO 2: design, carry out, record and interpret the results of volumetric titration.

CO 3: apply their skill in the analysis of water/hardness.

CO 4: analyze the chemical constituents in allied chemical products

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 – Low

Level of Correlation between PSO's and CO's

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="7">CHEMISTRY PRACTICAL FOR PHYSICAL AND BIOLOGICAL SCIENCES
(For Mathematics and Physics – II year/III & IV semesters;
For Botany and Zoology II year/III & IV semesters)</td></tr>
<tr><td>Paper No.</td><td colspan="7">Discipline Specific Elective-I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
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<tr><td rowspan="2">Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">-</td><td colspan="3">3</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7"></td></tr>
<tr><td rowspan="2">Objectives of the course</td><td colspan="7">This course aims to provide knowledge on
• identification of organic functional groups
• different types of organic compounds with respect to their properties.
• determination of elements in organic compounds..</td></tr>
<tr><td colspan="7">SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS
The analysis must be carried out as follows:
(a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose].
(b) Detection of elements (N, S, Halogens).
(c) To distinguish between aliphatic and aromatic compounds.
(d) To distinguish – Saturated and unsaturated compounds.</td></tr>
<tr><td>Reference Books</td><td colspan="7">V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second edition, 1997.</td></tr>
</table>

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette.

CO 2: design, carry out, record and interpret the results of volumetric titration.

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CO 4: analyze the chemical constituents in allied chemical products

CO-PO Mapping (Course Articulation Matrix)

	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

3 – Strong, 2 – Medium, 1 – Low

Level of Correlation between PSO's and CO's

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 – Low

Semester	Subject Title	Subject Code	Category	Total hrs	Credits
	Climate Change		**Extra Credit Course**		**2**

General Objectives:
❖ To understand the climate change, controls, classifications, boundary layer climates, effects of topography, energy and mass exchange. ❖ To learn the role of construction as a driver and solution of climate change and enhanced greenhouse effect. ❖ To understand the science of climate change and concepts of global warming potential. ❖ To study the climate change scenarios of India and co-benefits of mitigation and adaptation strategies.

CO No.	Course Outcomes
	On successful completion of this course, students will be able to
CO-1	understand the climate change, controls and classifications.
CO-2	identify the boundary layer climates, effects of topography, energy and mass exchange.
CO-3	learn to role of construction as a driver and solution of climate change and enhanced greenhouse effect.
CO-4	understand the science of climate change and concepts of global warming potential.
CO-5	enrich the knowledge on the climate change scenarios of India and co-benefits of mitigation and adaptation strategies.

Unit I Earth Climatology (6 hours)	
1.1	Climatology: Elements of weather and climate, climate change factors affecting health (e.g - vector borne illnesses and zoonosis) - climatic controls, Milankovitch cycles - Earth energy balance - energy transfer in atmosphere - elementary ideas about weather systems, climatic classifications; climates in India; monsoons of India.
Unit II Climate change (6 hours)	
2.1	Climate change - the basics of climate change-causes and Boundary layer climates-impacts of climate change on the built environment and human health – effects of topography, energy and mass exchange, climates of vegetated surface, urban climatology.
Unit III Earth Climates and its circulation (6 hours)	
3.1	Pollution Climatology: the role of construction as a driver and solution of climate change - Preliminary concepts of climate change - seasons in India; Monsoons; El Nino and La Nina - tropical cyclone - Indian monsoon - Indian ocean Dipole (IOD) - Impact of Indian monsoon on Indian economy - Enhanced greenhouse effects – global warming - Greenhouse gases (GHGs) in the atmosphere; Effects of global warming.

Unit IV Global warming and climate change (6 hours)	
4.1	Science of Climate Change: Drivers of climate change - greenhouse gases, aerosols – reflective and black carbon, land use changes, distinguish between carbon-neutral construction and wellbeing architecture - Energy balance, feed-back processes in climate system, concepts of global warming potential (GWP), radiative forcing.
Unit V Climate change scenarios of India (6 hours)	
5.1.	Effects of ozone depletion - design and build for a better future and contribute to positive change - impact of climate change on agriculture, forest, water resources, monsoon system of India, co-benefits of mitigation and adaptation strategies - Climate change - carbon credit and carbon trading clean development mechanism.

References	
Text Books	
1.	Barry, R. G. 2003. Atmosphere, Weather and Climate. Routledge Press, UK.
2.	Mitra, A.P., Sharma, S., Bhattacharya, S., Garg, A., Devotta, S. & Sen, K. 2004. Climate Change and India. Universities Press, India.
Reference Books	
1.	Gillespie, A. 2006. Climate Change, Ozone Depletion and Air Pollution: Legal Commentaries with Policy and Science Considerations. Martinus Nijhoff Publishers.
2.	Hardy, J.T. 2003. Climate Change: Causes, Effects and Solutions. John Wiley & Sons.
3.	Harvey, D. 2000. Climate and Global Climate Change. Prentice Hall.
4.	Manahan, S.E. 2010. Environmental Chemistry. CRC Press, Taylor and Francis Group.
5.	Maslin, M. 2014. Climate Change: A Very Short Introduction. Oxford Publications.
6.	Mathez, E.A. 2009. Climate Change: The Science of Global Warming and our Energy Future. Columbia University Press.
7.	Philander, S.G. 2012. Encyclopedia of Global Warming and Climate Change (2^{nd} edition). Sage Publications.

Semester	Subject Title	Subject Code	Category	Total hours	Credits
	Health is Wealth: Theory & Practices		**Extra Credit Course**		**2**

Learning Objectives:
❖ To understand and appreciate the role of interdisciplinary sciences in the development and well-being of individuals, families and communities, also to study the food and nutrition, food adulteration, diseases and home remedies, and practices for health and hygiene.

CO No.	Course Outcomes
I	To gain the knowledge of nutrients andtheir importance.
II	To learn the hazards of food adulteration.
III	To know about the various diseases and prevention measures.
IV	To improve immunity of the body with home medicine.
V	To understand the importance and practices of health & hygiene.

Unit I Food and Nutrition (6 hours)	
1.1	Nutrients and their nutritive values - Balanced diet – Deficiency diseases – Malnutrition and Over nutrition - Therapeutic nutrition and diet.
Unit II Food adulteration (6 hours)	
2.1	Food additives - Preservatives, Sweeteners and Colourants – Adulterants - Physical and chemical adulterants and their identification - Food Packing materials.
Unit III Diseases (6 hours)	
3.1	Symptoms, Causes and Prevention of common diseases - Headache, Cold, Fever, Malaria, Typhoid, Dengue, Chikungunya, Dysentery, Diarrhea, Cholera, Tuberculosis, Blood sugar, Blood pressure and Corona.
Unit IV Home remedies (6 hours)	
4.1	Importance of water and water therapy - Preparation of home medicine for common diseases - Do's and Dont's - Importance of common Indian medicinal plants.
Unit V Practices for Health and Hygiene (6 hours)	
5.1	Physical activities - Walking and Exercise – Mental health – Yoga and Meditation – Sanitation - Self and surroundings - Handling and management of harmful Chemicals and Pollutants.

References	
Text Books	
1.	Alex V.Ramani, Food Chemistry, MJ Publishers, Chennai (2009).
2.	R.Gopalan, P.S.Subramanian and K.Rengarajan, Elements of Analytical Chemistry, S. Chand and Sons, New Delhi (2003).
3.	Ashutosh Kar, Medicinal Chemistry, 7th edition, New Age International Publishers, New Delhi (2018).
Reference Books	
1.	M.Swaminathan, Hand book of Food and Nutrition, 5th edition, The Bangalore Press, Bengaluru (2018).
2.	P.S.Kalsi and Sangeeta Jagtap, Pharmaceutical, Medicinal and Natural Product Chemistry, Narosa Publishing House New Delhi (2013).

Semester	Subject Title	Subject Code	Category	Total hrs	Credits
	Entrepreneurship Skills in Domestic and Cosmetology		**Extra Credit Course**		**2**

Learning Objectives:
❖ To understand and appreciate the role of interdisciplinary sciences in the development and well-being of individuals, families and communities, also to study the common ingredients of house hold synthetic products. ❖ To develop professional and entrepreneurial skills in preparing domestic and cosmetic products. ❖ To develop curiosity and scientific attitude towards the applications of chemistry in daily life.

CO No.	**Course Outcomes**
	On successful completion of this course, students will be able to
CO-1	enrich the knowledge on basics of cosmetics.
CO-2	empower the knowledge on essential oils and its significance in cosmetic industries.
CO-3	learn the knowledge on skin care products.
CO-4	study the skin care products.
CO-5	develop the skills on the preparation of domestic products.

Unit I Basics of Cosmetics (6 hours)	
1.1	Definition of cosmetics-historical background-classification and structure of skin, hair, nails and teeth-applications of cosmetics to skin and hair- skin lighteners, sun screen lotions, skin tones, antiwrinkling creams, lip care, lip gloss and lipsticks, lip liners, moisturizers, crack creams-hair shampoo and hair dye.
Unit II Perfumes and Cleaning agents (6 hours)	
2.1	Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, Sandalwood oil, Eucalyptus, rose oil, Jasmone, Civetone, Muscone. Cleaning Agents - manufacture and uses of soaps, detergents, baking powder, shampoo, and bleaching powder. (Common ingredients and health aspects)
Unit III Skin care (6 hours)	
3.1	Introduction to skin care, importance of skin care, skin lighteners, sun screen lotions, skin toners - anti wrinkling creams, skin moisturizers, tips to maintain the skin moisture - Lip care - lip gloss, lipsticks, lip liners, moisturizers, lip crack creams (raw materials and uses only).

Unit IV Face creams and Shampoos (6 hours)	
4.1	Ingredients and preparation of face creams, toilet powders-preparations of facial packs for different types of skin and dentifrices - Ingredients and preparation of shampoos - preparation of hair dyes (natural and synthetic)-conditioners-types and method of application-moisturizing cream-composition, types and its purpose.
Unit V Preparation of domestic products (6 hours)	
5.1.	Detergent washing powder, utensils cleaning powder, room freshener, tooth powder, tooth paste, talcum powder, pain relieving balm, pain relieving liniment, hand lotion moisturizer, white pheneol, shaving foam liquid, after shave lotion.

References	
Text Books	
1.	G.Sharma, J. Gadhiya and M. Dhanawat, Textbook of Cosmetic Formulations (2018).
2.	Cosmetics Science and Technology, Edited by M.S.Balsam, E.Sagarin, S.D.Gerhon, S.J.Strianse and M.M.Rieger, Volumes 1, 2 and 3, Wiley-Interscience, Wiley India Pvt. Ltd. (2008).
3.	Harry's Cosmeticology, Edited by R.G.Harry, J.B.Wilkinson and R.J.Moore, Longman Scientific Publishers, 7^{th} Edition, NY (1994).
4.	Handbook of Cosmetic Science and Technology, Edited by M.Paye, A.O.Barel, H.I.Maibach, Informa Healthcare, USA Inc. (2007).
Reference Books	
1.	Domestic products preparation and food analysis practical-Lab manual, Compiled by PG & Research Department of Chemistry, Jamal Mohamed College (Autonomous), Trichy.
2.	Poucher's Perfumes, Cosmetics and Soaps, Editor-Hilda Butler, Academic Publishers, 10^{th} Edition, Klewer Academic Publishers, Netherlands (2000).
Web Resources	
1.	https://www.researchgate.net/publication/325023106 Textbook of Cosmetic Formulations
2	https://chem.libretexts.org/@go/page/152267