THANTHAI PERIYAR GOVERNMENT ARTS AND SCIENCE COLLEGE (Autonomous), TIRUCHIRAPPALLI-23.

M.Sc. CHEMISTRY COURSE STRUCTURE (From the Academic Year 2023-2024 onwards)

SL. No.	PART	COURSE		Sub-Code	Course Title	Hrs.	Credits	CIA	Sem. Exam	Total
I SEMESTER										
1.	-	Core	I		Organic Reaction Mechanism - I	6	5	25	75	100
2.		Core	II		Structure and Bonding in Inorganic Compounds	6	5	25	75	100
3.		Core	III		Physical Chemistry - I	5	4	25	75	100
4.		Core	IV-P		Inorganic Chemistry Practicals - I	5	4	40	60	100
5.		Core	V-P		Organic Chemistry Practicals - I	6	4	40	60	100
6.		SEC	I		Skill Enhancement Course-I: Chemistry in Everyday Life	2	2	25	75	100
					Total	30	24	180	420	600
II SEMESTER										
7.		Core	VI		Organic reaction mechanism - II	5	5	25	75	100
8.		Core	VII		Physical Chemistry - II	5	5	25	75	100
9.		Core	VIII		Inorganic Chemistry Practicals - II	5	4	40	60	100
10.		Core	IX-P		Organic Chemistry Practicals - II	5	4	40	60	100
11.		CBE	I		Discipline Specific Elective - I: Bioinorganic Chemistry	5	3	25	75	100
12.		NME	I		Non-Major Elective - I: Chemistry for social studies	3	2	25	75	100
13.		SEC	II		Skill Enhancement Course - II: Cosmetic Chemistry	2	2	25	75	100
					Total	**30**	**25**	**205**	**495**	**700**
III SEMESTER										
14.		Core	X		Organic synthesis and Photochemistry	6	5	25	75	100
15.		Core	XI		Coordination Chemistry - I	5	4	25	75	100
16.		Core	XII-P		Physical Chemistry Practicals - I	5	4	40	60	100
17.		CBE	II		Discipline Specific Elective - II: Electrochemistry	4	3	25	75	100
18.		CBE	III		Discipline Specific Elective - III: Molecular Spectroscopy	5	3	25	75	100
19.		NME	II		Non-Major Elective - II: Chemistry in Consumer Products	3	2	25	75	100
20.		SEC	III		Skill Enhancement Course - III: Research Tools and Techniques	2	2	25	75	100
					Total	**30**	**23**	**190**	**510**	**700**
IV SEMESTER										
21.		Core	XIII		Coordination Chemistry - II	6	4	25	75	100
22.		Core	XIV-P		Physical Chemistry Practicals - II	5	4	40	60	100
23.		CBE	IV		Discipline Specific Elective - IV: Biomolecules and Heterocyclic compounds	5	3	25	75	100
24.		SEC	IV		Skill Enhancement Course - IV: Industrial Chemistry	2	2	25	75	100
25.		EA			Extension activity	-	1	25	75	100
26.		Project			Project	12	4	25	75	100
					Total	**30**	**18**	**165**	**435**	**600**
					Grand Total	**120**	**90**	**710**	**1890**	**2600**

<table>
<tr><td>Title of the Course</td><td colspan="8">ORGANIC REACTION MECHANISM - I</td></tr>
<tr><td>Paper No.</td><td colspan="8">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" colspan="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="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">Basic concepts of organic chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• To understand the feasibility and the mechanism of various organic reactions.
• To comprehend the techniques in the determination of reaction mechanisms.
• To understand the concept of stereochemistry involved in organic compounds.
• To correlate and appreciate the differences involved in the various types of organic reaction mechanisms.
• To design feasible synthetic routes for the preparation of organic compounds.</td></tr>
<tr><td rowspan="2">Course outline</td><td colspan="8">UNIT-I: Methods of Determination of Reaction Mechanism: Reaction intermediates, The transition state, Reaction coordinate diagrams, Thermodynamic and kinetic requirements of reactions: Hammond postulate. Methods of determining mechanism: non-kinetic methods - product analysis, determination of intermediates-isolation, detection, and trapping. Cross-over experiments, isotopic labelling, isotope effects and stereo chemical evidences. Kinetic methods - relation of rate and mechanism. Effect of structure on reactivity: Hammett and Taft equations. Swain - Scott, Grunwald-Winstein relationship - Linear free energy relationship, substituent and reaction constants.</td></tr>
<tr><td colspan="8">UNIT-II: Aromatic and Aliphatic Electrophilic Substitution: Aromaticity: Aromaticity in benzenoid, non-benzenoid, heterocyclic compounds and annulenes. Aromatic electrophilic substitution: Orientation and reactivity of di- and polysubstituted phenol, nitrobenzene and halobenzene. Reactions involving nitrogen electrophiles: nitration, nitrosation and diazonium coupling; Sulphur electrophiles: sulphonation; Halogen electrophiles: chlorination and bromination; Carbon electrophiles: Friedel-Crafts alkylation, acylation and arylation reactions. Aliphatic electrophilic substitution Mechanisms: SE2 and SEi, SE1- Mechanism and evidences.</td></tr>
</table>

	UNIT-III: Aromatic and Aliphatic Nucleophilic Substitution: Aromatic nucleophilic substitution: Mechanisms - S_NAr, S_N1 and Benzyne mechanisms - Evidences - Reactivity, Effect of structure, leaving group and attacking nucleophile. Reactions: Oxygen and Sulphur-nucleophiles, Bucherer and Rosenmund reactions, von Richter, Sommelet - Hauser and Smiles rearrangements. S_N1, ion pair, S_N2 mechanisms and evidences. Aliphatic nucleophilic substitutions at an allylic carbon, aliphatic trigonal carbon and vinyl carbon. S_N1, S_N2 and S_Ni mechanism and evidences - Ambident nucleophiles.
	UNIT-IV: Stereochemistry - I: Introduction to molecular symmetry and chirality – axis, plane, center, alternating axis of symmetry. Optical isomerism due to asymmetric and dissymmetric molecules with C, N, S based chiral centers. Optical purity, prochirality, enantiotopic and diastereotopic atoms, groups, faces, axial and planar chirality, chirality due to helical shape. Racemic modifications: Racemization by thermal, anion, cation, reversible formation, epimerization, mutarotation. Resolution of racemic mixture, asymmetric transformations, asymmetric synthesis, D, L system, Cram's and Prelog's rules of asymmetric synthesis: R, S-notations, Cahn-Ingold-Prelog rules - Configurations of allenes, spiranes, biphenyls, cyclooctene, helicene, ansa and cyclophanes. Criteria for optical purity: Stereoselective and stereospecific synthesis.
	UNIT-V: Stereochemistry-II: Winstein-Eliel equation, Curtin-Hammett Principle. Stability of five and six-membered rings: mono- and di-substituted cyclohexanes, conformation and reactivity in cyclohexane systems - Saponification of esters, esterification of alcohols, Chromic acid oxidation of cyclohexanols, deamination and neighbouring group participation. Optical rotation and optical rotatory dispersion, conformational asymmetry, ORD curves, octant rule, configuration and conformation, Cotton effect, axial haloketone rule and determination of configuration.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.

Recommended Text	1. J. March and M. Smith, Advanced Organic Chemistry, 5th edition, John-Wiley and Sons.2001. 2. E. S. Gould, Mechanism and Structure in Organic Chemistry, Holt, Rinehart and Winston Inc., 1959. 3. P.S.Kalsi, Stereochemistry of carbon compounds, 8th edition, New Age International Publishers, 2015. 4. P. Y. Bruice, Organic Chemistry, 7th edn, Prentice Hall, 2013. 5. J.Clayden, N. Greeves, S. Warren, Organic Compounds, 2nd edition, Oxford University Press, 2014.
Reference Books	1. F.A. Carey and R.J. Sundberg, Advanced Organic Chemistry Part-A and B, 5th edition, Kluwer Academic / Plenum Publishers, 2007. 2. D. G. Morris, Stereochemistry, RSC Tutorial Chemistry Text 1, 2001. 3. N.S. Isaacs, Physical Organic Chemistry, ELBS, Longman, UK, 1987. 4. E. L. Eliel, Stereochemistry of Carbon Compounds, Tata-McGraw Hill, 2000. 5. I. L. Finar, Organic chemistry, Vol-1 & 2, 6th edition, Pearson Education Asia, 2004.
Website and e-learning source	1. https://sites.google.com/site/chemistryebookscollection02/home/organic-chemistry/organic 2. https://www.organic-chemistry.org/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To recall the basic principles of organic chemistry.

CO2: To understand the formation and detection of reaction intermediates of organic reactions.

CO3: To predict the reaction mechanism of organic reactions and stereochemistry of organic compounds.

CO4: To apply the principles of kinetic and non-kinetic methods to determine the mechanism of reactions.

CO5: To design and synthesize new organic compounds by correlating the stereochemistry of organic compounds.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	S	M	S	S	S	S	M
CO 2	M	S	S	S	S	M	S	S	S	S
CO 3	S	S	M	S	S	S	S	M	S	S
CO 4	M	S	S	S	S	M	S	S	S	S
CO 5	M	S	M	S	S	M	S	M	S	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">STRUCTURE AND BONDING IN INORGANIC COMPOUNDS</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">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="2">Lecture</td><td colspan="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="2">6</td><td colspan="3">-</td><td colspan="2">6</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basic concepts of Inorganic Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To determine the structural properties of main group compounds and clusters.
• To gain fundamental knowledge on the structural aspects of ionic crystals.
• To familiarize various diffraction and microscopic techniques.
• To study the effect of point defects and line defects in ionic crystals.
• To evaluate the structural aspects of solids.</td></tr>
<tr><td rowspan="3">Course outline</td><td colspan="7">UNIT-I: Structure of main group compounds and clusters: VB theory – Effect of lone pair and electronegativity of atoms (Bent’s rule) on the geometry of the molecules; Structure of silicates - applications of Paulings rule of electrovalence - isomorphous replacements in silicates – ortho, meta and pyro silicates – one dimensional, two dimensional and three-dimensional silicates. Structure of silicones, Structural and bonding features of B-N, S-N and P-N compounds; Poly acids – types, examples and structures; Borane cluster: Structural features of closo, nido, arachano and klado; carboranes, hetero and metalloboranes; Wade’s rule to predict the structure of borane cluster.</td></tr>
<tr><td colspan="7">UNIT-II: Solid state chemistry – I: Ionic crystals: Packing of ions in simple, hexagonal and cubic close packing, voids in crystal lattice, Radius ratio, Crystal systems and Bravis lattices, Symmetry operations in crystals, glide planes and screw axis; point group and space group; Solid state energetics: Lattice energy – Born-Lande equation - Kapustinski equation, Madelung constant.</td></tr>
<tr><td colspan="7">UNIT-III: Solid state chemistry – II: Structural features of the crystal systems: Rock salt, zinc blende and wurtzite, fluorite and anti-fluorite, rutile and anatase, cadmium iodide and nickel arsenide; Spinels - normal and inverse types and perovskite structures. Crystal Growth methods: From melt and solution (hydrothermal, sol-gel methods) – principles and examples.</td></tr>
</table>

	UNIT-IV: Techniques in solid state chemistry: X-ray diffraction technique: Bragg's law, Powder diffraction method – Principle and Instrumentation; Interpretation of XRD data – JCPDS files, Phase purity, Scherrer formula, lattice constants calculation; Systematic absence of reflections; Electron diffraction technique – principle, instrumentation and application. Electron microscopy – difference between optical and electron microscopy, theory, principle, instrumentation, sampling methods and applications of SEM and TEM.
	UNIT-V: Band theory and defects in solids Band theory – features and its application of conductors, insulators and semiconductors, Intrinsic and extrinsic semiconductors; Defects in crystals – point defects (Schottky, Frenkel, metal excess and metal deficient) and their effect on the electrical and optical property, laser and phosphors; Linear defects and its effects due to dislocations.
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. A R West, Solid state Chemistry and its applications, 2ndEdition (Students Edition), John Wiley & Sons Ltd., 2014. 2. A K Bhagi and G R Chatwal, A textbook of inorganic polymers, Himalaya Publishing House, 2001. 3. L Smart, E Moore, Solid State Chemistry – An Introduction, 4th Edition, CRC Press, 2012. 4. K. F. Purcell and J. C. Kotz, Inorganic Chemistry; W.B. Saunders Company: Philadelphia, 1977. 5. J. E. Huheey, E. A. Keiter and R. L. Keiter, Inorganic Chemistry; 4th ed.; Harper and Row: NewYork, 1983.
Reference Books	1. D. E. Douglas, D.H. McDaniel and J. J. Alexander, Concepts and Models in Inorganic Chemistry, 3rd Ed, 1994. 2. R J D Tilley, Understanding Solids - The Science of Materials, 2nd edition, Wiley Publication, 2013.

	3. C N R Rao and J Gopalakrishnan, New Directions in Solid State Chemistry, 2nd Edition, Cambridge University Press, 199. 4. T. Moeller, Inorganic Chemistry, A Modern Introduction; John Wiley: New York, 1982. 5. D. F. Shriver, P. W. Atkins and C.H. Langford; Inorganic Chemistry; 3rd ed.; Oxford University Press: London, 2001.
Website and e-learning source	https://ocw.mit.edu/courses/3-091-introduction-to-solid-state-chemistry-fall-2018/video_galleries/lecture-videos/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: Predict the geometry of main group compounds and clusters.

CO2: Explain about the packing of ions in crystals and apply the radius ratio rule to predict the coordination number of cations.

CO3: Understand the various types of ionic crystal systems and analyze their structural features.

CO4: Explain the crystal growth methods.

CO5: To understand the principles of diffraction techniques and microscopic techniques.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">PHYSICAL CHEMISTRY - I</td></tr>
<tr><td>Paper No.</td><td colspan="8">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">4</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td></td><td colspan="3">Lecture</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>Instructional hours per week</td><td colspan="3">5</td><td colspan="2">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Basic concepts of physical chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• To recall the fundamentals of thermodynamics and the composition of partial molar quantities.
• To understand the classical and statistical approach of the functions
• To compare the significance of Maxwell-Boltzman, Fermi-Dirac and Bose-Einstein
• To correlate the theories of reaction rates for the evaluation of thermodynamic parameters.
• To study the mechanism and kinetics of reactions.</td></tr>
<tr><td rowspan="2">Course outline</td><td colspan="8">UNIT-I: Classical Thermodynamics: Partial molar properties - Chemical potential, Gibb’s - Duhem equation - binary and ternary systems. Determination of partial molar quantities. Thermodynamics of real gases - Fugacity-determination of fugacity by graphical and equation of state methods-dependence of temperature, pressure and composition. Thermodynamics of ideal and non-ideal binary mixtures, Duhem - Margulus equation applications of ideal and non-ideal mixtures. Activity and activity coefficients-standard states - determination-vapour pressure, EMF and freezing point methods.</td></tr>
<tr><td colspan="8">UNIT-II: Statistical thermodynamics: Introduction of statistical thermodynamics concepts of thermodynamic and mathematical probabilities - distribution of distinguishable and non-distinguishable particles. Assemblies, ensembles, canonical particles. Maxwell - Boltzmann, Fermi Dirac & Bose-Einstein Statistics - comparison and applications. Partition functions-evaluation of translational, vibrational and rotational partition functions for monoatomic, diatomic and polyatomic ideal gases. Thermodynamic functions in terms of partition functions-calculation of equilibrium constants. Statistical approach to Thermodynamic properties: pressure, internal energy, entropy, enthalpy, Gibb’s function, Helmholtz function residual entropy, equilibrium constants and equipartition principle. Heat capacity of mono and di atomic gases - ortho and para hydrogen. Heat capacity of solids - Einstein and Debye models.</td></tr>
</table>

	UNIT-III: Irreversible Thermodynamics: Theories of conservation of mass and energy, entropy production in open systems by heat, matter and current flow, force and flux concepts. Onsager theory-validity and verification - Onsager reciprocal relationships. Electro kinetic and thermo mechanical effects - Application of irreversible thermodynamics to biological systems.
	UNIT-IV: Kinetics of Reactions: Theories of reactions - effect of temperature on reaction rates, collision theory of reaction rates, Unimolecular reactions - Lindemann hypothesis - molecular beams, collision cross sections, effectiveness of collisions, Potential energy surfaces. Transition state theory - evaluation of thermodynamic parameters of activation-applications of ARRT to reactions between atoms and molecules, time and true order-kinetic parameter evaluation. Factors determine the reaction rates in solution - primary salt effect and secondary salt effect, Homogeneous catalysis - acid - base catalysis-mechanism of acid base catalyzed reactions - Bronsted catalysis law, enzyme catalysis - Michelis-Menton equation.
	UNIT-V: Kinetics of complex and fast reactions: Kinetics of complex reactions, reversible reactions, consecutive reactions, parallel reactions, chain reactions. Chain reactions-chain length, kinetics of $H_2 – Cl_2$ & $H_2 – Br_2$ reactions (Thermal and Photochemical reactions) - Rice Herzfeld mechanism. Study of fast reactions - relaxation methods - temperature and pressure jump methods electric and magnetic field jump methods - stopped flow method - flash photolysis and pulse radiolysis.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. J. Rajaram and J.C. Kuriacose, Thermodynamics for Students of Chemistry, 2nd edition, S.L.N. Chand and Co., Jalandhar, 1986. 2. I.M. Klotz and R.M. Rosenberg, Chemical thermodynamics, 6th edition, W.A. Benjamin Publishers, California, 1972.

	3. M.C. Gupta, Statistical Thermodynamics, New Age International, Pvt. Ltd., New Delhi, 1995. 4. K.J. Laidler, Chemical Kinetics, 3rd edition, Pearson, Reprint - 2013. 5. J. Rajaram and J.C. Kuriokose, Kinetics and Mechanisms of chemical transformation, M acmillan India Ltd, Reprint - 2011.
Reference Books	1. D.A. Mcqurrie And J.D. Simon, Physical Chemistry - A Molecular Approach, Viva Books Pvt. Ltd., New Delhi, 1999. 2. R.P. Rastogi and R.R. Misra, Classical Thermodynamics, Vikas Publishing, Pvt. Ltd., New Delhi, 1990. 3. S.H. Maron and J.B. Lando, Fundamentals of Physical Chemistry, Macmillan Publishers, New York, 1974 4. K.B. Ytsiimiriski, "Kinetic Methods of Analysis", Pergamom Press, 1996. 5. Gurdeep Raj, Phase rule, Goel Publishing House, 2011.
Website and e-learning source	1. https://nptel.ac.in/courses/104/103/104103112/ 2. https://bit.ly/3tL3GdN

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To explain the classical and statistical concepts of thermodynamics.

CO2: To compare and correlate the thermodynamic concepts to study the kinetics of chemical reactions.

CO3: To discuss the various thermodynamic and kinetic determination.

CO4: To evaluate the thermodynamic methods for real gases ad mixtures.

CO5: To compare the theories of reactions rates and fast reactions.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">INORGANIC CHEMISTRY PRACTICALS-I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core IV-P</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</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">Qualitative analysis and colorimetric estimation</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To learn the principles of semi-micro qualitative analysis, enumerated the difference between common cations and rare cations.
• To obtain the skill of finding out the common cations and rare cations in the given inorganic mixture.
• To gain the knowledge of theory behind the reactions.
• To understand Beer-Lambert’s law and its application in the estimation of ions, complex forming ability of the metals.</td></tr>
<tr><td rowspan="3">Course outline</td><td colspan="7">UNIT-I: Semi-micro qualitative analysis</td></tr>
<tr><td colspan="7">UNIT-II: Analysis of two common and two rare earth cations in a given inorganic mixture.
Common : Pb, Cu, Bi, Cd, Zn, Co, Ni, Ca, Ba, Sr
Rare : W, Se, Mo, Ce, Zr, V, Li</td></tr>
<tr><td colspan="7">UNIT-III: Colorimetric estimation : Cu, Fe, Ni, Cr</td></tr>
<tr><td></td><td colspan="7">UNIT-IV: Viva-voce on related practicals</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</td><td colspan="7">Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC others to be solved
(To be discussed during the Tutorial hours)</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">V.V.Ramanujan – Semi micro Qualitative Analysis. Applied Chemistry (Theory & Practice), O.P.Vermani & A.K.Narula, Wiley Eastern (1989).</td></tr>
<tr><td>Reference Books</td><td colspan="7">A.I.Vogel - A Text Book of Qualitative Analysis including semi-micro methods. Vogel's text book of macro and Semimicro Qualitative Inorganic Analysis Ed G.Svehla Orient Longman (1982).</td></tr>
</table>

Website and e-learning source	1. https://www.youtube.com/watch?v=-uPejc15uDk 2. https://www.youtube.com/watch?v=MTRXh-RZ2I0

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To identify cations present in a mixture of salts.

CO2: To apply the principles of semi micro qualitative analysis to categorize acid radicals and basic radicals.

CO3: To acquire the qualitative analytical skills by selecting suitable confirmatory tests and spot tests.

CO4: To choose the appropriate chemical reagents for the detection of cations.

CO5: To identify the heavy metals by colorimetric estimation

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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 PRACTICALS-I</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core V-P</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 colspan="2" 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="3">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td colspan="3"></td><td colspan="3"></td><td colspan="2">6</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Practical skills in the organic estimation and two-stage preparation</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• To describe the significance of organic quantitative analysis in organic estimation
• To prepare the organic compound through double-stage.
• To perform laboratory techniques including preparation and recrystallization</td></tr>
<tr><td rowspan="3">Course outline</td><td colspan="8">UNIT-I: Estimation
Phenol, Aniline, Ethyl methyl ketone/Acetone, glucose, hydroxyl group and nitro group.</td></tr>
<tr><td colspan="8">Unit II : Demonstration Experiment
Iodine value of an oil and Saponification value of an oil</td></tr>
<tr><td colspan="8">UNIT-III: Two-Stage Preparation
i. Acetyl salicylic acid from methyl salicylate
ii. 1,3,5-Tribromobenzene from aniline
iii. p-Nitroaniline from acetanilide
iv. p-Bromoacetanilide from aniline
v. Benzanilide from benzophenone
vi. Methyl-m-ntirobenzoic acid from methyl benzoate
vii. Methyl-m-nitrobenzoic acid from methyl benzoate
viii. Benzilic acid from benzoin</td></tr>
<tr><td></td><td colspan="8">UNIT-IV: Viva-voce on related practicals</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC others to be solved
(To be discussed during the Tutorial hours)</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="8">Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</td></tr>
</table>

Recommended Text	1. A I Vogel, A Text Book of Practical Organic chemistry, Longman. 2. Elementary Practical Organic Chemistry, Part 3 Quantitative Organic Analysis", Longman.
Reference Books	1. P R Singh, D.C. Guptha and K S Bajpai, Experimental Organic Chemistry Vol I & II. 2. F G Mann and B C Saunders, Practical Organic Chemistry, Longman.
Website and e-learning source	https://www.youtube.com/watch?v=VfoFbtovls8

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To recall the basic principles of organic separation, qualitative analysis and preparation.

CO2: To explain the method of separation and analysis of organic mixtures and the organic compound through double-stage

CO3: To determine the characteristics of separation of organic compounds by various chemical reactions.

CO4: To develop strategies of analyze and prepare organic compounds.

CO5: To formulate a method including preparation and recrystallization

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">CHEMISTRY IN EVERYDAY LIFE</td></tr>
<tr><td>Paper No.</td><td colspan="8">Skill Enhancement Course-I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" 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="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">Basic concepts of Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">To study the diagnostics of sugar and cholesterol, detection of poison.
To learn about the importance of first aid.
To know the basics of antipyretic analgesics.
To learn the chemistry of food adulteration and adulterants.</td></tr>
<tr><td rowspan="5">Course outline</td><td colspan="8">UNIT-I: Clinical chemistry
Diagnostics test for sugar in urine (Benedicts test and Fehling’s test only), Diagnostics test for sugar in serum (Folin and Wu’s method, Nelson-Somogyi method). Diagnostics test for cholesterol (Sackett’s method) in serum-important test for cholesterol - Salkowski test and Libermann Burchaed test.</td></tr>
<tr><td colspan="8">UNIT-II: First aid for accidents
Important rules of first aid – articles in first aid box-First aid for burns, cuts, abrasion, bleeding, fractures, fainting, poisonous bites. Common poisons and their antidotes-acid poisoning-Alkali poisoning, Mercury poisoning, poisoning by disinfectants.</td></tr>
<tr><td colspan="8">UNIT-III: Medicinal chemistry
Analgesics – definition - classification - narcotic analgesics – morphine and pethidine (medicinal uses and adverse effects only (structure not needed). Antipyretic analgesics – salicylic acid derivatives – aspirin, methyl salicylate, salicin, p-aminophenol derivatives-paracetamol, phenacetin (medicinal uses and structures only).</td></tr>
<tr><td colspan="8">UNIT-IV: Food adulteration
Adulterants and contaminants in food – definition of adulterated food – common adulterants of milk and milk products, vegetables, fats and oil. Contamination of food with toxic chemicals- packing hazards.</td></tr>
<tr><td colspan="8">UNIT-V: Domestic products in day today life
Preparation of chalk crayons, writing ink, incense sticks, naphthalene balls, wax candle, face powder, tooth powder, tooth paste, gum paste and shoe polish. Methods of removing stains – nail polish, paint, iron rust, grease, tea and coffee stain.</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. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, 2nd edition, S. Chand & Co., New Delhi (2008). 2. M.Swaminathan, Food Science and Experimental Foods, 1st edition, Ganesh and Company (1979). 3. B.K.Sharma, Industrial Chemistry, Volume-I, Goel Publishing House, Meerut (2017).
Reference Books	1. B. Srilakshmi, Food Science, 3rd edition, New Age International Publisher (2005). 2. L.H. Meyar, Food Chemistry, 6th edition, CBS Publisher & Distributors (2017).
Website and e-learning source	1. http://studymaterialcenter.in 2. http://ncert.nic.in 3. http://www.studiestoday.com

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To recall the diagnostics of sugar and cholesterol, detection of poison.

CO2: To understand the importance of first aid.

CO3: To recall the basics of antipyretic analgesics

CO4: Learn the chemistry of food adulteration and adulterants

CO5: To acquire the methods of preparation of domestic products.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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 REACTION MECHANISM-II</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core VI</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 colspan="2" 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="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">Basic knowledge of organic chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• To understand the concept of aromaticity in benzenoid, non-benzenoid, heterocyclic and annulene compounds.
• To understand the mechanism involved in various types of organic reactions with evidences.
• To understand the applications of synthetically important reagents.
• To correlate the reactivity between aliphatic and aromatic compounds.
• To design synthetic routes for synthetically used organic reactions.</td></tr>
<tr><td rowspan="2">Course outline</td><td colspan="8">UNIT-I: Elimination and Free Radical Reactions: Mechanisms: E2, E1, and E1cB mechanisms. Syn- and anti-eliminations. Orientation of the double bond: Hoffmann and Saytzeff rules. Reactivity: Effect of substrate, attacking bases, leaving group and medium. Stereochemistry of eliminations in acyclic and cyclic systems, pyrolytic elimination. Long lived and short-lived radicals – Production of radicals by thermal and photochemical reactions, Detection and stability of radicals, characteristics of free radical reactions and free radical, reactions of radicals; polymerization, addition, halogenations, aromatic substitutions, rearrangements. Reactivity: Reactivity on aliphatic, aromatic substrates, reactivity in the attacking radical, effect of solvent.</td></tr>
<tr><td colspan="8">UNIT-II: Oxidation and Reduction Reactions: Mechanisms - Direct electron transfer, hydride transfer, hydrogen transfer, displacement, addition-elimination, oxidative and reductive coupling reactions. Mechanism of oxidation reactions: Dehydrogenation by quinones, selenium dioxides, ferricyanide, mercuric acetate lead tetraacetate, permanganate, manganese dioxide, osmium tetroxide, oxidation of saturated hydrocarbons, alkyl groups, alcohols, halides and amines. Reactions involving cleavage of C-C bonds - cleavage of double bonds, oxidative decarboxylation, allylic oxidation, oxidation by chromium trioxide-pyridine, DMSO-Oxalyl chloride (Swern oxidation) and Corey-Kim oxidation, dimethyl sulphoxide-dicyclohexyl carbodiimide (DMSO-DCCD). Mechanism of reduction reactions: Wolff-Kishner, Clemmenson, Rosenmund, reduction with Trialkyl and triphenyltin hydrides. Homogeneous hydrogenation, Hydroboration with cyclic systems, MPV and Bouveault-Blanc reduction.</td></tr>
</table>

	UNIT-III: Rearrangements: Rearrangements to electron deficient carbon: Pinacol-pinacolone and semi-pinacolone rearrangements - applications and stereochemistry, Wagner-Meerwein, Demjanov, Dienone-phenol, Baker-Venkataraman, Benzilic acid and Wolff rearrangements. Rearrangements to electron deficient nitrogen: Hofmann, Curtius, Schmidt, Lossen and Beckmann rearrangements. Rearrangements to electron deficient oxygen: Baeyer-Villiger oxidation and Dakin rearrangements. Rearrangements to electron rich atom: Favorskii, Quasi-Favorskii, Stevens, [1,2]-Wittig and [2,3]-Wittig rearrangements. Fries and Photo Fries rearrangement. Intramolecular rearrangements – Claisen, abnormal Claisen, Cope, oxy-Cope Benzidine rearrangements.
	UNIT-IV: Addition to Carbon Multiple Bonds: Mechanisms: (a) Addition to carbon-carbon multiple bonds - Addition reactions involving electrophiles, nucleophiles, free radicals, carbenes and cyclic mechanisms - Orientation and reactivity, hydrogenation of double and triple bonds, Michael reaction, addition of oxygen and Nitrogen; (b) Addition to carbon-hetero atom multiple bonds: Mannich reaction, acids, esters, nitrites, addition of Grignard reagents, Wittig reaction, Prins reaction. Stereochemical aspects of addition reactions. Addition to Carbon-Hetero atom Multiple bonds: Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds. Mechanism of condensation reactions involving enolates – Stobbe reactions. Hydrolysis of esters and amides, ammonolysis of esters.
	UNIT-V: Reagents and Modern Synthetic Reactions: Lithium diisopropylamine (LDA), Azobisisobutyronitrile (AIBN), Sodium cyanoborohydride ($NaBH_3CN$), *meta*-Chloroperbenzoic acid (m-CPBA), Dimethyl aminiopyridine (DMAP), n-Bu_3SnD, Triethylamine (TEA), Diazobicyclo[5.4.0]undec-7-ene (DBU), Diisopropylazodicarboxylate (DIAD), Diethylazodicarboxylate (DEAD), *N*-bromosuccinimide (NBS), Trifluoroacetic acid (TFA), Tetramethyl piperiridin-1-oxyl (TEMPO), Phenyltrimethylammonium tribromide (PTAB). Diazomethane and Zn-Cu, Diethyl maleate (DEM), Copper diacetylacetonate ($Cu(acac)_2$), $TiCl_3$, $NaIO_4$, Pyridinium chlorochromate (PCC), Pyridinium dichromate (PDC), Meisenheimer complex. Suzuki coupling, Heck reaction, Negishi reaction, Baylis-Hillman reaction.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC others to be solved (To be discussed during the Tutorial hours)

Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. J. March and M. Smith, *Advanced Organic Chemistry*, 5th ed., John-Wiley and Sons. 2001. 2. E. S. Gould, *Mechanism and Structure in Organic Chemistry,* Holt, Rinehart and Winston Inc., 1959. 3. P. S. Kalsi, *Stereochemistry of carbon compounds*, 8th edn, New Age International Publishers, 2015. 4. P. Y. Bruice, *Organic Chemistry*, 7th edn., Prentice Hall, 2013. 5. R. T. Morrison, R. N. Boyd, S. K. Bhattacharjee, *Organic Chemistry*, 7th edn., Pearson Education, 2010.
Reference Books	1. S. H. Pine, *Organic Chemistry*, 5thedn, McGraw Hill International Edition, 1987. 2. L. F. Fieser and M. Fieser, *Organic Chemistry*, Asia Publishing House, Bombay, 2000. 3. E.S. Gould, *Mechanism and Structure in Organic Chemistry*, Holt, Rinehart and Winston Inc., 1959. 4. T. L. Gilchrist, *Heterocyclic Chemistry*, Longman Press, 1989. 5. J. A. Joule and K. Mills, *Heterocyclic Chemistry*, 4th ed., John-Wiley, 2010.
Website and e-learning source	1. https://sites.google.com/site/chemistryebookscollection02/home/organic-chemistry/organic 2. https://www.organic-chemistry.org/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To recall the basic principles of aromaticity of organic and heterocyclic compounds.

CO2: To understand the mechanism of various types of organic reactions.

CO3: To predict the suitable reagents for the conversion of selective organic compounds.

CO4: To correlate the principles of substitution, elimination, and addition reactions.

CO5: To design new routes to synthesis organic compounds.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">PHYSICAL CHEMISTRY - II</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core VII</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 colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</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">Basic knowledge of physical chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• To understand the essential characteristics of wave functions and need for the quantum mechanics.
• To know the importance of quantum mechanical models of particle in a box, rigid rotor and harmonic oscillator.
• To apply the quantum mechanics to hydrogen and polyelectronic systems.
• To familiarize the symmetry in molecules and predict the point groups.
• To predict the vibrational modes using the concepts of group theory.</td></tr>
<tr><td rowspan="4">Course outline</td><td colspan="8">UNIT-I: Quantum mechanics: Introduction to quantum mechanics-black body radiation, photoelectric effect, hydrogen spectrum. Need for quantum mechanics, Wave particle duality, Uncertainty principle, Particle wave and Schrodinger wave equation - Time independent and time dependent wave functions. Properties of wave function - Normalized, Orthogonal, orthonormal, Eigen values, Eigen functions, Operators and types. Hermitian properties of operators, Postulates of Quantum Mechanics.</td></tr>
<tr><td colspan="8">UNIT-II: Quantum models: Particle in a box-1D, two dimensional and three-dimensional, degeneracy, application to linear conjugated molecular system, free particles, ring systems. Harmonic Oscillator-wave equation and solution, anharmonicity, force constant and its significance. Rigid Rotor-wave equation and solution, calculation of rotational constants and bond length of diatomic molecules.</td></tr>
<tr><td colspan="8">UNIT-III: Applications to Hydrogen and Poly electron atoms: Hydrogen atom and hydrogen like ions, Hamiltonian-wave equation and solutions, radial and angular functions, representation of radial distribution functions. Approximation methods – variation methods: trial wave function, variation integral and application to particle in 1D box. Perturbation method - first order applications. Hatrefock self-consistent field method, Helium atom-electron spin, Paulis exclusion principle and Slater determination.</td></tr>
<tr><td colspan="8">UNIT-IV: Group theory: Groups, sub groups, symmetry elements, operations, classification-axial and non-axial. Dihedral point groups - C_n, C_{nh}, D_n, D_{nh}, D_{nd}, Td and Oh. Matrix representation and classes of symmetry operations, reducible irreducible and direct product representation. The Great orthogonality theorem – irreducible representation and reduction formula, construction of character table for C_{2v} and C_{3v} point groups.</td></tr>
</table>

	UNIT-V: Applications of quantum and group theory: Hydrogen Molecule - Molecular orbital theory and Heitler London (VB) treatment, Energy level diagram, Hydrogen molecule ion; Use of linear variation function and LCAO methods. Electronic conjugated system: Huckel method to ethylene* and trans 1,3-butadiene*. Applications of group theory to molecular vibrations - H_2O* and NH_3*.
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. R.K. Prasad, Quantum Chemistry, New Age International Publishers, New Delhi, 2010, 4th revised edition. 2. F. A. Cotton, Chemical Applications of Group Theory, John Wiley & Sons, 2003, 2nd edition. 3. Vincent, Molecular Symmetry and Group Theory. A Programmed Introduction to Chemical Applications, John and Willy & Sons Ltd., 2013, 2nd Edition. 4. T. Engel & Philip Reid, Quantum Chemistry and Spectroscopy, Pearson, New Delhi, 2018, 4th edition. 5. G. K. Vemulapalli, Physical Chemistry, Prentice Hall of India Pvt. Ltd. 2001. 6. D.A. McQuarrie, Quantum Chemistry, Viva Books PW. Ltd, 2013, 2nd edition.
Reference Books	1. N. Levine, Quantum Chemistry, Allyn& Bacon Inc, 1983, 4th edition. 2. D.A. McQuarrie and J. D. Simon, Physical Chemistry, A Molecular Approach, Viva Books Pvt. Ltd, New Delhi, 2012. 3. R. P. Rastogi & V. K. Srivastava, An Introduction to Quantum Mechanics of Chemical Systems, Oxford & IBH Publishing Co., New Delhi, 1999. 4. R.L. Flurry. Jr, Symmetry Group Theory and Chemical applications, Prentice Hall. Inc, 1980. 5. J. M. Hollas, Symmetry in Molecules, Chapman and Hall, London, 2011, Reprint.

Website and e-learning source	1. https://nptel.ac.in/courses/104101124 2. https://ipc.iisc.ac.in/~kls/teaching.html

*respective character table should be given to students.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To discuss the characteristics of wave functions and symmetry functions.

CO2: To classify the symmetry operation and wave equations.

CO3: To apply the concept of quantum mechanics and group theory to predict the electronic structure.

CO4: To specify the appropriate irreducible representations for theoretical applications.

CO5: To develop skills in evaluating the energies of molecular spectra.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">INORGANIC CHEMISTRY PRACTICALS-II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core VIII-P</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>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">-</td><td colspan="3">5</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Principle of Volumetry, gravimetry and complex preparation</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To acquire the skill of doing the estimations both by gravimetry and by volumetry.
• To learn the skill of preparing inorganic complexes.
• To obtain the knowledge of preparing solutions of known concentrations.
• To enrich the knowledge on volumetric principles and techniques of handling the precipitate etc.
• To understand the IUPAC naming of complexes, the ability of complex formation.
• To acquire the knowledge of ligands and central metal ions.
• To gain the skill of preparing the complexes.</td></tr>
<tr><td rowspan="4">Course outline</td><td colspan="7">Estimation of the following elements by volumetric and gravimetric methods.</td></tr>
<tr><td colspan="7">UNIT-I
i) Cu (V) & Ni (G)
ii) Cu (V) & Zn (G) Note: V -Volumetric
iii) Cu (V) & Cu (G) G -Gravimetric
Zn (V) & Cu(G)</td></tr>
<tr><td colspan="7">UNIT-II
i) Tetramminecopper (II) sulphate
ii) Potassiumtrioxalato chromate(III)
iii) Hexathiourealead(II) nitrate</td></tr>
<tr><td colspan="7">UNIT-III
i) Potassiumtrioxalato alulminate(III)
ii) Tristhioureacopper(I) chloride
iii) Tristhioureacopper(II) sulphate</td></tr>
<tr><td></td><td colspan="7">UNIT-IV: Viva-voce on related practicals</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</td><td colspan="7">Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved
(To be discussed during the Tutorial hours)</td></tr>
</table>

Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. G.H. Jeffrey, J. Bassette, J. Mendham and R.C. Denny, 'Vogel's Text Book of Quantitative Inorganic Analysis' ELBS Publication, London (1997). 2. W.G. Palmer, Experimental Inorganic Chemistry, Cambridge University Press, New York (1970). O. Glemser, Inorganic Synthesis 3. G.G. Guilbault and L.G. Hargis, Instrumental analysis manual - Modern Experiments for Laboratory
Reference Books	1. D.M. Adams and J.B Raynor 'Advanced Practical Inorganic Chemistry' CRC Press, New York. 2. W.L. Jolly, 'Preparative Inorganic Reactions' Interscience Publishers, New York.
Website and e-learning source	https://soe.unipune.ac.in/studymaterial/ashwiniWadegaonkarSelf/Volumetric%20Analysis.pdf

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To recall the basic principles of Inorganic volumetry gravimetry and complex preparation.

CO2: To explain the method of preparation and knowledge on volumetric principles and techniques of handling

CO3: To determine the characteristics of separation of inorganic compounds by various chemical reactions.

CO4: To develop strategies of analyze and prepare inorganic compounds.

CO5: To formulate a method including preparation ability of complex formation.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">ORGANIC CHEMISTRY PRACTICALS - II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core IX-P</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>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">-</td><td colspan="3">5</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">To acquire the practical skills in the organic mixture analysis and to empower knowledge on chromatography techniques.</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• Identify the separation for the given organic mixture through pilot separation.
• Identify the functional groups and elements present in the organic components.
• Synthesize the derivatives obtained from the pure organic component.
• Learn the skills of preparing organic compounds.
• Learn the skills of recrystallization, drying, etc.
• Acquire analytical skill to analyze the given organic compound qualitatively.
• Learn chromatographic techniques.</td></tr>
<tr><td rowspan="3">Course outline</td><td colspan="7">UNIT-I: Separation of the following types of mixture (pilot and bulk separation) and analysis of components present:
a. Ether soluble and insoluble
b. Acidic and Neutral
c. Phenolic and Neutral
d. Basic and Neutral
e. Phenolic and Basic</td></tr>
<tr><td colspan="7">UNIT-II: Analysis of any one separated compound.
1. Determination of Boiling point/Melting point of any one separated compound.</td></tr>
<tr><td colspan="7">UNIT-III: Determination of R_f values of select organic compounds by Paper chromatography or Thin layer chromatography.</td></tr>
<tr><td></td><td colspan="7">UNIT-IV: Viva-voce on related practicals</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</td><td colspan="7">Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC others to be solved
(To be discussed during the Tutorial hours)</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>
</table>

Recommended Text	1. Elementary Practical Organic chemistry Part II, Qualitative Organic analysis by A.I Vogel 2nd Ed., CBS publications (1987). 2. J. N. Guthru & R. Kapoor, Advance experimental chemistry, S. Chand Company, New Delhi (1991).
Reference Books	1. R. K. Bansal, Laboratory Manual of Organic Chemistry, New AGE International (P) Ltd. London, 3rd edition (1996). 2. N. K. Visno, Practical Organic Chemistry, New AGE International (P) Ltd. London, 3rd edition (1996).
Website and e-learning source	1. https://www.csub.edu/chemistry/organic/manual/Lab14_QualitativeAnalysis.pdf 2. https://www.umlub.pl/gfx/umlub/userfiles/shared/przedmiotyenrw/generalandanalyticalchem.lab/lab.2./lab.no2.tlcmainnew.pdf

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To recall the identify the functional groups and present in the organic components.

CO2: To develop the synthesize and the derivatives obtained from the pure organic component.

CO3: To determine the characteristics compounds and the skills of preparing organic compounds.

CO4: To develop the skills of recrystallization, drying, etc.

CO5: To formulate applying method of chromatographic techniques.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">BIOINORGANIC CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Based Elective-I (Discipline Specific Elective -I)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CBE</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</td></tr>
<tr><td></td><td colspan="2">Lecture</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>Instructional hours per week</td><td colspan="2">5</td><td colspan="2">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basic knowledge of chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To understand the role of trace elements.
• To understand the biological significance of iron, sulpur.
• To study the toxicity of metals in medicines.
• To have knowledge on diagnostic agents.
• To discuss on various metalloenzymes properties.</td></tr>
<tr><td rowspan="5">Course outline</td><td colspan="7">UNIT-I: Essential trace elements: Selective transport and storage of metal ions: Ferritin, Transferrin and sidorphores; Sodium and potassium transport, Calcium signalling proteins. Metalloenzymes: Zinc enzymes– carboxypeptidase and carbonic anhydrase. Iron enzymes – catalase, peroxidase. Copper enzymes – superoxide dismutase, Plast ocyanin, Ceruloplasmin, Tyrosinase. Coenzymes - Vitamin-B12 coenzymes.</td></tr>
<tr><td colspan="7">UNIT-II: Transport Proteins: Oxygen carriers - Hemoglobin and myoglobin - Structure and oxygenation Bohr Effect. Binding of CO, NO, CN– to Myoglobin and Hemoglobin. Biological redox system: Cytochromes - Classification, cytochrome a, b and c. Cytochrome P-450. Non-heme oxygen carriers-Hemerythrin and hemocyanin. Iron-sulphur proteins-Rubredoxin and Ferredoxin- Structure and classification.</td></tr>
<tr><td colspan="7">UNIT-III: Nitrogen fixation-Introduction, types of nitrogen fixing microorganisms. Nitrogenase enzyme - Metal clusters in nitrogenase - redox property - Dinitrogen complexes transition metal complexes of dinitrogen - nitrogen fixation via nitride formation and reduction of dinitrogen to ammonia. Photosynthesis: photosystem-I and photosystem-II-chlorophylls structure and function.</td></tr>
<tr><td colspan="7">UNIT-IV: Metals in medicine: Metal Toxicity of Hg, Cd, Zn, Pb, As, Sb. Therapeutic Compounds: Vanadium-Based Diabetes Drugs; Platinum-Containing Anticancer Agents. Chelation therapy; Cancer treatment. Diagnostic Agents: Technetium Imaging Agents; Gadolinium MRI Imaging Agents. temperature and critical magnetic Field.</td></tr>
<tr><td colspan="7">UNIT-V: Enzymes - Introduction and properties - nomenclature and classification. Enzyme kinetics, free energy of activation and the effects of catalysis. Michelis - Menton equation - Effect of pH, temperature on enzyme reactions. Factors contributing to the efficiency of enzyme.</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	Williams, D.R. – Introduction to Bioinorganic chemistry. F.M. Fiabre and D.R. Williams – The Principles of Bioinorganic Chemistry, Royol Soceity of Chemistry, Monograph for Teachers-31. K.F. Purcell and Kotz., Inorganic chemistry, WB Saunders Co., USA. G.N. Mugherjea and Arabinda Das, Elements of Bioinorganic Chemistry - 1993. R. Gopalan, V. Ramalingam, *Concise Coordination Chemistry*, S. Chand, 2001.
Reference Books	1. M. Satake and Y. Mido, Bioinorganic Chemistry - Discovery Publishing House, New Delhi (1996). 2. M.N. Hughes, 1982, The Inorganic Chemistry of Biological processes, II Edition, Wiley London. 3. R. W. Hay, Bio Inorganic Chemistry, Ellis Horwood, 1987. 4. R. M. Roat-Malone, Bio Inorganic Chemistry, John Wiley, 2002. 5. T. M. Loehr, Iron carriers and Iron proteins, VCH, 1989.
Website and e-learning source	1. https://www.pdfdrive.com/instant-notes-in-inorganic-chemistry-the-instant-notes-chemistry-series-d162097454.html 2. https://www.pdfdrive.com/shriver-and-atkins-inorganic-chemistry-5th-edition-d161563417.html

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: The students will be able to analyses trace elements.

CO2: Students will be able to explain the biological redox systems.

CO3: Students will gain skill in analyzing the toxicity in metals.

CO4: Students will have experience in diagnosis.

CO5: Learn about the nitrogen fixation and photosynthetic mechanism.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">PHARMACEUTICAL CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core Based Elective-I (Discipline Specific Elective -I)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CBE</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2" colspan="2"></td></tr>
<tr><td>Semester</td><td>II</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">Basic knowledge on drugs and doses</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• To understand the advanced concepts of pharmaceutical chemistry.
• To recall the principle and biological functions of various drugs.
• To train the students to know the importance as well the consequences of various drugs.
• To have knowledge on the various analysis and techniques.
• To familiarize on the drug dosage and its structural activities.</td></tr>
<tr><td rowspan="3">Course outline</td><td colspan="8">UNIT-I: Physical properties in Pharmaceuticals: Physical properties of drug molecule: physical properties. Refractive index - Definition, explanation, formula, importance, determination, specific & molar refraction. Optical activity\rotation- monochromatic & polychromatic light, optical activity, angle of rotation, specific rotation examples, measurement of optical activity. Dielectric constant & Induced Polarization- Dielectric constant explanation & determination. Rheology of pharmaceutical systems: Introduction, Definition, Applications, concept of viscosity, Newton’s law of flow, Kinematic, Relative, Specific, Reduced & Intrinsic viscosity. Newtonian system, non-Newtonian system- Plastic flow, Pseudoplastic flow, Dilatent flow. Viscosity measurements- selection of viscometer for Newtonian and non-Newtonian system.</td></tr>
<tr><td colspan="8">UNIT-II: Isotopic Dilution analysis: principle and applications, Neutron activation analysis: Principle, advantages and limitations, Scintillation counters: Body scanning. Introduction to radiopharmaceuticals. Properties of various types of radiopharmaceuticals, Radiopharmaceuticals as diagnostics, as therapeutics, for research and sterilization. Physico Chemical Properties and drug action. Physico chemical properties of drugs (a) Partition coefficient, (b) solubility (c) surface activity, (d) degree of ionization.</td></tr>
<tr><td colspan="8">UNIT-III: Drug dosage and product development: Introduction to drug dosage Forms & Drug Delivery system – Definition of Common terms. Drug Regulation and control, pharmacopoeias formularies, sources of drug, drug nomenclature, routes of administration of drugs products, need for a dosage form, classification of dosage forms. Drug dosage and product development. Introduction to drug dosage Forms & Drug Delivery system – Definition of Common terms. Drug Regulation and control, pharmacopoeias formularies, sources of drug, drug nomenclature, routes of administration of drugs products, need for a dosage form, classification of dosage forms.</td></tr>
</table>

	UNIT-IV: Development of new drugs: Introduction, procedure followed in drug design, the research for lead compounds, molecular modification of lead compounds. Structure-Activity Relationship (SAR): Factors effecting bioactivity, resonance, inductive effect, isoterism, bioisosterism, spatial considerations, biological properties of simple functional groups, theories of drug activity, occupancy theory, rate theory, induced-fit theory,4.3 Quantitative structure activity relationship (QSAR): Development of QSAR, drug receptor interactions, the additivity of group contributions, physico-chemical parameters, lipophilicity parameters, electronic parameter, ionization constants, steric parameters, chelation parameters, redox potential, indicator-variables.
	UNIT-V: Computers in Pharmaceutical Chemistry: Need of computers for chemistry. Computers for Analytical Chemists-Introduction to computers: Organization of computers, CPU, Computer memory, I/O devices, information storage, software components. Application of computers in chemistry: Programming in high level language (C+) to handle various numerical methods in chemistry – least square fit, solution to simultaneous equations, interpolation, extrapolation, data smoothing, numerical differentiation and integrations.
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. Physical Chemistry - Bahl and Tuli. 2. Text Book of Physical Pharmaceutics, IInd edition, Vallabh Prakashan - C.V.S. Subramanyam. 3. Medicinal Chemistry (Organic Pharmaceutical Chemistry), G.R Chatwal, Himalaya Publishing house. 4. Instrumental method of Analysis: Hubert H, Willard, 7^{th} edition. 5. Textbook of Pharmaceutical Chemistry by, Jayshree Ghosh, S. Chand & Company Ltd. Pharmaceutical Chemistry by Dr. S. Lakshmi, Sultan Chand & Sons.

Reference Books	1. Computers in chemistry, K.V. Raman, Tata McGraw-Hill, 1993. 2. Computers for Chemists, S.K Pundir, Anshu Bansal, A Pragate Prakashan., 2nd edition, New Age International (P) Limited, New Delhi. 3. Physical Pharmacy and Pharmaceutical Sciences by Martins, Patrick J. Sinko, Lippincott. William and Wilkins. 4. Cooper and Gunn's Tutorial Pharmacy, 6th edition by S.J. Carter, CBS Publisher Ltd. 5. Ansels pharmaceutical Dosage forms and Drug Delivery System by Allen Popvich and Ansel, Indian edition-B.I. Publication Pvt. Ltd.
Website and e-learning source	1. https://www.ncbi.nlm.nih.gov/books/NBK482447/ 2. https://training.seer.cancer.gov/treatment/chemotherapy/types.html

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To identify the suitable drugs for various diseases.

CO2: To apply the principles of various drug action and drug design.

CO3: To acquire the knowledge on product development based on SAR.

CO4: To apply the knowledge on applications of computers in chemistry.

CO5: To synthesize new drugs after understanding the concepts SAR.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">CHEMISTRY FOR SOCIAL STUDIES</td></tr>
<tr><td>Paper No.</td><td colspan="7">Non Major Elective - I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">NME</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>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">3</td><td colspan="3">-</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basic knowledge of agricultural and environmental chemistry.</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To learn about soil composition, soil formation and soil properties.
• To study different types of fertilizers and their role on plant growth, pesticides, fungicides, herbicides, acaricides and their characteristics.
• To gain the knowledge about environment, air pollution, water pollution and thermal pollution.</td></tr>
<tr><td rowspan="5">Course outline</td><td colspan="7">UNIT-I: Soil Chemistry: Soil – Definition of soil – soil composition – soil formation – factors of soil formation – soil forming processes. Soil properties - soil texture and structure – soil air, soil water, soil temperature – biological properties of soil – nutrient availability-significance of physical properties to plant growth.</td></tr>
<tr><td colspan="7">UNIT-II: Fertilizers: Fertilizer – definition – fertilizer recommendation based on soil testing – fertility index – NPK ratio. Role of primary, secondary and micro nutrients on plant growth. Complex and mixed fertilizers – organic manures – compost – farm yard manure – handling and storage. Oil cakes, bone meal and fish meal – integrated nutrient management.</td></tr>
<tr><td colspan="7">UNIT-III: Pesticides: Pesticides – Classification of pesticides, mode of action – characteristics – uses – impact of pesticides on soil, plants and environment. Insecticides, Fungicides, Herbicides, Acaricides – characteristics – uses. Safety measures in analysis and handling of pesticides.</td></tr>
<tr><td colspan="7">UNIT-IV: Environment: Environment and its segments – Ecosystem – Biogeochemical cycles of carbon, nitrogen and sulphur. Structure and major regions of atmosphere. Air pollutants – types, sources, environmental effects of sulphur and nitrogen oxides, ozone, CO_2 and chlorofluorocarbons.</td></tr>
<tr><td colspan="7">UNIT-V: Environmental Pollution: Water Pollution – Hydrological cycle, water resources, aquatic ecosystem, sources and nature of water pollutants, impact of water pollution on ecosystem.
Thermal Pollution – sources and their impact on aquatic environment.
Nuclear Pollution – disposal of nuclear waste, nuclear disaster and its management. Pollution control practices and Environment Protection Act.</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. N.C. Brady, The Nature and Properties of Soils, 10th Edition, Macmillan Publishing Co., New York (1990). 2. B.K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut (1997). 3. N.K. Roy, Chemistry of Pesticides, CBS Publishers & Distributors, New Delhi (2010). 4. A.K. De, Environmental Chemistry, Wiley Eastern Ltd., New Delhi (1994). 5. S.S. Dara, A Textbook of Environmental Chemistry and Pollution Control, S. Chand & Co., New Delhi (1997). 6. P.S. Sindhu, Environmental Chemistry, New Age International Publishers, New Delhi (2010).
Reference Books	
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: To Gain the knowledge of soil composition, soil formation process, soil texture and structure, nutrient availability, properties of soil and help farmers in cultivation of appropriate plants.

CO2: To Get the idea behind the plant growth by studying about fertilizers, organic manures, compost, farm yard manure and integrated nutrient management.

CO3: To understand the classification of pesticides, their mode of action, characteristics, impact of them on soil, plants and environment.

CO4: To interpret environmental segments, atmospheric regions, biogeochemical cycles, types of air pollutants and their effect on environment.

CO5: To acquire the knowledge of sources and impact of water pollution, thermal pollution and nuclear pollution. Help in making clean environment by learning pollution control practices and Environment Protection Act.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">CHEMISTRY IN FOOD PRESERVATION</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>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2" colspan="2"></td></tr>
<tr><td>Semester</td><td>II</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">3</td><td colspan="3">-</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Basics of Food chemistry.</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• To learn the nutritive value of foods.
• To acquire the knowledge about food preservation.
• To be aware of the nutrition required for children, adolescents and pregnant & lactating women.
• To learn to treat certain diseases by the required diet.
• To find adulterants in food and to study their effects.</td></tr>
<tr><td rowspan="5">Course outline</td><td colspan="8">UNIT-I: Nutrients and nutritive value of foods: Nutritional classification of foods -nutrients and type of nutrients - proteins, carbohydrates, fats, minerals -requirements (C, Na, K, Mg, Fe, S and P) and vitamins-their importance -balanced diet (definition only). Nutritive value of foods-cereals, wheat, rice, vegetables, fruits, milk, egg, meat and fish.</td></tr>
<tr><td colspan="8">UNIT-II: Food preservation and poisoning: Requirement of water, mineral and trace elements for human. Food preservation-definition, principle and importance-food spoilage-causes of food Spoilage-types of food spoilage-fermentation, rancidity and putrefication – food poisoning-Sources, causes and remedy.</td></tr>
<tr><td colspan="8">UNIT-III: Nutrition: Nutrition for children and adolescents. Nutrition during pregnancy and lactation. Health-definition-requirements of good health.</td></tr>
<tr><td colspan="8">UNIT-IV: Food deficiency diseases and treatment: Diets during diseases-peptic ulcer, dysentery, constipation, blood pressure and diabetes-treatment. Obesity and under nutrition-causes, complications and treatment.</td></tr>
<tr><td colspan="8">UNIT-V: Food adulteration and practical rules for good sanitation of food: Food adulteration - definition, common adulterants in food and their ill effects and detection. Food laws and standards-Bureau of Indian standards, AGMARK-consumer protection act.</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. M. Swaminathan, Handbook of Food & Nutrition, 5th edition, Bangalore Printing (2005). 2. B. Srilakshmi, Food Science, 3rd edition, New Age International (P) Ltd., New Delhi (2005). 3. B. Srilakshmi, Nutrition Science, 1st edition, New Age International (P) Ltd., New Delhi. 4. H.Corinne and Robinson, Fundamentals of Normal Nutrition, Macmillan Publishing Co., Inc. New York.
Reference Books	1. M. Swaminathan, Food Science and Experimental Foods, Ganesh and Company, Chennai. 2. M.Raheena Begum, A Text book of Foods Nutrition and Dieterics, Sterling Publishers, New Delhi (2010). 3. Seema Yadav, Food Chemistry, Anmol Publishing (P) Ltd, New Delhi (2006). 4. Sumathi R.Mudambi, M.V.Rajagobal Fundamentals of Foods, Nutrition and Diet Therapy, 5th Edition, New Age International (P) Ltd., Publishers, New Delhi (2007).
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: To learn Nutrients and Nutritive value of foods.

CO2: To gain knowledge about Food preservation and poisoning.

CO3: To study Nutrition and Health for children, adolescents.

CO4: To acquire Food deficiency diseases and treatment.

CO5: To gain knowledge about Food adulteration and practical rules for good sanitation of food.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">COSMETIC CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="8">Skill Enhancement Course - II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>Semester</td><td>II</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">Basics of Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• To learn cosmeceuticals
• To understand fragrances.
• To know about lotions, makeup types and cosmetic chemicals.</td></tr>
<tr><td rowspan="5">Course outline</td><td colspan="8">Unit I: Cosmeceuticals: Anti-ageing creams-ingredients, anti-wrinkle creams. Sunscreen-active ingredients adverse effects. Antiperspirants-deodorants.</td></tr>
<tr><td colspan="8">Unit II: Fragrances: Soap and hair fragrances. Perfumes, colognes, men perfumes, women beauty perfumes. Fabrics and fragrances.</td></tr>
<tr><td colspan="8">Unit III: Lotions: Face creams, hand creams and body lotions.</td></tr>
<tr><td colspan="8">Unit IV: Makeup Types: Lipstick, lipgloss, lipliner, face concealor, Rouge, bindi, Thanka creams, eyeliner, eye shadow.</td></tr>
<tr><td colspan="8">Unit V: Common cosmetic chemicals: Emulsifiers, ingredients, preservatives, thickeners, fragrance, pH stabilizers, colour.</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC others to be solved
(To be discussed during the Tutorial hours)</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="8">Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</td></tr>
<tr><td>Recommended Text</td><td colspan="8">1. Peter Elsner, Howard I. Maibiach and Marcel Dekker (ed), Cosmecuticals: drugs vs cosmetics.
2. Randy Schuller and Perry Romanowski, “Beginning Cosmetic Chemistry”.
3. Randy Schuller and Perry Romanowski, “Beginning Cosmetic Chemistry-An overview for Chemists”.</td></tr>
</table>

Reference Books	
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: To gain the knowledge on cosmeceuticals.

CO2: To understand about fragrances.

CO3: To learn about lotions

CO4: To understand the types of makeups

CO5: To gain knowledge on cosmetic chemicals

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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 SYNTHESIS AND PHOTOCHEMISTRY</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>II</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>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="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">Basic knowledge of organic chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• To understand the molecular complexity of carbon skeletons and the presence of functional groups and their relative positions.
• To study various synthetically important reagents for any successful organic synthesis.
• To apply disconnection approach and identifying suitable synthons to effect successful organic synthesis.
• To learn the concepts of pericyclic reaction mechanisms.
• To gain the knowledge of photochemical organic reactions.</td></tr>
<tr><td rowspan="3">Course outline</td><td colspan="8">UNIT-I: Planning an Organic Synthesis and Control elements: Preliminary Planning – knowns and unknowns of the synthetic system studied, analysis of the complex and interrelated carbon framework into simple rational precursors, retrosynthetic analysis, alternate synthetic routes, key intermediates. Available starting materials and resulting yield of alternative methods. Linear Vs convergent synthesis. Synthesis based on umpolung concepts of Seeback, regiospecific control elements. Use of protective groups, activating groups and bridging elements. Examples of retrosynthetic approach, calculation of yield, advantages of convergent synthesis, synthesis of stereochemistry-controlled products.</td></tr>
<tr><td colspan="8">UNIT-II: Organic Synthetic Methodology: Retrosynthetic analysis; Alternate synthetic routes. Synthesis of organic mono and bifunctional compounds via disconnection approach. Protection of hydroxyl, carboxyl, carbonyl, thiol and amino groups. Illustration of protection and deprotection in synthesis. Control elements: Regiospecific control elements. Use of protective groups, activating groups, and bridging elements. Stereospecific control elements. Functional group alterations and transposition.</td></tr>
<tr><td colspan="8">UNIT-III: Pericyclic Reactions: Woodward Hoffmann rules; The Mobius and Huckel concept, FMO method and correlation diagrams. Cycloaddition and retrocycloaddition reactions; [2+2], [2+4], [4+4, Cationic, anionic, and 1,3-dipolar cycloadditions. Cheletropic reactions; Electrocyclization and ring opening reactions of conjugated dienes and trienes. Sigmatropic rearrangements: (1,3), (1,5) and(3,3)-carbon migrations, degenerate rearrangements. Ionic sigmatropic rearrangements. Group transfer reactions. Regioselectivity, stereoselectivity and periselectivity in pericyclic reactions.</td></tr>
</table>

	UNIT-IV: Organic Photochemistry-I: Photochemical laws, Photochemical excitation: Experimental techniques; electronic transitions; Jablonskii diagrams; intersystem crossings; energy transfer processes; Stern Volmer equation. Reactions of electronically excited ketones; $\pi \rightarrow \pi^*$ triplets; Norrish type-I and type-II cleavage reactions; Photo oxidation - photo reductions - Paterno-Buchi reactions;
	UNIT-V: Organic Photochemistry-II: Photochemistry of α,β-unsaturated ketones; cis-trans isomerisation. Photon energy transfer reactions, Photo cycloadditions, Photochemistry of aromatic compounds; photochemical rearrangements; photo-stationery state; di-π-methane rearrangement; Reaction of conjugated cyclohexadienone to 3,4-diphenyl phenols; Barton's reactions.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. F. A. Carey and Sundberg, Advanced Organic Chemistry, 5thed, Tata McGraw-Hill, New York, 2003. 2. J. March and M. Smith, Advanced Organic Chemistry, 5th ed., John-Wiley and sons, 2007. 3. R. E. Ireland, Organic synthesis, Prentice Hall India, Goel Publishing House, 1990. 4. Clayden, Greeves, Warren, Organic Chemistry, Oxford University Press, Second Edition, 2016. 5. M. B. Smith, Organic Synthesis 3rd edn, McGraw Hill International Edition, 2011.
Reference Books	1. Gill and Wills, Pericyclic Reactions, Chapman Hall, London, 1974. 2. J.A. Joule, G.F. Smith, Heterocyclic Chemistry, Garden City Press, Great Britain, 2004. 3. W. Caruthers, Some Modern Methods of Organic Synthesis 4th edn, Cambridge University Press, Cambridge, 2007. 4. H. O. House. Modern Synthetic reactions, W.A. Benjamin Inc, 1972. 5. Jagdamba Singh and Jaya Singh, Photochemistry and Pericyclic Reactions, New Age International Publishers, New Delhi, 2012.

Website and e-learning source	https://rushim.ru/books/praktikum/Monson.pdf

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To recall the basic principles of organic chemistry and to understand the various reactions of organic compounds with reaction mechanisms.

CO2: To understand the versatility of various special reagents and to correlate their reactivity with various reaction conditions.

CO3: To implement the synthetic strategies in the preparation of various organic compounds.

CO4: To predict the suitability of reaction conditions in the preparation of tailor-made organic compounds.

CO5: To design and synthesize novel organic compounds with the methodologies learnt during the course.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">COORDINATION CHEMISTRY – I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core XI</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</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">Basic knowledge of inorganic chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To gain insights into the modern theories of bonding in coordination compounds.
• To learn various methods to determine the stability constants of complexes.
• To understand and construct correlation diagrams and predict the electronic transitions that are taking place in the complexes.
• To describe various substitution and electron transfer mechanistic pathways of reactions in complexes.
• To evaluate the reactions of octahedral and square planar complexes.</td></tr>
<tr><td rowspan="3">Course outline</td><td colspan="7">UNIT-I: Modern theories of coordination compounds: Crystal field theory - splitting of d orbitals in octahedral, tetrahedral and square planar symmetries - measurement of 10Dq - factors affecting 10Dq - spectrochemical series - crystal field stabilisation energy for high spin and low spin complexes- evidences for crystal field splitting - site selections in spinels and antispinels - Jahn Teller distortions and its consequences. Molecular Orbital Theory and energy level diagrams concept of Weak and strong fields, Sigma and pi bonding in octahedral, square planar and tetrahedral complexes.</td></tr>
<tr><td colspan="7">UNIT-II: Spectral characteristics of complexes: Term states for d^{1-9} ions - characteristics of d-d transitions - charge transfer spectra - selection rules for electronic spectra - Orgel diagrams - Tanabe-Sugano energy level diagrams - nephelauxetic series - Racha parameter and calculation of inter-electronic repulsion parameter.</td></tr>
<tr><td colspan="7">UNIT-III: Stability and Magnetic property of the complexes: Stability of complexes: Factors affecting stability of complexes, Thermodynamic aspects of complex formation, Stepwise and overall formation constants, Stability correlations, statistical factors and chelate effect, Determination of stability constant and composition of the complexes: Formation curves and Bjerrum’s half method, Potentiometric method, Spectrophotometric method, Ion exchange method, Polorographic method and Continuous variation method (Job’s method) Magnetic property of complexes: Spin-orbit coupling, effect of spin-orbit coupling on magnetic moments, quenching of orbital magnetic moments.</td></tr>
</table>

	UNIT-IV: Kinetics and mechanisms of substitution reactions of octahedral and square planar complexes: Inert and Labile complexes; Associative, Dissociative and SNCB mechanistic pathways for substitution reactions; acid and base hydrolysis of octahedral complexes; Classification of metal ions based on the rate of water replacement reaction and their correlation to Crystal Field Activation Energy; Substitution reactions in square planar complexes: Trans effect, theories of trans effect and applications of trans effect in synthesis of square planar compounds; Kurnakov test.
	UNIT-V: Electron Transfer reactions in octahedral complexes: Outer sphere electron transfer reactions and Marcus-Hush theory; inner sphere electron transfer reactions; nature of the bridging ligand in inner sphere electron transfer reactions. Photo-redox, photo-substitution and photo-isomerisation reactions in complexes and their applications.
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. J E Huheey, EA Keiter, RL Keiter and OK Medhi, Inorganic Chemistry – Principles of structure and reactivity, 4th Edition, Pearson Education Inc., 2006 2. G L Meissler and D ATarr, Inorganic Chemistry, 3rd Edition, Pearson Education Inc., 2008 3. D. Bannerjea, Co-ordination Chemistry, TATA McGraw Hill, 1993. 4. B. N. Figgis, Introduction to Ligand Fields, Wiley Eastern Ltd, 1976. 5. F. A. Cotton, G. Wilkinson.; C. A. Murillo; M. Bochmann, Advanced Inorganic Chemistry, 6th ed.; Wiley Inter-science: New York, 1988.
Reference Books	1. Keith F. Purcell and John C. Kotz, Inorganic Chemistry, Saunders Publications, USA, 1977. 2. Peter Atkins and Tina Overton, Shriver and Atkins' Inorganic Chemistry, 5th Edition, Oxford University Press, 2010.

	3. Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson, P. L. Guas, John Wiley, 2002, 3rd edn. 4. Concepts and Models of Inorganic Chemistry, B. Douglas, D. McDaniel, J. Alexander, John Wiley, 1994, 3rd edn. 5. Inorganic Chemistry, D. F. Shriver, P. W. Atkins, W. H. Freeman and Co, London, 2010.
Website and e-learning source	https://ocw.mit.edu/courses/5-04-principles-of-inorganic-chemistry-ii-fall-2008/pages/syllabus/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: Understand and comprehend various theories of coordination compounds.

CO2: Understand the spectroscopic and magnetic properties of coordination complexes.

CO3: Explain the stability of complexes and various experimental methods to determine the stability of complexes.

CO4: Predict the electronic transitions in a complex based on correlation diagrams and UV-visible spectral details.

CO5: Comprehend the kinetics and mechanism of substitution reactions in octahedral and square planar complexes.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">PHYSICAL CHEMISTRY PRACTICALS - I</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core XII-P</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</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">Basic principles of various physical chemistry experiments.</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To know the basic principles of various physical chemistry experiments.
• To learn the skills of drawing graph, handling of some precision instruments.
• To learn to do some experiments in different cycles.
• To know the handling of electrical methods Physical chemistry experiments.</td></tr>
<tr><td rowspan="3">Course outline</td><td colspan="7">UNIT I: Non-electrical methods
1. Effect of NaCl or succinic acid on CST of phenol – water system and determination of the strength of NaCl or succinic acid.
2. Rast method - determination of K_f and molecular weight.
3. Comparison of acid strength by kinetics
4. Heat of solution.
5. Adsorption of oxalic acid on charcoal.
6. Rate constant of persulphate oxidation by titrimetry and influence of ionic strength (Bronsted – Bjerrum model).</td></tr>
<tr><td colspan="7">UNIT II: Electrical methods
1. Mixture of acids vs Strong base
2. Solubility of sparingly soluble salt
3. Verification of Ostwald’s dilution law.</td></tr>
<tr><td colspan="7">UNIT III: Electrical methods
1. Mixture of acids (HCl, acetic acid Vs Strong base)
2. Solubility of sparingly soluble salt
3. Determination of pKa of weak acid (acetic acid)</td></tr>
<tr><td></td><td colspan="7">UNIT IV: Viva-voce on related practicals</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</td><td colspan="7">Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC others to be solved
(To be discussed during the Tutorial hours)</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>
</table>

Recommended Text	1. Ahluwalia, V. K., Dingra, S. and Gulati, A. College Practical Chemistry, Orient Longman Pvt. Ltd., Hyderabad (2005). 2. Sharma, K. K. and Sharma, D. S. Introduction to Practical Chemistry, Vikas Publishing House, New Delhi (2005).
Reference Books	1. V.Venkateswaran, R.Veeraswamy and A.R.Kulandaivelu A.R., Basic Principles of Practical Chemistry, 2nd edition, New Delhi, Sultan Chand & Sons (1997). 2. A.Findlay, Practical Physical Chemistry, 7th edition, London, Longman (1959).
Website and e-learning source	https://www.srcollege.edu.in/temp/lms/Manuals/PhysicalChemistry.pdf

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To recall the basic principles of various physical chemistry experiments

CO2: To develop the skills of drawing graph and mathematical approach

CO3: To scientifically and record systematically the readings in all the experiments

CO4: To interpret the experimental data scientifically to improve students

CO5: To calculate and process the experimentally measured values and compare with graphical data

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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

1 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="8">ELECTROCHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="8">Core Based Elective - II (Discipline Specific Elective -II)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CBE</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>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="3">Total</td></tr>
<tr><td colspan="2">4</td><td colspan="3">-</td><td colspan="3">4</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Basic knowledge of electrochemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• To understand the behavior of electrolytes in terms of conductance, ionic atmosphere, interactions.
• To familiarize the structure of the electrical double layer of different models.
• To compare electrodes between current density and over potential.
• To discuss the mechanism of electrochemical reactions.
• To highlight the different types of over voltages and its applications in electroanalytical techniques.</td></tr>
<tr><td rowspan="3">Course outline</td><td colspan="8">UNIT-I: Ionics: Arrhenius theory -limitations, van’t Hoff factor and its relation to colligative properties. Deviation from ideal behavior. Ionic activity, mean ionic activity and mean ionic activity coefficient-concept of ionic strength, Debye Huckel theory of strong electrolytes, activity coefficient of strong electrolytes Determination of activity coefficient ion solvent and ion-ion interactions. Born equation. Debye-Huckel Bjerrum model. Derivation of Debye-Huckel limiting law at appreciable concentration of electrolytes modifications and applications. Electrolytic conduction-Debye-Huckel Onsager treatment of strong electrolyte-qualitative and quantitative verification and limitations. Evidence for ionic atmosphere. Ion association and triple ion formations.</td></tr>
<tr><td colspan="8">UNIT-II: Electrode-electrolyte interface: Interfacial phenomena - Evidences for electrical double layer, polarizable and non-polarizable interfaces, Electrocapillary phenomena - Lippmann equation electro capillary curves. Electro-kinetic phenomena electro-osmosis, electrophoresis, streaming and sedimentation potentials, colloidal and poly electrolytes. Structure of double layer: Helmholtz - Perrin, Guoy - Chapman and Stern models of electrical double layer. Zeta potential and potential at zero charge. Applications and limitations.</td></tr>
<tr><td colspan="8">UNIT-III: Electrodics of Elementary Electrode Reactions: Behavior of electrodes: Standard electrodes and electrodes at equilibrium. Anodic and Cathodic currents, condition for the discharge of ions. Nernst equation, polarizable and non-polarizable electrodes. Model of three electrode</td></tr>
</table>

	system, over potential. Rate of electro chemical reactions: Rates of simple elementary reactions. Butler-Volmer equation-significance of exchange current density, net current density and symmetry factor. Low and high field approximations. Symmetry factor and transfer coefficient Tafel equations and Tafel plots.
	UNIT-IV: Electrodics of Multistep Multi Electron System: Rates of multi-step electrode reactions, Butler - Volmer equation for a multi-step reaction. Rate determining step, electrode polarization and depolarization. Transfer coefficients, its significance and determination, Stoichiometric number. Electro-chemical reaction mechanisms-rate expressions, order, and surface coverage. Reduction of I^{3-}, Fe^{2+}, and dissolution of Fe to Fe^{2+}. Overvoltage - Chemical and electro chemical, Phase, activation and concentration over potentials. Evolution of oxygen and hydrogen at different pH. Pourbiax and Evan's diagrams.
	UNIT-V: Concentration Polarization, Batteries and Fuel cells: Modes of Transport of electro active species - Diffusion, migration and hydrodynamic modes. Role of supporting electrolytes. Polarography-principle and applications. Principle of square wave polarography. Cyclic voltammetry - anodic and cathodic stripping voltammetry and differential pulse voltammetry. Sodium and lithium-ion batteries and redox flow batteries. Mechanism of charge storage: conversion and alloying. Capacitors - mechanism of energy storage, charging at constant current and constant voltage. Energy production systems: Fuel Cells: classification, alkaline fuel cells, phosphoric acid fuel cells, high temperature 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. D. R. Crow, Principles and applications of electrochemistry, 4th edition, Chapman & Hall/CRC, 2014. 2. J. Rajaram and J.C. Kuriakose, Kinetics and Mechanism of chemical transformations Macmillan India Ltd., New Delhi, 2011. 3. S. Glasstone, Electro chemistry, Affiliated East-West Press, Pvt., Ltd., New Delhi, 2008. 4. B. Viswanathan, S. Sundaram, R. Venkataraman, K. Rengarajan and P.S. Raghavan, Electrochemistry-Principles and applications, S. Viswanathan Printers, Chennai,2007. 5. Joseph Wang, Analytical Electrochemistry, 2nd edition, Wiley, 2004.
Reference Books	1. J.O.M. Bockris and A.K.N. Reddy, Modern Electro chemistry, vol.1 and 2B, Springer, Plenum Press, New York, 2008. 2. J.O.M. Bockris, A.K.N. Reddy and M.G. Aldeco Morden Electro chemistry, vol. 2A, Springer, Plenum Press, New York, 2008. 3. Philip H. Rieger, Electrochemistry, 2nd edition, Springer, New York, 2010. 4. L.I. Antropov, Theoretical electrochemistry, Mir Publishers, 1977. 5. K.L. Kapoor, A Text book of Physical chemistry, volume-3, Macmillan, 2001.
Website and e-learning source	https://www.pdfdrive.com/modern-electrochemistry-e34333229.

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To understand the behaviour of electrolytes in solution and compare the structures of electrical double layer of different models.

CO2: To predict the kinetics of electrode reactions applying Butler-Volmer and Tafel equations

CO3: To study different thermodynamic mechanism of corrosion,

CO4: To discuss the theories of electrolytes, electrical double layer, electrodics and activity coefficient of electrolytes

CO5: To have knowledge on storage devices and electrochemical reaction mechanism.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">MATERIAL SCIENCE</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Base Elective - II (Discipline Specific Elective - II)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CBE</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</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">Basic knowledge of solid-state chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To understand the crystal structure, growth methods and X-ray scattering.
• To explain the optical, dielectric and diffusion properties of crystals.
• To recognize the basis of semiconductors, superconductivity materials and magnets.
• To study the synthesis, classification and applications of nanomaterials.
• To learn about the importance of materials used for renewable energy conversion.</td></tr>
<tr><td rowspan="3">Course outline</td><td colspan="7">UNIT-I: Crystallography: symmetry - unit cell and Miller indices - crystal systems - Bravais lattices - point groups and space groups - X-ray diffraction - Laue equations - Bragg's law - reciprocal lattice and its application to geometrical crystallography. Crystal structure – powder and single crystal applications. Electron charge density maps, neutron diffraction - method and applications.</td></tr>
<tr><td colspan="7">UNIT-II: Crystal growth methods: Nucleation – equilibrium stability and metastable state. Single crystal – Low and high temperature, solution growth – Gel and sol-gel. Crystal growth methods – nucleation – equilibrium stability and metastable state. Single crystal–Low and high temperature, solution growth – Gel and sol-gel. Melt growth - Bridgeman-Stockbarger, Czochralski methods. Flux technique, physical and chemical vapour transport. Lorentz and polarization factor - primary and secondary extinctions.</td></tr>
<tr><td colspan="7">UNIT-III: Properties of crystals: Optical studies - Electromagnetic spectrum (qualitative) refractive index – reflectance – transparency, translucency and opacity. Types of luminescence – photo-, electro-, and injection luminescence, LEDs – organic, Inorganic and polymer LED materials - Applications. Dielectric studies - Polarisation - electronic, ionic, orientation, and space charge polarisation. Effect of temperature. dielectric constant, dielectric loss. Types of dielectric breakdown – intrinsic, thermal, discharge, electrochemical and defect breakdown.</td></tr>
</table>

	UNIT-IV: Special Materials: Superconductivity: Meissner effect, Critical temperature and critical magnetic Field, Type I and II superconductors, BCS theory-Cooper pair, Applications. Soft and hard magnets – Domain theory Hysteresis Loop-Applications. Magneto and gian magneto resistance. Ferro, ferri and antiferromagnetic materials-applications, magnetic parameters for recording applications. Ferro-, Piezo-, and pyro electric materials – properties and applications. Shape memory Alloys-characteristics and applications, Non-linear optics-Second Harmonic Generators, mixing of Laser wavelengths by quartz, ruby and $LiNbO_3$.
	UNIT-V: Materials for Renewable Energy Conversion: Solar Cells: Organic, bilayer, bulk heterojunction, polymer, perovskite based. Solar energy conversion: lamellar solids and thin films, dye-sensitized photo voltaic cells, coordination compounds anchored onto semiconductor surfaces - Ru(II) and Os(II) polypyridyl complexes. Photochemical activation and splitting of water, CO2 and N2. Manganese based photo systems for water - splitting. Complexes of Rh, Ru, Pd and Pt - photochemical generation of hydrogen from alcohol.
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. S. Mohan and V. Arjunan, Principles of Materials Science, MJP Publishers, 2016. 2. Arumugam, Materials Science, Anuradha Publications, 2007. 3. Giacavazzo et al., Fundamentals of Crystallography, International Union of Crystallography. Oxford Science Publications, 2010 4. Woolfson, An Introduction to Crystallography, Cambridge University Press, 2012. 5. James F. Shackelford and Madanapalli K. Muralidhara, Introduction to Materials Science for Engineers. 6^{th} ed., PEARSON Press, 2007.

Reference Books	1. M.G. Arora, Solid State Chemistry, Anmol Publications, New Delhi, 2001. 2. R.K. Puri and V.K. Babbar, Solid State Physics, S Chand and Company Ltd, 2001. 3. C. Kittel, Solid State Physics, John-Wiley and sons, NY, 1966. 4. H.P. Meyers, Introductory Solid State Physics, Viva Books Private Limited, 1998. 5. A.R. West, Solid State Chemistry and Applications, John-Wiley and sons, 1987.
Website and e-learning source	1. http://xrayweb.chem.ou.edu/notes/symmetry.html. 2. http://www.uptti.ac.in/classroom-content/data/unit%20cell.pdf. 3. https://bit.ly/3QyVg2R

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To understand and recall the synthesis and characteristics of crystal structures, semiconductors, magnets, nanomaterials and renewable energy materials.

CO2: To integrate and assess the structure of different materials and their properties.

CO3: To analyse and identify new materials for energy applications.

CO4: To explain the importance of crystal structures, piezoelectric and pyroelectric materials, nanomaterials, hard and soft magnets, superconductors, solar cells, electrodes, LED uses, structures and synthesis.

CO5: To design and develop new materials with improved property for energy applications.

PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">MOLECULAR SPECTROSCOPY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Based Elective - III (Discipline Specific Elective - III)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CBE</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</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">Basic knowledge of spectroscopy</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To understand the influence of rotation and vibrations on the spectra of the polyatomic molecules.
• To study the principle of Raman spectroscopy, ESR spectroscopy, EPR spectroscopy and fragmentation patterns in Mass spectroscopy.
• To highlight the significance of Franck-Condon principle to interpret the selection rule, intensity and types of electronic transitions.
• To interpret the first and second order NMR spectra in terms of splitting and coupling patterns using correlation techniques such as COSY, HETCOR, NOESY.
• To carry out the structural elucidation of molecules using different spectral techniques.</td></tr>
<tr><td rowspan="2">Course outline</td><td colspan="7">UNIT-I: Rotational and Raman Spectroscopy: Rotational spectra of diatomic and polyatomic molecules. Intensities of rotational spectral lines, effect of isotopic substitution. Non-rigid rotators. Classical theory of the Raman effect, polarizability as a tensor, polarizability ellipsoids, quantum theory of the Raman effect, Pure rotational Raman spectra of linear and asymmetric top molecules, Stokes and anti-Stokes lines. Vibrational Raman spectra, Raman activity of vibrations, rule of mutual exclusion, rotational fine structure-O and S branches, Polarization of Raman scattered photons.</td></tr>
<tr><td colspan="7">UNIT-II: Vibrational Spectroscopy: Vibrations of molecules, harmonic and anharmonic oscillators- vibrational energy expression, energy level diagram, vibrational wave functions and their symmetry, selection rules, expression for the energies of spectral lines, computation of intensities, hot bands, effect of isotopic substitution. Diatomic vibrating rotor, vibrational - rotational spectra of diatomic molecules, P, R branches, breakdown of the Born-Oppenheimer approximation. Vibrations of polyatomic molecules – symmetry properties, overtone and combination frequencies. Influence of rotation on vibrational spectra of polyatomic molecule, P, Q, R branches, parallel and perpendicular vibrations of linear and symmetric top molecules.</td></tr>
</table>

	UNIT-III: Electronic spectroscopy: Electronic Spectroscopy: Electronic spectroscopy of diatomic molecules, Frank-Condon principle, dissociation and predissociation spectra. $\pi \rightarrow \pi^*$, $n \rightarrow \pi^*$ transitions and their selection rules. Photoelectron Spectroscopy: Basic principles, photoelectron spectra of simple molecules, X-ray photoelectron spectroscopy (XPS). Lasers: Laser action, population inversion, properties of laser radiation, examples of simple laser systems.
	UNIT-IV: NMR and ESR spectroscopy: Chemical shift, Factors influencing chemical shifts: electronegativity and electrostatic effects; Mechanism of shielding and deshielding. Spin systems: First order and second order coupling of AB systems, Simplification of complex spectra. Spin-spin interactions: Homonuclear coupling interactions - AX, AX2, AB types. Vicinal, germinal and long-range coupling-spin decoupling. Nuclear Overhauser effect (NOE), Factors influencing coupling constants and Relative intensities. 13CNMR and structural correlations, Satellites. Brief introduction to 2D NMR – COSY, NOESY. Introduction to ^{31}P, ^{19}F NMR. ESR spectroscopy Characteristic features of ESR spectra, line shapes and line widths; ESR spectrometer. The g value and the hyperfine coupling parameter (A), origin of hyperfine interaction. Interpretation of ESR spectra and structure elucidation of organic radicals using ESR spectroscopy; Spin orbit coupling and significance of g-tensors, zero/non-zero field splitting, Kramer's degeneracy, application to transition metal complexes (having one to five unpaired electrons) including biological molecules and inorganic free radicals. ESR spectra of magnetically dilute samples.
	UNIT-V: Mass Spectrometry, EPR and Mossbauer Spectroscopy: Ionization techniques - Electron ionization (EI), chemical ionization (CI), desorption ionization (FAB/MALDI), electrospray ionization (ESI), isotope abundance, molecular ion, fragmentation processes of organic molecules, deduction of structure through mass spectral fragmentation, high resolution. Effect of isotopes on the appearance of mass spectrum. EPR spectra of anisotropic systems - anisotropy in g-value, causes of anisotropy, anisotropy in hyperfine coupling, hyperfine splitting caused by quadrupole nuclei. Zero-field splitting (ZFS) and Kramer's degeneracy. Applications of EPR to organic and inorganic systems. Structural elucidation of organic compounds by combined spectral techniques. Principle of Mossbauer spectroscopy: Doppler shift, recoil energy. Isomer shift, quadrupole splitting, magnetic interactions. Applications: Mossbauer spectra of high and low-spin Fe and Sn compounds.

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. C. N. Banwell and E. M. McCash, *Fundamentals of Molecular Spectroscopy*, 4th Ed., Tata McGraw Hill, New Delhi, 2000. 2. R. M. Silverstein and F. X. Webster, *Spectroscopic Identification of Organic Compounds*, 6th Ed., John Wiley & Sons, New York, 2003. 3. W. Kemp, *Applications of Spectroscopy*, English Language Book Society, 1987. 4. D. H. Williams and I. Fleming, *Spectroscopic Methods in Organic Chemistry*, 4th Ed., Tata McGraw-Hill Publishing Company, New Delhi, 1988. 5. R. S. Drago, *Physical Methods in Chemistry*; Saunders: Philadelphia, 1992.
Reference Books	1. P.W. Atkins and J. de Paula, *Physical Chemistry*, 7th Ed., Oxford University Press, Oxford, 2002. 2. N. Levine, *Molecular Spectroscopy*, John Wiley & Sons, New York, 1974. 3. Rahman, *Nuclear Magnetic Resonance-Basic Principles*, Springer-Verlag, New York, 1986. 4. K. Nakamoto, *Infrared and Raman Spectra of Inorganic and coordination Compounds*, Part B: 5th ed., John Wiley& Sons Inc., New York, 1997. 5. J. A. Weil, J. R. Bolton and J. E. Wertz, *Electron Paramagnetic Resonance*; Wiley Interscience, 1994.
Website and e-learning source	1. https://onlinecourses.nptel.ac.in/noc20_cy08/preview 2. https://www.digimat.in/nptel/courses/video/104106122/L14.html

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To understand the importance of rotational and Raman spectroscopy.

CO2: To apply the vibrational spectroscopic techniques to diatomic and polyatomic molecules.

CO3: To evaluate different electronic spectra of simple molecules using electronic spectroscopy.

CO4: To outline the NMR, ^{13}C NMR, 2D NMR – COSY, NOESY, Introduction to ^{31}P, ^{19}F NMR and ESR spectroscopic techniques.

CO5: To develop the knowledge on principle, instrumentation and structural elucidation of simple molecules using Mass Spectrometry, EPR and Mossbauer Spectroscopy techniques.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">GREEN CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Based Elective - III (Discipline Specific Elective - III)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CBE</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</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">Basic knowledge of general chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To discuss the principles of green chemistry.
• To propose green solutions for chemical energy storage and conversion.
• Propose green solutions for industrial production of Petroleum and Petrochemicals.
• Propose solutions for pollution prevention in Industrial chemical and fuel production, Automotive industry and Shipping industries.
• Propose green solutions for industrial production of Surfactants, Organic and inorganic chemicals.</td></tr>
<tr><td rowspan="5">Course outline</td><td colspan="7">UNIT-I: Introduction - Need for Green Chemistry. Goals of Green Chemistry. Limitations of Green Chemistry. Chemical accidents, terminologies, International green chemistry organizations and Twelve principles of Green Chemistry with examples.</td></tr>
<tr><td colspan="7">UNIT-II: Choice of starting materials, reagents, catalysts and solvents in detail, Green chemistry in day today life. Designing green synthesis - green reagents: dimethyl carbonate. Green solvents: Water, Ionic liquids - criteria, general methods of preparation, effect on organic reaction. Supercritical carbon dioxide- properties, advantages, drawbacks and a few examples of organic reactions in $scCO_2$. Green synthesis-adipic acid and catechol.</td></tr>
<tr><td colspan="7">UNIT-III: Environmental pollution, Green Catalysis-Acid catalysts, Oxidation catalysts, Basic catalysts, Polymer supported catalysts-Poly styrene aluminum chloride, polymeric super acid catalysts, Poly supported photosensitizers.</td></tr>
<tr><td colspan="7">UNIT-IV: Phase transfer catalysis in green synthesis-oxidation using hydrogen peroxide, crown ethers-esterification, saponification, anhydride formation, Elimination reaction, Displacement reaction. Applications in organic synthesis.</td></tr>
<tr><td colspan="7">UNIT-V: Micro wave induced green synthesis-Introduction, Instrumentation, Principle and applications. Sonochemistry – Instrumentation, Cavitation theory - Ultra sound assisted green synthesis and Applications.</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. Ahluwalia, V.K. and Kidwai, M.R. New Trends in Green Chemistry, Anamalaya Publishers, 2005. 2. W. L. McCabe, J.C. Smith and P. Harriott, Unit Operations of Chemical Engineering, 7th edition, McGraw-Hill, New Delhi, 2005. 3. J. M. Swan and D. St. C. Black, Organometallics in Organic Synthesis, Chapman Hall, 1974. 4. V. K. Ahluwalia and R. Aggarwal, Organic Synthesis: Special Techniques, Narosa Publishing House, New Delhi, 2001. 5. A. K. De, Environmental Chemistry, New Age Publications, 2017.
Reference Books	1. Anastas, P.T. and Warner, J.K. Oxford Green Chemistry -Theory and Practical, University Press, 1998. 2. Matlack, A.S. Introduction to Green Chemistry, Marcel Dekker, 2001. 3. Cann, M.C. and Connely, M.E. Real-World Cases in Green Chemistry, American Chemical Society, Washington, 2000. 4. Ryan, M.A. and Tinnesand, M., Introduction to Green Chemistry, American Chemical Society Washington, 2002. 5. Chandrakanta Bandyopadhyay, An Insight into Green Chemistry, Books and Allied (P) Ltd, 2019.
Website and e-learning source	1. https://www.organic-chemistry.org/ 2. https://www.studyorgo.com/summary.php

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

<table>
<tr><td>Title of the Course</td><td colspan="8">CHEMISTRY IN CONSUMER PRODUCTS</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>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">3</td><td colspan="3">-</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="8"></td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• 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.</td></tr>
<tr><td rowspan="5">Course outline</td><td colspan="8">Unit I: Basics of Cosmetics and Herbal Cosmetics: Definition of cosmetics - classification and structure of skin, hair, nails and teeth - Classification of cosmetics. Herbal cosmetics – Classification - Aloe vera - Cucumber – turmeric – Neam – Amla – Reetha – Lemon - Henna.</td></tr>
<tr><td colspan="8">Unit II: Perfumes and Cleaning agents: Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, Sandalwood oil, Eucalyptus, rose oil, Jasmone. Cleaning Agents- manufacture and uses of soaps, detergents, baking powder, shampoo, and bleaching powder (Common ingredients and health aspects).</td></tr>
<tr><td colspan="8">Unit III: Skin care: 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).</td></tr>
<tr><td colspan="8">Unit IV: Face creams and Shampoos: 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.</td></tr>
<tr><td colspan="8">Unit V: Preparation of domestic products: 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.</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. 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, 7th 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). 5. G.Sharma, Text Book of Cosmetics, Pragati Prakashan (2012).
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, 10th Edition, Klewer Academic Publishers, Netherlands (2000).
Website and e-learning source	1. https://www.researchgate.net/publication/325023106 TextbookofCosmeticFormulations 2. https://chem.libretexts.org/@go/page/152267

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To enrich the knowledge on basics of cosmetics and herbal cosmetics.

CO2: To empower the knowledge on essential oils and its significance in cosmetic industries.

CO3: To learn the knowledge on skin care products.

CO4: To study the skin care products.

CO5: To develop the skills on the preparation of domestic products.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">CHEMINFORMATICS, DRUGS AND HEALTH 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>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">3</td><td colspan="3">-</td><td colspan="2">3</td></tr>
<tr><td>Prerequisites</td><td colspan="8"></td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• To enable the students to know the basic concepts of cheminformatics, drug discovery and designs.
• To learn the composition of body fluids and the vital role of various vitamins.</td></tr>
<tr><td rowspan="5">Course outline</td><td colspan="8">Unit I: Cheminformatics: Introduction – evolution - history of chemical information science - uses.
Drug design: Pharmacodynamics - biological testing and bioassays - chemical parameters in drug design - physicochemical parameters in drug design - structure based drug design.</td></tr>
<tr><td colspan="8">Unit II: Introduction to drug discovery: Rational approaches to lead discovery based on traditional medicine, Radom screening, Non-random screening. Serendipitous drug discovery, lead discovery based drug metabolism, lead discovery based on clinical observation</td></tr>
<tr><td colspan="8">Unit III: Drugs: Classification - drugs acting on CNS - general anesthetics, hypnotics and sedatives, narcotics, antipyretics, antirheumatics, analgesics, anticonvulsants and antitussives. Chemotherapeutic drugs - antibiotics, antiseptics and disinfectants - cardiovascular agents - anticancer drugs - adverse effects of drugs.</td></tr>
<tr><td colspan="8">Unit IV: Health and Body Fluids
Health - mental health and physical health-food pyramid-types of malnutrition - causes and remedies - macro and micronutrients-carbohydrates, proteins and vitamins - biological function only-dietary elements (Na, K, Ca, P, Mg, S, Fe, Zn, Se and Mo).
Body Fluids: composition of blood - blood volume, blood groups, functions of blood, oxygen and caron dioxide transport in blood – haemoglobin – myoglobin - composition of urine-electrolyte balance-Na/K pump.</td></tr>
<tr><td colspan="8">Unit V: Common and Vitamin deficiency diseases: Jaundice, kidney stone - typhoid, dengue, ulcer, goiter, diabetes, rickets, scurvy, beriberi, pellagra, night blindness.
Covid-19: Causes-symptoms-diagnosis-vaccines/treatment.</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. Andrew R. Leach, Vallerie J.Gillet and A.R.Leach, An introduction to cheminformatics, Springer (2003). 2. A.V.Ramani, Food Chemistry, MJP Publishers, Chennai (2009). 3. Johann Gasteiger, Handbook of cheminformatics: From Data to Knowledge, Volumes 1-4, Wiley-VCH Verlag GmbH & Co, Weinheim (2003). 4. G.C.K.Robert, Drug action at the molecular level, University Park Press, Baltimore.
Reference Books	1. J.A.Ghosh, Text book of Pharmaceutical Chemistry, S. Chand and Co. Ltd. (1999). 2. Ashutosh Kar, Medicinal Chemistry, Wiley Easterns Limited, New Delhi (1993). 3. A.C.Deb, Fundamentals of Biochemistry, New Central Book Agency, Calcutta (1994). 4. M.Satake and Y.Mido, Chemistry for Health Science, Discovery Publishing House, New Delhi (2003).
Website and e-learning source	https://www.youtube.com/watch?v=wrDX3dNQSBg

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To study about basic concepts of cheminformatics and drug designs

CO2: To under the function of drugs and their mode of action.

CO3: To lean techniques adopted using drugs.

CO4: To understand the function of body fluids.

CO5: To learn about the importance of vitamins.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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

1 – Strong, 2 – Medium, 1 – Low

<table>
<tr><td>Title of the Course</td><td colspan="8">RESEARCH TOOLS AND TECHNIQUES</td></tr>
<tr><td>Paper No.</td><td colspan="8">Skill Enhancement Course - III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td 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"></td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• To enable the scholars to learn literature survey
• To gain the knowledge on thesis writing and preparation of manuscript
• To understand about chemical drawing softwares</td></tr>
<tr><td rowspan="5">Course outline</td><td colspan="8">Unit I: Survey of Literature: Need for literature survey - Primary, Secondary and Tertiary Sources - Journals, Chemical Abstracts - Subject index, Substance index, Author Index, Formula index and other indices. Use of computers in the literature Survey – Websites – Search Engines - chemspider, google scholar, scifinder, scopus.</td></tr>
<tr><td colspan="8">Unit II: Use of computers in the literature Survey: Websites – Search Engines - chemspider, google scholar, scifinder, scopus. Scientific Information and Documentation centers - INSDOC, BANSDOC, NCSI, British Library.</td></tr>
<tr><td colspan="8">Unit III: Error Analysis: Types of errors – Precision and accuracy – Significant figures – Mean standard deviation-determination of accuracy of results – Positive and negative deviation from accuracy.
Chemical drawing softwares: ChemDraw, ISIS draw, ChemSketch, MarvinSketch and ChemDoodle.</td></tr>
<tr><td colspan="8">Unit IV: Paper Writing: Title, Abstract, Introduction, Materials and Experimental methods, Results and discussion, Conclusion, Acknowledgement, References. Impact factor, Citation Index, h-Index, Patent filing.</td></tr>
<tr><td colspan="8">Unit V: Thesis writing: Title, Abstract, Introduction, Scope of the Work, Literature Review, Problem and Time Limitation, Experimental Methods, Results and Discussion, Foot Notes. Data Presentation - Figures and Tables. Sign Conventions followed. Bibliography - Conclusion and Recommendations. Abbreviations used.</td></tr>
<tr><td>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</td><td colspan="8">Questions related to the above topics, from various competitive examinations UPSC/JAM/TNPSC others to be solved
(To be discussed during the Tutorial hours)</td></tr>
<tr><td>Skills acquired from this course</td><td colspan="8">Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</td></tr>
</table>

Recommended Text	1. C.R.Kothari, *Research Methodology (Methods & Techniques)*, 2nd edition, Vishwa Prakasam (2002). 2. J.Anderson, B.H.Durston and M.Poole, *Thesis and Assignment writing*, John Wiley Publications, Sydney (1970). 3. P.Ramadass and A.Wilson Aruni, Research and Writing Across the Disciplines, MJP Publishers, Chennai (2009).
Reference Books	1. J.March, *Advanced Organic Chemistry: Reactions, Mechanisms and Structure*, 5th Edition, Wiley, New York (1996). 2. Hans F. Ebel, Claus Bliefert, The Art of Scientific Writing, Wiley Publishing, 2nd edition (2005).
Website and e-learning source	1. https://www.ilovephd.com/6-best-online-tools-for-drawing-chemical-structures/ 2. https://www.youtube.com/watch?v=4dNh1N63HkQ 3. https://www.gunda.hu/dprogs/index.html

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To learn literature survey

CO2: To gain the knowledge on the use of information technology on literature survey

CO3: To know the error analysis and chemical drawing softwares

CO4: To understand the article writing for publication

CO5: To understand the thesis writing

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">COORDINATION 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>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>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">6</td><td colspan="3">-</td><td colspan="2">6</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Basic knowledge of inorganic chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• To recognize the fundamental concepts and structural aspects of organometallic compounds.
• To learn reactions of organometallic compounds and their catalytic behaviour.
• To identify or predict the structure of coordination compounds using spectroscopic tools.
• To understand the structure and bonding in coordination complexes.
• To evaluate the spectral characteristics of selected complexes.</td></tr>
<tr><td rowspan="3">Course outline</td><td colspan="8">UNIT-I: Chemistry of organometallic compounds: Classification of organometallic compounds based on M-C bond – 18 and 16 electron rule; Bonding in metal – olefin complexes - Ziese’s salt, metal-acetylene and metal-allyl complexes; Metal-cyclopentadienyl complexes – Examples and MO approach to bonding in metallocenes; fluxional isomerism. Metal – carbonyl complexes: MO diagram of CO; Structure and bonding − bonding modes, MO approach of M-CO bonding, π-acceptor nature of carbonyl group, synergistic effect (stabilization of lower oxidation states of metals); Carbonyl clusters: Low nuclearity and high nuclearity carbonyl clusters – Structures based on polyhedral skeleton electron pair theory - Wade’s rule.</td></tr>
<tr><td colspan="8">UNIT-II: Reactions and catalysis of organometallic compounds: Reactions of organometallic compounds: Oxidative addition, reductive elimination (α and β eliminations), migratory insertion reaction and metathesis reaction. Organo-metallic catalysis: Hydrogenation of olefins (Wilkinson's catalyst), hydroformylation of olefins using cobalt or rhodium catalysts (oxo process), oxidation of olefin (Wacker process), olefin isomerisation - Zeigler-Natta polymerization, water gas shift reaction, cyclo-oligomerisation of acetylenes using Reppe's catalyst.</td></tr>
<tr><td colspan="8">UNIT-III: Inorganic spectroscopy-I: IR spectroscopy: Effect of coordination on the stretching frequency-sulphato, carbonato, sulphito, aqua, nitro, thiocyanato, cyano, thiourea, DMSO complexes; IR spectroscopy of carbonyl compounds. NMR spectroscopy- Introduction, applications of ^{1}H, ^{15}N, ^{19}F, ^{31}P-NMR spectroscopy in structural identification of inorganic complexes, fluxional molecules, quadrupolar nuclei - effect in NMR spectroscopy.</td></tr>
</table>

	UNIT-IV: Inorganic spectroscopy-II: Introductory terminologies: g and A parameters - definition, explanation and factors affecting g-value - Applications of ESR to coordination compounds with one and more unpaired electrons – hyperfine and secondary hyperfine splitting and Kramer's doublets; ESR spectra of V(II), Mn(II), Fe(II), Co(II), Ni(II), Cu(II) complexes, bis(salicylaldimine)copper(II) and $[(NH_3)_5Co\text{-}O_2\text{-}Co(NH_3)_5]^{5+}$. Mossbauer spectroscopy – Mossbauer effect, Recoil energy, Mossbauer active nuclei, Doppler shift, Isomer shift, quadrupole splitting and magnetic interactions. Applications of Mössbauer spectra to Fe and Sn compounds.
	UNIT-V: Photo Electron Spectroscopy: Theory, Types, origin of fine structures - shapes of vibrational fine structures – adiabatic and vertical transitions, PES of homonuclear diatomic molecules (N_2, O_2) and heteronuclear diatomic molecules (CO, HCl) and polyatomic molecules (H_2O, CO_2, CH_4, NH_3) – evaluation of vibrational constants of the above molecules. Koopman's theorem- applications and limitations. Optical Rotatory Dispersion – Principle of CD and ORD; Δ and λ isomers in complexes, Assignment of absolute configuration using CD and ORD techniques.
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. JE Huheey, EA Keiter, RL Keiter and OK Medhi, Inorganic Chemistry – Principles of structure and reactivity, 4th Edition, Pearson Education Inc., 2006. 2. G L Meissler and D A Tarr, Inorganic Chemistry, 3rd Edition, Pearson Education Inc., 2008. 3. D. Bannerjea, Co-ordination Chemistry, TATA McGraw Hill, 1993. 4. B D Gupta and A K Elias, Basic Organometallic Chemistry: Concepts, Syntheses and Applications, University Press, 2013. 5. F. A. Cotton, G. Wilkinson.; C. A. Murillo; M. Bochmann, Advanced Inorganic Chemistry, 6th ed.; Wiley Inter-science: New York, 1988.

Reference Books	1. Crabtree, Robert H. The Organometallic Chemistry of the Transition Metals. 3rd ed. New York, NY: John Wiley, 2000. 2. P Gütlich, E Bill, A X Trautwein, Mossbauer Spectroscopy and Transition Metal Chemistry: Fundamentals and Applications, 1st edition, Springer-Verlag Berlin Heidelberg, 2011. 3. Concepts and Models of Inorganic Chemistry, B. Douglas, D. McDaniel, J. Alexander, John Wiley, 1994, 3rd edn. 4. K. F. Purcell, J. C. Kotz, Inorganic Chemistry; Saunders: Philadelphia, 1976. 5. R. S. Drago, PhysicaI Methods in Chemistry; Saunders: Philadelphia, 1977.
Website and e-learning source	https://archive.nptel.ac.in/courses/104/101/104101100/

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: Understand and apply 18 and 16 electron rule for organometallic compounds.

CO2: Understand the structure and bonding in olefin, allyl, cyclopentadienyl and carbonyl containing organometallic compounds.

CO3: Understand the reactions of organometallic compounds and apply them in.

CO4: Understanding the catalytic cycles.

CO5: Identify / predict the structure of coordination complexes using spectroscopic tools such as IR, NMR, ESR, Mossbauer and optical rotatory dispersion studies to interpret the structure of molecules by various spectral techniques.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">PHYSCIAL CHEMISTRY PRACTICALS - II</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core XIV-P</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>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">5</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7"></td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To know the basic principles of various physical chemistry experiments.
• To learn the skills of drawing graph, handling of some precision instruments.
• To learn to do some experiments in different cycles.
• To gain knowledge on determination of IR spectrum compounds.
• To enrich the principles of various physical chemistry experiments.
• To gain knowledge for determination of IR spectrum compounds.</td></tr>
<tr><td rowspan="3">Course outline</td><td colspan="7">UNIT-I: Non-electrical methods
1. Determination of Arrhenius parameters (A and E_a) using acid hydrolysis of an ester
2. Transition Temperature–determination of K_{tr} and molecular weight.
3. Adsorption of oxalic acid on charcoal
4. Partition coefficient and K_{eqm}
5. Phase diagram three component system or phase diagram two component system with compound formation.</td></tr>
<tr><td colspan="7">UNIT-II: Electrical methods
Conductometry
1. Mixture of bases
2. Mixture of halides
3. Estimation of K_2SO_4
4. Verification of Debye-Huckel-Onsager Equation</td></tr>
<tr><td colspan="7">UNIT-III: Potentiometry
1. Estimation of KI ($K_2Cr_2O_7$Vs KI) or Estimation of KI($AgNO_3$Vs KI)
2. Mixture of halides (KCl and KI)
3. pH and pKa of buffer solution
4. Determination of standard electrode potential of Cu/Cu^{2+}system.
5. Estimation of $FeSO_4$.</td></tr>
</table>

	Interpretation of IR spectrum of known compounds
	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.
Recommended Text	1. V.K.Ahluwalia, S.Dingra, A.Gulati, College Practical Chemistry, Orient Longman Pvt. Ltd., Hyderabad (2005). 2. K.K.Sharma and D.S. Sharma, Introduction to Practical Chemistry, Vikas Publishing House, New Delhi (2005).
Reference Books	1. V.Venkateswaran, R.Veeraswamy and A.R. Kulandaivelu, Basic Principles of Practical Chemistry, 2nd edition, New Delhi, Sultan Chand & Sons (1997). 2. A.Findlay, Practical Physical Chemistry, 7th edition, London, Longman (1959).
Website and e-learning source	http://home.iitk.ac.in/~madhavr/CHM423manual2012.pdf

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

CO1: To recall the principles of various physical chemistry experiments
CO2: To scientifically plan and perform all the experiments
CO3: To scientifically and record systematically the readings in all the experiments
CO4: To interpret the experimental data scientifically to improve students
CO5: To improve the students efficiency for societal developments

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">BIOMOLECULES AND HETEROCYCLIC CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Based Elective - IV (Discipline Specific Elective -IV)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CBE</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">5</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basic knowledge of chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To learn the basic concepts and biological importance of biomolecules and natural products.
• To explain various of functions of carbohydrates, proteins, nucleic acids, steroids and hormones.
• To understand the functions of alkaloids and terpenoids.
• To elucidate the structure determination of biomolecules and natural products.
• To extract and construct the structure of new alkaloids and terpenoids from different methods.</td></tr>
<tr><td rowspan="3">Course outline</td><td colspan="7">UNIT-I: Chemistry and metabolism of carbohydrates: Definition, classification and biological role of carbohydrates. monosaccharides: Linear and ring structures (Haworth formula) of ribose, glucose, fructose and mannose (structure determination not required), physical and chemical properties of glucose and fructose. Disaccharides: Ring structures (Haworth formula) – occurrence, physical and chemical properties of maltose, lactose and sucrose. Polysaccharides: Starch, glycogen and cellulose – structure and properties, glycolysis of carbohydrates.</td></tr>
<tr><td colspan="7">UNIT-II: Steroids and Hormones: Steroids-Introduction, occurrence, nomenclature, configuration of substituents. Diels' hydrocarbon, stereochemistry, classification, Diels' hydrocarbon, biological importance, colour reactions of sterols, cholesterol-occurrence, tests, physiological activity, biosynthesis of cholesterol from squalene. Hormones - Introduction, classification, functions of sex hormones - androgens and estrogens, adrenocortical hormones - cortisone and cortisol structure and functions of non-steroidal hormones - adrenaline and thyroxin.</td></tr>
<tr><td colspan="7">UNIT-III: Proteins and nucleic acids: Separation and purification of proteins – dialysis, gel filtration and electrophoresis. Catabolism of amino acids - transamination, oxidative deamination and decarboxylation. Biosynthesis of proteins: Role of nucleic acids. Amino acid metabolism and ureacycle. Structure, methods for the synthesis of nucleosides - direct combination, formation of heterocyclic base and nucleoside modification, conversion of nucleoside to nucleotides. Primary and secondary structure of RNA and DNA, Watson-Crick model, solid phase synthesis of oligonucleotides.</td></tr>
</table>

	UNIT-IV: Alkaloids: Introduction, occurrence, classification, isolation and functions of alkaloids. General methods of structural elucidation. Chemical methods of structure determination of Coniine, Piperine, Papaverine, Atropine, Quinine and Morphine (Synthesis not required). **Terpenoids:** Introduction, occurrence, Isoprene rule, classification. General methods of determining structure. Structure determination of Camphor, Cadinene and Squalene (Synthesis not required). **Carotenoids:** Introduction, geometrical isomerism, Structure, functions and synthesis of β-carotene and vitamin-A.
	UNIT-V: Fused Ring Heterocyclic Compounds: Benzofused five membered rings: Indole, isoindole, benzofuran and benzothiophene, Preparation and properties. Benzofused six membered rings: Quinoline and isoquinoline: Preparation by ring closure reactions, Reactions: Mechanism of electrophilic and nucleophilic substitutions, oxidation and reduction reactions. Preparation and reactions of oxazole, thiazole, imidazole and pyrazole.
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. T. K Lindhorst, Essentials of Carbohydrate Chemistry and Biochemistry, Wiley VCH, North America, 2007. 2. I. L. Finar, Organic Chemistry Vol-2, 5th edition, Pearson Education Asia, 1975. 3. V. K. Ahluwalia and M. Goyal, Textbook of Heterocyclic compounds, Narosa Publishing, New Delhi, 2000. 4. M. K. Jain and S. C. Sharma, Modern Organic Chemistry, Vishal Publishing Co., Jalandhar, Delhi, 2014. 5. V. K. Ahluwalia, Steroids and Hormones, Ane books pub., New Delhi, 2009.
Reference Books	1. I. L. Finar, Organic Chemistry Vol-1, 6th edition, Pearson Education Asia, 2004. 2. Pelletier, Chemistry of Alkaloids, Van Nostrand Reinhold Co, 2000.

	3. Shoppe, Chemistry of the steroids, Butterworthes, 1994. 4. I. A. Khan, and A. Khanum. Role of Biotechnology in medicinal & aromatic plants, Vol 1 and Vol 10, Ukkaz Publications, Hyderabad, 2004. 5. M. P. Singh and H. Panda, Medicinal Herbs with their formulations, Daya Publishing House, Delhi, 2005.
Website and e-learning source	1. https://www.organic-chemistry.org/ 2. https://www.studyorgo.com/summary.php 3. https://www.clutchprep.com/organic-chemistry

Course Learning Outcomes (for Mapping with POs and PSOs)

On completion of the course the students should be able to

CO1: To understand the basic concepts of biomolecules and natural products.

CO2: To integrate and assess the different methods of preparation of structurally different biomolecules and natural products.

CO3: To illustrate the applications of biomolecules and their functions in the metabolism of living organisms.

CO4: To analyse and rationalise the structure and synthesis of heterocyclic compounds.

CO5: To develop the structure of biologically important heterocyclic compounds by different methods.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">POLYMER CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core Based Elective - IV (Discipline Specific Elective -IV)</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">CBE</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">5</td><td colspan="3">-</td><td colspan="2">5</td></tr>
<tr><td>Prerequisites</td><td colspan="7">Basic knowledge of general chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">• To learn the basic concepts and bonding in polymers.
• To explain various types of polymerization reactions and kinetics.
• To understand the importance of industrial polymers and their synthetic uses.
• To determine the molecular weight of polymers.
• To predict the degradation of polymers and conductivities.</td></tr>
<tr><td rowspan="4">Course outline</td><td colspan="7">UNIT-I: Characterization, Molecular weight and its Determination: Primary and secondary bond forces in polymers; cohesive energy, molecular structure, chemical tests, thermal methods, Tg, molecular distribution, stability. Determination of Molecular mass of polymers: Number Average molecular mass (M_n) and Weight average molecular mass (M_w) of polymers. Molecular weight determination of high polymers by physical and methods.</td></tr>
<tr><td colspan="7">UNIT-II: Mechanism and kinetics of Polymerization: Chain growth polymerization: Cationic, anionic, free radical polymerization, Stereo regular polymers: Ziegler Natta polymerization. Reaction kinetics. Step growth polymerization, Degree of polymerization.</td></tr>
<tr><td colspan="7">UNIT-III: Techniques of Polymerization and Polymer Degradation: Bulk, Solution, Emulsion, Suspension, solid, interfacial and gas phase polymerization. Types of Polymer Degradation, Thermal degradation, mechanical degradation, photodegradation, Photo stabilizers, Solid and gas phase polymerization.</td></tr>
<tr><td colspan="7">UNIT-IV: Industrial Polymers: Preparation of fibre forming polymers, elastomeric material. Thermoplastics: Polyethylene, Polypropylene, polystyrene, Polyacrylonitrile, Poly Vinyl Chloride, Poly tetrafluoro ethylene, nylon and polyester. Thermosetting Plastics: Phenol formaldehyde and expoxide resin. Elastomers: Natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene. Conducting Polymers: Elementary ideas; examples: poly sulphur nitriles, poly phenylene, poly pyrrole and poly acetylene. Polymethylmethacrylate, polyimides, polyamides, polyurethanes, polyureas, polyethylene and polypropylene glycols.</td></tr>
</table>

	UNIT-V: Polymer Processing: Compounding: Polymer Additives: Fillers, Plasticizers, antioxidants, thermal stabilizers, fire retardants and colourants. Processing Techniques: Calendaring, die casting, compression moulding, injection moulding, blow moulding and reinforcing. Film casting, Thermofoaming, Foaming. Catalysis and catalysts – Polymerization catalysis, catalyst support, clay compounds, basic catalyst, auto-exhaust catalysis, vanadium, heterogeneous catalysis and active centres.
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.R. Gowariker, *Polymer Science*, Wiley Eastern, 1995. 2. G.S. Misra, *Introductory Polymer Chemistry*, New Age International (Pvt) Limited, 1996. 3. M.S. Bhatnagar, A Text Book of Polymers, Vol-I & II, S. Chand & Company, New Delhi, 2004.
Reference Books	1. F. N. Billmeyer, *Textbook of Polymer Science*, Wiley Interscience, 1971. 2. A. Kumar and S. K. Gupta, *Fundamentals and Polymer Science and Engineering*, Tata McGraw-Hill, 1978.
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: To understand the bonding in polymers.

CO2: To scientifically plan and perform the various polymerization reactions.

CO3: To observe and record the processing of polymers.

CO4: To calculate the molecular weight by physical and chemical methods.

CO5: To interpret the experimental data scientifically to improve the quality of synthetic polymers.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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">INDUSTRIAL CHEMISTRY</td></tr>
<tr><td>Paper No.</td><td colspan="8">Skill Enhancement Course - IV</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Course Code</td><td rowspan="2" colspan="2"></td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td></td><td colspan="3">Lecture</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>Instructional hours per week</td><td colspan="3">2</td><td colspan="2">-</td><td colspan="2">2</td></tr>
<tr><td>Prerequisites</td><td colspan="8">Fundamentals of Chemistry</td></tr>
<tr><td>Objectives of the course</td><td colspan="8">• To enable the general and basic scientific concepts required for industrial technology, the concepts in solving industrial problems.
• To gain knowledge in the new developments in engineering and technology.
• To familiarize with concepts, theories, processes and applications for industry.
• To study on the electrochemical processes involved in industries.</td></tr>
<tr><td rowspan="4">Course outline</td><td colspan="8">UNIT-I: Glass, fertilizers and polymers: Glass-types-composition-manufacture of optical glass, coloured glasses, lead glass and neutron absorbing glass. Fertilizers-fertilizer industries in India-manufacture of ammonia, ammonium salts, urea, superphosphate, triple superphosphate and nitrate salts. Polymers-introduction-polymerization – classification of polymers - types of polymerization - preparation, properties and uses of polyethylene, PVC, polystyrene and Teflon.</td></tr>
<tr><td colspan="8">UNIT-II: Paints, varnishes and cleansing agents: Paints and varnishes - primary constituents of paints, dispersion medium (solvent), binder, pigments, oil based paints, latex paints baked on paints (alkyl resins) - formulation of paints and varnishes-requirements of a good paint. Cleansing agents - preparation of toilet and washing soaps, synthetic detergents – alkyl and aryl sulphonates-fatty alcohol sulphates–non-ionic detergents – builders - additives – corrosion inhibitors.</td></tr>
<tr><td colspan="8">UNIT-III: Chemical explosives and leather technology: Chemical Explosives - origin of explosive- preparation and chemistry of lead azide, nitro glycerine, nitrocellulose, TNT, dynamite, cordite, picric acid, gunpowder- introduction to rocket propellants. Leather technology – curing, preservation and tanning of hides and skins- process of dehairing and dyeing-treatment of tannery effluents.</td></tr>
<tr><td colspan="8">UNIT-IV: Pulp and paper: Pulp – introduction, manufacture of pulp-mechanical process, chemical process. Sulphite pulp, sulphate pulp and soda pulp. Paper- manufacture, calendering and uses, important features of good pulp and paper industry.</td></tr>
</table>

	UNIT-V: Electrochemical industries and production of materials Electrochemical industries – advantages of electrochemical methods, industrial applications of electrolysis, requirement of electrode materials, cathode materials and anode materials. Production of materials like chlorine, caustic soda, potassium permanganate. Electrolytic reduction of aluminium. Batteries – primary and secondary 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.K Sharma, Industrial Chemistry, Goel Publishing House, Meerut (2003). 2. P.P.Singh, T.M.Joseph, R.G.Dhavale, College Industrial Chemistry, 4th edition, Himalaya Publishing House, Bombay (1983). 3. B.N. Chakrabarty, Industrial Chemistry, Oxford & IBH Publishing Co., New Delhi (1981).
Reference Books	1. Dr.G.S.Gugale, Dr. R.A.Pawar, Dr.A.V.Nagawade, Dr.R.R.Kale, Industrial chemistry, Nirali Prakashan Publications (2018). 2. Dr.B.K.Sharma, Industrial Chemistry, Goel Publishing House, 19th edition, Krishna Prakashan Media (P) Ltd., (2016).
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: To study the different types and manufacture of glasses, fertilizers and polymers.

CO2: To gain knowledge on paints, varnishes and cleansing agents.

CO3: To learn on chemical explosives and leather technology.

CO4: To understand the manufacturing process of pulp and paper.

CO5: To enrich the knowledge on batteries and fuel cells.

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**
CO 2	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 3	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO 4	**M**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**
CO 5	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**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

Title of the Course	**EXTENSION ACTIVITY**						
Paper No.	**Extension Activity**						
Category	**EA**	**Year**	**II**	**Credits**	**1**	**Course Code**	
		Semester	**IV**				
Instructional hours per week	**Lecture**		**Lab Practice**			**Total**	
	-		**-**			**-**	

Title of the Course	**PROJECT WORK**						
Paper No.	**Project Work**						
Category	**PW**	**Year**	**II**	**Credits**	**4**	**Course Code**	
		Semester	**IV**				
Instructional hours per week	**Lecture**		**Lab Practice**			**Total**	
	-		**12**			**12**	
Prerequisites	Fundamentals of all disciplines of chemistry						
Objectives of the course	• To understand the importance of experimental analysis, scientific approach in solving problems related to the environment and society. • To educate and train the students to write scientific papers.						
Course outline	**Individual Project and Viva Voce:** Each faculty will be allotted one or two students. A specific problem will be assigned to the students or they will be asked to choose a problem/area of interest. The research work can be carried out in the college or at any other organization approved by the guide and the HOD. Viva Voce/presentation will be conducted by a panel comprising of internal / external examiners.						
	Methodology: Each project should contain the following details: Brief introduction on the topic, Review of Literature, Materials and Methods, Results and Discussions (evidences in the form of figures, tables and photographs), Conclusion / Summary and Bibliography.						
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.						